FBC Quick Start Guide

Patterns, Systems and Interpretation

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Functional Blood Chemistry Mastery Resources

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1. Common Blood Panels

Complete Blood Count		
Marker	Optimal	Lab Range
WBC	5.5 – 7.5	3.5 – 10.0
RBC	3.9 – 4.5 female 4.2 – 4.9 male	3.7 – 5.8
Hemoglobin (HGB)	13.5 – 14.5 female 14 – 15 male	12 – 16
Hematocrit (HCT)	37% – 44% female 40% – 48% male	36% – 48.2%
MCV	82 – 89.9	82 – 103
MCH	28 – 31.9	27 – 34
MCHC	32 – 35	30.9 – 35.4
Platelets	150 – 385 (x1000)	150 – 400 (x1000)
RDW	11.7 – 13.0	11 – 15
Neutrophils	40% – 60%	Not established
Lymphocytes	24% – 44%	Not established
Monocytes	0 – 7%	Not established
Eosinophils	0 – 3%	Not established
Basophils	0 – 1%	Not established

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Comprehensive Metabolic Panel		
Marker	Optimal	Lab Range
Glucose	75 – 86	65 – 99
BUN	10 – 16	7 – 25
Calcium	9.2 – 10.0	8.6 – 10.4
Carbon Dioxide (CO_2)	25 – 30	19 – 30
Chloride	100 – 106	97 – 107
Creatinine	0.8 – 1.1	0.5 – 1.0
Sodium	135 – 142	135 – 145
Potassium	4.0 – 4.5	3.5 – 5.3
Albumin	4.0 – 5.0	3.6 – 5.1
Bilirubin, Total	0.3 – 0.9	0.2 – 1.2
Protein, Total	6.9 – 7.4	6.1 – 8.1
ALT	10 – 26	0 – 35
AST	10 – 26	0 – 35
Alkaline Phosphatase	70 – 100	35 – 115
Anion Gap	7 – 12	6.6 – 16

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Iron Panel		
Marker	Optimal	Lab Range
Total Iron	85 – 130	40 – 160
Ferritin	30 – 70	10 – 232
TIBC	250 – 350	250 – 425
% Transferrin Saturation	25% – 35%	15% – 50%

Lipid Panel		
Marker	Optimal	Lab Range
Total Cholesterol	180 – 220	100 – 200
LDL	80 – 100	< 130
HDL	55 – 70	40 – 90
VLDL	5 – 40	5 – 40
Triglycerides	70 – 80	50 – 150
Chol/HDL Ratio	0 – 3	0 – 5

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Thyroid Panel (Comprehensive)		
Marker	Optimal	Lab Range
TSH	1.3 – 2.0	.45 – 4.5
Total T4	6.0 – 11.9	4.5 – 12
Total T3	90 – 168	71 – 180
Free T4	1.0 – 1.5	0.82 – 1.77
Free T3	3.0 – 3.5	2.0 – 4.4
T3 Uptake	27% – 37%	24% – 39%
Reverse T3	14.9 – 26.7	9.2 – 24.1
TPO Antibody	None	0 – 9 (0 – 34 LabCorp)
Thyroglobulin Ab	None	0.0 – 0.9

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2. Markers by Body System

Acid-Base Balance Markers	
CO_2	Chloride
Anion Gap	Potassium

Adrenal Gland Markers	
Potassium	Sodium
Chloride	Triglycerides
Cholesterol	Glucose

Allergy Markers	
Basophils	Eosinophils

Blood Sugar Markers	
Glucose	Hemoglobin A1c
LDH	Triglycerides
Total Cholesterol	LDL
HDL	Fasting Insulin
Phosphorus	Total WBCs

Cardiovascular Markers	
Total Cholesterol	Fasting Insulin
Triglycerides	LDL
HDL	LDH
C-Reactive Protein	Ferritin
Fibrinogen	Vitamin D
Homocysteine	Hemoglobin A1c
Glucose	AST

Gallbladder and Fatty Acid Markers	
GGT	Triglycerides
Total Bilirubin	Direct Bilirubin
Total Cholesterol	LDL
Alkaline Phosphatase	ALT

GI Markers	
Protein	BUN
Phosphorous	Creatinine
Globulin	Eosinophils

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Immune Markers	
WBCs	Monocytes
Neutrophils	Eosinophils
Lymphocytes	Basophils
Alkaline Phosphatase	Vitamin D
Ferritin	Globulin

Inflammation Markers	
LDH	Alkaline Phosphatase
Albumin	Uric Acid
C-Reactive Protein	Sed Rate
Ferritin	Lymphocytes
Platelets	Fibrinogen
Homocysteine	Cholesterol
Globulin	Iron
HDL	RDW

Kidney Markers	
BUN	Creatinine
BUN/Creatinine ratio	eGFR
Uric Acid	Phosphorus
LDH	AST

Liver Markers		
AST	Total Cholesterol	A/G Ratio
ALT	Triglycerides	Total Protein
LDH	Alkaline Phosphatase	RDW
GGT	Bilirubin	MCV
Ferritin	Albumin	

Mineral Balance Markers		
Calcium	Alkaline Phosphatase	Ferritin
Phosphorous	Iron	Uric Acid

Thyroid Markers		
TSH	Reverse T3	Total T3
Free T3	TGB	T3 Uptake
Free T4	Total T4	TPO

Vitamin Markers		
RBCs	MCHC	Methylmalonic Acid
Homocysteine	ALT	Folate
Vitamin B_{12}	GGT	MCH
Alk phos	Anion Gap	AST
MCV	Vitamin D	Albumin

