

BLOOD CHEMISTRY PATTERNS

How to use the pattern guide:

This book is meant to be a companion guide used in conjunction with Dr. Lundell's Holistic Blood Chemistry Manual. The following laboratory patterns are meant to give the practitioner general trends in interpreting blood work and making assessments about the overall condition of the patient. These are not absolutes, and treating every patient as an individual is paramount. Very few people will fit these patterns *exactly* as they are written. However, the helpfulness of these patterns will become apparent as one begins to run labs, interpret them from a functional perspective and attempts to connect the dots (see patterns among several analytes), rather than make a “diagnosis” of illness based on a single laboratory analyte.

Under each heading you will see a “high” and a “low” indicating which analytes are most likely, *but not always*, going to appear in that category. In addition, keep in mind that sometimes only one or two analytes under the high or low may be abnormal and it may still indicate that condition. One does not have to have all analytes abnormal for an accurate diagnosis to be made.

Also, individuals may have multiple illnesses at one time or have multiple factors influencing each analyte, shifting the analytes out of their typical high, low or normal status. This is why we never rely on one single analyte for complete diagnosis. For example, one may have hypothyroidism which would typically raise cholesterol. However, that person may be on a cholesterol lowering medication or have liver damage which causes the cholesterol to show low or normal. This does not mean the patient does not have hypothyroidism. Other signs and analytes should be present confirming the assessment. One may show *normal* thyroid markers such as TSH and T3 or T4 but may still have other lab analytes indicating thyroid resistance such as elevated cholesterol, liver enzymes and creatine kinase. **Remember, also, to always correlate laboratory tests with clinical information from history, physical exam and questionnaires.**

This list is not meant to be a comprehensive list of analytes for each condition. The idea is to give *the most common* abnormal lab markers associated with each condition, and since each person will express health and illness in a unique way, there may be many other analytes that are abnormal that are not listed. Remember to think like a doctor and *understand* what each analyte is from a physiological perspective, not just memorize a list of highs and lows. Lab tests are only useful if interpretation includes understanding the biochemistry of each analyte.

There is no greater single tool to the modern practitioner than blood chemistry. May these patterns help illuminate and expand your understanding of the uses of laboratory testing and its value in seeing a greater view into each person's unique biochemistry and overall health picture.

~ Dr. Brandon M Lundell

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Ominous Patterns

(3 or More Indicates Serious Illness)

This pattern often indicates cancer or other end stage disease. However, each one by itself merits investigation into possible serious illness or dysfunction.

- Cholesterol: a sudden drop with levels below 140
- Albumin: below 4.0
- Globulin: above 4.5
- Lymphocytes: below 20
- Absolute lymphocytes: below 1.5
- Platelets: below 150 or above 450

Inflammation Patterns

Systemic Inflammation

High

- See “positive” acute phase reactants below
- ESR
- Homocysteine (in some individuals)
- WBC – especially monocytes if acute, but could be any of the differentials
- RBC – in beginning phases
- Total Protein
- Alk Phos
- CK
- LDH
- AST
- ALT
- GGT
- Total Cholesterol
- Lp (a)

Low

- See “negative” acute phase reactants below
- RBC
- WBC – especially if long-term inflammation
- HDL
- Thyroid hormone production, especially T3

Positive Acute Phase Reactants = Increased Synthesis During Acute or Severe Inflammation

- Ferritin
- C-Reactive Protein (CRP)
- HDL
- Fibrinogen
- Plasminogen
- Prothrombin Factor
- Haptoglobin – excellent marker for antioxidant deficiency
- Complement Factors
- SOD (super oxide dismutase)
- Serum Amyloid P
- Serum Amyloid A
- sAlpha-2 Macroglobin
- Ceruloplasmin
- Alpha-1 Antitrypsin
- Alpha-1 Antichymotrypsin

Negative Acute Phase Reactants = Decreased Synthesis During Acute or Severe Inflammation

- Albumin
- Transferrin
- Transcortin
- Testosterone
- Transthyretin
- Retinol-binding protein
- Total cholesterol
- Antithrombin

Increased Oxidative Stress/Free Radical Activity

High

- LDL
- RDW
- Uric Acid
- Total Globulin
- Bilirubin
- Ferritin

Low

- Lymphocytes
- Cholesterol (sudden or uncharacteristic drop)
- Albumin
- Platelets

Tissue Destruction (Injury or Autoimmune)

High

- Potassium
- LDH
- ESR
- C.K.

