Important Biomarkers

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1 Heart Health

- **Apolipoprotein B (ApoB)**:
  - **Function**: A primary protein in LDL cholesterol responsible for carrying cholesterol throughout the bloodstream.
  - **Normal Range**: 40-125 mg/dL
  - **Issues if less than normal**: Rare, but can indicate abetalipoproteinemia.
  - **Issues if more than normal**: Increased risk of heart disease.
- **HDL cholesterol**:
  - **Function**: Known as "good" cholesterol, it helps to remove LDL cholesterol from the arteries.
  - **Normal Range**: 40-60 mg/dL
  - **Issues if less than normal**: Increased risk of heart disease.
  - **Issues if more than normal**: Generally considered protective against heart disease.
- **LDL cholesterol**:
  - **Function**: Known as "bad" cholesterol, it can build up on artery walls, leading to atherosclerosis.
  - **Normal Range**: <100 mg/dL optimal
  - **Issues if above optimal**: Increased risk of heart disease.
- **Triglycerides**:
  - **Function**: A type of fat found in the blood used by the body for energy.
  - **Normal Range**: <150 mg/dL
  - **Issues if more than normal**: Can increase the risk of heart disease.
- **Total cholesterol**:
  - **Function**: Measures the total amount of cholesterol in the blood, including HDL, LDL, and other lipid components.
  - **Normal Range**: <200 mg/dL
  - **Issues if more than normal**: Increased risk of heart disease.

2 Hormone Balance

- **Estradiol (Female only)**:
  - **Function**: A form of estrogen, the primary female sex hormone. It regulates the menstrual cycle and supports reproductive health.

  - **Normal Range**: Varies based on menstrual cycle phase, 15-350 pg/mL (follicular phase), up to 2000 pg/mL (mid-cycle), and 30-450 pg/mL (luteal phase).
  - **Issues if less than normal**: Can lead to menstrual irregularities, hot flashes, night sweats, vaginal dryness, and mood changes.
  - **Issues if more than normal**: Can increase risk of breast cancer and endometrial cancer.
- **Progesterone (Female only)**:
  - **Function**: Plays a key role in the menstrual cycle and pregnancy.
  - **Normal Range**: Varies based on menstrual cycle phase, <1 ng/mL (follicular phase), 5-20 ng/mL (luteal phase).
  - **Issues if less than normal**: Can lead to menstrual irregularities and infertility.
  - **Issues if more than normal**: Can result in depression, weight gain, frequent urination, and bloating.
- **Thyroid-stimulating hormone (TSH)**:
  - **Function**: Stimulates the thyroid gland to produce thyroid hormones.
  - **Normal Range**: 0.4-5.0 mIU/L
  - **Issues if less than normal**: Indicates hyperthyroidism, leading to rapid heartbeat, anxiety, weight loss, and tremors.
  - **Issues if more than normal**: Indicates hypothyroidism, leading to fatigue, weight gain, dry skin, and

    Issues if more than normal: Indicates hypothyroidism, leading to fatigue, weight gain, dry skin, and cold sensitivity.
- **Testosterone (Male)**:
  - **Function**: The primary male sex hormone responsible for development of male characteristics.
  - **Normal Range**: 280-1,100 ng/dL
  - **Issues if less than normal**: Fatigue, depression, decreased libido, and osteoporosis.
  - **Issues if more than normal**: Aggression, acne, testicular atrophy, and increased risk of heart disease.
- **Testosterone (Female)**:
  - **Function**: Supports ovarian function and bone strength.
  - **Normal Range**: 15-70 ng/dL
  - **Issues if less than normal**: Decreased libido, fatigue, and mood disturbances.
  - **Issues if more than normal**: Acne, irregular menstrual cycles, and excess hair growth.

3 More Hormone - Thyroid Issues

- **Free T3 (Triiodothyronine)**:
  - **Function**: Active thyroid hormone that regulates metabolism.
  - **Normal Range**: 2.0-4.4 pg/mL
  - **Issues if less than normal**: Indicates hypothyroidism.
  - **Issues if more than normal**: Indicates hyperthyroidism.
- **Free T4 (Thyroxine)**:

  - **Function**: Precursor to T3 and a storage form of thyroid hormone.
  - **Normal Range**: 0.9-2.3 ng/dL
  - **Issues if less than normal**: Indicates hypothyroidism.
  - **Issues if more than normal**: Indicates hyperthyroidism.
- **Thyroid Peroxidase Antibodies (TPOAb)**:
  - **Function**: Detects the presence of antibodies against thyroid peroxidase, an enzyme in the thyroid gland.
  - **Normal Range**: 0-34 IU/mL
  - **Issues if more than normal**: Can indicate an autoimmune thyroid disorder, such as Hashimoto's thyroiditis or Graves' disease.
- **Thyroglobulin Antibodies (TgAb)**:
  - **Function**: Measures the level of antibodies against thyroglobulin, a protein made by the thyroid gland.
  - **Normal Range**: 0-0.9 IU/mL
  - **Issues if more than normal**: Can indicate an autoimmune thyroid disorder, often seen in Hashimoto's thyroiditis.

