KRESSER INSTITUTE
FOR FUNCTIONAL AND EVOLUTIONARY MEDICINE

Blood Chemistry Basics - Part 2

Okay. So, on the next few slides, I'm going to present markers that I use in an initial functional blood chemistry panel. We're going to break these down into chunks. You'll be able to order my custom panel for your patients, and I'll be showing you how to do that in the training.

I fine-tuned this panel over the last five years. It's always changing, and, in fact, just a few days ago, I added three more markers, so I will be keeping you up to date as we go through the course.

Marker	Value	Functional Range	Lab Range
Glucose	93	75 – 90	65 - 99
Hemoglobin A1c	5.4	4.4 – 5.4	4.8 - 5.6
Uric Acid	3.6	3.2 - 5.5	2.5 - 7.1
BUN	16	13 – 18	6 - 24
Creatinine	1.04	0.85 – 1.1	0.57 - 1
Sodium	139	135 – 140	134 - 144
Potassium	5.3	4.0 – 4.5	3.5 - 5.2
Chloride	101	100 – 106	97 - 108
C02	25	25 – 30	18 - 28
Calcium	8.9	9.2 – 10.1	8.7 - 10.2
Phosphorus	4.0	3.5 – 4.0	2.5 - 4.5
Magnesium	1.8	2.0 – 2.6	1.6 - 2.6
Protein, total	6.5	6.9 – 7.4	6.0 - 8.5
Albumin	4.5	4.0 – 5.0	3.5 - 5.5
Globulin	2.0	2.4 – 2.8	1.5 - 4.5
A/G ratio	2.3	1.5 – 2.0	1.1 - 2.5
Bilirubin, total	0.6	0.1 – 1.2	0.0 - 1.2
Alkaline Phosphatase	52	42 – 107	39 - 117
LDH	168	140 - 180	119 - 226
AST	33	10 - 30	0 - 40
ALT	18	10 - 22	0 - 32
GGT	19	0 - 28	0 - 60
TIBC	266	250 – 350	250 - 450
UIBC	138	150 - 375	150 - 375
Iron	128	85 – 135	35 - 155
Iron saturation	48	15 – 40	15 - 55
Ferritin	55	15 - 120	15 - 150
Cholesterol, total	174	150 – 250	100 - 199
Triglycerides	41	50 – 100	0 - 149
HDL	72	55 – 85	> 39
LDL	94	0 – 175	0 - 99
T. Chol / HDL Ratio	2.4	< 3	0 4.4
Triglycerides / HDL Ratio	0.57	< 2	< 3.8
TSH	2.610	0.5 – 2.5	0.45 - 4.50
T4, total	8.4	6.0 – 12	4.5 - 12
T3 Uptake	32	28 - 35	24 - 39
T3, Total	78	100 – 180	71 - 180
Vitamin D, 25-hydroxy	28.7	35 - 60	30.0 - 100.0

Marker	Value	Functional Range	Lab Range
WBC	5.8	5.0 – 8.0	3.4 - 10.8
RBC	4.63	4.4 – 4.9	3.77 - 5.28
Hemoglobin	14.8	13.5 - 14.5	11.1 - 15.9
Hematocrit	45	37 - 44	34.0 - 46.6
MCV	97	85 – 92	79 - 97
MCH	32.0	27.7 – 32.0	26.6 - 33.0
MCHC	32.9	32 – 35	31.5 - 35.7
RDW	13.4	11.5 – 15.0	12.3 - 15.4
Platelets	288	150 – 415	150 - 379
Neutrophils	50	40 – 60	
Lymphocytes	41	25 – 40	
Monocytes	6	4.0 – 7.0	
Eosinophils	2	0.0 – 3.0	
Basophils	1	0.0 – 3.0	

