



# Functional Nutrition Evaluation

## Biomarkers: PFC-MVP Laboratory Testing

	1st Tier Clinically Useful, More Cost Effective	2nd Tier Clinically Useful, Less Cost Effective	3rd Tier Unique Associated Patterns, May Be Less Cost Effective
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P = Protein			
	<ul style="list-style-type: none"> <li>Total Protein</li> <li>Albumin</li> <li>Globulin</li> </ul>	<ul style="list-style-type: none"> <li>Prealbumin – Transthyretin</li> <li>Plasma Amino Acids</li> <li>Carnitine</li> </ul>	<ul style="list-style-type: none"> <li>Urinary Amino Acids</li> <li>Transferrin</li> <li>Fibronectin</li> <li>Somatomedin C</li> <li>3-Methylhistidine</li> <li>Serum Proteins Electrophoresis</li> </ul>

F = Fats			
	<ul style="list-style-type: none"> <li>Lipid Profile and Ratios               <ul style="list-style-type: none"> <li>Total Cholesterol (TC)</li> <li>Low Density Lipoprotein (LDL)</li> <li>High Density Lipoprotein (HDL)</li> <li>Triglycerides (TG)</li> </ul> </li> <li>Lipid Particle Number, Size and Subfractions</li> <li>TG/HDL Ratio</li> <li>Apolipoprotein B (ApoB)</li> <li>Apolipoprotein A1 (ApoA1)</li> <li>ApoB/A1 Ratio</li> </ul>	<ul style="list-style-type: none"> <li>Red Blood Cell Essential Fatty Acid Panel (RBC EFA)</li> <li>Omega 3 Index</li> <li>Plasma Essential Fatty Acid (EFA) Panel</li> <li>Oxidized LDL</li> </ul>	

C = Carbohydrates			
	<ul style="list-style-type: none"> <li>Fasting Blood Glucose</li> <li>Fasting Insulin               <ul style="list-style-type: none"> <li>Homeostatic Model Assessment of Insulin Resistance (HOMA-IR) Score</li> </ul> </li> <li>Hemoglobin A1c (HgA1c)</li> <li>Triglycerides</li> <li>Gamma-Glutamyl Transferase (GGT)</li> <li>Uric Acid</li> </ul>	<ul style="list-style-type: none"> <li>Adiponectin</li> <li>Fructosamine</li> </ul>	<ul style="list-style-type: none"> <li>½ hour Glucose Tolerance Test (gTT) for glucose and insulin</li> <li>1 and 2 hour gTT for glucose and insulin levels</li> </ul>

M = Minerals			
<b>Foundational</b>	<ul style="list-style-type: none"> <li>Complete Blood Count with differential (CBC w/diff)</li> <li>Comprehensive Metabolic Panel (CMP)</li> </ul>		
<b>Calcium</b>	<ul style="list-style-type: none"> <li>Serum Calcium (Ca<sup>2+</sup>)</li> <li>Ionized Calcium</li> </ul>		<ul style="list-style-type: none"> <li>Parathyroid Hormone (PTH)</li> <li>1,25-Dihydroxy Vitamin D<sub>3</sub> (1,25 OH<sub>2</sub> D<sub>3</sub>)</li> <li>25-Hydroxy Vitamin D<sub>3</sub> (25 OH<sub>2</sub> D<sub>3</sub>)</li> <li>Urinary Calcium</li> </ul>