4 Kidney Function

- **Creatinine**:
  - **Function**: Indicates kidney function; produced when creatine, used for muscle energy, breaks down.
  - **Normal Range**: 0.8-1.4 mg/dL for males, 0.6-1.2 mg/dL for females.
  - **Issues if less than normal**: Possible liver disease or malnutrition.
  - **Issues if more than normal**: Potential kidney dysfunction or disease.
- **Blood Urea Nitrogen (BUN)**:
  - **Function**: Measures the amount of urea nitrogen in the blood, which is a waste product from protein metabolism.
  - **Normal Range**: 7-20 mg/dL
  - **Issues if more than normal**: Potential kidney dysfunction.

5 Liver Function

- **Alanine Aminotransferase (ALT)**:
  - **Function**: An enzyme found in the liver; high levels may indicate liver damage.
  - **Normal Range**: 7-56 U/L
  - **Issues if more than normal**: Potential liver damage or disease.
- **Aspartate Aminotransferase (AST)**:
  - **Function**: An enzyme found in the liver and heart; high levels may indicate damage.
  - **Normal Range**: 10-40 U/L
  - **Issues if more than normal**: Potential liver or heart damage.

6 Blood Health

- **Hemoglobin**:
  - **Function**: A protein in red blood cells that carries oxygen.
  - **Normal Range**: 13.8-17.2 g/dL for males, 12.1-15.1 g/dL for females.
  - **Issues if less than normal**: Potential anemia.
  - **Issues if more than normal**: Risk of heart disease or other conditions.
- **White Blood Cell (WBC) Count**:
  - **Function**: Measure of the body's immune response.
  - **Normal Range**: 4,500-11,000 WBCs/mcL
  - **Issues if less than normal**: Possible immune deficiency.
  - **Issues if more than normal**: Infection, inflammation or other conditions.

7 Sleep

- **Magnesium**:
  - **Function**: Magnesium is a mineral crucial for nerve transmission, muscle contraction, and overall cellular function. In the context of sleep, it plays a role in the regulation of neurotransmitters, which send signals throughout the nervous system and brain. It also regulates the hormone melatonin, which guides sleep-wake cycles in the body.
  - **Normal Range**: 1.7 - 2.2 mg/dL
  - **Issues if less than normal**: Deficiency can lead to insomnia, restless sleep, waking frequently during the night, and other sleep-related disorders.
  - **Issues if more than normal**: Excess magnesium, usually due to supplementation, can cause diarrhea, nausea, abdominal cramping, and irregular heartbeat.
- **Red blood cell (RBC) magnesium**:
  - **Function**: Measures the amount of magnesium inside the red blood cells. This can be a better indicator of the body's magnesium status than a regular serum magnesium test because the majority of the body's magnesium is stored inside cells.
  - **Normal Range**: 4.2 - 6.8 mg/dL
  - **Issues if less than normal**: Similar to low serum magnesium, low RBC magnesium can be linked to poor sleep quality and insomnia.
  - **Issues if more than normal**: Excess RBC magnesium can indicate kidney dysfunction or hypothyroidism.
- **Vitamin D**:
  - **Function**: Vitamin D is important for bone health, immune function, and inflammation regulation. Low levels have been associated with a range of health problems, including disrupted sleep and reduced sleep duration.
  - **Normal Range**: 20 - 50 ng/mL
  - **Issues if less than normal**: Deficiency can lead to bone pain, fatigue, mood changes, and poor sleep.
  - **Issues if more than normal**: Excessive vitamin D can lead to hypercalcemia, which

causes nausea, vomiting, muscle weakness, and serious complications like kidney damage.