Arthralgias

High

- ESR
- CRP
- Albumin
- Globulin
- Platelets
- Ferritin

Low

- Albumin

Autoimmune Processes

High

- ESR
- CRP
- LDH
- Globulin
- Total Protein
- Platelets
- HDL
- Ferritin
- WBC
- Other Positive acute phase reactants
- ANA positive (nonspecific autoimmune)
- Specific antibodies (AB's) positive (i.e. TPO, TG, Parietal cell, etc.)

Low

- WBC
- Platelets
- Triglycerides
- Cholesterol
- Globulin
- Total Protein
- Albumin
- Transferrin
- Other negative acute phase reactants

Red Blood Cell Patterns

Anemia-B12/Folate Deficiency

See B12 deficiency for more discussion

High

- MCH
- MCV
- RDW
- MCHC
- Serum Iron
- LDH

Low

- RBC's
- HCT
- HGB
- WBC's
- Neutrophils
- Uric Acid

Pernicious Anemia

High

- MCV
- MCH
- MCHC
- RDW
- Intrinsic factor AB positive (may take decades for anemia to show up even when AB's are positive)

Low

- RBC
- HGB
- HCT

Anemia-Hemolytic

High

- LDH
- Reticulocytes
- Indirect bilirubin
- Iron
- Urine hemoglobin

Anemia - Iron Deficiency

High

- RDW
- TIBC
- Reticulocyte count
- Transferrin

Low

- Iron
- Iron saturation
- Ferritin
- RBC
- Hemoglobin
- Hematocrit
- MCV
- MCHC
- Globulin
- Phosphorous

Anemia of Chronic Blood Loss

High

- RDW
- TIBC

Low

- RBC
- Hemoglobin
- Hematocrit
- Ferritin
- MCV
- MCHC
- Iron
- Iron saturation

Anemia of Acute Blood Loss

High

- Ferritin (may be normal)
- RDW (may be normal if caught very early)

Low

- RBC
- Hemoglobin
- Hematocrit
- TIBC
- Transferrin

Anemia of Illness or Inflammation

High

- Ferritin (if acute)
- RDW (chronic)
- See positive acute phase reactants

Low

- RBC
- Ferritin (if chronic)
- HGB
- HCT
- MCV/MCHC (chronic, may be normal if acute)
- TIBC
- Transferrin
- Albumin
- See negative acute phase reactants

Sideroblastic Anemia

Blood Smear microscopy will reveal sideroblastic RBC morphology

High

- RDW
- Iron
- Iron saturation
- Ferritin

Low

- RBC
- Hemoglobin
- Hematocrit
- MCV
- MCH
- MCHC

Renal EPO Deficiency Anemia

High

- BUN
- Creatinine
- Phosphorus
- Urinalysis - increased proteins

Low

- RBC
- Hemoglobin
- Hematocrit
- GFR
- Serum EPO

Hemolytic Anemia

High

- Iron
- Iron saturation
- Ferritin
- RDW
- Total bilirubin
- Unconjugated bilirubin
- LDH
- Urobilinogen - urinalysis

Low

- RBC
- Hemoglobin
- Hematocrit
- Transferrin
- TIBC
- Haptoglobin

Thalassemia (Hemolytic Anemia)

High

- HbC (alpha, beta or delta subtype)
- Classified as major, minor, intermediate
- Iron
- Iron saturation
- Ferritin
- Total bilirubin
- Unconjugated bilirubin
- LDH
- Urobilinogen - urinalysis

Low

- RBC
- Hemoglobin
- Hematocrit
- Transferrin

- TIBC
- Haptoglobin
- MCV
- MCH
- MCHC

Sickle Cell Anemia

High

- Hb electrophoresis shows HbSS gene
- Iron
- Iron saturation
- Ferritin
- Total bilirubin
- Unconjugated bilirubin
- LDH
- Urobilinogen - urinalysis

Low

- RBC
- Hemoglobin
- Hematocrit
- Transferrin
- TIBC
- Haptoglobin

G6PD Deficiency Hemolytic Anemia

High

- Iron
- Iron saturation
- Ferritin
- Total bilirubin
- Unconjugated bilirubin
- LDH
- Urobilinogen - urinalysis

Low

- G6PD - RBC
- RBC
- Hemoglobin
- Hematocrit
- Transferrin
- TIBC
- Haptoglobin

Autoimmune Hemolytic Anemia

Coomb's antibody test positive if hereditary

High

- Iron
- % Iron saturation
- Ferritin
- Total bilirubin
- Indirect bilirubin
- LDH
- Urobilinogen - urinalysis