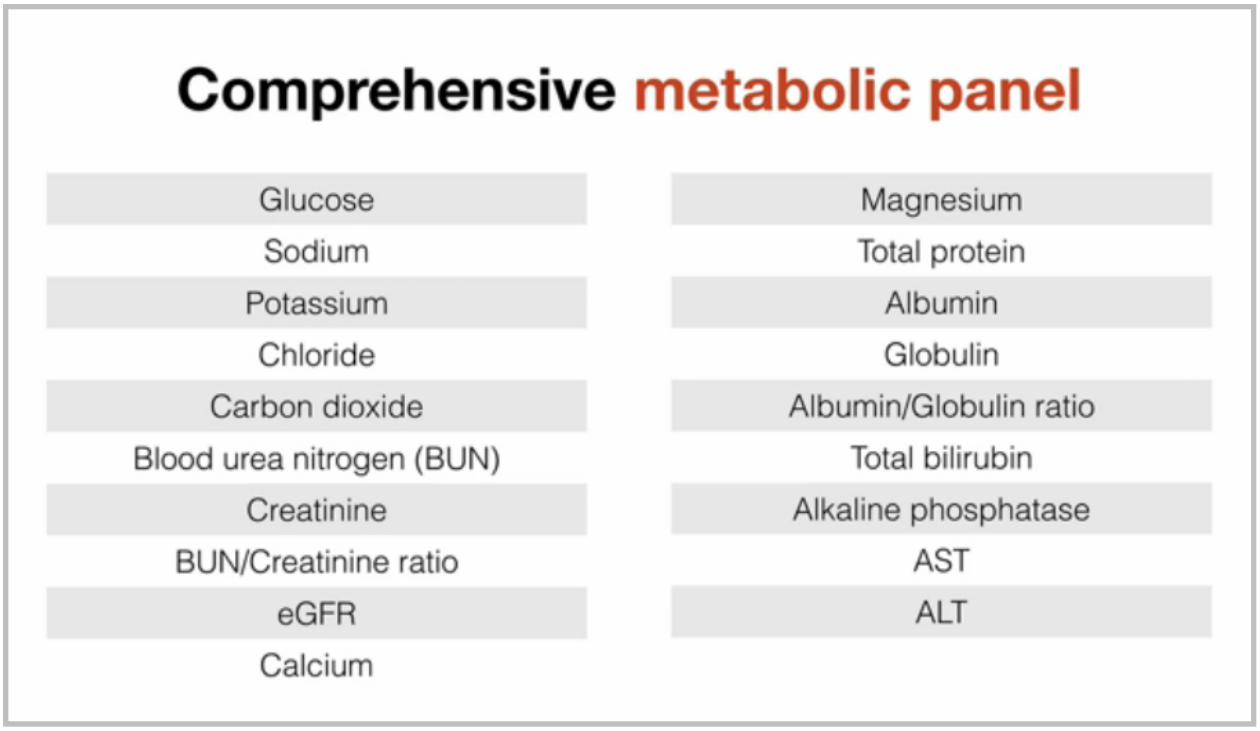
Additional Tests:			
T3, Free	2.4	2.5 - 4.0	2 - 4.4
T4, Free	1.66	1 - 1.5	0.82 - 1.77
CRP-hs	0.49	< 1.0	0.00 - 3.00
Homocysteine	6.8	< 9.0	0.0 - 15.0
Vitamin B-12	1022	450 – 2000	211 - 946
Copper	101		72 - 166
Zinc	72		56 - 134
Zinc / Copper Ratio	0.71	> 0.85	

The initial panel that you run as a functional blood chemistry screening tool is always a middle ground between being as thorough as you can be and also being cost efficient. If a patient comes in—to some extent, it would be ideal if you could just run every possible marker that you think you might ever need and have all that information up front. If cost is no concern for the patient, then some clinicians do that. I know of some, or one at least functional medicine practitioner who does $10,000 worth of testing upfront on his patients. Personally, I think that is a little excessive just from the way that I approach things because my belief is that you can't do everything at once, and you need to structure and layer a treatment. Actually having too much information all at once can be a challenge not only for the patient but for the clinician. I think striking a balance between getting a comprehensive amount of information that can help you structure and layer an effective treatment plan and being cost efficient and staying focused is the way to go with the initial case review blood panel.

So, I start with markers that I feel are most important and are most likely to reveal underlying patterns that need to be addressed or need to be followed up on with additional testing. Now some of this, of course, is personal preference, and it's how I work. You will probably evolve your own custom panel over time as you do more of this work, and even Dr. Schweig, my co-director at

