

# The LabSmarts Functional Blood Work Map

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## 130 Unique Biomarkers

The LabSmarts Functional Blood Work Map organizes every biomarker by the body system or process it reflects — a framework for reading blood work as connected patterns rather than isolated values. It is arranged using The 5-System Method™ — five high-level functional groups — then into body systems and processes, then individual markers.

## Part 1 · The 5-System Method™

The five high-level functional groups that organize every body system and process.

### 1. Energy & Metabolic Function — *Fuel & Energize*

**Body Systems & Processes:** Blood Oxygen & Red Blood Cell Function · Iron Status & Utilization · Glucose Regulation & Metabolic Function · Lipid Balance · Thyroid Function

The Energize group shows how well the body delivers oxygen, uses fuel, and sustains steady energy. It groups systems and processes related to oxygen delivery, iron utilization, glycemic regulation, insulin response, lipid metabolism, and thyroid-related metabolic pacing — helping organize patterns that may affect cellular energy production and metabolic regulation.

### 2. Digestion, Nutrients, & Building Blocks — *Digest & Build*

**Body Systems & Processes:** Digestive & Gut Health (coming soon) · Protein Status · Vitamin & Mineral Status

The Build group shows how well the body breaks down, absorbs, and uses the raw materials needed to function, repair, and regulate. It groups systems and processes related to digestion, protein status, vitamin and mineral availability, and nutrient-related building blocks — helping organize patterns that may affect tissue repair, enzyme activity, hormone production, immune function, detoxification, and metabolic resilience.

### 3. Immune, Inflammatory, & Repair Activity — *Defend & Repair*

**Body Systems & Processes:** Immune Activity · Inflammation & Oxidative Stress · Blood Clotting Function

The Defend & Repair group shows how the body is responding to inflammation, immune activity, oxidative stress, and tissue repair demands. It groups systems and processes related to immune activity, inflammatory signaling, oxidative stress, clotting, and repair-related physiology — helping organize patterns that may reflect defense activity, inflammatory burden, tissue response, clotting demand, and recovery needs.

### 4. Detoxification & Elimination Function — *Detoxify & Eliminate*

**Body Systems & Processes:** Liver Function · Kidney Function · Electrolyte Balance

The Eliminate group shows how well the body filters, clears, and eliminates waste while maintaining acid-base balance. It groups systems and processes related to liver function, kidney function, electrolyte balance, waste clearance, detoxification, renal handling, and acid-base regulation — helping organize patterns that may affect processing, filtration, clearance, elimination, and fluid-electrolyte balance.

### 5. Hormonal & Endocrine Health — *Signal & Regulate*

**Body Systems & Processes:** Stress & Adrenal Balance · Hormone Balance · Prostate Function

The Signal & Regulate group shows how the body communicates and regulates stress response, reproductive hormones, sex-specific markers, and metabolic signaling. It groups systems and processes related to adrenal signaling, stress response, reproductive hormone balance, sex-specific markers, and endocrine regulation — helping organize patterns that may affect stress adaptation, hormone communication, metabolic signaling, and reproductive physiology.

## Part 2 · Body Systems & Processes within Each Group

### Energy & Metabolic Function — Fuel & Energize

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**Blood Oxygen & Red Blood Cell Function.** Shows markers and pattern insights related to oxygen delivery, red blood cell production and quality, and the body's ability to support steady energy production.

**Iron Status & Utilization.** Shows markers related to iron availability, storage, transport, and how iron supports red blood cell function and oxygen delivery.

**Glucose Regulation & Metabolic Function.** Shows markers and pattern insights related to blood sugar regulation, insulin response, pancreatic output, lipid-related metabolism, and metabolic stability.

**Lipid Balance.** Shows markers related to lipid transport, cholesterol balance, triglyceride regulation, and broader cardiometabolic function.

**Thyroid Function.** Shows markers related to thyroid signaling, hormone production, conversion, transport, and metabolic pace.