## Functional Nutrition PFC-MVP Biomarkers

<b>Calcium</b> (cont.)			<ul style="list-style-type: none"> <li>■ Bone Resorption Markers (N-Telopeptide, 24 Hour Urine Calcium, 24 Hour Urine Protein, Pyridinium Crosslinks, Deoxypyridinoline,...)</li> </ul>
<b>Copper</b>	<ul style="list-style-type: none"> <li>■ Serum Copper</li> <li>■ Ceruloplasmin</li> </ul>	<ul style="list-style-type: none"> <li>■ Red Blood Cell (RBC) Copper</li> </ul>	
<b>Iodine</b>		<ul style="list-style-type: none"> <li>■ Spot First Morning Urine Iodine</li> <li>■ 24 Hour Urine Iodine</li> </ul>	
<b>Iron</b>	<ul style="list-style-type: none"> <li>■ Serum Iron</li> <li>■ Transferrin</li> <li>■ Total Iron Binding Capacity (TIBC)</li> <li>■ Ferritin</li> <li>■ Complete Blood Count (CBC)                             <ul style="list-style-type: none"> <li>■ Hemoglobin (Hgb)</li> <li>■ Hematocrit (Hct)</li> <li>■ Mean Corpuscular Volume (MCV)</li> <li>■ Mean Corpuscular Hemoglobin (MCH)</li> </ul> </li> <li>■ Hemachromatosis (HFE) Gene Panel</li> </ul>		
<b>Magnesium</b>	<ul style="list-style-type: none"> <li>■ Serum Magnesium (<math>Mg^{2+}</math>)</li> <li>■ Red Blood Cell (RBC) Magnesium</li> </ul>	<ul style="list-style-type: none"> <li>■ Buccal Cell Magnesium</li> <li>■ Ionized Magnesium by Nuclear Magnetic Resonance (NMR)</li> <li>■ Urinary Magnesium – 24 hour</li> </ul>	<ul style="list-style-type: none"> <li>■ Magnesium Load</li> </ul>
<b>Phosphorus</b>	<ul style="list-style-type: none"> <li>■ Serum Phosphorus</li> </ul>		
<b>Selenium</b>	<ul style="list-style-type: none"> <li>■ Serum Selenium</li> </ul>	<ul style="list-style-type: none"> <li>■ Red Blood Cell (RBC) Selenium</li> </ul>	<ul style="list-style-type: none"> <li>■ Glutathione Peroxidase</li> </ul>
<b>Zinc</b>	<ul style="list-style-type: none"> <li>■ Plasma Zinc (<math>Zn^{2+}</math>)</li> </ul>	<ul style="list-style-type: none"> <li>■ Red Blood Cell (RBC) Zinc</li> <li>■ Urinary Zinc – 24 hour</li> </ul>	<ul style="list-style-type: none"> <li>■ Serum Metallothionein</li> </ul>

## V = Vitamins

<b>Foundational</b>	<ul style="list-style-type: none"> <li>■ Complete Blood Count with differential (CBC w/diff)</li> </ul>		
<b>Fat Soluble</b>			
<b>Vitamin A</b>		<ul style="list-style-type: none"> <li>■ Serum Beta Carotene</li> <li>■ Serum Retinol</li> </ul>	<ul style="list-style-type: none"> <li>■ Retinol Binding Protein</li> </ul>
<b>Vitamin D</b>	<ul style="list-style-type: none"> <li>■ Serum 25-Hydroxy Vitamin <math>D_3</math> (<math>25\text{ OH}_2\text{ D}_3</math>)</li> </ul>	<ul style="list-style-type: none"> <li>■ Serum 1,25-Dihydroxy Vitamin <math>D_3</math> (<math>1,25\text{ OH}_2\text{ D}_3</math>)</li> </ul>	<ul style="list-style-type: none"> <li>■ Parathyroid Hormone (PTH)</li> <li>■ Ionized Calcium</li> <li>■ Vitamin D Receptor (VDR) Gene Panel – Fok1, Taq1, Bsm1 SNPs*</li> </ul>

