

How to Use & Interpret Blood Tests for High Performance

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Dr. Andy Galpin

The science and practice of enhancing human performance for sport, play, and life. Welcome to Perform. Welcome back, friends. I'm Dr. Andy Galpin. I'm a professor of kinesiology in the Center for Sport Performance at Cal State Fullerton. I want to start today by asking a couple of questions. The first is, how many of you have ever gotten any blood testing done? Well, my assumption is basically all of you at this point. And the second one is, how many of you, outside of maybe finding out you had an acute infection or disease or something, a medical emergency going on, have found that that blood testing was insightful, helpful, or really gave you specific directions about what to do? Well, my guess is not many of you still have your hands up. In fact, generally, people have done testing like this, and the results and data come back, and it's fairly underwhelming. So my goal of today is to help you better understand what's going on so that you can get more out of your blood work.

Dr. Andy Galpin

Let me give you a couple of examples. Well, there's a particular protein that's measured in almost all blood panels, and that's called albumin. Now, for my money, it is the single best marker of overall health of any test you could get, but we'll come back to that later. Now, albumin is interesting because it is known as an acute phase reactant, which means it is reduced or goes down in the presence of inflammation. However, it goes up in the presence of dehydration. So if you're running the math a little bit there, and you can imagine a scenario in which you're a little bit inflamed and a little bit dehydrated, the inflammation brings it down, the dehydration brings it up, so your albumin comes right back in as perfectly normal. Now, if one doesn't look at your blood results properly and contextualize it and understands your history and symptomatology and other things going on, one may look at that result and say your albumin is perfect.

Dr. Andy Galpin

And the reality of it is you would not be feeling perfect because you're slightly inflamed and dehydrated. This is a classic example of not feeling your best or performing at your best, yet your labs don't necessarily show any dysfunction. Right? Now, I could do this example for many other things. Another really common one that we see is a marker called mean corpuscular volume. This is kind of like the average size of your red blood cells. Again, we'll come back to these things later. It has the same issue where it goes up in the presence of vitamin B12 or

vitamin B6 deficiency, which is actually quite common, but it is reduced in the presence of inflammation or even iron deficiency. So not uncommon for someone to be low in B12 and B6 as well as iron, in which case, again, mean corpuscular volume would be normalized. So there are things like this that are happening that you can actually identify and you can see in your labs if you know what's going on, which then gives you specific and direct information about what exactly to do to resolve those problems.

Dr. Andy Galpin

It's these types of things I'd like to cover today, again, to give you more information about what's going on so that you know exactly what to do to help improve or reduce or relieve any symptoms you've got going on that you don't like, and more importantly, just simply helping you look, feel, and perform at your best. Now, before we go too much further, I'd like to take a quick break and thank our sponsors because they make this show possible. Not only are they on this list because they offer great products and services, but because I actually personally love them and use them myself. Today's episode is brought to you by Eight Sleep. Eight Sleep makes smart mattress covers with cooling, heating, sleep tracking, and more. I've had one for years, and it is glorious. I even put one on the bed in my guest bedroom because as you'll hear me talk about endlessly here on the Perform podcast, there really is nothing you can do that makes a larger impact on your health and performance than getting tremendous sleep.

Dr. Andy Galpin

The Eight Sleep is a game changer because I run hot, or as my wife calls it, I'm a furnace. And that's particularly driven by the fact that I often have to do my exercise training in the evenings, which is honestly not always great for sleep. But this is also the case of many of the athletes that I work with who don't have a choice when they compete. And so being able to cool down immediately in bed does wonders for both sleep latency and sleep quality. Eight Sleep recently launched their newest generation of the pod cover, the Pod 4 Ultra. The Pod 4 Ultra has two times more cooling power, yet is virtually silent and even has snoring detection that will automatically lift your head in a few degrees to improve the airflow and stop you from snoring. Go to eightsleep.com/perform to save \$350 off their Pod 4 Ultra. Eight Sleep currently ships to the USA, Canada, UK, and select countries in the EU and Australia.

Dr. Andy Galpin

Again, that's eightsleep.com/perform. Today's episode is also brought to you by Vitality Blueprint. Vitality is the world's only comprehensive blood work company built specifically for high performance. A high-quality blood test is one of the best ways to better understand your physiology and areas for improvement. Vitality Blueprint uses over 100 molecular biomarkers that are critical to physical and mental performance, then provides unrivaled interpretation and analysis of these data so you know exactly what's going on in your body. From there, Vitality's

innovative software allows you to easily create clear and highly specific lifestyle, nutrition, and supplementation plans based upon your unique physiology and goals. Experience the world's most premium performance blood work by going to vitalityblueprint.com/perform. I know exactly how dope this thing is because Dan Garner and I built it ourselves based upon the system we've used in thousands of athletes over the last decade or so.

Dr. Andy Galpin

So we're stoked that something that's previously only been accessible to the world's most decorated athletes, musicians, and so on is now open to everyone. Let's finally get you looking, feeling, and performing at your absolute best, and that starts by going to vitalityblueprint.com/perform. Let's go. So the outline for today is going to be the following. We're actually going to start with what I call the pros and cons of getting blood work done for performance anyways. As much as I'm going to advocate it, of course, and there are many benefits, there are also some cons and some downsides and some things that make it unrealistic or even maybe not the best option. And so I'd like to make sure we address both sides of the coin before going any further. After that, though, we'll get into what I call the first I, and that's investigate. Within that, we'll first talk about which measures to actually go after and which markers to select.

Dr. Andy Galpin

We'll then get into some of the more common panels, and we'll talk about what those things are, what they mean, and what they actually tell you. We'll get into information about how to get the best data and getting the most useful information out of your blood draw, and then finally, how to pick these markers based upon your specific goals, sports, or other activities and situations. From there, we'll move on to how to interpret that information. We'll start off by going over what I call the "compared to what" conversation. So that is understanding how to interpret your data compared to the right reference range, whether or not you're high or low, or that matters depending on your situation and context. And then finally, we'll talk about the importance of using patterns versus individual markers. May not make sense now, but I promise you, it will later. After we've done all that, we'll finally get into our third I, which is intervene.

Dr. Andy Galpin

And so we'll talk about things like going after systemic changes versus actual direct targets. We'll get into a couple of case studies. So the goal here is if this is all new to you, I want you to learn more about what this terminology even is, what to ask your medical provider, how to even advocate for the right things. If you're more advanced, and maybe you do this stuff for a living, or you've done it for a while, there's a lot of conversation we can have about the difference between performance-based blood work versus medical or disease prevention, treatment, and management. So all of that will be wrapped into today's episode. We've got a lot of ground to

cover, but I think we're going to have a lot of fun doing it, so let's dive in. Now, to get ourselves started, we've got to make sure that we're framing this thing appropriately. The reality of it is blood work itself is an enormous area.

Dr. Andy Galpin

You could have an entire podcast with many seasons just dedicated to blood work. We are going to specifically contain this show to blood work for high performance. All right? We've talked at length about what high performance mean, but just to remind you or those of you tuning in for the first time, I don't necessarily just mean sports. I mean that think about this as going from good to great, right? Medicine is awesome at keeping you out of terrible and bad and disease and getting you back to normal and all those things. But really what we're getting after here is taking someone from an already healthy position and trying to help them improve even more. Now, obviously, there is a large Venn diagram if we balance health, performance, and disease, and there is some overlap there. Clearly, you can't be performing at your highest if you're unhealthy, and there's maybe some fighting and nomenclature and pedantics over what those words mean.

Dr. Andy Galpin

I don't want to get into any of that. Hopefully, you understand what I'm trying to say when I say performance versus disease, given the fact that there's clearly an overlap, but I think we're hopefully on the same page now. The second big assumption we're going to have to do here is that medication is off the table. So the interventions I'm going to talk about at the end are going to be things that you can do with exercise, food, third-party tested supplements, and so on and so forth. Obviously, we are very pro-medicine. That's important, but that's not within the scope of my practice, not being an MD, and it's just a way for me to, one more time, bring down the scope of our discussion. Okay, so now all the back end office stuff is out of the way. Let's get to the fun. I want to start off by talking about what I call the pros and cons of getting blood work done. And let's start with the cons, because the reality of it is, you do not need to get blood work done.

Dr. Andy Galpin

I have coached many world champions in many sports, broken world records. We've had incredible feats of performance. We've coached a lot of individuals who are non-athletes and regular people to weight loss and muscle gain and all kinds of improvements without ever taking a single vial of blood. So I want to make it incredibly clear, it is not mandatory or necessary for anybody at all to get blood work done just to have success and performance. Obviously, I think there are strong benefits here, but it is not needed at all. Right? In addition, it is expensive. Sometimes, depending on your situation, you may be able to get your insurance to cover some of it, other times not. Even if some of these panels are as low as \$500 to \$700 or so, that's still outside of a lot of people's pocketbooks. I know it was outside of mine for many years of my life.

And so we need to acknowledge that this stuff can be very expensive, and they typically scale up from there.

Dr. Andy Galpin

Furthermore, we don't have measures for many things you feel like are important. I mentioned a little bit earlier the relevance of vitamin B12, and a lot of folks realize and know that that's an important role in energy production. But the reality of it is, and a lot of people will not tell you this, many micronutrients, B12 specifically here, are very, very poorly measured in blood. Right? So really unreliable markers. And so we know B12 matters a ton for energy production and performance, but we just simply can't pull it out of your blood and know your status. It's not really how that works for many of our micronutrients. And so as you're kind of seeing here, another major downside is that your results are highly context-specific. So you really have to know what you're doing interpreting these things. And this is why maybe a medical provider is going to look at things differently than someone who's looking at it from the perspective of high performance, and I'll share with you plenty of examples of that later.