8 Inflammation

- **High-sensitivity c-reactive protein (hsCRP)**:
  - **Function**: hsCRP is a protein produced by the liver and is a marker of inflammation in the body. It's particularly useful for assessing the risk of cardiovascular diseases.
  - **Normal Range**: <3 mg/L
  - **Issues if more than normal**: Elevated levels suggest an increased risk of heart attacks and strokes. High hsCRP levels can also indicate an inflammatory condition such as rheumatoid arthritis or lupus.
- **White blood cell count (WBC)**:
  - **Function**: White blood cells are key components of the immune system, helping to fight off infections and other diseases.
  - **Normal Range**: 4,500 - 11,000 cells/mcL
  - **Issues if less than normal**: A low count can increase susceptibility to infections.
  - **Issues if more than normal**: Elevated WBC can indicate an infection, inflammation, an autoimmune disorder, or other conditions.
- **Neutrophils**:
  - **Function**: They are the most common type of white blood cell and are the first responders to infections.
  - **Normal Range**: 55-70% of total WBC
  - **Issues if less than normal**: A deficiency can lead to frequent infections.
  - **Issues if more than normal**: Elevated levels can be seen in various conditions like acute infections, stress, or inflammation.
- **Basophils**:
  - **Function**: Basophils release histamine and are involved in allergic reactions.
  - **Normal Range**: 0.5-1% of total WBC
  - **Issues if more than normal**: Elevated levels can indicate allergic reactions or certain types of leukemia.
- **Eosinophils**:
  - **Function**: Eosinophils are involved in combating parasitic infections and are also a component of allergic reactions.
  - **Normal Range**: 1-4% of total WBC
  - **Issues if more than normal**: High levels can indicate a parasitic infection, allergic reactions, or certain autoimmune diseases.
- **Lymphocytes**:
  - **Function**: Lymphocytes include T cells and B cells and are crucial for the immune system's adaptive response.
  - **Normal Range**: 20-40% of total WBC
  - **Issues if less than normal**: Low levels can be a sign of an immune system disorder or prolonged illness.

  - **Issues if more than normal**: Elevated levels can indicate conditions such as chronic viral infections or certain types of cancer.
- **Monocytes**:
  - **Function**: Monocytes are a type of white blood cell that transform into macrophages to combat infections.
  - **Normal Range**: 2-8% of total WBC
  - **Issues if more than normal**: Increased levels can indicate chronic inflammation, certain types of leukemia, or viral infections.

9 Metabolism

- **Insulin (US only)**:
  - **Function**: Insulin is a hormone produced by the pancreas that regulates glucose levels in the blood. It facilitates the uptake of glucose into cells, providing them with energy.
  - **Normal Range**: 2.6-24.9 microU/mL (values might vary slightly depending on the laboratory)
  - **Issues if less than normal**: Low levels can indicate type 1 diabetes or a rare type of type 2 diabetes.
  - **Issues if more than normal**: Elevated levels suggest insulin resistance, often a precursor to type 2 diabetes.
- **Glucose**:
  - **Function**: Glucose is the main source of energy for cells in the body. Blood glucose levels are regulated by insulin.
  - **Normal Range**: Fasting: 70-99 mg/dL
  - **Issues if less than normal**: Low blood glucose (hypoglycemia) can lead to symptoms such as sweating, trembling, dizziness, and confusion.
  - **Issues if more than normal**: High blood glucose (hyperglycemia) is a symptom of diabetes and can lead to complications if untreated.
- **Hemoglobin A1c (HbA1c)**:
  - **Function**: HbA1c measures the percentage of hemoglobin that is glycosylated, indicating average blood glucose levels over the past 2-3 months.
  - **Normal Range**: Below 5.7%
  - **Issues if more than normal**: A reading between 5.7% and 6.4% indicates prediabetes, and 6.5% or higher indicates diabetes.
- **Alanine aminotransferase (ALT)**:
  - **Function**: ALT is an enzyme found primarily in the liver. It plays a role in breaking down protein and converting stored glucose into usable energy.
  - **Normal Range**: 7-56 units per liter (U/L) of blood
  - **Issues if more than normal**: Elevated ALT levels can suggest liver damage or inflammation, potentially from conditions like hepatitis, fatty liver disease, or alcohol use.