Low

- RBC
- Hemoglobin
- Hematocrit
- Transferrin
- TIBC
- Platelets
- Haptoglobin

Aplastic Anemia

Low

- RBC
- Hemoglobin
- Hematocrit
- WBC
- Platelets

Primary Polycythemia Vera (Bone Marrow Overproduction)

High

- RBC
- HGB
- HCT
- RDW
- EPO (elevated if primary, normal or decreased if secondary)

Iron Metabolism Dysfunction Patterns

Excess Consumption of Iron

High

- Serum Iron
- Ferritin
- AST
- ALT

Primary Hemochromatosis (Hereditary)

Gene Test HFE Genotype = Positive

High

- Iron
- Ferritin
- Iron saturation (transferrin saturation)
- AST

Low

- Transferrin
- TIBC
- UIBC

Secondary Hemochromatosis (Acquired)

HFE Genotype = Negative

High

- Iron
- Ferritin
- Iron saturation (transferrin saturation)

Low

- Transferrin
- TIBC
- UIBC

Acute-Phase Reactant Response (Iron)

High

- Ferritin

Low

- Transferrin (normal or depressed)
- TIBC (normal or depressed)
- UIBC (normal or depressed)

Early Iron Storage Depletion

Low

- Ferritin

Most other markers of iron may be normal. Ferritin is often the first sign of iron deficiency.

Iron-Deficiency Non-Anemia

High

- TIBC

Low

- Ferritin
- Iron
- Iron saturation

Immune Dysfunction Patterns

Acute Bacterial Pattern

High

- WBC
- Neutrophils
- ESR
- CRP (often elevated in bacterial but NOT viral)

Low

- Lymph (percentage and perhaps absolute)

Acute Viral Pattern

High

- WBC
- Lymphocytes (Lymph)
- Monocytes
- ESR
- LDH

Low

- Neutrophils

Chronic Infection

High

- Neutrophils (relative percentage may be high if chronic viral)
- Lymphocytes (relative percentage may be high if chronic bacterial)

Low

- WBC
- Neutrophils (chronic bacterial or yeast)
- Lymph (chronic viral)

Chronic Immunodeficiency

Low

- WBC
- Neutrophils
- Lymph
- Monocytes
- Eos
- Baso
- Vit A. and Vit D (see deficiencies below)

Mononucleosis (Epstein-Barr Virus)

High

- WBC
- EBV antigens positive (IgM acute/active, IgG acute and chronic)
- Lymph
- Monocytes
- AST
- Alkaline Phosphatase

Low

- Neutrophils

Parasite Infection or Allergy

High

- Eos
- Eos (absolute) (normal to elevated)

Asthma

High

- HGB
- Eosinophils
- HCT
- Neutrophils
- WBC
- CO₂

Low

- Lymphocytes
- Cortisol (adrenal fatigue)

Urinary Tract Infection

High

- WBC
- Monocytes
- Neutrophils
- Creatinine
- LDH
- ESR
- CRP
- Urinalysis – elevated leukocytes, leukocyte esterase, blood and or cast cells

Digestive Patterns

Increased Intestinal Permeability (Leaky Gut) and/or Hypochlorhydria Pattern

High

- Total protein (inflammation or infection)
- WBC (dysbiosis and/or parasite)
- Serum globulin
- BUN (sign of small intestinal bacterial overgrowth)
- Uric acid
- ESR (if severe or with IBD)
- Chronic UTI's
- MCV (if B12 deficiency)
- CRP
- Alkaline Phos

Low

- Total protein (malabsorption)
- WBC
- Globulin
- RBC
- MCV (if iron deficiency)
- BUN
- Phosphorus
- Iron

Digestive Dysfunction/Inflammation *(see section below on IBD)

High

- BUN
- Basophils
- CRP
- Alkaline Phos

With Ulceration or Erosion:

- Alk Phos Intestinal Isoenzyme

Low

- Total Protein
- Total Globulin
- Albumin
- Phosphorus
- Creatinine

Intestinal Parasites

High

- Eosinophils (the primary marker for parasitic infection)
- MCV
- MCH
- Basophils
- Monocytes
- IgE
- Stool positive for parasites or ova (run a PCR test either in addition to or instead of microscopic for greater accuracy)

Low

- Serum iron
- HGB
- HCT

Pancreatic Insufficiency

High

- GGT
- Amylase (if inflammatory/obstructive)
- Lipase (if inflammatory/obstructive)

Low

- WBC
- BUN
- Protein
- Cholesterol

***Lab tests for Crohn's and UC**

In tests for antibodies, about 70% of tests for patients with UC will show perinuclear-staining antineutrophil cytoplasmic antibodies (pANCA) and over 50% of Crohn's patients have *anti-Saccharomyces cerevisiae* antibodies. Each of these antibody groups shows up only occasionally in the other disorder.