Dr. Andy Galpin

But as you also saw from the albumin example at the beginning and the vitamin B12 as well, a lot of context and information needs to go into a proper interpretation here, and that's not always possible, again, or affordable or accessible for everyone. Another major downside here of blood is most big blood draws are going to be a single snapshot in time, and so you need to really be able to contextualize and not be prey to false positives, negatives, and outliers and things like that, that can screw with your results and interpretation. Finally here, the biggest battle with blood work is understanding the difference between what's normal or normal for you. And so when we look at research in these areas, we're looking at what's normal across a large population. So what's normal across average 45-year-old men who live in the Midwest, and what's average for cricket ...ers and racquetball players and what's average for you, so on and so forth, right?

Dr. Andy Galpin

Well, that doesn't really tell me anything about what's normal for you. Physiology is unique, and so while I know what an average person in your sport looks like, I still don't know what is actually normal for you, and that is a really big problem. The good news is I can provide you some information on all these things to help. I'm not perfect, and I can't cover all the ground needed in a single show here, but we can definitely do a lot to at least attenuate some of these problems, and in minimum, let you know what battles you're facing so we don't over or under interpret anything. Now, I know that was a lot, but I really did genuinely want to make sure none of you left this thing feeling like you were overly sold on blood work because I'll be honest with you, the next bit of time I have with you here, it's going to be very convincing. And so I really need to

make sure that people understood there are downsides.

Dr. Andy Galpin

You don't have to do this at all. Because one thing I've always worked in my career against is making sure we don't overly market or sell or hype something up to a level that was maybe not appropriate or fair without acknowledging the downsides. So pros and cons has always been a big part of my career, always will be, and so I wanted to make that list elaborate and long and truthful. But that being said, let's flip the script here and talk about the benefits of it. The very first one is that there is a deep evidence base for what's called blood chemistry. Now, you're going to hear me say that basically the rest of the show. That's what we'll often refer to. When you get blood work done from the perspective of health and performance, most people are going to refer to this as a basic blood chemistry or an advanced blood chemistry. So that's what we mean when we say that. And there is an enormous, and I mean enormous, evidence base for this.

Dr. Andy Galpin

You've got, again, thousands of markers with decades of data on them, in America and Australia and Europe and Asia, and all over the world. And so we really do have large amounts of quality data to go after. And especially if you can compare this and contrast this to things like a sweat test or a saliva test or a hair test, the information available scientifically gets way smaller. So blood chemistry is very well-established and has a lot of information you can go back on. It's also able to help you solve very specific problems. And so if you go in thinking you've got a hydration issue, or a cramping, or fatigue, or feel like you're plateauing with muscle growth, or you feel like something specifically is going on, blood chemistry lets you go right after that. And if you know what physiological processes are a part of those areas, then you know what to go test. And so it can really help you pinpoint whether or not an issue is going on in your physiology or whether it's maybe due to your nutrition or your training or some other factor that's not physiological.

Dr. Andy Galpin

Another major benefit is it lets you know why things are happening, not just what is happening. And so again, if we think about hitting a plateau like we've talked about in other episodes of this show, or you've had this drop in energy, or functionality's gone down, or whatever else is going on, well, if all you do is, say, do a performance test or a body composition test, you might know that you've lost some muscle, but you don't know why. Well, the blood work is going to tell us why for the most part. We're at least going to see the physiological reaction, and that's going to give us insights about what to do to go solve it. So high-precision information about what's happening for more high-precision solutions. On a similar note, it lets you differentiate symptoms versus causes. A really important thing, and as you'll see later and I'll highlight a bunch of times, just because an area is symptomatic doesn't mean necessarily that's the place you want to target.

Dr. Andy Galpin

You want to find out what's causing the symptom and then go back and solve that or address that. That not only actually gets you the correct solution, but in large part, if possible, when possible, it allows you to stop the problem permanently. Not always possible, but is sometimes. And I think most of you would agree here, almost always, we'd rather solve the core of the problem if we can, rather than just continually cover up the symptom. Blood work gives you that possibility, at least. Another major benefit we've used over the years is the fact that it is objective, meaning it doesn't care if you had a great day the day before. It doesn't care if someone is worried about hurting your feelings or not. It's not subjective like that. It helps you solve the problems that you need versus the ones that you want. So really helps us know what to solve versus the one you think you need to solve.

Dr. Andy Galpin

And then finally, and perhaps my biggest point, is what I'll call a baseline or a passport. Now, you heard me refer to this a second ago when I said one of the major cons is differentiating normal for you versus normal against the average population. The only way we can really understand what's normal for you is if we have multiple draws from you. And so one of the things I have to tell people is like, "Hey, your first time getting really good blood work done, you may or may not get a lot out of it, but that's okay." The real value is starting to understand your baseline physiology. We have to understand what's normal for you over time. Now, this is critical for things like aging. The easiest one to pick on here is testosterone. A lot of individuals, particularly men, but plenty of women as well, when they start getting into their 30s, 40s, and 50s, get excited about using exogenous testosterone.

Dr. Andy Galpin

That's fine. That's medical. That's not in the scope of this conversation. But they do that because there's a lot of information now about how testosterone levels have declined over the last, say, decades. True or not, don't really care. My point, though, is saying, "Hey, look, you think your testosterone is lower now? All right, great. Well, how do we know if that's just normal for you? I don't know what your baseline was." And so by starting your blood work, say, in your early 20s, and then when you get to your 30s, you actually know, "Hey, for the last 10 years, I've been at 400," for example. And now all of a sudden I'm at 250. Okay, clearly testosterone's gone down, and now your medical provider can choose to do what treatment option they'd like. But if we don't know that baseline, we don't actually know. Maybe 250 was normal for you. Maybe that's been your whole life, but your symptoms have only started two years ago.

Dr. Andy Galpin

If that's the case, your symptoms aren't being caused by your testosterone if that's where it's been the last 25 years. We need to understand what's normal for you over time, and the only

way to do that is to have some routine blood work done. And last one then is progress tracking, of course, right? If you're doing something and you're working on your sleep, you're working on sunlight exposure, having better relationships, eating better quality food, because you think it's going to make you healthier, which it should, well, having some blood work done will give you a lot of objective markers about, hey, it's working or it's not. Or you tried a different supplement regimen, or whatever else has happened. You don't really know if it's making a physiological change unless you have a physiological measure. So hopefully, that gave you a lot of information about some of the benefits of routine and high-quality blood work.

Dr. Andy Galpin

And so if that has happened and you're all fired up and you're like, "I'm in. I'm so in, Andy. Now just give me the goods," it's time to do it. Let's get into it. Getting the most out of your blood work starts by choosing the right markers. So we're going to get into that now in the first section that we call Investigate. Now, the reason we like blood chemistry in general is because of the things I just mentioned. It has the most science behind it. It's really robust. It's going to tell you information about every organ in your body that has a blood supply, which is all of them. And the list of markers is almost unending. There's over 4,000 the last time I checked. And so really, you have the ability to look at broad-spectrum markers. You can look at organ-specific ones. You can look at ones that are really indicative of a particular area, say hydration or inflammation or recovery, or others that are telling you global fatigue and physiological resilience and anything else that you can really think of, you can hone in and analyze.

Dr. Andy Galpin

And so it gives you a large ability to go after any particular area you think is a concern or may be of a concern based upon your scenario. And so the first thing that we have to understand is you never want to put too much stock into any individual marker. Rather, you should treat them more like a detective would. It's just a clue. Now, if you were on a crime scene, you would look at maybe dozens or hundreds of clues, and by the time you solved the mystery, you realize that some of those clues didn't matter, or in fact, they were just a fluke or an accident, or they were totally irrelevant to the case, and others weren't. But you don't necessarily know that right out the gates until you've gotten to the end. And so you always want to take every marker with a little bit of a grain of salt, understand what they mean and don't mean, and build that together with a complete case. Ideally, you layer that on top of subjective symptoms and performance markers and so on and so forth, and that's really going to help you determine your cause of action.

Dr. Andy Galpin

And so starting off with the right markers is critical. The most common blood chemistry analysis done is what's generally called a CBC and a CMP. All right? Now, many of you have heard of these things. It is by far the most common. It is almost always covered by insurance and can be

ordered pretty easily. Almost every medical provider will know exactly what you're talking about there. And so it's a really nice place for us to get started. So let's get into them a little bit. What's a CBC? So a CBC stands for a complete blood count, and it's going to tell you information about two broad areas, your red blood cells and white blood cells. Your red blood cells are nice because it tells you a little bit about oxygenation and overall energy production, while your white blood cells tell you about immunity and infections. Now, if you ask for an additional thing with your CBC called a differential, I would strongly encourage it.

Dr. Andy Galpin

But what that's going to do is actually help you differentiate within your white blood cells. So this is a bunch of other information that's going to tell you insights about if you have something going on in your immune system, is that because of an allergic reaction, a viral infection, a bacterial infection, or otherwise, maybe even potentially gut health things going on. A differential will be able to pull up different markers there and tell you that. And so rather than just knowing your immune system's up, it'll tell you why your immune system's up. So a CBC with differential has about 17 total markers or so in it. I'm not going to go through all of them, though I have provided a list that is available in the show notes. You can also Google this pretty quickly. But a general CBC comes with things like red blood cell count, hematocrit, hemoglobin, white blood cells, platelets. It's going to have a bunch of things that are a further analysis of the size and width and distribution of your red blood cells because that tells you a lot about what's going on, and so on and so forth.