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3. Marker Dysfunctions

Marker	Decreased	Increased
ALT (Optimal: 10 – 26)	• *Early stage fatty liver* • *Protein deficiency* • B_6 deficiency • Liver congestion • Malabsorption • Alcoholism	• *Dysfunction located inside liver* • *NAFLD* • *Metabolic S, IR, T2D* • *Biliary tract obstruction* • Viral hepatitis • Excessive exercise or muscle breakdown • Hepatocyte damage • Alcohol consumption • Iron overload
AST (Optimal: 10 – 26)	• *B_6 deficiency* • *Protein deficiency* • *Malabsorption* • Alcoholism	• *Dysfunction outside liver and biliary tree* • *Mono, EBV, CMV* • Early congestive heart disease • Hepatocyte damage • Acute MI • Excessive muscle breakdown • Alcohol consumption • Liver dysfunction • Coronary artery insufficiency
Albumin (Optimal: 4.0 – 5.0)	• *Hypochlorhydria* • *Insufficient protein intake* • *Liver dysfunction* • Edema • Oxidative stress • Need for vitamin C • Low T4	• *Dehydration*

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Marker	Decreased	Increased
Albumin/Globulin Ratio (Optimal: 1.4 – 2.1)	• *Liver dysfunction* • *Immune activation* • Decreased blood viscosity • Chronic aspirin use • Blood thinners	• *Dehydration* • *Increased blood viscosity/stasis* • Poor vascular tone • Sedentary lifestyle
Alkaline Phosphatase (Optimal: 70 – 100)	• *Zinc deficiency* • *Hypochlorhydria* • *Estrogen imbalance* • *Magnesium deficiency* • *Vitamin C deficiency*	• *Biliary obstruction* • *Increased bone loss or turnover* • *Hepatitis, cirrhosis, fatty liver* • Vitamin D deficiency • Liver damage due to drug toxicities • Herpes zoster (shingles) • Intestinal hyperpermeability (>100)
Anion Gap (Optimal: 7 – 12)	**(Rare)** • Lab error • Lithium toxicity • Multiple myeloma • Some neoplasms	• *Thiamine (B_1) deficiency* • *Metabolic acidosis*
Basophils (Optimal: 0 – 1%)		• *Intestinal parasites* • *Non-specific inflammation*
Bilirubin (Optimal: 0.3 – 0.9)	• Spleen insufficiency	• *Biliary stasis (cholecystitis)* • *Biliary obstruction* • Oxidative stress • Liver dysfunction/injury • RBC breakdown • Gilbert's syndrome
Bilirubin – Direct (Optimal: 0 – 0.19)		• Biliary tract obstruction • Gall stones

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Marker	Decreased	Increased
Bilirubin – Indirect (Optimal: 0.1 – 0.7)		• RBC breakdown • Gilbert's Syndrome
BUN (Optimal: 10 – 16)	• *Malabsorption* • *Intestinal hyperpermeability* • *Low protein intake* • Pancreatic insufficiency • Posterior pituitary dysfunction (ADH) • Liver dysfunction	• *Dehydration* • *Renal insufficiency or disease* • *Hypochlorhydria* • *Dysbiosis* • Excessive protein intake • Anterior pituitary dysfunction • Edema • Adrenal stress (cortisol)
C-Peptide (Optimal: 1.1 – 1.6)	• *Hypoglycemia* • *Type 1 diabetes*	• *General blood sugar dysregulation* • *Type II diabetes* • *Metabolic Syndrome* • *Insulin resistance*
CO_2 (Optimal: 25 – 30)	• *Thiamine deficiency* • *Metabolic acidosis* • Respiratory acidosis	• *Hypochlorhydria* • *Metabolic alkalosis* • Respiratory alkalosis • Adrenal hyperfunction
Calcium (Optimal: 9.2 – 10.0)	• *Hypochlorhydria* • *Calcium deficiency* • *Phosphorus or magnesium deficiency* • *Vitamin D deficiency* • *Acid-Base imbalances* • Parathyroid hypofunction • Malabsorption/malnutrition • Poor fatty acid utilization	• *Parathyroid hyperfunction* • Kidney hypofunction • Impaired cell membrane health • Excess calcium intake

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Marker	Decreased	Increased
Calcium/Phosphorus Ratio (Optimal: 2.3 – 2.7)	• *Decreased calcium and increased phosphorus* • *Hypochlorhydria* • Parathyroid hyperfunction • Excessive phosphate intake • Calcium deficiency • Bone growth (children) or bone repair (fractures) • Kidney insufficiency	• *Increased calcium and decreased phosphorus* • Tissue or cell damage • Parathyroid hypofunction • Hyperinsulinemia • High carbohydrate diet • Calcium deposition
Chloride (Optimal: 100 – 106)	• *Hypochlorhydria* • Excessive loss (diarrhea, vomiting, laxatives, sweating) • Insufficient intake • Metabolic alkalosis • Adrenal insufficiency	• *Dehydration* • *Metabolic acidosis* • Adrenal stress • Excess salt intake
Cholesterol (Optimal: 180 – 220)	• *Liver/biliary dysfunction* • *Malnutrition / malabsorption* • *Statin drugs* • Inflammation or infection • Endocrine disorders • Oxidative stress • Heavy metal burden • Poor cell membrane health • Autoimmune disorders • Hyperthyroidism • Neurological concerns / nerve transmission	• *Cardiovascular disease* • *Atherosclerosis* • *Metabolic Syndrome or fatty liver* • *Insulin resistance / dysglycemia* • *Biliary stasis* • *Hypothyroidism* • Poor metabolism/utilization of fats • Adrenal cortical dysfunction • Hyperlipoproteinemia • Early stage hyperglycemia • Multiple sclerosis