The prevalence of abnormal values of initial screening laboratory tests was assessed for 24 children who eventually proved to have Crohn's disease. The screening tests included in this analysis were fecal alpha 1-antitrypsin (FA) concentration, erythrocyte sedimentation rate (ESR), total leukocyte count, serum albumin level, hemoglobin concentration, and qualitative testing of stool for the presence of blood. Of the 24 patients, 21 had abnormal FA values, 17 had anemia, 19 had an increased ESR, 14 had hypoalbuminemia, rectal bleeding was found in 8, and **none had leukocytosis**. All 24 patients had at least one abnormal screening test value; the most frequently abnormal result was the FA concentration. Pediatric patients without elevated FA values, anemia,

a high ESR, bloody stools, or hypoalbuminemia are unlikely to have active Crohn's disease.

CRP is better for Crohn's

Fecal Calprotectin better for UC but used for Crohn's as well

Hypoproteinemia and/or hypoalbuminemia

RDW is a great marker for IBD (both UC and Crohn's)

Anemia (both cofactor and iron anemia)

Platelets also used as marker for active disease

Other laboratory markers, including erythrocyte sedimentation rate (ESR), leucocyte and platelet count, albumin, and α_1 acid glycoprotein (orosomucoid), have been studied either less extensively in IBD or have proven to be less useful than CRP.

Immunologic markers

- Calprotectin
- Lactoferrin
- Secretory IgA (sIgA)
- Lysozyme
- Alpha 1-antichymotrypsin
- Eosinophilic Protein X

Overview of other FXMED tests for IBD

- Comprehensive Stool Analysis
- Autoimmune Antibodies (pANCA, sANCA, S.Cerivisiae)
- PCR gene Stool Analysis
- Organic Acids
- Amino Acids
- Fatty Acids
- Mineral analysis
- Oxidative Stress
- Food Sensitivities
- Candida Immune Activity

Acid-Alkaline pH Balance Patterns

The general compensatory mechanisms of acid base balance are as follows:

Respiratory acidosis – kidneys will retain CO_2 to increase blood pH and CO_2 levels will go down.

Respiratory alkalosis – kidneys will excrete increased amounts of CO_2 to lower pH.

Metabolic acidosis – lungs expel CO_2 to raise pH so blood CO_2 goes down.

Metabolic alkalosis – lungs do not expel CO_2 so that pH will go down and blood CO_2 goes up.

Metabolic Acidosis

High

- Anion gap (AG) – typically, acidosis will present with incr AG
- Potassium
- Chloride

Low

- CO_2 (CO_2 will be used up in buffering the acid, or it may be lost in renal failure or GI diseases)
- AG – may be low or normal if compensation mechanisms are intact

Metabolic Alkalosis

High

- CO_2

Low

- AG ratio
- Chloride
- Potassium
- Albumin - if alkalosis is from loss of protein

Respiratory Acidosis/Alkalosis

Blood gases need to be measured to assess respiratory acid-base balance. These include the pH of the arterial blood as well as partial pressure of CO_2 and O_2 .

Renal Patterns

Renal Dysfunction/Insufficiency

High

- BUN
- Creatinine - Creatinine creep: look for slowly elevating levels of creatinine over years while still within normal levels – suggests progressive kidney insufficiency.
- BUN-Creatinine Ratio
- Phosphorus
- Uric Acid
- Sodium
- Calcium
- Potassium
- LDH
- AST
- GGT
- Urinalysis will show proteinuria and/or microalbuminuria

Low

- Albumin
- Total Protein
- EGFR < 60

Hepatic and Biliary Patterns

Biliary Obstruction/Calculi

High

- Alkaline Phosphatase
- ALT
- AST
- GGTP
- Bilirubin
- Direct bilirubin (if extrahepatic – gallbladder)
- Indirect bilirubin (if intrahepatic – liver)
- ESR
- CRP
- Cholesterol (high or low)
- LDH
 - LDH isoenzymes 3 and 5 are elevated if obstruction is in the gallbladder
 - LDH isoenzymes 1 and 5 elevated if in the common bile duct or biliary tree

Biliary Stasis/Insufficiency

High

- Cholesterol
- GGT
- Bilirubin
- Alk Phos
- Stool test will show elevated fats (undigested)