### Digestion, Nutrients, & Building Blocks — Digest & Build

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**Digestive & Gut Health** (*coming soon*). Shows markers related to digestion, gut barrier function, microbial balance, and the body's ability to break down and absorb nutrients.

**Protein Status.** Shows markers related to protein reserves, protein metabolism, tissue repair capacity, and nutritional building blocks.

**Vitamin & Mineral Status.** Shows markers related to vitamin and mineral availability that supports enzyme activity, nutrient-dependent metabolic processes, and tissue function.

### Immune, Inflammatory, & Repair Activity — Defend & Repair

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**Immune Activity.** Shows markers and pattern insights related to white blood cell activity, immune cell distribution, and how the immune system may be responding.

**Inflammation & Oxidative Stress.** Shows markers related to inflammatory activity, oxidative stress, and systemic repair demands.

**Blood Clotting Function.** Shows markers related to platelet activity, clotting balance, vascular integrity, and repair-related physiology.

### Detoxification & Elimination Function — Detoxify & Eliminate

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**Liver Function.** Shows markers related to liver enzymes, bile flow, protein synthesis, detoxification, and metabolic clearance.

**Kidney Function.** Shows markers related to kidney filtration, waste clearance, and renal handling.

**Electrolyte Balance.** Shows markers related to sodium, potassium, chloride, CO<sub>2</sub>, anion gap, fluid balance, nerve signaling, and acid-base regulation.

### Hormonal & Endocrine Health — Signal & Regulate

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**Stress & Adrenal Balance.** Shows markers related to adrenal signaling, the stress response, cortisol rhythm, the adrenal regulation of sodium and potassium, and the body's ability to adapt to stress.

**Hormone Balance.** Shows markers related to reproductive and sex hormone signaling, hormone metabolism, and broader endocrine communication.

**Prostate Function.** Shows markers related to prostate-specific markers and related androgen context.

## Part 3 · Biomarkers within Each Body System & Process

Cross-referenced markers (shown in smaller grey text) appear where clinically relevant but are counted in their primary system or process.

### Energy & Metabolic Function — Fuel & Energize

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#### Blood Oxygen & Red Blood Cell Function

- RBC**  
Red blood cells carry oxygen from the lungs to every part of the body, helping support energy production.
- Hemoglobin (HGB)**  
The iron-rich protein inside red blood cells that carries oxygen through the bloodstream.
- Hematocrit (HCT)**  
The percentage of blood composed of red blood cells; helps indicate how concentrated the blood is.
- MCV**  
The average size of red blood cells, which helps show how they form and mature.
- MCH**  
The average amount of hemoglobin inside each red blood cell.
- MCHC**  
The average concentration of hemoglobin inside red blood cells.
- RDW**  
A measure of how much red blood cells vary in size.
- Reticulocyte Count\***  
A measure of newly made red blood cells, showing how actively the body is producing fresh red blood cells.
- RPI\***  
A corrected measure of new red blood cell production that accounts for the body's current red blood cell needs.

#### Iron Status & Utilization

- Iron**  
The iron circulating in the blood, available to help make red blood cells and support energy production.
- TIBC**  
A measure of how much capacity the blood has to carry iron.
- % Saturation**  
The percentage of iron-carrying capacity currently being used.
- Ferritin**  
The body's stored iron, reflecting how much iron is being held in reserve.
- Transferrin\***  
The main protein that carries iron through the blood to where it is needed.

*Bar graphs for the markers below appear here because copper and vitamin A work closely with iron, even though each is counted in its own system or process. Copper — carried by ceruloplasmin — helps load iron onto its transport protein, so copper status (ceruloplasmin, serum and red-cell copper, and free copper) shapes how iron moves and gets used. Vitamin A helps the body release stored iron and build healthy red blood cells.*

- Ceruloplasmin (Vitamin & Mineral Status)
- Copper, RBC (Vitamin & Mineral Status)
- Copper, Serum (Vitamin & Mineral Status)
- Free Copper (%) (Vitamin & Mineral Status)
- Vitamin A (Vitamin & Mineral Status)

## Glucose Regulation & Metabolic Function

15. **Glucose**  
The main sugar in the blood that cells use for energy.
16. **Hemoglobin A1c\***  
An estimate of average glucose levels over the past two to three months.
17. **Insulin**  
A hormone that helps move glucose from the blood into cells for energy or storage.
18. **C-peptide**  
A companion marker released when the body makes insulin, helping show natural insulin production.
19. **Amylase**  
An enzyme made by the pancreas and salivary glands that helps break down starches into sugars.