10 Recovery

- **Albumin**:
  - **Function**: Albumin is the main protein in blood plasma and helps maintain the oncotic pressure, transport various substances, and support growth and tissue repair.
  - **Normal Range**: 3.4-5.4 g/dL
  - **Issues if less than normal**: Low levels can suggest malnutrition, liver disease, kidney disease, or inflammation.
  - **Issues if more than normal**: High levels are rare but can indicate dehydration or a high protein diet.
- **Aspartate aminotransferase (AST)**:
  - **Function**: AST is an enzyme found in the liver and some other organs. It helps metabolize amino acids.
  - **Normal Range**: 10-40 U/L
  - **Issues if more than normal**: Elevated AST levels can indicate liver damage, heart damage, or muscle diseases.
- **Creatine kinase (CK)**:
  - **Function**: CK is an enzyme found in the heart, brain, and skeletal muscles. It plays a role in energy production.
  - **Normal Range**: Male: 38-174 U/L, Female: 26-140 U/L
  - **Issues if more than normal**: High CK levels can indicate muscle damage, heart attack, or conditions like muscular dystrophy.
- **Gamma-glutamyl transpeptidase (GGT)**:
  - **Function**: GGT is an enzyme located in the liver and is involved in the transport of amino acids and peptides into cells.
  - **Normal Range**: 9-48 U/L
  - **Issues if more than normal**: Elevated GGT levels can suggest liver disease or excessive alcohol consumption.
- **Potassium**:
  - **Function**: Potassium is an essential mineral and electrolyte that helps nerves and muscles communicate and maintain the body's fluid balance.
  - **Normal Range**: 3.6-5.2 mEq/L
  - **Issues if less than normal**: Low levels (hypokalemia) can cause muscle weakness, twitching, or heart issues.
  - **Issues if more than normal**: High levels (hyperkalemia) can impact heart rhythm and may be life-threatening.
- **Sodium**:
  - **Function**: Sodium is a major electrolyte that helps maintain water balance in and around cells and supports nerve function.
  - **Normal Range**: 135-145 mEq/L
  - **Issues if less than normal**: Low sodium (hyponatremia) can cause symptoms like nausea, headache, and confusion.

  - **Issues if more than normal**: High sodium (hypernatremia) can lead to symptoms such as irritability, muscle twitching, and even seizures.

11 Cognition

- **Vitamin B12**:
  - **Function**: Vitamin B12, also known as cobalamin, is essential for nerve tissue health, brain function, and the production of red blood cells. It plays a key role in the formation of DNA and is involved in the metabolism of proteins and fats.
  - **Normal Range**: 200-900 pg/mL
  - **Issues if less than normal**: A deficiency can lead to anemia, numbness or tingling in the extremities, balance problems, depression, memory decline, and, in severe cases, damage to the nerves.
  - **Issues if more than normal**: Excess levels are rare, but if present, can be a result of certain conditions like liver disease, kidney failure, or certain types of leukemia.
- **Folate**:
  - **Function**: Folate, or vitamin B9, is vital for the synthesis of DNA and RNA, and it plays a role in amino acid metabolism. It's crucial for the formation of red and white blood cells in the bone marrow.
  - **Normal Range**: 2.0-20.0 ng/mL
  - **Issues if less than normal**: Folate deficiency can cause fatigue, poor growth, tongue inflammation, and the development of megaloblastic anemia. It can also increase the risk of neural tube defects in pregnancies.
  - **Issues if more than normal**: High levels of folate in the presence of low vitamin B12 levels can hide a vitamin B12 deficiency, leading to neurological complications.

12 Endurance

- **Ferritin**:
  - **Function**: Ferritin is a protein that stores iron in the body, and its levels in the blood can indicate the total amount of iron stores.
  - **Normal Range**: Males: 20-250 ng/mL; Females: 10-120 ng/mL
  - **Issues if less than normal**: Indicates potential iron-deficiency anemia, which can lead to fatigue and reduced endurance.
  - **Issues if more than normal**: Can indicate iron overload or inflammation.
- **Hematocrit (HCT)**:
  - **Function**: Represents the percentage of red blood cells in the blood.
  - **Normal Range**: Males: 38.8-50.0%; Females: 34.9-44.5%
  - **Issues if less than normal**: Can indicate anemia, bleeding, or bone marrow disorders.
  - **Issues if more than normal**: Can indicate dehydration, lung or heart disease.
- **Hemoglobin**:
  - **Function**: A protein in red blood cells that carries oxygen throughout the body.