Low

- Triglyceride
- Cholesterol

Liver Dysfunction

High

- ALT
- LDH
- AST
- Bilirubin
- Indirect Bilirubin
- Serum Iron
- Ferritin
- Monocytes
- BUN
- CRP

Low

- BUN
- Total Protein
- Albumin
- Albumin/Globulin Ratio
- Triglycerides
- Cholesterol

Chronic Liver Disease

High

- AST
- ALT
- GGT
- Alk Phos
- Total cholesterol

Low

- Albumin
- Total protein

- A/G ratio
- BUN
- Platelets

Fatty Liver (Steatosis) Early Phase

High

- Glucose
- Triglycerides
- Cholesterol
- LDL

Low

- ALT
- AST
- GGTP
- HDL

Fatty Liver (Steatosis) Chronic or NAFLD

Fatty liver is most commonly associated with alcoholism. In non-alcoholics who are obese or diabetic or insulin resistant, it is called non-alcoholic fatty liver disease (NAFLD).

High

- ALT
- AST
- GGT
- Glucose
- Triglycerides
- Cholesterol
- LDL

Low

- HDL
- Platelets

Hepatitis (Confirm with Antibody Panel)

High

- WBC (acute or severe)
- Lymphocytes
- AST
- ALT

- GGT
- PCR hepatitis positive

Low

- WBC (if chronic)

Gilbert's Syndrome

This was once thought to be a benign condition but is now associated with multiple health issues as a result of impaired detoxification associated with Gilbert's.

High

- Bilirubin
- Indirect Bilirubin

Blood Glucose Patterns

Hypoglycemia

Low

- Glucose
- HbA1C
- LDH

Reactive Hypoglycemia

High

- Glucose
- HbA1c

Low

- Glucose
- LDH
- HbA1c

Insulin Resistance

High

- Glucose >85
- Triglycerides

- TG:HDL ratio >2
- Cholesterol
- Fasting Insulin >8
- Post prandial insulin >16
- Fasting Insulin <2 or >12
- Fructosamine
- Potassium
- Cholesterol/HDL ratio <3
- Uric acid
- HA1C
- HOMA IR – equation taking into account more subtle elevations of glucose and triglycerides. The following link is to an easy to use calculator:
<http://www.dtu.ox.ac.uk/homacalculator/index.php>
- LDL
- LDH – if inflammation is present in sufficient amount
- Alpha hydroxybutyrate (AHB) (organic acid)
- Oral Glucose Tolerance Test (OGTT)

Low

- HDL
- LDH (reactive hypoglycemia)
- CK
- Sodium

Medically Accepted Criteria for Metabolic Syndrome

Must have three or more of the following:

- **Abdominal obesity**
 - Men: waist circumference > 40 inches
 - Women: waist circumference > 35 inches
- **Fasting glucose** > 110 (>126 = diabetes)
- **Blood pressure** >130/80 mmHg
- **Triglycerides** > 150
- **HDL cholesterol**
 - Men < 40
 - Women < 50

Diabetes

High

- Glucose, fasting >126
- HbA1C > 6.5 (ADA range for official diagnosis)
- Triglycerides
- Cholesterol (run VAP to determine CVD risk)
- Uric acid

- LDL
- Fructosamine
- Fasting Insulin (decreased if late stage or uncontrolled diabetes)

Low

- HDL

Acquired Type I Adult Diabetes/Latent Autoimmune Diabetes in Adults (LADA)

High

- Glucose
- HbA1c
- (see IR and diabetes above)
- GAD ABs = positive (earliest finding)
- IA2 ABs = positive
- Pancreatic Islet Cell (beta cell) ABs = positive

Low

- C-Peptide

Cardiovascular Patterns

Cardio-Vascular Disease/Atherosclerosis

High

- Triglycerides
- CRP
- Homocysteine
- Total Cholesterol
- Lp (a)
- LDL
 - LDL (LDL size pattern of B/AB)
- Chol : HDL ratio >3
- Glucose
- HA1c
- Fasting insulin
- Fibrinogen
- RDW
- Uric acid
- Platelets
- Calcium
- ESR
- MCV
- MCH

- LDH
- Heavy metals (lead, mercury, arsenic etc. Run HM urine test. If elevated, consider chelation therapy – oral and IV)
- AST

Low

- HDL
- Vitamin D
- RBC magnesium
- Glutathione
- Thyroid
- Free and/or total testosterone

Atherosclerosis

High

- Triglycerides
- Homocysteine
- Cholesterol
- RDW
- Lp (a)
- Uric Acid
- Platelets
- C Reactive protein
- Fibrinogen

Low

- HDL
- Thyroid hormones
- Glutathione

Adrenal Patterns

The following are what you may find on blood chemistry tests. If adrenal dysfunction is suspected, consider running saliva or urinary cortisol and hormone patterns.