*Bar graphs for the markers below appear here because each connects to glucose and metabolic regulation, though they are counted in their primary system or process.*

- Triglycerides/HDL Ratio — *a practical surrogate for insulin resistance (Lipid Balance)*
- Triglycerides — *tend to rise when insulin isn't managing fat metabolism well (Lipid Balance)*
- HDL — *often runs low when insulin resistance is present (Lipid Balance)*
- LDL — *shifts with insulin-driven lipid metabolism (Lipid Balance)*
- ALT — *rises with fatty-liver changes linked to metabolic dysfunction (Liver Function)*
- AST — *reflects liver involvement in metabolic and fatty-liver patterns (Liver Function)*
- Cortisol, AM — *a stress hormone that raises blood sugar (Stress & Adrenal Balance)*
- Cortisol, PM — *a stress hormone that raises blood sugar (Stress & Adrenal Balance)*
- NLR — *an inflammation ratio associated with insulin resistance (Immune Activity)*
- hs-CRP — *inflammation that tracks with metabolic dysfunction (Inflammation & Oxidative Stress)*
- Carbon Dioxide — *shifts with the acid-base changes of metabolic imbalance (Electrolyte Balance)*
- BUN — *influenced by protein metabolism and hydration tied to glucose status (Kidney Function)*
- Potassium — *moves into cells under insulin's action (Electrolyte Balance)*
- Calcium — *involved in insulin secretion and signaling (Vitamin & Mineral Status)*
- Vitamin B6 — *a cofactor in glucose and amino-acid metabolism (Vitamin & Mineral Status)*

## Lipid Balance

20. **Cholesterol, Total**  
The overall amount of cholesterol in the blood; a building block the body uses for cell membranes, hormones, and more.
21. **Triglycerides**  
The main type of fat in blood; used for energy and stored for later.
22. **HDL**  
A cholesterol carrier that helps move cholesterol away from the tissues and back to the liver.
23. **LDL**  
A cholesterol carrier that delivers cholesterol from the liver out to the body's tissues.
24. **Cholesterol/HDL Ratio\***  
A simple comparison that puts total cholesterol in context with the helpful HDL carriers.
25. **Triglycerides/HDL Ratio\***  
A comparison of blood fats to HDL that provides a practical sense of how the body is handling fat and sugar.
26. **Apolipoprotein A-1**  
The main protein that builds HDL particles, the carriers that bring cholesterol back to the liver.
27. **Apolipoprotein B**  
The main protein on cholesterol-delivering particles; since each particle carries one, it reflects how many such particles are present.
28. **Apo B/Apo A-1 Ratio\***  
A comparison of the cholesterol-delivering particles to the cholesterol-clearing ones.
29. **Lipoprotein(a)\***  
A cholesterol-carrying particle whose level is mostly set by genetics.