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Marker	Decreased	Increased
Creatinine (Optimal: 0.8 – 1.1)	• *Muscular atrophy* • *Sedentary lifestyle* • Muscular degenerative diseases (ALS, MS, etc…)	• *Renal insufficiency or disease* • *Dehydration* • *Moderate to high intensity exercise* • BPH or prostatitis • Uterine hypertrophy or inflammation • Urinary tract congestion • Cardiovascular disease • Creatinine supplementation
eGFR (Optimal: > 90)	• Kidney insufficiency	
Eosinophils (Optimal: < 3%)		• *Intestinal parasites* • *Skin issues* • *Food and environmental allergies or sensitivities* • Asthma
Fasting Insulin (Optimal: < 5)	• *Trending toward hypoglycemia* • *Type 1 diabetes*	• *Early stage Diabetes or glucose intolerance* • *Hyperglycemia or Diabetes* • *Metabolic Syndrome or Insulin Resistance* • *Cardiovascular disease risk*
Ferritin (Optimal: 30 – 70)	• *Iron deficient anemia*	• *Excess iron consumption* • *Inflammation* • *Cardiovascular disease* • Liver dysfunction • Oxidative stress • Hemochromatosis / hemosiderosis

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Marker	Decreased	Increased
Fibrinogen (Optimal: 295 – 369)		• *Atherosclerosis* • *Peripheral artery disease* • Rheumatoid arthritis • Stroke • Glomerulonephritis • Heart attack
Folate (Optimal: 15 – 25)		• *Folate and/or B_{12} anemia* • *Poor dietary intake* • Pregnancy • Antiseizure medications • Methotrexate • Damaged SI lining • Alcoholics
GGT (Optimal: 10 – 30)	• *Early stage fatty liver* • *Malabsorption* • *B_6 deficiency* • Magnesium deficiency • Hypothyroidism • Protein deficiency • Alcoholism	• *Dysfunction located outside the liver, inside the biliary tree* • *Biliary insufficiency, stasis or gallstones* • *Biliary obstruction* • Liver disease – hepatitis, fatty liver, etc. • Chronic alcohol or drug use • Acute/chronic pancreatitis • Obesity • Deficiency of fat-soluble nutrients
Globulin (Optimal: 2.4 – 2.8)	• *Immune insufficiency* • Inflammation • Digestive dysfunction	• *Hypochlorhydria* • *Immune activation* • *Chemical or heavy metal toxicity* • Oxidative stress • Liver cell damage

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Marker	Decreased	Increased
Glucose (Optimal: 75 – 86)	• *Reactive hypoglycemia* • *Excessive insulin* • *Impaired glycogen storage in liver* • Adrenal hypofunction	• *Insulin resistance* • *Early stage diabetes* • *Metabolic Syndrome* • Thiamine (B_1) deficiency • Liver congestion or fatty liver • Anterior pituitary resistance to cortisol
HDL (Optimal: 55 – 70)	• Liver congestion / fatty liver • Atherosclerosis • Metabolic Syndrome • Sedentary lifestyle • Oxidative stress • Hyperthyroidism • Heavy metal burden • Hyperlipidemia • Smoking • Obesity	• Familial hypercholesterolemia • Alcohol intake • Use of H_2 blockers • Exogenous estrogen use • Steroid use • Autoimmune diseases
Hematocrit (Optimal: 37% – 44% female; 40% – 48% male)	• *Anemia's – iron deficient, B_{12}/folate, B_6 and copper* • *Nutrient deficiencies* • Pregnancy • Inflammation • Bone marrow insufficiency • Increased breakdown in spleen or liver • Chronic diseases	• *Dehydration* • *Exogenous testosterone or steroid hormone use* • *Hypoxia* • Respiratory distress, pulmonary disease • Smoking • Polycythemia Vera • Spleen hypofunction

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Marker	Decreased	Increased
Hemoglobin (Optimal: 13.5 – 14.5 female; 14 – 15 male)	• *Anemia's – iron deficient, B_{12}/folate, B_6 and copper* • *Internal bleeding or blood loss* • *Nutrient deficiencies* • Inflammation • Intestinal parasites • Pregnancy • Chronic disease	• *Dehydration* • *Exogenous testosterone use* • *Hypoxia* • Respiratory distress • Polycythemia Vera • Spleen hypofunction
Hemoglobin A1c (Optimal: 4.6 – 5.5)	• *Trending toward hypoglycemia*	• *Diabetes (if > 6.5)* • *Insulin resistance* • *Cardiovascular disease risk*
High Sensitivity CRP (Optimal: < 1.55 female; < 0.55 male)		• *Inflammation or infection* • *Increased sugar and fat intake* • *Periodontal disease* • *Hypertension* • Oral contraceptives or HRT • Smoking
Homocysteine (Optimal: < 7.2)		• *Nutrient deficiencies; specifically vitamin B* • *Atherosclerosis* • Kidney dysfunction • Genetic factors • Aging • Neurological issues • Neoplasms
Iron (Optimal: 85 – 130)	• *Iron deficient anemia* • *Hypochlorhydria* • Internal bleeding • Chronic illness • Bacterial infection	• *Liver dysfunction* • *Excess consumption* • Viral infection • Hemochromatosis or hemosiderosis • Thalassemia • Hemolytic or sideroblastic anemia

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Marker	Decreased	Increased
LDH (Optimal: 140 – 200)	• *Reactive hypoglycemia*	• *B_{12}/folate deficiency anemia* • *Liver or biliary obstruction* • *Cardiovascular disease* • Tissue destruction • Hemolytic anemia (>200) • Non-specific tissue inflammation • Mono, EBV, CMV • Hypothyroidism • Acute and chronic pancreatitis
LDL (Optimal: 80 – 100)	• *Need for exercise* • *Steroid hormone imbalances* • Hyperthyroidism • Severe liver disease • Coronary artery disease	• *Atherosclerosis* • *Inflammation / infection* • *Increased refined carb and fat intake* • *Metabolic Syndrome / Insulin resistance* • *Liver congestion / fatty liver* • Exogenous hormone intake • Elevated cortisol / hypothyroidism • Oxidative stress • Hyperlipidemia
Lymphocyte (Optimal: 24% – 44%)	• *Chronic viral infections* • Oxidative stress or free radical activity • Active infection of unknown cause • Bone marrow insufficiency	• *Acute viral infection* • *Chronic viral infections (with low WBC count)* • *Excessive systemic toxins* • Inflammation • Infectious mononucleosis
MCH (Optimal: 28.0 – 31.9)	• *Iron deficient anemia* • *B_6 anemia* • *Heavy menstrual bleeding* • *Vitamin C deficiency* • Heavy metal burden • Internal bleeding	• *B_{12}/folate anemia* • *Hypochlorhydria* • Alcoholism • Hypothyroidism • Liver disease • Pernicious anemia