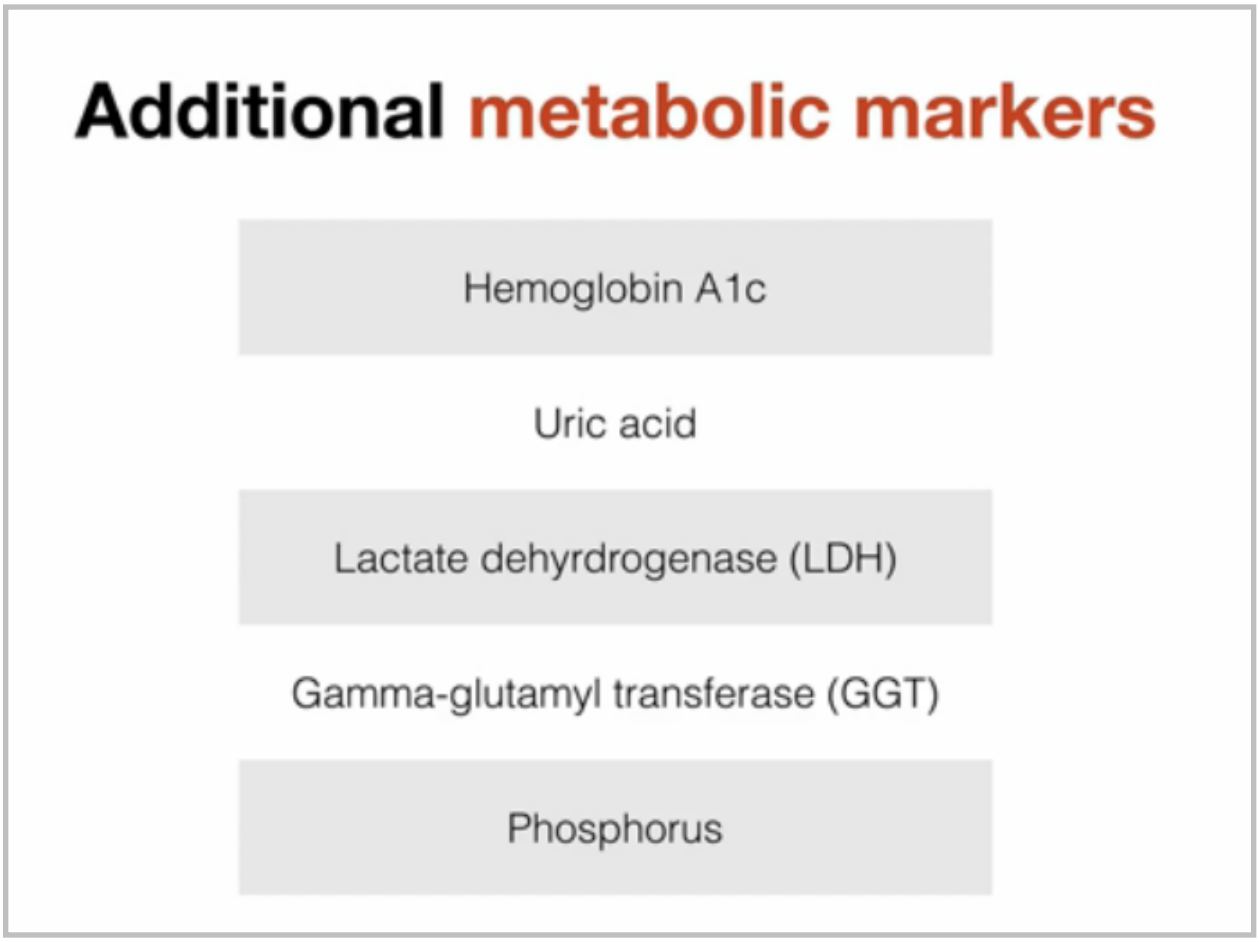
California Center for Functional Medicine, has a different panel that he starts with, with his new patients. He is a specialist in chronic infection. That is a lens that he spends a lot of time looking through, so each patient that he sees, many of whom are coming to him either with existing chronic infections or a history of chronic infection or are suspicious that they have a chronic infection, so he includes a lot of infectious disease markers on his intro panel that I don't include in mine.

So, there is really definitely room for variation, but I do think there are some basic markers that we should all be looking at because there are certain systems of the body that we know contribute to most of the modern inflammatory diseases that exist. For example, blood sugar regulation is very important for cardiovascular disease risk, metabolic disease, and just about every modern disease. We want to look at nutrient status, things such as magnesium, iron, B12, and vitamin D. We want to look at immune function. We want to look at metabolic function. We want to look at thyroid. So there are some important markers that I think pretty much everyone should include, and then from there, there is plenty of room for customization.