## Thyroid Function

30. **TSH**  
The signal the brain sends to the thyroid, telling it how much thyroid hormone to make — the body's main thyroid thermostat.
31. **T4 Total\***  
The total amount of T4, the main hormone the thyroid releases to help set the body's pace.
32. **Free T4\***  
The portion of T4 that's unattached and ready for the body to use.
33. **T3 Total\***  
The total amount of T3, the more active thyroid hormone that drives metabolism.
34. **Free T3\***  
The portion of active T3 that's free and available to the tissues.
35. **Reverse T3\***  
An inactive form of thyroid hormone, which offers insight into how the body is processing T4.
36. **TPO Antibodies\***  
An immune marker aimed at a thyroid enzyme, offering a window into thyroid-related immune activity.
37. **Thyroglobulin Antibodies\***  
An immune marker aimed at a thyroid protein; another window into thyroid-related immune activity.
38. **TBG\***  
The main protein that carries thyroid hormones through the bloodstream.
39. **T3 Uptake\***  
An older measure that helps show how much room the carrier proteins have for thyroid hormone.
40. **Free T4 Index\***  
A calculated estimate of available T4 that accounts for how much is bound to carrier proteins.

## Digestion, Nutrients, & Building Blocks — Digest & Build

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### Digestive & Gut Health *(coming soon)*

*Markers to be added.*

### Protein Status

41. **Protein, Total**  
The overall amount of protein in the blood; a broad sense of nourishment and protein supply.
42. **Albumin**  
The most plentiful protein in blood, made by the liver; it helps hold fluid in the vessels and carries many things around the body.
43. **Globulin**  
A family of blood proteins that includes immune antibodies along with various carrier and clotting proteins.
44. **Albumin/Globulin Ratio**  
A simple comparison of the two main families of blood proteins.

### Vitamin & Mineral Status

45. **Calcium**  
A mineral best known for bone, but also key for nerves, muscles, and steady signaling; the blood level is kept in a tight range.
46. **Ceruloplasmin**  
The main protein that carries copper in the blood also helps with iron.
47. **Copper, RBC\***  
Copper measured inside red blood cells, giving a longer-term view of copper status.
48. **Copper, Serum**  
The copper circulating in the blood; copper helps with energy, iron handling, and healthy connective tissue.
49. **Copper/Zinc Ratio\***  
A look at the balance between copper and zinc, two minerals that work in tandem.
50. **Free Copper (%)\***  
The share of copper that's loosely carried and more readily available to the body.

51. **Folate, RBC\***  
Folate stored inside red blood cells — a longer-term view of this B vitamin that supports cell renewal.
52. **Folate, Serum\***  
Folate in the blood, reflecting more recent intake of this B vitamin.
53. **Magnesium, RBC\***  
Magnesium inside red blood cells — a longer-term view of a mineral the body uses in countless reactions.
54. **Magnesium, Serum\***  
Magnesium in the blood, a mineral that supports energy, calm nerves, and relaxed muscles.
55. **Phosphorus\***  
A mineral that teams up with calcium for bone and is central to the body's energy supply.
56. **Vitamin A**  
A vitamin important for vision, immune strength, skin, and helping the body draw on stored iron.
57. **Vitamin B6**  
A B vitamin that helps the body work with proteins, brain chemistry, and blood sugar.
58. **Vitamin B12**  
A vitamin essential for making red blood cells and keeping nerves healthy.
59. **Vitamin D (25-OH)**  
The main storage form of vitamin D and the usual way to gauge overall vitamin D status.
60. **Vitamin D (1,25-OH2)\***  
The active form of vitamin D that helps manage calcium balance.
61. **Zinc, RBC\***  
Zinc inside red blood cells, a longer-term view of zinc status.
62. **Zinc, Serum**  
Zinc in the blood, a mineral that supports immunity, healing, and many enzymes.

## **Immune, Inflammatory, & Repair Activity — Defend & Repair**

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### **Immune Activity**

63. **WBC**  
The total white blood cell count is the number of immune cells that defend the body and respond to inflammation.
64. **Neutrophils (%)**  
The share of immune cells that are neutrophils, the first responders to many infections and to stress.
65. **Lymphocytes (%)**  
The share of immune cells that are lymphocytes, central to handling viruses and to lasting immunity.
66. **Monocytes (%)**  
The share of immune cells that are monocytes, which clean up debris and become tissue defenders.
67. **Eosinophils (%)**  
The share of immune cells that are eosinophils, involved in allergies and parasite defense.
68. **Basophils (%)**  
The share of immune cells that are basophils, which take part in allergic and inflammatory responses.
69. **Neutrophils, Absolute**  
The actual count of neutrophils in the blood.
70. **Lymphocytes, Absolute**  
The actual count of lymphocytes in the blood.
71. **Monocytes, Absolute**  
The actual count of monocytes in the blood.
72. **Eosinophils, Absolute**  
The actual count of eosinophils in the blood.
73. **Basophils, Absolute**  
The actual count of basophils in the blood.
74. **NLR**  
A simple balance of two immune-cell types that gives a quick read on the body's overall stress and inflammation.