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Marker	Decreased	Increased
MCHC (Optimal: 32.0 – 35.0)	• *Iron deficient anemia* • *B_6 anemia* • *Heavy menstrual bleeding* • *Vitamin C deficiency* • Heavy metal burden • Internal bleeding	• *B_{12}/folate anemia* • *Hypochlorhydria* • Alcoholism • Hypothyroidism • Liver disease • Pernicious anemia
MCV (Optimal: 82.0 – 89.9)	• *Iron deficient anemia* • *B_6 anemia* • *Heavy menstrual bleeding* • *Vitamin C deficiency* • Internal bleeding	• *B_{12}/folate anemia* • *Hypochlorhydria* • Alcoholism • Hypothyroidism • Liver disease • Pernicious anemia
Magnesium (Optimal: 2.2 – 2.5)	• *Magnesium deficiency* • *Poor dietary intake* • *Muscle spasms or cramps* • Hyperinsulinemia • Aging • Oral contraceptives or other HRT • Acute emotional stress • Antidiuretics	• Thyroid dysfunction • Anterior pituitary dysfunction • Kidney dysfunction
Methylmalonic Acid (Optimal: 0 – 260)		• *Parietal cell insufficiency* • *Vitamin B_{12} deficiency* • Impaired absorption of B_{12} • Kidney insufficiency
Monocyte (Optimal: 0% – 7%)		• *Recovery phase of acute infection* • *Intestinal parasites* • Liver dysfunction • BPH

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Marker	Decreased	Increased
Neutrophils (Optimal: 40% – 60%)	• *Chronic viral infections* • Leukemia • Pernicious anemia	• *Acute bacterial infections* • *Chronic bacterial infections* • Inflammation • Gout, RA, SLE • Dysbiosis
Phosphorus (Optimal: 3.0 – 4.0)	• *Hypochlorhydria* • *Excess sweating or dehydration* • *Excessive carbohydrate intake* • Parathyroid hyperfunction • Hyperinsulinemia • Alcoholism	• *Excess phosphorus consumption* • Calcium deposition • Osteoporosis • Kidney insufficiency • Parathyroid hypofunction • Bone growth and repair
Platelet (Optimal: 185 – 385 [x1000])	• *Infections* • *Oxidative stress* • *Folate/B_{12} deficiency*	• *Atherosclerosis* • *Inflammation* • Excessive antioxidant stress
Potassium (Optimal: 4.0 – 4.5)	• *Adrenal stress* • *Insufficient dietary intake* • Diuretic use • Hypertension	• *Dehydration* • *Metabolic acidosis* • Cell damage or destruction • Adrenal hypofunction
Protein (Optimal: 6.9 – 7.4)	• *Protein deficiency* • *Hypochlorhydria* • Liver dysfunction • Digestive dysfunction and/or inflammation	• *Dehydration* • Liver / biliary dysfunction • Increased globulin

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Marker	Decreased	Increased
Sodium (Optimal: 135 – 142)	• *Adrenal hypofunction* • *Dietary insufficiency* • *Excessive sweating* • Addison's disease • Diuretics, vomiting or diarrhea • Edema • Chronic renal insufficiency	• *Dehydration* • Cushing's disease • Adrenal stress • Water softeners • Congestive heart failure
Sodium/Potassium Ratio (Optimal: 30 – 35)	• Chronic stress • Adrenal insufficiency • Catabolism	• Acute stress • Possible inflammation
RBC (Optimal: 3.9 – 4.5 female; 4.2 – 4.9 male)	• *Anemia's – iron deficient, B_{12}/folate, B_6 and copper* • *Internal bleeding or blood loss* • *Nutrient deficiencies* • Inflammation • Pregnancy • Chronic disease – cancer, some AI conditions, kidney disease, sickle cell, thalassemia or hemolytic anemia	• *Dehydration* • *Hypoxia* • Respiratory distress • Polycythemia Vera • Spleen hypofunction
RDW (Optimal: 11.7 – 13.0)	• Post-hemorrhagic anemia	• *B_{12}/folate anemia* • *Iron deficient anemia*
Reticulocyte Count (Optimal: 0.5 – 1.5)	• *Anemia*	• *Occult bleeding* • Increased hemolysis
TIBC (Optimal: 250 – 350)	• *Iron overload* • Hemochromatosis / hemosiderosis • Chronic infection • Chronic illness	• *Iron deficiency anemia* • *Hypochlorhydria*