Dr. Andy Galpin

So about 10 different markers of your red blood cells come with a CBC. For your white blood cells, if you get that differential, it's going to tell you your neutrophils, lymphocytes, monocytes, your eosinophils, and basophils. Even some of them will tell you about things like immature granulocytes and nucleated red blood cells and just different things like that. Okay? So all in all, about 17 different markers, and you can again quickly see why that is going to give you a really nice snapshot about if you're feeling poor, is it because energy production and oxygen is way low or way off, or do you have some sort of infection happening and your immune system's going nuts? So that's the CBC. The CMP is a comprehensive metabolic panel, and that's going to globally tell you about four things, your hydration, metabolism, kidneys, and liver. And so you combine that with your red blood cells and white blood cells, and one more time, you can see why this is a nice marker of overall health that many physicians may want to make sure if you're not feeling great, that we check out exactly what's going on.

Dr. Andy Galpin

So the CMP, the metabolic panel, it is going to include about 13 markers or so. Things like blood glucose, calcium, sodium, potassium, carbon dioxide, blood urea nitrogen, albumin, which we'll

talk about a lot because it's my favorite marker of all in physiology, bilirubin, and a whole bunch of other stuff within that panel. So that's the basics of what's going on. Now, a lot of people will add to their CBC and CMP With markers of either anabolic hormones like testosterone, free testosterone total, so on and so forth, as well as oftentimes thyroid markers. If you were to do something like that, CBC, CMP, add on some anabolic hormones, as well as thyroid hormones, you would get a pretty comprehensive overview of what's going on with your health. It's going to check off many of the big markers. You're looking at now maybe 50 or so panels, and that's oftentimes, depending on the company you're working with, somewhere in the neighborhood of \$300 to \$700 as cash price.

Dr. Andy Galpin

However, again, most insurances will cover that if they deem it necessary and you can work with your physician. That's a pretty good starting place of markers to ask for. So at the same time, we can do a lot better in terms of choosing markers for high performance. So not only is that package a really nice start, frankly, I measure all of those in every one of the individuals I work with. But then there's a handful of things we're going to want to do that are maybe more advanced and more specific to high performance, and I'd like to talk about those next. Now, this is a nice contrast to other markers that I'd say are really more about health and don't have a ton of high-performance application. Everything's important, of course, Venn diagram, but an easy example of this would be a marker that my friend and colleague, Dr. Peter Attia, talks about often, and that is ApoB. Really, really important for long-term health management and risk factors for disease and so on and so forth.

Dr. Andy Galpin

But I can't say I've ever measured it in a high-performing individual, and I can't see a situation without information changing that I would. So really important for health, probably not on my list. At the same time, there's many of the things I'm going to talk about now that someone like Peter may or may not measure for long-term health considerations. Now, the reason I'm saying that there is some distinction, but then we just covered that CBC and CMP and other panel is because there is that big overlap. The primary difference between blood work for performance and blood work for health or disease is not just in the markers. It's mostly in the interpretation, the context, and the evaluation of the results. But that's the next section. So what do we know about the markers themselves right now? Let's get into a couple examples, and I think that's the easiest way to go about it. So let's imagine we have a female, and we'll call this individual a bodybuilder.

Dr. Andy Galpin

Doesn't matter that they're actually training or competing in bodybuilding. So think of this as a female who is trying to increase muscle mass while at the same time restricting calories, and

they're probably somewhat close to competition or the end of their diet. Now, I'm setting this example up on purpose because this is pretty common. Oftentimes, individuals want to gain muscle, but they want to stay lean as well. And so this is what can happen, or these are the things I would want to look for in someone, particularly a female, who's trying to accomplish both of those goals at the same time. In that scenario, I'm particularly concerned about what's called protein turnover. So we're trying to gain muscle, so we have to have a lot of protein, but at the same time, we're restricting calories, so we don't have any extra supply there. This is not as much of a challenge for somebody who's just hypercaloric and doesn't really care about adding additional calories.

Dr. Andy Galpin

And so we want to make sure we're maximizing our protein here. So in this case, we might go really excessive in our protein markers. We would look at, of course, total protein, albumin, again, coming back again, like I said, it's great. We'd also look at globulin, which is almost always calculated, what's called bun urea nitrogen or BUN from here on out, nitrogen balance, as well as maybe even some amino acids. I wouldn't necessarily look at all those markers, though, in other individuals. And the reason I'm doing that is because not a single one of those markers will tell me the entire story. They're representing different phases of our protein turnover. They're representing different scenarios in which we have insufficiencies or problems that have happened in the past or are coming up. And in addition, like we've talked about, what's critical always is that we've got backup markers. We can't make super high, strong decisions on one marker, and so by having data about every part of the protein cycle, I'm now less concerned about getting overzealous or underzealous about one individual marker.

Dr. Andy Galpin

Now, the albumin, we can go into a little more detail now. As I mentioned at the beginning of the show, this is called an acute phase reactant, so we know it goes down in the case of inflammation and up in the case of dehydration. Really, really common in these individuals. So we're probably going to be inflamed because we're training hard, potentially dehydrated, may or may not be. We also know albumin is associated with growth hormone, though I still have not found any direct information about why, but that's been shown now a handful of times. And so we clearly need to have a better understanding and reference range for optimal albumin for female high performers. That doesn't exist to my knowledge. I would love to know it. And so we're going to have to go based on the information we do have about albumin in other similar scenarios. But as I said, overall, probably the single best marker in the world for overall health, and you'll see as the show unfolds as to why.

Dr. Andy Galpin

Hopefully, most of you were able to follow what I was getting at there with that cycle. But I do

think it would be helpful if I spent just a little bit of time talking about a couple of those individual markers because we're going to see them play out in a lot of different scenarios. In fact, in just one second, once we finish this, I will change our scenario, and you'll see how the markers we select change. But let's go back and talk about a couple of these markers, and the first one is what's called BUN, B-U-N, or blood urea nitrogen. Now, we know this is a product of protein degradation, and therefore it loosely suggests protein breakdown. Really pretty important and critical for our case study here. It's not the exact same or as accurate as taking a muscle biopsy and looking at muscle protein synthesis and breakdown, but it gives us some insights. Remember, we're never too high or low on any individual marker.

Dr. Andy Galpin

We also know BUN has been associated and is elevated in response to protein intake. Here we're referring to dietary intake. Catabolism, especially with a lot of exercise, catabolism being the breakdown, in this case, of protein. Also increased and elevated with fevers and infections, glucocorticoid action, hydration, and hepatic and renal urine excretion. And so you can see, again, it's not just telling us one thing. So another thing we have to think about always with blood chemistry is one marker doesn't always tell us everything, but also one marker represents many different things. And so we can put this little algorithm together a little bit in a couple of different ways. So one of them would be if we had low total protein, low albumin, and high BUN, that's going to tell us that we have low dietary protein. And so you see what I'm talking about. I just figured out a very quick nutrition solution by understanding blood chemistry.

Dr. Andy Galpin

I saw that the protein in the blood was low. I saw albumin was low. I saw BUN was high. I immediately then had really good insights that they weren't just eating enough protein. Now, maybe they were eating one gram per pound of body weight, which is our normal reference range I recommend. But remember, friends, that's just a general recommendation. How do I know that number's working for that individual? The honest answer is I never know. You have to try and see, and this is exactly what trying and seeing with. In this particular person, it wasn't enough. Why? I don't know. Maybe gut issues going on, maybe some other natural physiology, normal physiology thing. Doesn't matter. Clearly, their blood is telling me this was not enough protein in this individual at this time. This is how we get to high-precision nutrition, and we're coming all the way back to not a drug or a supplement, but just simply saying, "Okay, you just need more protein in your diet, and your blood told me that."

Dr. Andy Galpin

A nice objective marker with a very specific solution. I'd like to take a quick break and thank our sponsors. Today's episode is brought to you by Momentous. Momentous makes supplements of the absolute highest quality. For example, we've long known about the numerous health and

performance benefits of fish oil. I've personally been taking it for probably 15 years or more. Now, you can get fish oil anywhere, but personally, I only use Momentous because it's never once given me a fishy aftertaste, and more importantly, every single batch is NSF tested to ensure the lead and mercury levels are undetectable for purity and safety. Their fish oil is pure, potent, and sustainably sourced. Another major benefit is that you won't find any fillers in their fish oil. See, the dirty secret in the industry here is that most companies will add non-EPA and DHAs to their fish oil to keep their, quote, "fish oil count high," but to keep the active ingredients and therefore costs low.

Dr. Andy Galpin

And it makes you actually feel like when you're purchasing it, you're getting more fish oil at a cheaper price, but you actually have to double or triple your dose to get the same amount of active ingredient, which means you end up spending more money in the long run, or you don't, and you get worse results. If you want to give their fish oil a shot or any other Momentous product, go to livemomentous.com/perform to get 20% off your order. Again, that's livemomentous.com/perform to get 20% off. Today's episode is also brought to you by LMNT. LMNT is an electrolyte drink mix that has an ideal ratio of sodium, potassium, and magnesium, but has no sugar. Electrolytes are critical to proper hydration, which I've been harping on for years. But you can't do that by only drinking water. In fact, many of you will probably remember that I featured LMNT in my YouTube series on optimizing hydration all the way back in 2020, which is obviously long before this podcast even existed.