Adrenal Hyperfunction

High

- Sodium (N, E or L but very likely E)
- Chloride
- Glucose
- CO2
- BUN
- Triglyceride (N, E or L)
- Potassium (N, E, or L)

Low

- Potassium (N, E, or L)
- Cholesterol

Adrenal Hypofunction

High

- Potassium (N, E or L)
- Cholesterol
- Triglycerides

Low

- Sodium
- Chloride
- Blood Glucose
- Cholesterol

Thyroid Patterns

Primary Hypothyroidism

High

- Thyroid-stimulating hormone (TSH)
- MCV
- MCH
- Cholesterol
- Homocysteine
- Creatine Kinase

Low

- Total T4 (TT4) (normal or low)
- Free T4 (FT4)
- Free thyroxine index (FTI)
- Resin T3 uptake (T3U)
- Free T3 (FT3)

Autoimmune Hypothyroidism (Hashimoto's)

High

- Thyroid-stimulating hormone (TSH)
- MCV
- MCH
- Cholesterol
- Homocysteine
- Creatine Kinase

Low

- Total T4 (TT4) (normal or low)
- Free T4 (FT4) (normal or low)
- Free thyroxine index (FTI) (normal or low)
- Resin T3 uptake (T3U) (normal or low)
- Free T3 (FT3) (normal or low)

TPO AB's = positive

Thyroglobulin AB's = positive or negative (often the first to show in early disease)

Early Thyroid Autoimmune Reaction

Low

- Free T3 (FT3) (normal or low)

One or both of the following will be positive:

Thyroglobulin AB's = positive or negative (this one often the first to show)

TPO AB's = positive or negative

Also look at other autoimmune markers such as ANA, intrinsic factor AB's etc.

Secondary Hypothyroidism/Anterior Pituitary Insufficiency

High

- Triglycerides
- Cholesterol
- Homocysteine

Low

- TSH
- Total T4
- T-3 Uptake
- Free T₃
- Free T₄

Thyroid Hormone Underconversion

High

- Reverse T3 (rT3)
- Cholesterol
- MCV
- MCH

Low

- TT3
- Free T3 (FT3)

Elevated Thyroid-Binding Globulins

High

- Thyroid-binding globulin

Low

- Free T4 (FT4)
- Free thyroxine index (FTI)
- T3 Uptake (T3U)
- Free T3 (FT3)

Decreased Thyroid-Binding Globulins

High

- Free T4 (FT4) (high or normal)
- Free thyroxine index (FTI) (high or normal)
- T3 uptake (T3U)
- Free T3 (FT3) (high or normal)

Low

- Thyroid-binding globulin

Grave's Hyperthyroidism

TSI, TSH receptor AB's = usually positive

TPO, TG AB's = positive or negative

High

- Total T4
- Free T4
- Free thyroxine index
- Free T3

Low

- TSH

Thyroid Hyperfunction (Overmedication)

Thyroid antibodies are negative

High

- Total T-3
- Total T-4
- T-3 Uptake

Low

- Triglyceride
- Cholesterol
- HDL
- TSH

Prostate Patterns

Prostatitis/Prostate Hypertrophy (benign or cancer)

High

- PSA - Could be normal in many cases. False elevations are increased if PSA is done *after* a DRE. Always do a DRE *after* lab tests)
- Creatinine
- Alkaline phosphatase
- WBC (if it is infection)
- Monocytes
- DHT
- Acid phosphatase (prostatic acid phosphatase)

Low

- Free PSA (normal or decreased)
- Testosterone

Prostate Cancer

High

- PSA - Could be normal in many cases. False elevations are increased if PSA is done *after* a DRE. Always do a DRE *after* lab tests)
- Biopsy is suggested if serial PSA tests reveal a sharp and sudden increase and injury/infection to prostate is ruled out
- DRE will often be nodular, hard or very soft feel
- DHT

Low

- Free PSA (the lower the result, and the older the patient, the more likely it is cancer)

Parathyroid Patterns

Parathyroid Hyperfunction

High

- Calcium
- PTH
- Alkaline phosphatase

Low

- Phosphorus

Parathyroid Hypofunction

High

- Phosphorus

Low

- Calcium
- Alkaline phosphatase
- PTH

Spleen Patterns

Spleen Hyperfunction

High

- Bilirubin
- HGB
- HCT

Low

- RBC

Spleen Hypofunction

High

- Total iron

Low

- Bilirubin
- HGB
- HCT
- RBC

Pancreatic Patterns

Early Pancreatic Dysfunction

High

- AST
- LDH

Low

- Calcium
- Triglycerides

Pancreatitis

High

- Glucose
- Triglycerides
- Alkaline phosphatase
- Lipase
- Amylase
- GGTP
- AST
- ALT