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Marker	Decreased	Increased
TSH (Optimal: 1.3 – 2.0)	• *Pituitary or hypothalamus dysfunction or signaling* • *Hyperthyroid or Graves' disease* • *Heavy metal burden* • *Thyroid medications* • *Hashimoto's*	• *Primary Hypothyroidism* • *Anterior pituitary dysfunction* • *Liver congestion* • *Hashimoto's* • *Stress* • *Sex hormone dysfunction* • Thyroiditis
Transferrin (Optimal: 200 – 370)	• *Iron overload* • *Inflammation or infection* • Liver disease • Malnutrition • Sideroblastic and hemolytic anemias • Blood transfusions	• *Hormonal changes (ex: oral contraceptives)* • *Iron deficiency anemia*
% Transferrin Saturation (Optimal: 25% – 35%)	• *Iron-deficient anemia* • *Hypochlorhydria* • Chronic infection or illness	• *Iron overload* • Hemochromatosis / hemosiderosis • Sideroblastic anemia • Hemolytic anemia
Triglycerides (Optimal: 70 – 80)	• *Protein malnutrition* • *Insufficient fat intake* • *Liver or biliary dysfunction* • Autoimmune disorders • Hyperthyroidism	• *High carb or high fat diet* • Cardiovascular disease • *Poor metabolism of fats* • Primary hypothyroidism • *Atherosclerosis* • Secondary hypothyroidism / anterior pituitary dysfunction • *Liver congestion / fatty liver* • Alcoholism • *Metabolic Syndrome / Insulin resistance* • Estrogen or oral contraceptives • *Excess fructose consumption* • Early stage dysglycemia

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Marker	Decreased	Increased
UIBC (Optimal: 130 – 300)	• *Iron overload* • Hemochromatosis / hemosiderosis • Microscopic bleeding • Chronic infection or illness • Hemolytic anemia • Sideroblastic anemia	• *Iron deficiency anemia* • *Hypochlorhydria*
Uric Acid (Optimal: 3.0 – 5.5 female; 3.5 – 5.9 male)	• *B_{12}/folate anemia* • *Molybdenum deficiency* • Copper deficiency • Pregnancy • Aspirin use • Heavy metals • Corticosteroids	• *Atherosclerosis* • Oxidative stress • *Metabolic Syndrome* • Bone spurs • Inflammation • Gout • Hypertension • Renal dysfunction • Raynaud's • Cirrhosis • Rheumatoid arthritis • Increased cellular destruction • Stroke
Vitamin B_{12} (Optimal: 450 – 800)	• *Poor dietary intake or vegan/vegetarian* • *Malabsorption* • *Hypochlorhydria* • SIBO / Celiac • Pancreatic insufficiency • Pernicious anemia • Gastric bypass	• *Inadequate tissue uptake* • Neoplasms • Diabetes • Severe liver disease

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Marker	Decreased	Increased
Vitamin D (Optimal: 35 – 50)	• *Insufficient dietary intake* • *Decreased cholesterol* • Impaired liver function • Renal insufficiency	• *Vitamin D overdose* • *Elevated serum calcium* • Abnormal calcium accumulation
WBC (Optimal: 5.5 – 7.5)	• *Chronic viral infection* • *Chronic bacterial infection* • *Pancreatic insufficiency* • Bone marrow insufficiency • Raw food diet • Systemic Lupus Erythematosus • High-performance athletes	• *Acute viral infection* • *Acute bacterial infection* • *Stress* • Intestinal parasites • Diet high in refined foods • Certain cancers

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4. Common Patterns

Marker	Decreased	Increased
Adrenal Hyperfunction	• Potassium (< 4.0) • Cholesterol (< 180) • Triglycerides (< 70)	• Sodium (> 142) • Chloride (> 106) • CO_2 (> 30) • BUN (> 16)
Adrenal Hypofunction	• Sodium (< 135) • Chloride (< 100) • Glucose (< 75)	• Potassium (> 4.5) • Cholesterol (> 220) • Triglycerides (> 80)
Alcohol Use		• GGT (> 30) • Triglycerides (> 80) • ALT (> 30 – possible) • AST (> 30 – possible)
Anemia – B_6	• Hematocrit (< 37% female; < 40% male) • MCV (< 82) • MCH (< 28) • MCHC (< 32)	• Hemoglobin (N or > 14.5 female; N or > 15 male) • Serum iron (N or > 100)
Anemia – B_{12}/Folate Deficiency	• RBCs (< 3.9) • HCT (< 37% female; < 40% male) • HGB (< 13.5 female; < 14 male) • WBCs (< 5.5) • Neutrophils (< 40%) • Uric acid (< 3.0 female; < 3.5 male) • Serum B_{12} (< 450) • Folate (< 15)	• MCH (> 31.9) • MCV (> 89.9 – if above 99, not being absorbed well; may need IM) • RDW (> 13) • MCHC (> 35) • LDH (> 200) • Methylmalonic Acid (> 260) • Homocysteine (> 7.2)

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Marker	Decreased	Increased
Anemia – Copper Deficiency	• Uric acid (< 3.5) • HCT (< 37% female; < 40% male) • HGB (< 13.5 female; < 14 male) • RBCs (< 3.9 female; < 4.2 male)	• MCV (> 89.9) • MCH (N or > 31.9) • Bilirubin (> 1.2) • Alk phos (> 100)
Anemia – Iron Deficiency	• Serum iron (< 85) • Ferritin (< 30) • % Transferrin saturation (< 25%) • RBCs (N or < 3.9 female; N or < 4.2 male) • HGB (< 13.5 female; < 14 male) • HCT (N or < 37% female; N or < 40% male) • MCV (< 82) • MCH (< 28) • MCHC (< 32) • Globulin (< 2.4) • Phosphorus (< 3.0)	• TIBC (> 350) • Transferrin (> 370) • Globulin (> 2.8 if hypochlorhydria is present) • RDW (> 13.0)
Anemia – Vitamin C	• RBC (< 3.9 female; < 4.2 male) • HGB (< 13.5 female; < 14 male) • HCT (< 37% female; < 40% male) • MCH (< 28) • MCHC (< 32) • Serum iron (< 50)	• MCV (> 89.9)
Atherosclerosis	• HDL (< 55)	• Triglycerides (> 80) • Cholesterol (N or > 220) • LDL (> 100) • Uric acid (> 5.9) • Platelets (> 385) • C-reactive protein (> 1.5 female; > 0.55 male) • Homocysteine (> 7.2) • Fibrinogen (> 369)