  - **Normal Range**: Males: 13.8-17.2 g/dL; Females: 12.1-15.1 g/dL
  - **Issues if less than normal**: Indicates anemia which can reduce oxygen transport, leading to fatigue.
  - **Issues if more than normal**: Seen in conditions like polycythemia vera; can increase risk of blood clots.
- **Iron**:
  - **Function**: Essential mineral that is a part of hemoglobin; helps red blood cells transport oxygen.
  - **Normal Range**: Males: 65-175 mcg/dL; Females: 50-170 mcg/dL
  - **Issues if less than normal**: Can lead to iron-deficiency anemia, resulting in fatigue and weakness.
  - **Issues if more than normal**: Can be due to conditions like hemochromatosis, leading to tissue damage.
- **Total iron binding capacity (TIBC)**:
  - **Function**: Measures the blood's capacity to bind iron with transferrin.
  - **Normal Range**: 240-450 mcg/dL
  - **Issues if less than normal**: Can be seen in conditions like malnutrition or inflammation.
  - **Issues if more than normal**: Often indicates iron-deficiency anemia.
- **Transferrin saturation (TS)**:
  - **Function**: Indicates how much serum iron is bound to transferrin.
  - **Normal Range**: 20-50%
  - **Issues if less than normal**: Suggests iron-deficiency.
  - **Issues if more than normal**: Can be a sign of iron overload or hemochromatosis.
- **Mean cell hemoglobin (MCH)**:
  - **Function**: Average amount of hemoglobin per red blood cell.
  - **Normal Range**: 27-33 pg/cell
  - **Issues if less than normal**: Can indicate microcytic anemia.
  - **Issues if more than normal**: Can indicate macrocytic anemia.
- **Mean cell hemoglobin concentration (MCHC)**:
  - **Function**: Average concentration of hemoglobin in a given volume of red cells.
  - **Normal Range**: 33-36 g/dL
  - **Issues if less than normal**: Indicates hypochromic anemia.
  - **Issues if more than normal**: Rare but can be seen in hereditary conditions.
- **Mean corpuscular volume (MCV)**:
  - **Function**: Average volume of a red blood cell.
  - **Normal Range**: 80-96 fL
  - **Issues if less than normal**: Indicates microcytic anemia.
  - **Issues if more than normal**: Indicates macrocytic anemia.
- **Red blood cell count (RBC)**:
  - **Function**: Counts the number of red blood cells in a volume of blood.
  - **Normal Range**: Males: 4.5-5.5 million cells/mcL; Females: 4.0-5.0 million cells/mc

    - **High RBC Count (Polycythemia)**: May indicate a condition that causes your body to produce too many red blood cells. It can be due to chronic lung disease, certain bone marrow diseases, or living at high altitude.
    - **Low RBC Count (Anemia)**: May suggest you have a condition that causes your body to produce too few red blood cells. It could be due to a number of conditions including iron deficiency, chronic diseases, or bone marrow disorders.
- **Red cell distribution width (RDW)**:
  - **Function**: Measures variation in red blood cell size or volume.
  - **Normal Range**: 11.5-14.5%
  - **Issues if outside the normal range**: Can indicate different types of anemia or other medical conditions.
- **Mean platelet volume (MPV)**:
  - **Function**: Average volume of platelets.
  - **Normal Range**: 7.5-11.5 fL
  - **Issues if outside the normal range**: Can be associated with various disorders including bone marrow diseases.
- **Platelets**:
  - **Function**: Small blood cells that help with clotting.
  - **Normal Range**: 150,000-450,000 cells/mcL
  - **Issues if less than normal**: Can lead to bleeding or bruising.
  - **Issues if more than normal**: Can increase the risk of blood clots.

13 Fitness

- **Testosterone**:
  - **Function**: A steroid hormone that plays a key role in the development of male reproductive tissues, the promotion of secondary sexual characteristics, muscle mass, and bone density in both genders.
  - **Normal Range**:
    - Males: 270-1070 ng/dL
    - Females: 15-70 ng/dL
  - **Issues if less than normal**: In males, can lead to symptoms like fatigue, depression, low libido, and reduced muscle mass. In females, low levels can cause fatigue and reduced bone density.
  - **Issues if more than normal**: In males, may lead to aggressive behavior, acne, and testicular atrophy. In females, symptoms like excess body hair, acne, and irregular menstrual cycles may occur.
- **Free testosterone (Male only)**:
  - **Function**: The amount of testosterone in the blood that is not bound to SHBG or albumin. Represents the active form of testosterone available for use by tissues.
  - **Normal Range**: 5-21 ng/dL (varies based on the lab)
  - **Issues if less than normal**: Can lead to symptoms like fatigue, depression, low libido,

and reduced muscle mass.
  - **Issues if more than normal**: May result in aggressive behavior, acne, and testicular atrophy.
- **Sex-hormone binding globulin (SHBG)**:
  - **Function**: A protein that binds tightly to testosterone, dihydrotestosterone (DHT), and estradiol. Regulates the amount of free, active hormone available to tissues.
  - **Normal Range**:
    * Males: 10-50 nmol/L
    * Females: 30-135 nmol/L
  - **Issues if less than normal**: Lower SHBG can increase the amount of free testosterone in the bloodstream, leading to potential symptoms of testosterone excess.
  - **Issues if more than normal**: Elevated SHBG can decrease the amount of free testosterone in the bloodstream, possibly resulting in symptoms of testosterone deficiency.