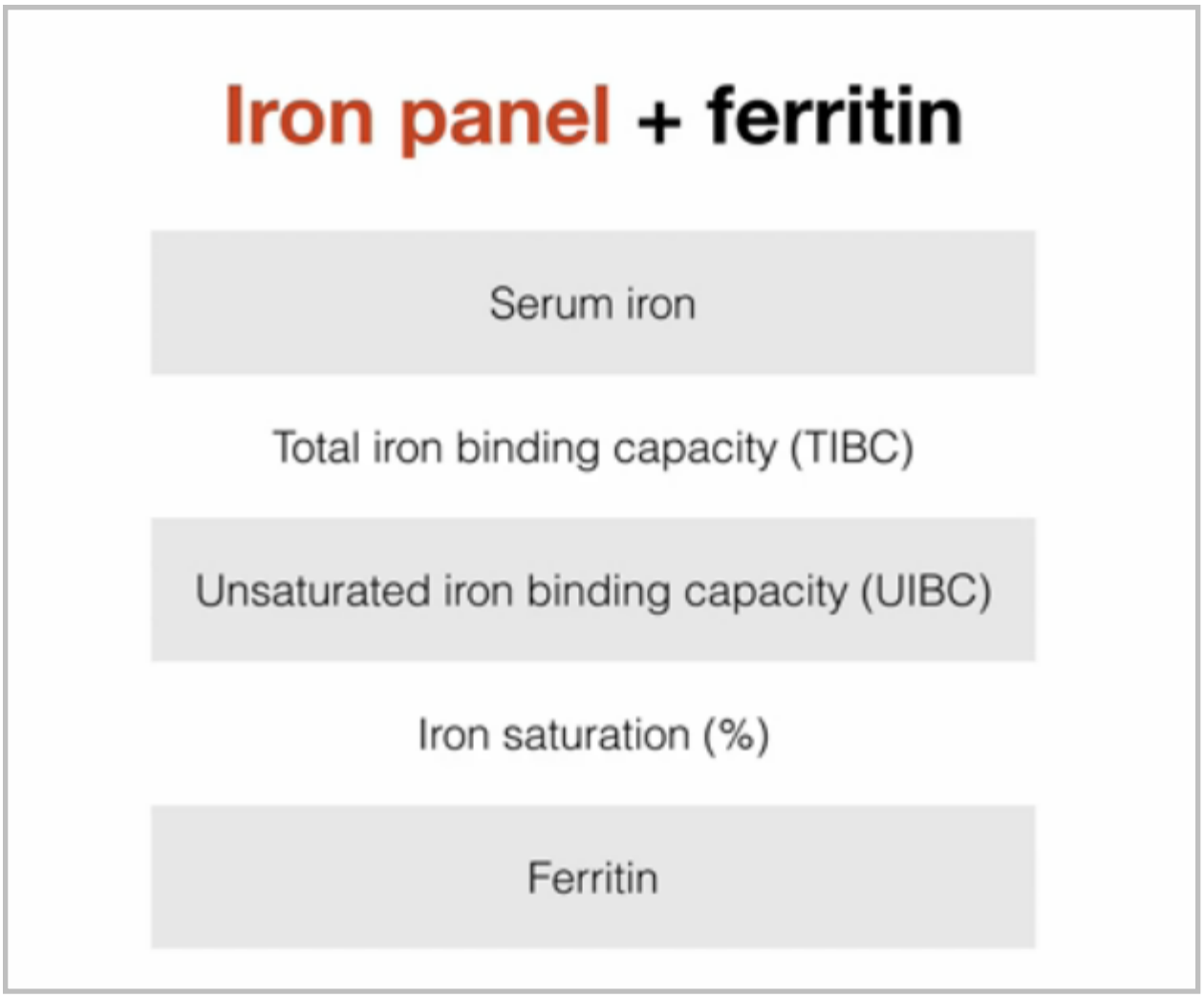


Okay. So, let's talk about a little bit more about my case review blood panel, again, broken into chunks, and these are often chunks that are used by lab panels that you can order, distinct panels at labs. The first is the comprehensive metabolic panel, or CMP. I'm sure you're familiar with this. It typically includes between 14 to 20 markers depending on the lab. It includes things such as glucose, sodium, potassium chloride, carbon dioxide, blood urea nitrogen, creatinine, BUN-to-creatinine ratio, glomerular filtration rate (EGFR), calcium, and magnesium. These are things that I actually have added to the CMP. They are not always part of the CMP; magnesium isn't, for example. Total protein, albumin globulin, albumin-to-globulin ratio, total bilirubin, alkaline