Dr. Andy Galpin

So I've been a fan of LMNT for a long time. In fact, astute listeners will also realize these hydration videos were the genesis of the Galpin Hydration Equation, named not by me, but by the legendary neuroscientist, Dr. Andrew Huberman. I featured LMNT in these videos because their blend of 1,000 milligrams of sodium, 200 milligrams potassium, and 60 milligrams magnesium really is different than any other electrolyte on the market and has great scientific support. However, I want to be ultra clear, 1,000 milligrams of sodium is a lot, and not everyone needs that much. In fact, that may be way too much if you don't exercise or sweat much, already eat a lot of salt in your diet, say, from a lot of processed foods, or otherwise have sodium-related medical concerns. I personally use the citrus and watermelon flavors a ton to pre-hydrate before heading out on a full day of training or a long hike or a hunt, since I know I'll be losing a bunch of fluids and won't have many opportunities to take things with me.

Dr. Andy Galpin

LMNT has also just released a new line of canned sparkling LMNT, which I am all about. If you'd like to try LMNT, you can go to drinklmnt.com/perform to claim a free LMNT sample pack with the purchase of any LMNT drink mix. Again, that's drinklmnt.com/perform to claim a free sample

pack. The other marker I'd like to talk about in detail is albumin. I've teased this a couple of times, but let's get right into it. As I've said, and I will reiterate it, it is arguably, in my opinion, the single best marker of anything for overall health. The optimal range here we're typically looking at is something like 4.0 to 5.0 grams per deciliter, and I almost always want to see them somewhere between 4.5 to 5. Men tend to be just a touch higher, but not always. Typically, something like 4.5 for women and 4.7 for men, but really, if they're between 4.5 and 5, I'm okay. And the reason is we know that, remember, it goes down in the scenario of inflammation.

Dr. Andy Galpin

And so if you are below four, it is associated with cardiovascular disease and something generally very bad is happening. In fact, if it is really below four, you may be even at risk of an acute issue happening. So something could be happening really, really soon. In and of itself alone, it is found to be a strong predictor of inflammation. And so what I mean by that is there are papers who have simply looked at albumin level and found associations between all-cause mortality. And so we can tell it is a really, really powerful marker. It is involved in a lot of function, like I mentioned. Making albumin requires a bunch of different stuff. Therefore- If your albumin number is off, you can then back calculate and figure something else is wrong. Here's what I mean. The liver, adequate protein intake, insulin signaling, acute and chronic inflammation, all of these things regulate albumin production.

Dr. Andy Galpin

So if albumin production or levels are gone, you can then go backwards and realize, okay, maybe something is going on with my nutrition, my liver, excessive inflammation, insulin signaling's off, and so on and so forth. That's what I meant by that comment. So you can work backwards to realize it's an indicator of something being off. Now, being excessively high isn't great either. Okay, so this is a common thing we want to be worrisome of. Low is not good, but high is not better either. Generally, physiology works in nice ranges, and they want to be in a certain spot. Okay? Above 5.0 indicates real high chronic dehydration, and the reason is albumin has about a 20-day half-life or so. And so if that is off, that typically represents something that's been going on for about 20 days or so. And so albumin is really, really nice because one of the common things that we see happen when we've had blood work come back and we tell people that they're dehydrated, they say, "Oh, yeah, yeah, I didn't drink enough water that day."

Dr. Andy Galpin

Well, that's not going to influence albumin, right? We will actually be able to differentiate whether that was acute or chronic dehydration. And albumin being off is going to be a reflection of at least the last 20 days or so. And so we know that this has been going on for at least that timeframe. All right. Now, I said over 5.0, but honestly, once it gets above 4.8, I start paying attention. Okay, so a real quick example on this hydration thing that we'll use is if you look at

things like sodium, hemoglobin, and hematocrit, if those are all high, then we might think you might just be acutely dehydrated. You didn't drink enough water that night before your blood draw. However, if sodium, hemoglobin, and hematocrit are all high and albumin is high, or at least it's even trending high, and by trending I mean above 4.8 in this particular case, then we know that this is probably chronic dehydration.

Dr. Andy Galpin

So just a little bit of insight again about how you can differentiate and get more insights about what's going on, which gives you more specific solutions. In that first case study, we focused on two areas, protein turnover and hydration. I'd like to change the scenario, and I want you to see how the markers we select are going to change based upon that different goal and situation. Okay? I want to keep it female, and I also want to keep it with caloric restriction. And I'm doing that so we can have a pretty direct apples-to-apples comparison. So in this case, the female, rather than emphasizing maximum muscle growth in this hypocaloric state, they're going to emphasize rowing performance. And I'm choosing that because this is honestly common, and I've personally dealt with this before. Working on endurance events in sports is honestly still normal for them to restrict calories because in a lot of times, any additional mass you have is only going to make you go slower because it's more mass you got to carry in the boat or in the pool or on your feet when you're running or whatever the case is.

Dr. Andy Galpin

And so you want to be as light as possible to go as fast as possible without compromising energy and recovery and so on. So a little bit of caloric restriction while still trying to maximize endurance performance is not totally abnormal. So what do our blood markers look like in this particular scenario relative to the first one? Well, here we know we've got a couple of things to pay attention to, low calories and a lot of training volume. Okay? We add on top of this female, and so several alarm bells are going off, and the very first one in my head is vitamins and minerals. The reason is we know that these things, if they are even at an okay level, are going to be compromised because we're not going to be able to have enough food to get in enough of these nutrients. In addition, they're going to be depleted based upon the training we're having. And so making sure that just being at an acceptable level before we start our intensified training is not going to be good enough.

Dr. Andy Galpin

We have to make sure that these things are really, really high, in a great spot, because we know they're going to be coming down with food restriction as well as advanced training. Right? Now, anyone who's worked in these areas also know that the place you're going to start is iron, no doubt. This is the place in which your body carries and transports oxygen throughout your body and is a particular problem or challenging to manage for female athletes and especially for

female endurance athletes. So this is the most common textbook, probably arguably the number one place to start. We also know that iron deficiency is really common. In fact, up to 30% of athletes experience this at some point. And so going to be common and going to be a problem and has a lot of physiological issues. Iron itself is disrupted by a lot of different things. It could be disrupted by intake. So insufficient iron intake happens sometimes in vegan and vegetarian athletes or-- And remember, when I say athletes, I don't necessarily mean you're competing.

Dr. Andy Galpin

Just someone doing a lot of this type of exercise or training would be fine. But those individuals are at advanced risk. Doesn't mean they're going to have a problem at all, just means they're at a little bit more risk here, or caloric restriction in general. And that's the scenario I picked in this case, right? So we know that intake of iron is probably going to be low based upon just not getting enough food in, potentially. Second area behind intake or diet is going to be absorption. So we know that there's going to be potential problems that come along with gut health disruptions. There's also what's called exercise-induced GI bleeding, which is to say some amount of gastrointestinal bleeding just happens with exercise, particularly high-endurance exercise. And that's normal. It's not cause to concern, but that will disrupt iron absorption. And then finally, what's called normal exercise-induced GI inflammation.

Dr. Andy Galpin

So in addition to the bleeding, some inflammation happens as well. Again, it's normal. It's not anything to be concerned about, but it will disrupt iron absorption. The third bigger area, though, and potentially the bigger place to focus on is iron loss. Now, these things are not specific only to this scenario that we're talking about in this case study, but they are exacerbated. Right? So we're talking about things like menstruation. It's a very common occurrence, of course, ideally happening in most female athletes. But a significant source of iron loss. We also have what's called heel strike hemolysis. So hemolysis, think of the H-E-M-O, like hemoglobin, right? That's just a fancy way of thinking about red blood cells. Lysis being the breaking. So hemolysis basically means the breakdown of red blood cells. So heel strike hemolysis refers to the amount of red blood cells you actually smash into pieces by your foot landing on the ground.

Dr. Andy Galpin

Now, our rower is not doing that, but really common in endurance athletes, and obviously we're talking about runners here. You may not realize it, but there is some amount of blood flow that's happening from the bottom of your foot and your heel. And so the blood that's going by the bottom of your foot every time you're landing gets squished and smashed, and you're physically smashing your red blood cells. Not a big deal for most of us. But when you start doing this for many, many miles over many weeks and months, the amount of red blood cells lost to that smashing ends up contributing a significant amount and can be definitely a contributor to iron

deficiency or low iron status. Other issues are things like urinary tract infections, what's called intramuscular pressure, that happens a lot with swimmers and cyclists, and basically that constant squeezing of the tissue. Even though it's not striking and landing, it's that constant squeezing that can cause damage.

Dr. Andy Galpin

Non-steroid anti-inflammatories or NSAIDs will happen as well. Alcohol use is a big problem. Even at moderate amounts can be a huge issue here. There's, again, a thing called normal exercise-induced hepcidin release, and then finally, even small amounts in your sweat. And so lots of scenarios that we've outlined here, half a dozen at least or more, that can be contributing and causing. In the case study we chose, they didn't tick all those boxes that we know of, but she ticked a lot of them, and so iron is going to be on our top priority list. All right? If iron gets low, it can do a number of things that are detrimental to performance, including things like reducing or compromising thyroid function. It's been shown to reduce time trial performance. It can impair VO2 max, reduce energy efficiency, lower time to exhaustion, reduce lactate threshold, lower training volume, and so on and so forth.