Low

- Albumin

Other Metabolic Patterns

Skeletal Muscle Rhabdomyolysis (increased muscle breakdown)

High

- Creatinine
- AST
- ALT
- LDH
- CPK
- LDH isoenzyme #4 and #5
- CPK isoenzyme CK:MM

Edema

High

- BUN

Low

- Sodium
- Albumin

Dehydration

High

- RBC's

- HGB
- HCT
- Total Protein (Chronic)
- Albumin (Chronic)
- Sodium
- Potassium (may be N or L)
- BUN (Chronic)

Gout

High

- Uric acid
- Cholesterol
- BUN
- Creatinine
- MCV (may indicate folate deficiency which is often a contributing factor to gout)

Low

- Phosphorus (may be normal)

Emphysema

High

- HCT
- HGB
- RBC
- CO₂

Low

- Chloride
- Alpha-1 globulin
- Potassium
- Calcium

Pregnancy

High

- Cholesterol
- MCV
- MCH
- T4
- WBC
- Neutrophils
- hCG positive

Low

- HGB
- RBC

- HCT
- Iron (later in pregnancy)
- Total protein
- Albumin
- T3 Uptake
- Calcium (later in pregnancy)
- Lymphocytes

Heavy Metal Burden/Toxicity

Blood tests are not specific for heavy metal burden. If you suspect heavy metal exposure and toxicity, a urinary challenge test is recommended. A hair analysis may also prove useful to determine time of exposure.

High

- Serum or urinary heavy metals
- Uric acid
- Total Bilirubin
- BUN
- Cholesterol
- Calcium
- ALT/AST/GGT (acute and/or severe)

Low

- Uric acid
- Cholesterol
- HDL
- TSH
- MCHC/MCH
- HCT
- HGB
- RBC's
- LDH isoenzyme #5
- Phosphorus
- Platelets

Chemical Toxicity

High

- Total Globulin
- Cholesterol

Low

- Uric Acid
- Cholesterol
- HDL

- MCH
- MCHC
- TSH
- Platelets

Methylation Defect

High

- Homocysteine
- MCV
- MCHC
- MTHFR “SNP” positive
- RDW
- CRP
- Eosinophils
- Uric acid
- MMA (urine) (after methionine challenge)

Low

- RBC
- WBC

Intrinsic factor Abs = positive

Cancer antigens = may be positive (methylation defect associated with higher risk of cancers)

Internal Bleeding (see Anemia of Blood Loss)

High

- Reticulocyte count
- TIBC
- Transferrin
- RDW

Low

- RBC
- Iron (if chronic)
- Ferritin
- HGB
- HCT
- MCV, MCH

Nutrient Deficiency Patterns

Copper Deficiency

High

- Inflammatory markers (copper is needed in SOD production)
- Ceruloplasmin (if acute inflammation due to deficiency or in pregnancy)

Low

- Iron (too much copper will also cause iron deficiency)
- Ceruloplasmin (in functional copper deficiency)
- Albumin
- Uric Acid
- MCV
- MCH
- HCT
- HGB
- RBC's
- WBC
- T3
- T4
- Serum copper (very insensitive test as only severe deficiency will show on serum copper test)

Iodine Deficiency

High

- TSH
- Triglycerides
- Cholesterol
- Reverse T3
- Cancer markers of breast, ovary, prostate
- Fibrocystic breasts (not lab marker but clinical sign that may indicate relative iodine deficiency)

Low

- T-3 Uptake (Iodine deficiency may cause the body to increase T3 production in response to low levels of total thyroid hormone)
- T4
- T3

Selenium Deficiency

High

- Total T-4 or T4:T3 ratio

Low

- Total T-3 and Free T-3

- T-3 Uptake

Vitamin A Deficiency

High

- Cancer markers (Vit A is needed for cellular differentiation)
- Cardiovascular markers
- Autoimmune markers

Low

- WBC
- Globulins

Vitamin B1/Thiamine Deficiency

High

- Glucose
- See Insulin Resistance and Diabetes
- Anion Gap

Low

- Albumin
- RBC transketolase
- CO2

Vitamin B6 Deficiency

Most commonly seen in excess alcohol consumption. There are some individuals born with error in B6 conversion to active P-5-P. These individuals are often deficient in zinc as well.