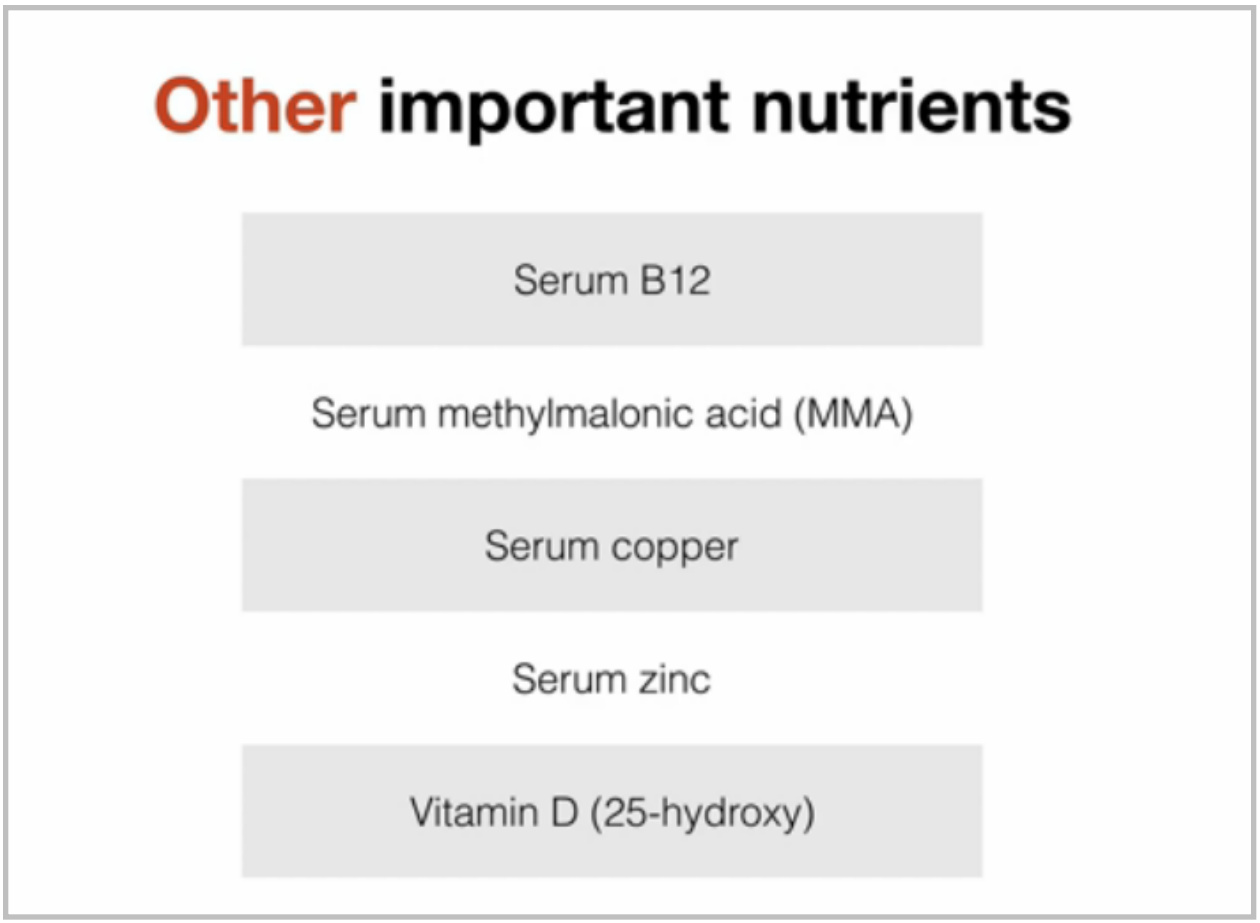
phosphatase. Most CMPs don't include that by default, but you can add it. Then the amino transferases, AST and ALT.