Dr. Andy Galpin

Right? And this has been documented in many, many studies over the years. And so it causes a physiological effect that has a significant reduction in actual performance. All right? So because we know that this is going on, we need to select a lot of markers of iron. In another scenario in which all these things aren't happening, I might pick one or two markers of iron. In this case, I'm probably going to look at a dozen or more. Why? Because I can't afford to miss something. We have to make sure we're really not over or under-interpreting something. This is not a full inclusive list here. You could maybe do others, but it would be something as one example, maybe you want to look at iron, and then there's another thing called TIBC, UIBC. There's transferrin saturation, ferritin, soluble transferrin receptors. I mentioned hepcidin peptide as well. Then you might want to also tack on red blood cell direct markers like hemoglobin, hematocrit, MCV, MCH, and MCHC.

Dr. Andy Galpin

Now, I know you didn't catch all that stuff, but the reality of it is we don't have time to go into all of these things. This conversation alone is worthy of an entire podcast. But I will put this list up in the notes. Again, there's nothing magical about this, but this would be just an example of how, if this scenario or an athlete presented itself to me, I would want to do an extensive look into the iron side of the equation for all of the reasons that I just mentioned. So please don't get caught up too much in the specific list I just provided. It's just a sample to explain and show a concept of understanding of choosing the right markers. So let's move on and talk about some of the other vitamins and minerals that would be important to pay attention to in this case study. Next one

that comes to mind really is zinc, and that is of relevance because it's low oftentimes. In fact, up to 25% of endurance athletes have low or insufficient zinc status.

Dr. Andy Galpin

It's involved in a lot of things that you would care about, like protein synthesis, cell function, glucose regulation, endocrine function, immunity, wound healing, and so on and so forth. So you'd really want to pay attention to overall zinc status. Same thing for chromium, one that many folks have not heard of and rarely paid attention to. We know exercisers excrete much more of this than the regular person, and so you're going to need this more in your diet, and it's also involved in things like insulin regulation and metabolism. So again, we know that that matters because people don't often pay attention to it, and calories are coming down. So ability to get chromium in is potentially coming down unless we're paying specific attention. Another incredibly important mineral is magnesium. Now we know that this thing is depleted about 20% faster in exercisers than non, so you really do want to pay attention to it.

Dr. Andy Galpin

But it's been reported that somewhere between 50% to 60% of people don't eat enough of it in their diet, and this often comes in things like leafy greens and things like that. So you can imagine why people don't eat enough of it. And we know, like I said, athletes lose somewhere between 10% to 20% of it in urine and sweat. And so one more time, it doesn't necessarily mean athlete here. It could just be an exerciser or someone who's sweating a lot. It's depleted significantly faster in these individuals, as I mentioned previously, and it's involved in over 600 different metabolic processes. Also, fun fact, high caffeine and low sodium, and even low selenium further reduce magnesium. And so caloric restriction, energy is low, potentially having more caffeine in our diet to make up for that. If we're not getting enough sodium or salt intake because we're training hard and/or selenium is not being paid attention to, this could exacerbate this already problematic drop or reduction or low intake of magnesium, which is going to make this problem even worse.

Dr. Andy Galpin

So we really do want to pay attention to this. Now, I cannot go any further without mentioning something Magnesium's super important. It's also basically impossible to measure in your blood. Okay, so you will see magnesium on almost every standard blood panel. It comes all the time, but not because it tells you about magnesium status. So we need to be really clear here. You need to actually do what's called a magnesium retention test to truly understand your magnesium status, okay? And that's because a very small amount of your magnesium is actually in your blood. Serum only tells you if you're really, really critically medically low. You would probably know that. You would probably be in some serious issue if that was actually happening. And the reason this is hard to measure is because the amount of magnesium in your body is

generally stored, and the amount that's in serum is insanely variable.

Dr. Andy Galpin

And so your numbers that you're going to get there are, again, honestly, I'll say it this way candidly, functionally useless for determining magnesium status. However, it is useful for insights into things like kidney and liver function, and so the reason why you're like, "Oh my God, if it's such a bad marker, why is it on all medical testing?" It's because of that. It's not because they're trying to determine your magnesium status. It's because it will tell you so much more about other aspects of your physiology, okay? Good part is there are validated questionnaires that are as good or better at predicting magnesium status than the serum marker. And so this is a nice way of blending objective and subjective, and we will of course, have a link to that questionnaire available in our show notes completely for free. But I would really encourage using that if you don't have access to a magnesium retention test, okay?

Dr. Andy Galpin

Now you probably remember I said a similar thing earlier about vitamin B12. It's got a similar issue as magnesium, where the serum measure is not at all a reflection of your intracellular status. Most of your B12 is in your cells, not in your serum. And so what's going on in your blood is not going to tell you much about what's happening inside the cell. So this is why some people think it's this great measure for athletes because B12 is so important for energy production, but it is really not. And so would really caution you about interpreting your B12 status from your basic blood work. The last two minerals I'd like to cover are sodium and potassium. And while you may recognize these and associate these with hydration, and they are, they can tell you tremendous insight about much, much, much more that are directly applicable to our case study. So let me tell you just a little bit more about each one of these.

Dr. Andy Galpin

Now, sodium or what you typically get in salt, right? Table salt is sodium chloride. And so sodium and potassium are both very tightly regulated. Now sodium does the opposite of potassium for the most part. So we know that going very, very low or high causes real issues. Typical number you're looking for here is something like 140 milliequivalents-ish or so per liter. That's generally where we like to be at. But about 90% of it is excreted in your urine, and so you don't have to be hyper-precise in terms of your intake because it's going to be regulated very, very well. In fact, this is one of the main things that your body fluctuates on purpose. That's to say that number, that 140 milliequivalents, it's not going to be impacted that much by what you eat or not because if you have too much in your diet, your body will just quickly and easily excrete it. If you don't have enough, it'll hold on to it more.

Dr. Andy Galpin

Your kidneys are very, very good, and it's quite easy and fast to regulate that. And so this is why

you will see we don't have exact hard specific numbers in terms of how much sodium you should bring in because, again, one more time, your body will alter this really quickly because it doesn't like this number to be that far off of its baseline. So if it is high or low, something significant is happening. Okay, now while we're here, I would love to give you the exact amount of sodium you should be having per day, but it is a hard number. I think most of the field is probably going to tell you something like five to six grams or so per day is probably the sweet spot for exercisers. But real, real, real caveat here. You need to check with your medical professional here before you start ingesting large amounts of sodium. Obviously, LMNT is a sponsor of the show, and it is a fantastic product.

Dr. Andy Galpin

I will talk endlessly about how awesome it is, but it is important to recognize if you are a non-exerciser, if you have high dietary sodium intake, and you have maybe other comorbidities and you have health problems, adding many, many more grams of sodium to your diet is maybe not beneficial and potentially dangerous. So I really do want to caution you against checking with a medical professional for sodium. It's not an area that I'm comfortable just saying, "Oh, it's not a big deal" on because it may not be for some of you, and it may be for others, and I think that's the most fair way to interpret it. Now, again, as I mentioned though, if you are healthy and you're exercising or you're sweating a lot, five, six grams a day is probably normal. And if you go a little bit higher than that, candidly, I do personally. I'm about 175 pounds or so. I exercise, but not an incredible amount. I suffer no ill consequences.

Dr. Andy Galpin

In fact, I generally feel a lot better with it. Potassium is like the sister to sodium. They work hand-in-hand in a lot of areas, and some of which we'll discuss a little bit later. But potassium honestly really doesn't change. It is insanely tightly regulated. It's often slightly higher in exercisers and slash athletes, but not much, okay? If you're over six millimoles per liter, you're probably at a very high risk of a cardiovascular event. Again, your body does not want to change. If you are suffering from cramps or you feel like potassium is low, you will probably not see anything different in your blood work. It will keep that number almost exact at all times. If your potassium levels get too high in your blood, your body will stop that. It will change whatever is happening and what's going on to make sure potassium does not get too high because none of your muscles, including your skeletal muscle or your heart, will contract if potassium gets too high.

Dr. Andy Galpin

So it is very tightly regulated, and if it gets over six, specifically, something bad is probably on the way, and you should definitely consider consulting with a medical professional probably really quickly. All right? Now What's also neat about this, or interesting here, is most people, again, on

average here from the data available, eat around one to two grams of potassium a day, where the need is probably more like five to six grams. It is a significantly under-consumed nutrient. There's many that are, but this is one of the highest on our list. And so this is why I actually like supplements or electrolytes that come with decent amounts of potassium. Many don't. You'd be surprised to know many of them are just sodium-based alone. Going back to LMNT, this is one of the things that-- And you can check the stats here. You can go watch my old hydration videos if you would like, many years ago, before I ever worked with LMNT, that this is one of the major benefits, is they come with a large amount, I believe 200 milligrams of potassium in each serving.

Dr. Andy Galpin

And so you're going to help in this area if you need electrolytes at all, which not all of you do. But this is a major benefit to it because oftentimes very under-consumed. We're bringing this up again, remember, in the case of an individual who's probably sweating a lot because they're an endurance athlete, so we know potassium is going to go down, and under-caloried. And so even if they are eating a good diet, they may not be getting enough or even have a chance to get enough, and so supplementing with potassium may be of particular benefit here. All right. So to recap what we just talked about, we went over one case study or example there where we emphasize hydration and protein turnover. And we changed the scenario a little bit, and not that we didn't care about protein turnover or hydration, but we really change our emphasis now to pay attention to vitamins and minerals, because we know these are exacerbated when we combine low calories with the additional workload and volume associated with endurance training, as in the case of a rower.