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<b>Vitamin E</b>		<ul style="list-style-type: none"> <li>■ Serum Vitamin E <ul style="list-style-type: none"> <li>■ Alpha Tocopherol</li> <li>■ Gamma Tocopherol</li> </ul> </li> </ul>	
<b>Vitamin K</b>	<ul style="list-style-type: none"> <li>■ Prothrombin Time (PT)</li> <li>■ Partial Thromboplastin Time (PTT)</li> </ul>	<ul style="list-style-type: none"> <li>■ Serum Phylloquinone (Vitamin K1)</li> <li>■ Under-Carboxylated Osteocalcin</li> </ul>	
<b>Water Soluble</b>			
<b>Vitamin B1</b> (Thiamine)	<ul style="list-style-type: none"> <li>■ Plasma Thiamine</li> </ul>	<ul style="list-style-type: none"> <li>■ Red Blood Cell (RBC) Transketolase index</li> </ul>	<ul style="list-style-type: none"> <li>■ Urine Alpha Ketoacids <ul style="list-style-type: none"> <li>■ Isovalerate</li> <li>■ Isocaproate</li> <li>■ Methylvalerate</li> </ul> </li> <li>■ Plasma Isoleucine</li> </ul>
<b>Vitamin B2</b> (Riboflavin)	<ul style="list-style-type: none"> <li>■ Plasma Riboflavin</li> </ul>		<ul style="list-style-type: none"> <li>■ Urine Alpha Ketoacids <ul style="list-style-type: none"> <li>■ Methyl succinate</li> <li>■ Ethylmalonate</li> </ul> </li> </ul>
<b>Vitamin B3</b> (Niacin)			<ul style="list-style-type: none"> <li>■ Urine Lactate</li> <li>■ Urine Pyruvate</li> <li>■ N-Methylnicotinamide</li> </ul>
<b>Vitamin B6</b> (Pyridoxine)	<ul style="list-style-type: none"> <li>■ Homocysteine</li> <li>■ Plasma Pyridoxal-5 Phosphate (P5P)</li> </ul>	<ul style="list-style-type: none"> <li>■ Urine Xanthurenate</li> <li>■ Urine Kynurenate</li> </ul>	<ul style="list-style-type: none"> <li>■ Tryptophan Load Test</li> <li>■ Methionine Load Test</li> <li>■ Cystathionine-Beta-Synthase (CBS) SNPs*</li> </ul>
<b>Vitamin B7</b> (Biotin)		<ul style="list-style-type: none"> <li>■ Urine Alpha and Beta Hydroxyisovalerate</li> </ul>	
<b>Vitamin B9</b> (Folate)	<ul style="list-style-type: none"> <li>■ Serum Folate</li> <li>■ Homocysteine</li> <li>■ Mean Corpuscular Volume (MCV)</li> </ul>	<ul style="list-style-type: none"> <li>■ Red Blood Cell (RBC) Folate</li> <li>■ Urine Formiminoglutamic acid (FIGLU)</li> </ul>	<ul style="list-style-type: none"> <li>■ Unmetabolized Folic Acid</li> <li>■ Methylene tetrahydrofolate reductase (MTHFR) (677, 1298,...) SNPs*</li> <li>■ Catechol-O-Methyltransferase (COMT) SNPs*</li> </ul>
<b>Vitamin B12</b> (Cobalamin)	<ul style="list-style-type: none"> <li>■ Serum B12</li> <li>■ Homocysteine</li> <li>■ Methylmalonic Acid (MMA)</li> <li>■ Mean Corpuscular Volume (MCV)</li> <li>■ Mean Corpuscular Hemoglobin (MCH)</li> </ul>		<ul style="list-style-type: none"> <li>■ Methionine Synthase (MTR) SNPs*</li> <li>■ Methionine Synthase Reductase (MTRR) SNPs*</li> </ul>
<b>Vitamin C</b> (Ascorbic Acid)			<ul style="list-style-type: none"> <li>■ Serum Vitamin C</li> <li>■ White Blood Cell (WBC) Vitamin C</li> </ul>

## P = Phytonutrients

		<ul style="list-style-type: none"> <li>■ Lipid Peroxides</li> <li>■ Oxidized LDL</li> <li>■ 8-Hydroxydeoxyguanosine (8-OHdG)</li> <li>■ Total Antioxidant Capacity</li> </ul>	<ul style="list-style-type: none"> <li>■ Red Blood Cell (RBC) Glutathione</li> <li>■ Serum Coenzyme Q10 (CoQ10)</li> </ul>
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\*SNPs = Single nucleotide polymorphisms