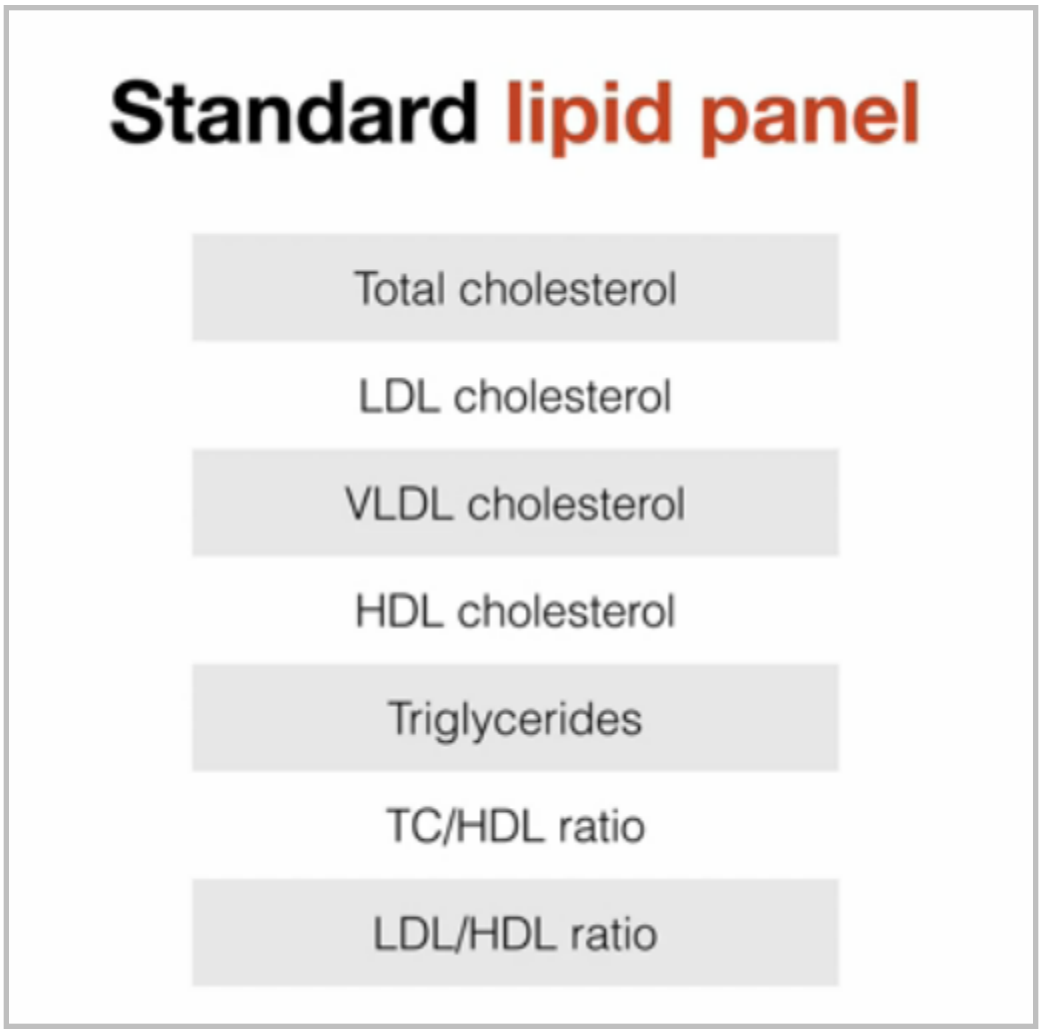
I add some additional markers to the CMP: hemoglobin A1c, which is a three-month average of blood sugar; uric acid, which is a chemical created when the body breaks down purines. It tends to be abnormal in blood sugar disorders, gout, and some other inflammatory conditions. Lactate dehydrogenase, or LDH, which is a marker of tissue breakdown and also in insulin resistance. GGT, which is used to determine the cause of high alkaline phosphatase, liver disease, and bile duct obstructions. It also can be very helpful in iron overload conditions. Then phosphorus, which is a marker for kidney, liver, and bone disease. Don't worry. We'll be going into detail on all of these markers or the groups of markers as we go through the unit.



Next is iron panel and ferritin. This is often neglected in conventional medicine, and it just baffles me. I cannot understand why an iron panel plus ferritin is not a part of a standard blood workup. There are over two billion people in the world who suffer from iron deficiency, and iron overload is a much more common condition than is typically recognized. Iron is an absolutely crucial nutrient. It's essential for life, and yet it can be deadly when it is elevated. It just absolutely needs to be part of an initial workup. Ferritin, in addition to being the long-term storage form of iron, is an acute-phase reactant, which can be elevated in the inflammatory response, so it's a marker of inflammation as well.