Dr. Andy Galpin

And so one more time, hopefully, that gave you some insights about how you could think about choosing different markers based upon the scenario and goal and situation that you're working with or going under. Now, before we move on to our next area, I actually think it'd be really helpful if I cover one more common area and show you how you would maybe select different markers based upon a need. And the example I'll give you here is probably the most common thing I've had come up in my personal coaching practice, and that is energy. And so what I'll show you is maybe some markers you'd choose if somebody is really not having problems with energy, you don't think there is one, versus someone who's coming in as a primary or secondary or otherwise a major complaint of energy. Okay, now, before we get into this, I need to give you the caveat. Something like energy or fatigue has many causes and explanations.

Dr. Andy Galpin

It is not as simple, and I don't want to make you think it is as simple as these couple of markers. But I just want to give you some examples of something to think about, all right? So fatigue and

fatigue management are multifactorial, of course, but nonetheless, here you go. So let's say somebody comes in and we're going to get some blood stuff done, and they've got other goals going on, but there's no real complaint of energy loss or fatigue of any kind. In that case, you might want to just start with a couple of markers for what we'll call overall fatigue or energy management. That is primarily starting with blood glucose regulation. So you might want to look at something like a fasting blood glucose, which tells you really information about what's happening right now. So that's what we call acute. Basically tells you what's going on in that exact moment with blood glucose. Now, to balance that out, you might also select something like an HbA1c marker, which tells you more like a 90-day blood glucose.

Dr. Andy Galpin

And so this really tells you how much glucose has been stored and used on your red blood cells. And since those have a 90-day turnover, it gives you that insight about what's happening with your blood glucose over that three-month span. So by choosing those two markers alone, you've gotten some insights into what's happening right now, as well as what's happening historically, so you got an acute and a chronic monitor. Now, most likely, since they're not having any issues, those two markers are going to come back fine. Or if they don't, then maybe you'll take some further insight. However, if someone's coming to you with the specific issue of energy regulation, maybe they're complaining maybe more specifically of energy is inconsistent throughout the day, and there's lots of fatigues and lulls or something like that, you may choose to examine this blood glucose in more detail. In such case, you would still do blood glucose.

Dr. Andy Galpin

You want to know what's happening there. You would still do your HbA1c, but you might want some more information there. And so instead of knowing right now and 90 days, you would tack on additional markers that give you more of a serial breakdown to help you differentiate why glucose dysregulation is occurring, if it is. Again, we're just assuming that's happening for the case here to help you understand the concept here. So you would do your blood glucose. You may also then use a marker called C-peptide. Now, that's an actual indication of generally what we call 24-hour insulin response. So when your blood glucose is elevated, insulin is secreted. Insulin then draws and pulls blood glucose out of the blood and into tissue and muscle and things like that. And so one of the things that happens is every time you release insulin, you also release this C-peptide. But since insulin is cleared quickly, C-peptide is not.

Dr. Andy Galpin

And so what's left around for about 24 hours or so is going to basically tell you that 24-hour insulin there. So by adding that on top of your blood glucose and HbA1c, you've got more information. But then I'd want to go further. I'd want to add things like GlycoMark and another one called fructosamine. Now, GlycoMark tells you something like a seven- to 14-day post-meal

blood glucose. Fructosamine is more like 14- to 21-day blood glucose. Now, how that's actually working is it's a metric of what's called the caramelized protein in the blood, which is really awesome. And to be totally honest, and I'm not your doctor, if you have diabetes or concerned of that, so on and so forth, but my opinion, for my sake, fructosamine is probably better than HbA1c because it requires a normal albumin to interpret. So if your albumin is off, your fructosamine is going to naturally be off. But typically, we're looking at something like less than 220 micromoles per liter as our number there.

Dr. Andy Galpin

But nonetheless You saw how we just did that, right? So if we really are concerned with blood glucose, if that's why we think energy is off, by doing this full spectrum, we got acute, we got 24-hour insulin, we got sort of seven to 14-day post-meal blood glucose, we got 14 to 21-day blood glucose, and then we got our 90-day blood glucose. This is now going to tell us a lot more information about the potential area or the problem. Now, if anything popped within that, you may or may not want to go on, or your physician, in this case, you'd probably want to refer out, but your physician may want to add things if something hit in terms of something came way off in one of these markers. You may want to now go into what are called your HOMAs, your H-O-M-As. There's a bunch of them, like HOMA-IR, which tells you about your insulin resistance, HOMA2%, B, which tells you, is this a beta cell issue?

Dr. Andy Galpin

Or your HOMA%S, which just tells you sensitivity. Point is, if you get all those markers, you now differentiate if blood glucose is dysregulated, is it an insulin resistance issue? Is it a sensitivity issue? Is it beta cells? And so now, again, we're just getting more information about where to go to further confirm that and/or now how to solve the problem. So don't want to overstep our bounds into medical, though, there. I know we sort of floated a potential line there, but just wanted to highlight how if you know or suspect a potential problem based on symptomology coming in, you may emphasize one area of physiology over others. Or if you don't have a reason to believe that, you could potentially pare down the markers you're looking at and save cost, save time, as well as avoiding false positive and negatives when a symptom or actual human function isn't present. I'd like to take a quick break and thank our sponsors.

Dr. Andy Galpin

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filling in the gaps where needed. I've also personally found that with many of my clients, AG1 helps move them just in the right direction for eating more high-quality foods because it helps them with cravings, digestion, and many other benefits. I especially personally like taking AG1 when I'm on vacation or traveling because it helps me just sort of stay on track with my nutrition.

Dr. Andy Galpin

I know that missing a few days of getting the proper vitamins and minerals and other micronutrients is not a big deal at all. That's not really how those things work. But for me, again, I just like knowing that I'm kind of staying somewhat on track when I'm definitely not making the best nutrition and food choices of my life. If you'd like to try AG1, you can go to drinkag1.com/perform to receive five free travel packs plus a year's supply of vitamin D3 plus K2. Again, that's drinkag1.com/perform to receive five free travel packs plus a year's supply of vitamin D3 plus K2. Today's episode is also brought to you by Renaissance Periodization. If you want to put on muscle through science-backed training programs, look no further than Renaissance Periodization. RP, as we call it in the industry, guides users through effective and easy-to-follow lifting programs all through their hypertrophy app.

Dr. Andy Galpin

These programs are designed by the absolute best in the industry, including one of my absolute favorite sports scientists and professional bodybuilder, Dr. Mike Israetel. You may recognize that name because I've referenced him and his work countless times over the years. So whether you're looking to put on muscle, gain strength, or both, these programs will help you achieve your goals and have produced results in literally thousands of men and women. Renaissance Periodization also has a diet app that is backed by the latest science and innovation in the fields of nutrition and takes the complexity out of dieting, helping you achieve your ideal body composition. If you'd like to try Renaissance Periodization, go to rpstrength.com/perform to save up to \$50 off of your subscription. Again, that's rpstrength.com/perform to save up to \$50 off your subscription. So now that we've talked about choosing the right markers, let's make sure we get the most out of our blood draws, and that starts by doing what we call getting good data.

Dr. Andy Galpin

And so at the beginning here, I talked about you may or may not necessarily want to take any actions or interpret a single blood draw. We do often, but more power is gleaned from serial or multiple blood draws in a row, particularly over time. And so there is really no reason, in my opinion, for the most part, to get your blood draw done more than every three months. And in fact, oftentimes that's not even necessary. Six months is probably appropriate. I would say most of the time, the average person getting blood done once every six months is enough. For a lot of cases, especially if things are going really, really well, we have no performance limitations, energy is great, recovery is great, our mental focus is sharp, and everything feels amazing, once

a year is probably fine as well. Okay? You don't really need to go more than once every three months because red blood cell turnover generally takes 90 to 120 days, and other areas that are going to be changing earlier than that window are subject to acute variability anyways, and so really, there's not much information that you're gleaning.

Dr. Andy Galpin

You can get it done every 30 or 45 days if you have a very specific marker and you're running a very specific intervention and you want to see if it's working or not. But for most people, most of the time, get blood done every three to six months is probably the normal number with, again, my most common recommendation being once every six months or so. On the day of the blood draw, you want to do a handful of standards, and I'm going to tell you some that are pretty well-established, as well as some that I have simply found in my personal practice based upon high performance and some of the individuals we work with that are maybe abnormal or not common in the medical communities. We generally want to make sure that if we're going to use blood to get anything useful out of it, and by that I mean make any changes That we are getting the correct data. That should be a part of the equation. Honestly, though, a lot of times it's not.

Dr. Andy Galpin

And I will tell you quite frequently, many times in my career, especially with our elite athletes or performers, we've had to make it work with suboptimal data. It's not realistic to make some of these standardizations, or they just don't care enough, and any other things pop in. So while I'm going to tell you what optimal looks like, I will, again, recognize that having done this many hundreds, if not thousands of times at this point, you're not always going to get perfect data. So nonetheless, in the ideal world, ideally, you would not do any hard exercise, drink alcohol, have excessively long travel or plane flights, not be sick or have any illnesses or infections, not utilize any supplements or do anything that's really incredibly novel to your body in at least the 48 hours prior. Okay, now, if you're a really consistent exerciser, you can probably work out two days before, if you do something moderate or light, but you really don't want to do something incredibly hard.