High

- Homocysteine
- Histamine (histamine is broken down by DAO which required Vit C and B6)
- Xanthurenic Acid (urinary test that will be elevated after tryptophan or methionine challenge in the presence of B6 deficiency)

Low

- ALT
- AST
- GGT
- MCV, MCH
- MCHC
- HCT
- HGB

Vitamin B12 and Folate Deficiency

One of the most common deficiencies, regardless of diet. There is a difference between having B12 and folate in the blood and being able to utilize it which, which requires proper methylation. The importance of methylation is now being understood and a significant majority of people may not methylate sufficient enough to side-step functional B12 and folate deficiency. Furthermore, the absorption of B12 is being eroded due to the high prevalence of leaky gut and destruction of intestinal mucosa and intrinsic factor production. The effects of B12 and folate deficiency on neurodevelopment and long term health of the brain, nervous system, DNA, cancer, metabolism, etc. are quite severe and contribute significantly to developmental disorders and chronic degenerative diseases.

High

- Homocysteine (probably most sensitive marker)
- Urinary Methylmalonic Acid
- MCH
- MCV
- RDW
- Serum Iron
- LDH
- Intrinsic factor AB positive

Low

- RBC's – see anemia section
- Serum B12 (keep in mind this is an insensitive test for functional B12 deficiency)
- Serum Folate (same as B12 – very insensitive to functional deficiency)
- HCT
- HGB
- WBC – especially in folate deficiency
- Neutrophils
- Uric Acid

Vitamin C Functional Deficiency

High

- MCV
- RDW
- Eosinophils
- Histamine (histamine is broken down by DAO which required Vit C and B6)
- Alk Phos
- Fibrinogen
- ALT/AST
- Osteoporosis

Low

- Albumin
- MCH
- MCHC

- HGB
- HCT
- RBC's
- Serum Iron
- WBCs

Vitamin D Deficiency

High

- T4:T3 ratio
- Calcium (if rickets or osteoporosis is severe enough for breakdown of bone)

Low

- Serum Vit D
- Calcium
- Phosphorous
- Cholesterol (signals fat malabsorption)
- WBC
- Other signs of malnutrition will be evident if this is the cause of hypovitaminosis D – albumin, protein, etc.

Zinc Deficiency

One of the most prevalent trace mineral deficiencies. High fiber diet, diet high in phytate (grains) and decreased intake of zinc-containing foods (animal protein, sesame and pumpkin seeds) are the most common reasons for deficiency.

Low

- Serum Zinc
- Alkaline Phosphatase
- Testosterone
- Sense of smell and taste
- Mental acuity

Vitamin K Deficiency

Often caused by biliary obstruction or insufficiency. Antibiotic use will also destroy the intestinal bacteria needed to produce vitamin K in the gut. Leaky gut may also produce vitamin K deficiency and excessive bleeding.

High

- Prothrombin time

Low

- Prothrombin II
- Factor VII, IX, X

- Protein C and S
- Fibrinogen

CANCER ANTIGEN TESTS

CA tests are not cleared by the FDA to be screening tests for cancer. They are not to take the place of traditional imaging or oncological tests. Many cancers do not release cancer or carbohydrate/cancer antigens. Furthermore, other disease states such as infection or inflammation may trigger release of these proteins. CA's are traditionally used to monitor progress of illness once a diagnosis is made by other means.

That said however, they can be useful in determining risk or presence of inflammation, immune or cancer potential if other clinical and /or laboratory findings indicate need for further evaluation. They can be used as part of an information gathering process that is evaluated along with clinical, laboratory and other exam findings. There is some evidence that CA's can be elevated long before other methods can detect cancer, so long as it is not used as absolute evidence of the presence or absence of disease. The following gives a brief description of associated disease states if CA's are elevated.

- AMAS: antimalignin antibody in serum. General immune activation marker for all types of cancers. Many people and different cancers do not secrete this marker. However, if present. It can be 97% specific for malignancy. (Oncolabs.com)
- CA 72-4: GI, ovarian, breast, general malignancy
- CA 19-9: pancreas, hepatobiliary, gastric, lung
- CA 15-3: breast
- CEA: good for extent of cancer, & prognosis – in GI, genital-urinary, breast. Also a general GI inflammation marker
- CA 27.29: breast – low sensitivity, high specificity
- CA 15-3: breast – low sensitivity, high specificity
- CA 125: ovarian, uterine, lung, pancreatic & others
- HCG, AFP: cancer of the ovary, testes