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Marker	Decreased	Increased
Bacterial Infection – Acute	• Lymphocytes (N or < 24%)	• Neutrophils (> 60%) • WBC's (> 7.5) • Monocytes (N or > 7% – recovery phase)
Bacterial Infection – Chronic	• Lymphocytes (< 24%) • WBCs (< 5.5)	• Neutrophils (N or > 60%)
Biliary Dysfunction	• Triglycerides (< 70) • Cholesterol (< 160)	• Alk phos (> 100) • GGT (> 30) • ALT (> 30) • LDH (> 200)
Biliary Obstruction		• Alk phos (> 100) • GGT (> 30) • ALT (> 30) • LDH (> 200) • Bilirubin (> 1.2) • Indirect bilirubin (> 0.2)
Biliary Obstruction – Extrahepatic		• Alk phos (> 140) • GGT (> 85) • ALT (N or > 55) • AST (N or > 55)
Biliary Stasis / Insufficiency		• Cholesterol (> 220) • ALT (> 30) • GGT (> 30) • Bilirubin (> 1.2) • Alk phos (> 100)
Bone Marrow Insufficiency	• WBCs (all are below reference range) • RBCs (< 3.9 female; < 4.2 male) • HCT (< 37% female; < 40% male) • HGB (< 13.5 female; < 14 male)	

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Marker	Decreased	Increased
Cardiovascular Disease Risk	• HDL (< 55) • Vitamin D (< 30)	• Triglycerides (> 80) • Cholesterol (> 220) • LDL (> 100) • LDH (> 200) • AST (> 30) • C-reactive protein (> 1.5 female; > 0.55 male) • Fibrinogen (> 369) • Homocysteine (> 7.2) • Serum Iron (> 160)
Dehydration	• Phosphorus (< 3.0)	• RBCs (> 4.5 female; > 4.9 male) • HGB (> 14.5 female; > 15 male) • HCT (> 44% female; > 48% male) • Sodium (> 142 – possible) • Potassium (> 4.5 – possible) • Chloride (> 106 – possible) • Creatinine (> 1.1 – possible) • Total protein (> 7.4 – chronic) • Albumin (> 5.0 – chronic) • BUN (> 16 – chronic)
Detoxification – Poor	• Uric acid (< 3.0 female; < 3.5 male)	
Diabetes / Hyperglycemia	• HDL (< 55)	• Glucose (> 86) • Hemoglobin A1c (> 4.5) • Fasting insulin (> 15) • Cholesterol (> 220) • Triglycerides (> 80) • BUN (> 16) • Creatinine (> 1.1) • C-Peptide (> 1.6)

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Marker	Decreased	Increased
Digestive Dysfunction or Inflammation	• Total protein (< 6.9) • Globulin (< 2.4) • Phosphorous (< 3.0) • Creatinine (< 0.8)	• BUN (> 16) • Basophils (> 1%)
Edema	• Sodium (< 135) • Albumin (< 4.0)	• BUN (> 16)
Fatty Liver	• ALT (< 10) • Albumin (< 4.0) • HDL (< 55)	• Cholesterol (> 220) • LDL (> 100) • Triglycerides (> 80) • Uric acid (> 4.5) • ALT (if higher than AST or GGT, advanced fatty liver is possible) • Ferritin (> 90)
Gout	• Phosphorus (< 3.0)	• Uric Acid (> 5.0) • Cholesterol (> 220) • BUN (N or > 16)
Heavy Metals or Chemical Toxicity	• Uric acid (< 3.5) • Cholesterol (< 180) • HDL (< 55) • MCH (< 28) • MCHC (< 32) • RBC (< 3.9) • Hemoglobin (< 13.5 female; < 14 male) • Hematocrit (< 37%) • TSH (< 1.3) • Platelets (< 155) • Bilirubin (< 0.3)	• Globulin (> 2.8)

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Marker	Decreased	Increased
Hemochromatosis	• TIBC (< 250)	• Serum iron (> 130) • Ferritin (> 1000) • % Transferrin saturation (> 35%) • AST (> 30)
Hyperinsulinemia	• Glucose (< 75) • HDL (< 55) • Phosphorus (< 3.00)	• Triglycerides (> 80) • Cholesterol (> 220) • Fasting Insulin (> 5)
Hyperlipidemia	• HDL (< 55)	• Triglycerides (> 80) • Cholesterol (> 220) • LDL (> 100)
Hyperpermeability	• BUN (< 10) • Iron deficient anemia • B_{12} deficiency anemia	• Alk phos (> 100) • Uric acid (> 5.9)
Hypochlorhydria	• Total protein (N or < 6.9) • Albumin (N or < 4.0) • Phosphorous (< 3.0) **Other Hypochlorhydria Indicators** • Alk phos (< 70) • Calcium (N or < 9.2) • Iron (< 50) • CO_2 (< 25)	• BUN (> 16) • Globulin (> 2.8) **Other Hypochlorhydria Indicators** • MCV (> 90) • MCH (> 31.9) • Anion Gap (> 12)
Hypoglycemia	• Glucose (< 75) • Hemoglobin A1c (< 4.1%) • LDH (< 140)	• ALT (> 30)
Immune Activation	• Albumin/Globulin Ratio (< 1.5)	• Globulin (> 2.8)

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Marker	Decreased	Increased
Immune Insufficiency	• Albumin (< 4.0) • Globulin (< 2.0) • WBCs (< 5.5) • Alk phos (< 70)	
Insulin Resistance		• Glucose (> 86) • Hemoglobin A1c (> 5.5) • C-Peptide (> 1.6) • Triglycerides (> 80) • Cholesterol (> 220) • Insulin (> 5)
Internal Bleeding	• TIBC (< 250) • Transferrin (< 200)	• Reticulocyte count (> 1%)
Intestinal Parasites	• Serum iron (N or < 85) • HGB (N or < 13.5 female; N or < 14 male) • HCT (N or < 37% female; N or < 40% male)	• Eosinophils (> 3%) • Basophils (N or > 1%) • Monocytes (N or > 7%) • IgE (increased)