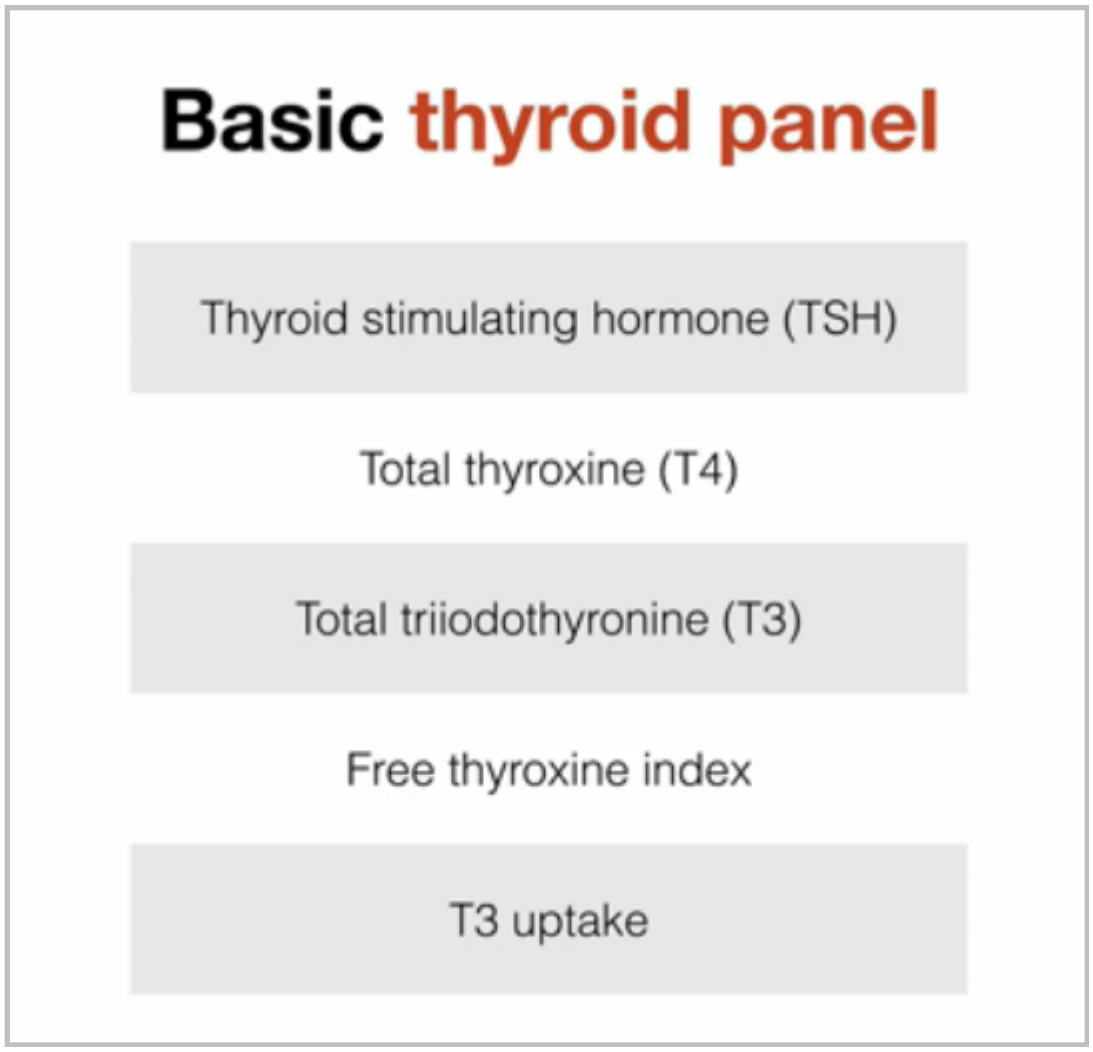


In addition to iron, we also want to measure several other important nutrients. B12 deficiency is not uncommon, even in omnivores, due to low stomach acid, digestive issues, and autoimmune conditions such as pernicious anemia. Serum B12 is not always accurate, and it misses a lot of people who are deficient, so I add serum methylmalonic acid. We also have urine methylmalonic acid on the organics comprehensive urine panel, if you use that. It's another good marker for B12. Serum copper and serum zinc: An altered serum copper-zinc ratio is associated with immune and inflammatory issues, more so than it is with dietary or supplemental intake of copper and zinc, as we'll discuss. Then 25-OH(D): Vitamin D is one of the most common deficiencies that we'll see, but we're also going to discuss how I think a lot of people are being misdiagnosed with vitamin D deficiency, and vitamin D toxicity is becoming an increasing concern with people now on long-term vitamin D supplementation.