Bar graphs for the markers below are shown here because they relate to the immune system, but are counted in their primary system or process.

- Globulin (Protein Status)
- Alk Phos (ALP) (Liver Function)
- Zinc, RBC (Vitamin & Mineral Status)
- Zinc, Serum (Vitamin & Mineral Status)

## Inflammation & Oxidative Stress

### 75. Homocysteine\*

An amino acid that reflects how well the body is working with B vitamins like folate, B6, and B12.

### 76. hs-CRP

A sensitive marker of inflammation anywhere in the body, made by the liver.

### 77. ESR\*

A long-used, general marker related to inflammation in the body.

Bar graphs for the markers below are shown here because they can indicate inflammation or oxidative stress, but are counted in their primary system or process.

- Albumin (Protein Status)
- Bilirubin (Liver Function)
- Ceruloplasmin (Vitamin & Mineral Status)
- Ferritin (Iron Status & Utilization)
- Fibrinogen (Blood Clotting Function)
- GGT (Liver Function)
- HDL (Lipid Balance)
- TIBC (Iron Status & Utilization)
- Transferrin (Iron Status & Utilization)
- Uric Acid (Kidney Function)

## Blood Clotting Function

### 78. Platelets

The tiny cell fragments that gather together to help blood clot and stop bleeding.

### 79. MPV

The average platelet size; the body tends to release larger platelets when it's actively making new ones, so MPV reflects platelet production.

### 80. D-Dimer

A small piece left behind when a clot breaks down, reflecting clotting and clot-clearing activity.

### 81. Fibrinogen\*

A clotting protein made by the liver that helps form the mesh of a clot; it is also one of the body's inflammation-related proteins.

# Detoxification & Elimination Function — Detoxify & Eliminate

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## Liver Function

82. **Bile Acids\***  
Made by the liver from cholesterol to help digest fats; the level reflects how well bile is flowing.
83. **Bilirubin, Total**  
A yellow pigment produced when red blood cells are naturally broken down and cleared through the liver.
84. **Bilirubin, Direct\***  
The conjugated form of bilirubin that the liver has processed for elimination.
85. **Bilirubin, Indirect\***  
The unconjugated form of bilirubin before it has been processed by the liver.
86. **Alk Phos (ALP)**  
An enzyme found in the liver, bile ducts, and bone, reflecting bile flow and bone activity.
87. **AST**  
An enzyme found in the liver, muscle, and heart.
88. **ALT**  
An enzyme found mostly in the liver — a fairly liver-specific marker.
89. **GGT\***  
A liver and bile-duct enzyme that's sensitive to bile flow and to many of the things the liver handles.
90. **Lactate Dehydrogenase (LDH)**  
An enzyme found in many tissues throughout the body.

## Kidney Function

91. **BUN**  
A waste product made when the body uses protein. The kidneys help clear it, and levels can also shift with hydration.
92. **Creatinine**  
A waste product from normal muscle activity. The kidneys filter it from the blood, making it a key marker of kidney filtration.
93. **eGFR**  
An estimate of how well the kidneys are filtering blood, calculated mainly from creatinine.
94. **BUN/Creatinine Ratio**  
A comparison between BUN and creatinine helps show how hydration, protein use, and kidney filtration may be influencing the results.
95. **Uric Acid\***  
A waste product cleared by the kidneys that can also function as an antioxidant in the blood.