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<table>
<tr><th>Marker</th><th>Decreased</th><th>Increased</th></tr>
<tr><td>Iron Disorder Patterns</td><td colspan="2">
<table>
<tr><th></th><th>Iron</th><th>Ferritin</th><th>% Sat</th><th>TIBC</th><th>Transferrin</th><th>HCB</th></tr>
<tr><td>Hemochromatosis</td><td>↑</td><td>↑</td><td>↑</td><td>↓</td><td>↓</td><td>Normal</td></tr>
<tr><td>Sideroblastic anemia</td><td>↑</td><td>↑</td><td>↑</td><td>↓</td><td>↓</td><td>↓</td></tr>
<tr><td>Thalassemia</td><td>↑</td><td>↑</td><td>↑</td><td>↓</td><td>↓</td><td>↓</td></tr>
<tr><td>Anemia of chronic disease</td><td>↓</td><td>↑ or N</td><td>↓ or N</td><td>↓ or N</td><td>↓ or N</td><td>↓</td></tr>
<tr><td>Iron deficient</td><td>↓</td><td>↓</td><td>↓</td><td>↑</td><td>↑</td><td>↓</td></tr>
<tr><td>Vitamin B_{12} def</td><td>↑ or N</td><td>↑ or N</td><td>↑ or N</td><td>↓ or N</td><td>↓ or N</td><td>↓</td></tr>
</table>
</td><td></td></tr>
<tr><td>Iron Overload</td><td></td><td>• Serum iron (> 130)
• Ferritin (80 – 160 moderate; < 160 significant)
• % Transferrin saturation (> 35%)
• ALT (> 40)</td></tr>
<tr><td>Kidney Disease</td><td>• eGFR (< 60)</td><td>• BUN (> 25)
• Creatinine (> 1.5)
• Uric acid (> 9.0)
• Phosphorus (> 4.5)
• LDH (> 240)
• AST (> 40)</td></tr>
<tr><td>Kidney Insufficiency</td><td>• eGFR (< 90)</td><td>• BUN (> 16)
• Creatinine (N or > 1.1)
• BUN/Creatinine ratio (< 22)
• Uric acid (N or > 5.5 female; N or > 5.9 male)
• Phosphorus (> 4.0)</td></tr>
</table>

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Marker	Decreased	Increased
Liver Cell Damage		• Globulin (> 28) • Alk phos (> 100) • AST (> 30) • ALT (> 30) • GGT (> 30)
Liver Dysfunction	• Albumin (< 4.0) • Total protein (< 6.9 – possible) • BUN (< 10) • Albumin/globulin ratio (< 1.4) • Triglycerides (< 70 – possible) • Cholesterol (< 180 – possible) • Uric acid (< 3.0 – possible)	• ALT (> 30) • LDH (> 200 – possible) • AST (> 30) • Bilirubin (> 1.2 – possible) • Direct bilirubin (> 0.2) • Serum iron (> 130 – possible) • Ferritin (> 70 – possible) • Alk phos (> 80 – possible) • Uric acid (> 4.5)
Low Protein Diet	• BUN (< 10) • Total protein (< 6.9) • Creatinine (< 0.9) • Albumin (< 4.0)	
Magnesium Deficiency	• Serum magnesium (< 2.2) • RBC magnesium (< 6) • GGT (< 10)	
Metabolic Acidosis	• CO_2 (< 25)	• Chloride (> 106) • Anion gap (> 12) • Potassium (N or > 4.5)
Metabolic Alkalosis	• Chloride < 100) • Calcium (< 9.2) • Potassium (N or < 4.0)	• CO_2 (> 30)

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Marker	Decreased	Increased
Metabolic Syndrome	• HDL (< 55)	• Glucose (> 86) • Triglycerides (> 80) • Cholesterol (> 220) • LDL (> 100) • Uric acid (> 4.5) • Hemoglobin A1c (> 5.5) • Fasting insulin (> 5)
Mononucleosis	• WBCs (decreased 1st week; increased in 2nd week)	• Lymphocytes (> 44% – can be extremely elevated) • LDH (> 200 – elevated in 95% of mono and EBV)) • Alk phos (> 80 – 5-14 days after onset) • GGT (> 30 – 7-21 days after onset)
Muscle Atrophy or Breakdown	• Creatinine (< 0.8)	• AST (> 30) • ALT (> 30)
Oxidative Stress / Free Radical Activity	• Lymphocytes (< 24%) • Cholesterol (below historical average) • Albumin (< 4.0) • Platelets (< 150)	• LDL (> 100) • Uric acid > 5.5 female; > 5.9 male) • Globulin (> 2.8) • Bilirubin (> 1.2) • Ferritin (> 70)
Pancreatic Insufficiency	• WBCs (< 5.5) • BUN (< 10)	• GGTP (> 30)
Parasites		• Eosinophils (> 3%) • Basophils (N or > 1%) • Monocytes (N or > 7%)
Parathyroid Hyperfunction	• Phosphorous (< 3.0)	• Calcium (> 10.0)
Parathyroid Hypofunction	• Calcium (< 9.2)	• Phosphorous (> 4.0)