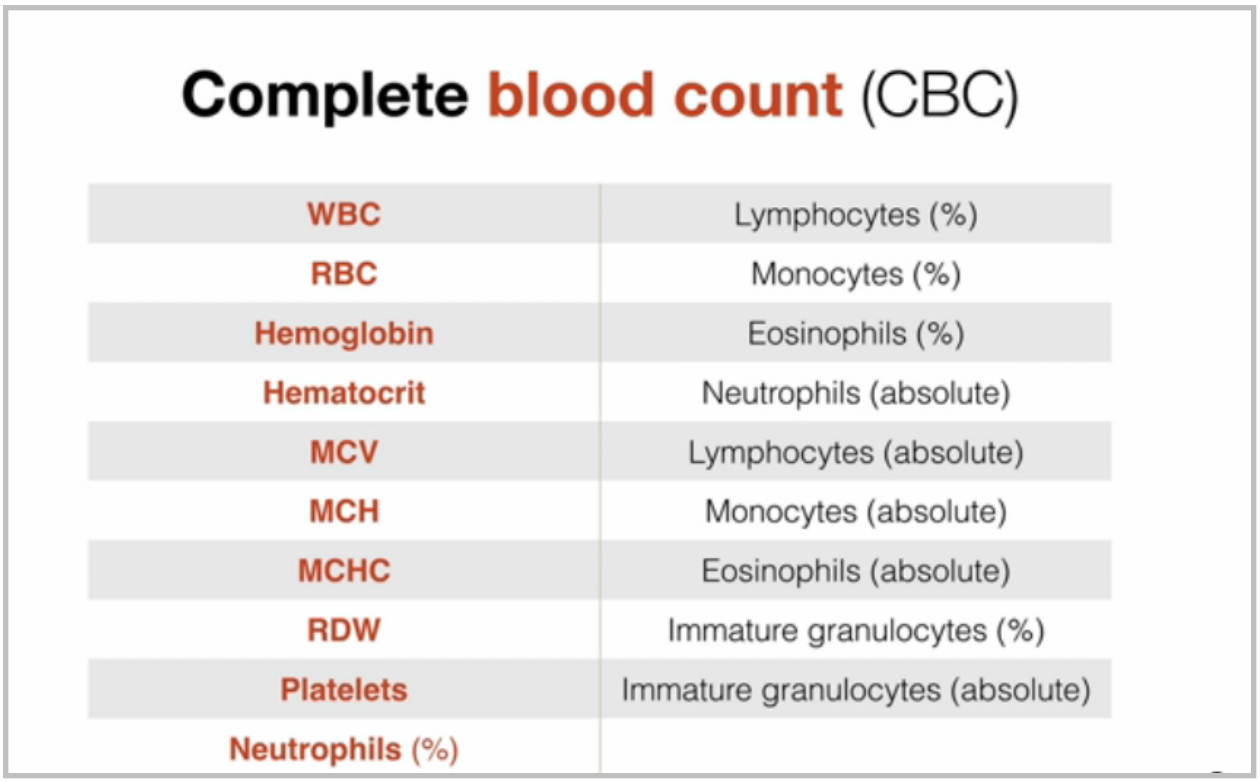


Next is a standard lipid panel. This provides information on lipid metabolism. All the obvious markers here are total LDL, HDL cholesterol, triglycerides, total cholesterol-to-HDL ratio. More advanced testing is often necessary in someone with abnormal lipid values. We're not going to go into great detail on that in this program, but I do have the high cholesterol action plan that you have access to that does go into great detail. We'll touch on this later in the unit, and I'll refer you for more info there.

You can get a surprisingly useful amount of info just from this standard lipid panel. For example, it turns out that the total cholesterol-to-HDL ratio correlates very well with LDL particle number, which is probably one of the more important lipid markers. Don't totally ignore this. It's still an important part of a basic blood panel.



We also do a basic thyroid panel. This is another situation where more advanced testing is often required. Many clinicians like to include free T3, free T4, and thyroid antibodies on the initial panel. I've actually gone back and forth with doing that myself, but it increases the cost by almost $100 in many cases if the patient doesn't have good insurance. Because not everybody needs this, and because you can almost always determine if someone does need additional testing by using TSH, T4, and T3, we don't include those markers on the basic case review panel. We leave it as the next round of follow-up testing that needs to be done. If any of the serum markers of thyroid function are abnormal, or, for example, we see on the DUTCH test that they have high free cortisol and low metabolized cortisol, which, as you know now is a marker for subclinical hypothyroidism or full-blown hypothyroidism, then we would go ahead and order that additional testing.



Finally, we have complete blood count. This is used for a wide variety of purposes. At the most basic level, it evaluates two types of cells in the blood: red blood cells and white blood cells. Red blood cells transport oxygen through the body, and white blood cells defend against infections and cancer, and they're involved in allergies and inflammation. The CBC helps identify conditions such as anemia, infection, inflammation, autoimmunity, bleeding disorders, and cancer. Platelet count and differential are often added. I do this in my panel. This gives you additional information that can be useful. The differential identifies and counts the number of white blood cells that are present.