Dr. Andy Galpin

If you actually exercise immediately prior to the blood draw, well, for the most part, that data is useless. As you'll see later, that's almost a non-starter. That has happened to us several times, and there's just very few markers you can properly interpret if you've literally exercised the morning of. The same thing with nutrition, okay? In some medical testing, if they're only looking for literally a handful of markers that are not subject to acute variations in energy production, fine, but this is not what we're talking about here. And so eating directly before and/or specifically exercising directly before are basically non-starters. You can't utilize this, okay? At minimum, give me that. I've also dealt with plenty of times people working out the day before. It's not ideal,

but it is possible. If you're going to do that, try to go light. Don't do any new exercises. Don't do any new workouts or arrange the motions you've never done before.

Dr. Andy Galpin

Try to keep things consistent. Remember, we're trying to make decisions about really changing your diet, training, nutrition, recovery strategies, and if we don't have good data, then what's the point? Okay. So in addition to that 48-hour rule, as I mentioned, you want to fast. You also don't want to have any caffeine, no tea, no coffee, none of that for, we'll call it 12 hours. Okay, now, if that really means an eight-hour food fast or caffeine fast, it's probably fine, but ideally, 12 hours. Anything less than eight hours, I'm going to get pretty skeptical pretty fast, okay? A couple things I'll give you, actually, that I've found in my practice that are a little bit off-script here. I don't have any data to back this. Now, I could probably scrape some, but that's not the point. Generally, what we try to say is no hard lower body exercise for five days prior, and then no hard upper body for three days prior.

Dr. Andy Galpin

I'll talk to you later about creatinine and creatine kinase and some of the wild numbers behind that, but just trust me on this one. If you are the type of person that does really hard lower body exercise, you don't want to do it within five days of that blood draw if possible, okay? Last one here that almost no one talks about. You really need to make sure you get your blood draw done at the same time of day. If you're ever going to compare yourself to yourself, either before or after, you really should have it within ideally an hour or so every single time. So if that's 7:00 a.m. every time, great. If that's 8:00 a.m., great. You do not want to do 7:00 a.m. one time, and then the six months later, do it at 10:00 a.m., and then the next time doing it at 4:00 a.m., or some wildly different times. Some of the markers will not matter, but many of them will change because they have what's called diurnal variations.

Dr. Andy Galpin

Testosterone, cortisol, some of these things you really care about, they change many orders of magnitude throughout the day. And so if you're off by three or four hours, you don't know if your intervention or anything you're doing made your testosterone higher or lower or worse or anything, because it could simply be a reflection of the diurnal variation and not actually what you're doing or reflecting your physiology. So being really consistent with your time is super important, especially as the months and years go on and you're trying to compare longitudinal data. Trust me when I tell you friends, very few people pay attention to that, and it can make all the difference in the world. Another thing almost universally ignored is your hydration status, okay? You do not want to be dehydrated. It will affect everything from your hemoglobin to hematocrit to albumin to creatinine, BUN, serum magnesium, red blood cells, and so on and so forth.

Dr. Andy Galpin

A ton of the data that you care the most about is acutely sensitive to hydration. So you don't want to be hyper-hydrated. Don't chug a gallon of water and be using the restroom every 10 minutes before a blood draw. But you also don't want to wake up the morning of and be urinating gold and then making decisions because a lot of these markers, not one or two, but again, many, if not most, are significantly impacted by that. So if you do all those things, don't eat before, be adequately hydrated, try not to do anything crazy and train super hard the day before, don't have caffeine, drink alcohol, nothing novel, and try to get your blood draw done at the same time of day. If you repeat that same standardization process like any good scientist would for any good experiment, you will significantly enhance the accuracy and validity of your blood draws, which means you're going to have much better information, and you can make much better decisions about what's working, what's not, or any changes you may or may not need to make in your protocols.

Dr. Andy Galpin

Like I've said a couple of times now, some markers you're going to get tested are what we call sensitive, and others are called resilient, and that's the phrase I typically use. What do I mean by sensitive? Things like blood glucose, cortisol, insulin, creatine kinase, your omega-3s, amino acids, AST and ALT, testosterone I've mentioned before, hematocrit, estrogen, C-reactive protein. These things are going to be 100% changed and altered by the actions I just got done talking about Right? Now that's a lot. That's a big list of some of the most important factors. Your exercise, nutrition, hydration, all that stuff will dramatically, and I mean, again, dramatically change some of these markers. However, on the resilience side, you have things like HbA1c. Remember, that's a 90-day marker, so if you're a little dehydrated that day, it's not going to matter. If you had some alcohol the day before, if you did some of these other practices and you missed it, that marker shouldn't be any different.

Dr. Andy Galpin

So you can have a lot of confidence in that relative to your acute mess-ups, if you will. Others, like DHEA, thyroid-stimulating hormone, GGT, cystatin C, total proteins, or globulins, and carbon dioxide concentrations, a lot of those are pretty resilient. And so when you go to our next area that we're going to talk about in terms of interpreting your data, it's really important to remember the ones that are sensitive to acute changes and those that are resilient. And hopefully, you're getting the idea here, but when possible, we probably want to put more interpretation weight on the resilient markers and a little bit less on the sensitive ones. Okay? It doesn't mean we ignore them, obviously, or anything else, but if, for example, everything looks great and your resilient markers of blood glucose regulation are all excellent, but your acute is off, well, you might have an issue, but you also may have just got super nervous that morning, or maybe you ate too soon within your blood draw, or you see what I'm saying?

Dr. Andy Galpin

There could be some other explanation that's like, "Eh, maybe we're not super worried about this." "Oh, my creatine kinase is really high, but my other markers of kidney function are great. All right, maybe I just haven't fully recovered from that workout three days ago. I feel fine. I'm not sore, but maybe there's still some markers of damage happening there that are fine." That's the point I'm talking about. And why I'm bringing this up in this particular show is because I have seen these things flag routinely. Okay? Now, I'm trying to help all of you who, again, are just new, and you're maybe interpreting your own work, as well as practitioners and providers here who are not accustomed to exercisers and athletes. These things, these sensitive markers, will be off a lot in high-volume exercisers, people that do high-intensity exercise, train their legs a lot. They do combat sports. They do things that require collisions, and contractions, and smashing.

Dr. Andy Galpin

That'll throw a lot of these markers off, and I will give you a bunch of direct examples later, but you want to just be really careful about over-interpreting those things. I certainly don't want to sound like I'm telling a medical doctor what to do about how to interpret blood. I don't want to come off like that at all. I'm just trying to share some insights from the performance side of the equation and how you can balance what's actually happening there by looking at those resilient markers and not over or under-interpreting the sensitive ones. My final point here for collecting good data is try your best to work with the same company consistently if you can. And the reason I'm saying that is many people don't realize common blood markers are not actually even analyzed the same way within each company. So if you examine and pay attention to these large national or international blood processing companies, they're great, but they're not actually always measuring the same thing.

Dr. Andy Galpin

The best example of this is free testosterone. Many people are concerned with this, as you rightfully should, but many people don't realize that's not actually directly measured. Very, very rarely, if ever, is free testosterone directly measured. It'll come in your report, but they didn't actually measure it. What they did is they measured your albumin. I keep coming back to it, I'm telling you why. Your sex hormone binding globulin, and your total testosterone, and they use that to calculate free testosterone. Why that matters is the equation is not the same with every blood company. And so you could give them the exact same albumin, sex hormone binding globulin, and testosterone score, and they will come back with different free testosterone levels for you because they're using different equations. Some of these equations are shown to be more accurate than others. And I don't want to actually specifically mention the lab companies right now on purpose.

Dr. Andy Galpin

I don't want to feel like I'm taking a shot at anybody for that reason, but I want to make you aware of that, okay? So if you, say, used LabCorp for your blood draw this time, and then you use, say, Quest the next time, and you're comparing your free testosterone, this draw, to your last one, it may be up, it may be down, or it may appear to be up or down, but matter of fact, it may not actually be. It could be a function of the fact that they use different equations. And so what you'd want to do in that case is to look at your albumin, sex hormone binding globulin, and testosterone numbers. If those three are the same, then your free testosterone is, in fact, actually the same. It's just a function of using slightly different equations. I hope that made sense and didn't feel like I'm overly pushing up or against any one of those companies because that was not the point. But honestly, it should make total sense because the way that this works is your total testosterone is actually bound very strongly to sex hormone binding globulin.

Dr. Andy Galpin

That's what it means. It's a sex hormone globulin or protein that binds things, and testosterone is bound very tightly to that. But testosterone is also very weakly bound to albumin. In fact, that actually is, if you've ever heard of things like bioavailable testosterone, that's what they're talking about. It's the amount of testosterone bound to albumin. It's not a strong bond, so it's pretty bioavailable because it's easy to break off. So if I know your total testosterone, I know how much is bound to sex hormone binding globulin, I know how much is bound to albumin, then I can very quickly calculate the difference there and figure out your free testosterone. That's exactly how it works. All right? So it's just the difference between those three numbers. So really just wanted to highlight that as, and there are others, but just really, again, an example of making sure you're comparing apples to apples here, so you're not thinking something happened good or bad when it actually did not.