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Marker	Decreased	Increased
Poor Fat Metabolism		• Triglycerides (> 80) • Cholesterol (> 220)
Posterior Pituitary Dysfunction	• BUN (< 10) • BUN/Creatinine Ratio (< 10)	
Reactive Hypoglycemia	• Glucose (< 75) • Hemoglobin A1c (< 4.1%) • LDH (< 140)	
Renal Disease		• Creatinine (> 1.1) • BUN (> 16) • BUN/Creatinine Ratio (> 16) • Uric acid (> 5.9) • Phosphorous (> 4.0) • LDH (> 200) • AST (> 30)
Renal Insufficiency	• eGFR (< 90)	• BUN (> 16) • Creatinine (N or > 1.1) • Uric acid (N or > 5.9) • Phosphorous (> 4.0)
Selenium Deficiency	• Total T3 (< 90) • T3 Uptake (< 27%) • Free T3 (< 3.0)	
Thiamine Deficiency	• CO_2 (< 25) • HCT (N or < 37% female; N or < 40% male) • HGB (N or < 13.5 female; N or < 14 male) • LDH (< 140 – possible)	• Glucose (N or > 86) • Anion Gap (> 12)

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Marker	Decreased	Increased
Thyroid Hypofunction (Primary)	• Total T3 (< 90) • Total T4 (< 6.0) • Free T3 (< 3.0) • Free T4 (< 1.0) • T3 Uptake (< 27%)	• TSH (> 2.0) • Triglycerides (> 80) • Cholesterol (> 220)
Thyroid Hypofunction (Secondary)	• TSH (< 2.0) • T3 Uptake (< 27%) • Total T3 (< 90) • Free T3 (< 3.0)	• Triglycerides (> 80) • Cholesterol (> 220) • BUN (> 16) • Reverse T3 (> 27)
Thyroid Hyperfunction	• Triglycerides (< 70) • Cholesterol (< 180) • HDL (< 55) • TSH (< 1.3)	• Total T3 (> 168) • Total T4 (> 12) • T3 Uptake (> 37%)
Thymus Insufficiency		• Bilirubin (> 1.2) • HGB (> 14.5 female; > 15.0 male) • HCT (> 44% female; > 48% male) • RBCs (> 4.5 female; > 4.9 male)
Tissue Inflammation / Destruction (GI, tendons/ bursa, sinusitis, musculoskeletal)		• Sed rate (> 10 female; > 5 male) • Potassium (> 4.5) • Basophils (> 1%) • Alk phos (> 100 – isoenzymes increased with liver, bone or gastric inflammation)
Viral Infection – Acute	• Neutrophils (N or < 40%)	• WBCs (> 7.5) • Lymphocytes (> 44%) • Monocytes (> 7% – recovery phase)
Viral Infection – Chronic	• WBCs (< 5.5) • Neutrophils (N or < 40%) • Lymphocytes (< 24% – very chronic infections)	• Lymphocytes (> 44%)

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Marker	Decreased	Increased
Vitamin B_6 Deficiency	• HCT (< 37% female; < 40% male) • HGB (< 13.5 female; < 14 male) • AST (< 10) • GGT (< 10) • ALT (< 10) • MCV (< 82) • MCH (< 28) • MCHC (< 32)	• Homocysteine (> 7.2)
Vitamin B_{12}/Folate Deficiency	• RBCs (< 3.9 female; < 4.2 male) • HCT (< 37% female; < 40% male) • HGB (< 13.5 female; < 14 male) • Total WBC (< 5.5) • Neutrophils (< 40%) • Uric acid (< 3.5)	• MCH (> 31.9) • MCV (> 89.9) • RDW (> 13) • Serum iron (> 130) • LDH (> 200) • Homocysteine (> 7.2)
Vitamin C Deficiency	• Albumin (< 4.0) • MCH (< 28) • MCHC (< 32) • HGB (< 13.5 female; < 14 male) • HCT (< 37% female; < 40% male) • RBCs (< 3.9 female; < 4.2 male) • Serum iron (< 85)	• MCV (> 89.9) • Alk phos (> 100) • Fibrinogen (> 300)
Zinc Deficiency	• Alk phos (< 70)	

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5. Other Charts

Key Anemia Markers			
Marker	M/F	Standard Lab Range	Optimal
RBC	Male	4.2 – 5.8	4.2 – 4.9
	Female	3.8 – 5.1	3.9 – 4.5
HGB	Male	13.2 – 17.1	14.0 – 15.0
	Female	11.7 – 15.5	13.5 – 14.5
HCT	Male	38.5% – 50%	40% – 48%
	Female	35% – 45%	37% – 44%

Direct and Indirect Bilirubin			
Marker	Standard Reference Range	Optimal Range	Alarm Range
Indirect	0.1 – 1.2	0.1 – 0.7	> 1.8
Direct	0 – 0.2	0 – 0.19	> 0.8

Dysfunction	Fasting Insulin	Fasting Glucose
Insulin Resistance or Metabolic Syndrome	> 15	Normal or > 100
Type I Diabetes	< 5	> 125
Type II Diabetes	Normal or > 100	< 80

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Liver Triad			
Marker	Standard Reference Range	Optimal Range	Alarm Range
ALT	0 – 29	10 – 26	> 100
AST	0 – 35	10 – 26	> 100
GGT	3 – 70	10 – 30	> 100

Transferase Enzyme Locations		
ALT	AST	GGTP
Liver Skeletal muscle Heart Kidney	Skeletal muscle Heart Liver Kidney Lungs	Liver/gall bladder Prostate Pancreas

LDH Isoenzyme Locations				
LDH-1	LDH-2	LDH-3	LDH-4	LDH-5
Heart RBCs	Heart Lymph RBCs	Lung Spleen Adrenals Kidney Pancreas	Liver Skeletal muscle Prostate Uterus Skin	Liver Skeletal muscle Skin

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Zinc Taste Time	Zinc Taste Intensity									
	Optimal			Mild		Moderate			Severe	
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										

- ❒ Optimal: Immediate, unpleasant taste within a few seconds
- ❒ Mild: Definite but not unpleasant taste within 4-6 seconds; can intensify with time
- ❒ Moderate: No taste initially but develops over 7-13 seconds; will be sweet or bitter
- ❒ Severe: No taste reported after 15 seconds

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