## Electrolyte Balance

96. **Sodium**  
A key electrolyte that helps manage fluid balance, hydration, and nerve signals.
97. **Potassium**  
A key electrolyte inside cells, essential for nerves, muscles, and a steady heartbeat.
98. **Chloride**  
An electrolyte that works with sodium for fluid balance and helps keep the body's pH steady.
99. **Carbon Dioxide**  
A measure that reflects the body's acid-base (pH) balance.
100. **Anion Gap (without K)**  
A value calculated from the electrolytes, used to check the body's acid-base (pH) balance.
101. **Anion Gap (with K)**  
A value calculated from the electrolytes (including potassium), used to check the body's acid-base (pH) balance.

# Hormonal & Endocrine Health — Signal & Regulate

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## Stress & Adrenal Balance

### 102. Cortisol, AM

The morning level of cortisol, the body's main stress hormone, is usually highest early in the day.

### 103. Cortisol, PM\*

The later-day cortisol, read together with the morning value to see the natural daily rhythm.

### 104. DHEA-Sulfate

An adrenal hormone that serves as a starting material for other sex hormones.

### 105. Pregnenolone

Made from cholesterol in the adrenal glands, it's the building block the body uses to make cortisol, DHEA, and other stress and sex hormones.

### 106. Sodium/Potassium Ratio (Na/K Ratio)

The balance between sodium and potassium, which the adrenal glands help regulate through the hormone aldosterone.

*Bar graphs for the markers below appear here because the adrenal glands help regulate sodium and potassium, though each is counted in its primary system or process.*

- Sodium (*Electrolyte Balance*)
- Potassium (*Electrolyte Balance*)

## Hormone Balance

### 107. AMH

A hormone made by reproductive tissue; in women it gives a sense of ovarian reserve, the remaining egg supply.

### 108. DHT\*

A strong androgen made from testosterone that acts on skin, hair, and the prostate.

### 109. Estradiol (E2)

The main, most active estrogen, important for reproductive health and many tissues in everyone.

### 110. Estriol (E3)\*

A gentler estrogen that rises notably during pregnancy.

### 111. Estrogens, Total

A combined look at the body's estrogens.

### 112. Estrone (E1)

An estrogen that becomes the main form after menopause.

### 113. FSH

A hormone from the pituitary that helps guide egg and sperm development.

### 114. hCG\*

A hormone made during pregnancy and by certain tissues.

### 115. IGF-1

A growth-related hormone, mostly from the liver, that reflects growth hormone activity.

### 116. LH

A hormone from the pituitary that triggers ovulation and supports sex-hormone production.

### 117. Progesterone

A hormone central to the menstrual cycle and pregnancy, and a building block for other hormones.

### 118. 17-OH-Progesterone

A stepping-stone in hormone production that offers a view into the adrenal pathways.

### 119. Prolactin

A hormone from the pituitary that supports milk production and influences reproductive balance.

### 120. Prolactin, Lactating\*

Prolactin read in the context of breastfeeding, when it's naturally higher.

### 121. SHBG

A protein that binds and carries sex hormones, shaping how much is free and active.

### 122. Testosterone, Bioavailable\*

The portion of testosterone the body can readily use — the free and loosely carried amounts.

### 123. Testosterone, Bioavailable (%)\*

What share of total testosterone is in that readily usable form.

124. Testosterone, Free (Calc)

The free, active portion of testosterone, estimated by calculation.

125. Testosterone, Free (Direct)

The free, active portion of testosterone, measured directly.

126. Testosterone, Total

The total testosterone in the blood, both carried and free.

127. Testosterone, Total (LC/MS)

Total testosterone measured with an especially precise lab method.

## Prostate Function

128. PSA, Total\*

A protein made by the prostate; the total level is the main prostate marker.

129. PSA, Free\*

The portion of PSA not bound to other proteins, used alongside the total for more context.

130. PSA, % Free\*

How much of the PSA is in that free form, which adds context to the total.

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\* No pediatric reference range available for this biomarker.