Dr. Andy Galpin

Oh, and while we're also here, this is another reason why you don't want to be dehydrated. Remember, dehydrated is going to take albumin up, and that's going to throw off your free testosterone reading. It's going to bring it down. So you may think, "Oh my gosh, my free testosterone went way down," but you could've just been dehydrated. Understanding how these things work, very, very important. Hopefully, you're getting that at this point of the show. I think it's fair to assume at this point you've been taking diligent notes, you're going to take action on this, you've chosen great markers based on your situation and context, and you've collected amazing data because you used great standardization. It's now time to properly interpret your results. When you get to this stage, first and foremost, please remember you're coaching humans, not labs. As much as I love the blood chemistry stuff, as you can see, never forget the main goal here.

Dr. Andy Galpin

In fact, I've heard many of my colleagues that are medical doctors, like Dr. Gabrielle Lyon and Dr. Peter Attia, and they are really good at reminding folks of this. We don't coach, in their case, they don't treat labs, they treat people. Same thing if you're coaching, okay? And what do I mean by that? Your performance and your subjective markers matter more than your labs. So if someone's coming in, they feel great, they're continuing to make progress, and you see some marker that I told you in this show is a little bit high or a little bit low, you might not care. Don't lose the forest for the trees here, right? They're feeling great, making progress, we're not going to overly interpret these things. If the opposite is happening, though, their labs look okay, but their subjective or performance markers aren't, well, then we're not just going to be like, "Well, I guess it's all in your head."

Dr. Andy Galpin

That's not necessarily the case either, okay? So remember, we coach humans, not labs. These are an important part of our equation, but we're going to be a detective. We're going to use all of our clues to make the best decisions possible, but we're never going to make all decisions based on one thing that is or is not off-kilter. I hate to use this one, I really do, but people latch onto it, so testosterone is a great example of this. We just got done talking about how not all labs are actually measuring the same thing, at least in the context of free testosterone. One thing you also don't realize is many labs have their own unique reference range. What do I mean by that? Some use what we call internal, and others use external. So if you're getting your report back and you're looking to the side, typically, your results are, say, on the right-hand side of your sheet, and it says, "Hey, your testosterone is," let's just say, "200."

Dr. Andy Galpin

And then you're going to have some context that'll either tell you that's high or that's low, and then they'll give you a reference range, okay? So in this case, let's say your testosterone is 200, and they say, "That is low. Our reference range says normal is 250 to 900." Those are pretty standard numbers. Well, that 250 to 900, depending on which company you selected, may have a different range. Others might think 350 to 1,000 is normal. Some might say 400 to 600 is normal. Now, some of them are using a national database. So they could be using what's called NHANES or Mayo Clinic or Cleveland Clinic or different giant databases for normative values, and they may be basing that normative value based on your age and sex and maybe some other factors. But other companies use what are called internal reference ranges, which means they are simply giving you feedback based upon every participant who's ever used their product.

Dr. Andy Galpin

It has nothing to do with what's normal for the population. It's simply what's average for the people who've bought their product before. I'm not going to tell you the internal or external is

better or worse, but you do need to recognize it's not the same thing here. And so when you're looking at whether or not you're high or low, ideally, we can look further than that, and we can say, "Well, wait a minute. What's the absolute number?" And just because this company told me it's high or low, if you take that exact number, say 250, and you put that into a different company, then they may say you're normal or not. And so what causes you to be normal or high or low, again, it's not even necessarily a function of physiological truth. It could be a function simply of the reference range. Now, I have a lot to say about reference ranges, but we're going over this right now because this is critical to you interpreting whether or not that result is good, bad, terrible, or otherwise, okay?

Dr. Andy Galpin

This is our very first step in that, and again, interpretation process is to make sure we're understanding who we're comparing to and in what scenario. These reference ranges I keep referring to are problematic for high performance, to say the least here. Now, I don't want to get into a situation where I, again, feel like I'm saying negative things about the medical system. It is incredible. I love it. I utilize it, and they do a phenomenal job. It's just different than high performance. That's the only distinction we're trying to draw, and we've made plenty of these caveats. I hope that you're continuing to remember the ones I've said before as we're getting in this conversation. I don't want to offend anybody. I do want to draw some distinctions, though, okay? Not being diseased yet is not necessarily the same, and in fact, pretty far from optimal performance. Here's what I mean. How reference ranges work, typically, internal or external, but they almost always use what's called the 95% rule.

Dr. Andy Galpin

Okay, so if we're using our testosterone example, and they say normal is 300 to 900, what they're telling you is 95% of people in our database, doesn't matter where they got it from, 95% of people land within that 300 to 900 range. Two and a half percent of people are lower than 300, and two and a half percent of people are higher than 900, okay? That said, from a medical or disease or emergency perspective, if you're in the 93rd percentile or 8th percentile, it's unlikely you're experiencing an acute disease, any trauma, any we have to treat you right now. So that's a great starting point, right? We're trying to triage emergency or not. All right? Awesome. And so whether, honestly, you're 95th percentile or 94th, who really cares? And this is oftentimes why folks have gone in, and perhaps a doctor has said something like, "Oh, yeah, your number's a little bit high, but I wouldn't worry about it."

Dr. Andy Galpin

Okay. What they're saying is like, "I wouldn't worry about it in terms of you're not at an egregious risk of disease right now." Obviously, from a performance perspective, though, if I'm at the 90th percentile, which means only 10% of people are higher than me or I'm at the eighth percentile,

both of those numbers are going to come back, quote unquote, "normal." And now I think we can all agree that's not the same person. Okay? Someone who's at the 10th percentile who's trying to perform at their best is not at the same level as someone who's at the 90th percentile, both of them the normal, quote-unquote, "reference range," but we're really not saying the same thing. This is not to say always you want your numbers and your blood work higher. We've talked about that. It's not just higher is better. Some cases, yes, but most time it is a nice sweet spot. Okay? So we don't want to just strive for higher, but we do want to understand, well, what is the best spot to be in, or as close as we can tell, to performing at my best, or at least maybe in an area that it's not significantly limiting my ability to do something with my body that I'm asking my body to do that normal non-exercisers are not asking their body to do.

Dr. Andy Galpin

That's a great way to think about it. I'm not just interested in disease management and risk. Remember, that's one of our assumptions. That's not our point today. What I'm trying to understand is where do I need to be so I can get the most out of my body in this situation that the reference range people, the people who are in this database, were probably not asking their body to do. So really, it's not a fair comparison. It's not the population I want to be compared against. Easy one to pick on here is blood glucose. Okay? Typical reference range is 70 to 99 milligrams per deciliter, and I'm telling you right now, you do not want to be near 99. Technically, you're not over 100, you're not pre-diabetic, you're not over another amount, you're not actually officially diabetic. But now we're talking about categories of disease. That's not what we're into, right? So if I'm at 99, I'm not diabetic yet.

Dr. Andy Galpin

I'm not going to get flagged for anything. I'm not even pre-diabetic. But I'm certainly not functioning in an optimal state, and definitely not for an athlete. Here's why. We know that if you're below 75, which is still within the reference range, or above 85, still within the reference range, that's associated with cardiovascular disease, all-cause mortality, clearly not optimal health. In fact, above 95 specifically increases your risk of retinopathy and neuropathy and other dysfunction. Okay? Now I'm using disease examples, but it's highlighting the point, if it's already at a state of advanced risk of disease, I'm certainly not in the place to optimize performance either. Another one we deal with a lot, and even honestly over the last couple of years has been a really, really common question, is a marker called homocysteine. Typical reference range here, five to 15 micromoles per liter.

Dr. Andy Galpin

Despite the fact that we know that over 9.47 increases risk of cardiovascular disease, over 10 increases risk of what's called hyperhomocysteinemia, increased oxidative stress, and hypertension risk. Over 11.84 increases all-cause risk, and over 15, still within the reference

range, over 15 is associated with cognitive issues like dementia and Alzheimer's. Now, it's not to say any of these things will give you that disease. That's not what I'm saying. But they're associated with it. I don't want to be anywhere near those markers, right? So interpreting reference ranges for high performance is quite different than just not diseased yet. So to round out our point here, I think it's useful to think about reference ranges on a bit of a spectrum. On one end of the equation here, we've got things that are indicative of an acute infection or a legitimate clinical deficiency or disease state. And then from there, you get into things that we'll call subclinical.

Dr. Andy Galpin

This is your blood glucose that is 98, 99. You're not technically diabetic yet, but we wouldn't call you high-performing either. Maybe we want to call this subclinical, or dysfunctional, or I don't really care what term you use. It's not all the way to the end, but it's not perfect either. And then keep going past that, and now we have things that are one of the needs or demands for someone who's at high performance. And so a blood glucose or testosterone or ferritin or any of these numbers, when we require the body to train really hard and recover, and we're doing multiple workouts a day, or we're trying to lose weight, or we're doing these things where it's not just okay to be healthy now, but we're asking high demands of the body, well, that's going to require different levels of a number of different factors. So I really do think it's fair to think about all three of these things as valuable and meritorious on their own, but they are different and should be interpreted as such.

Dr. Andy Galpin

So when you go to interpret your blood work, you not only need to be paying attention to clinical and non-clinical, but even within the healthy optimal. We have to understand context a little bit more. So let me give you an example. Let's say we've got a 27-year-old female. And now in one scenario, let's say one is trying to optimize for endurance performance, and another is trying to optimize for strength. And let's just say we've got a 5K runner, and then we've also got a shot putter or a thrower. Okay, now, if I just look at two really common simple markers to highlight my point and try to not make this overly confusing, let's just say we took a look at hemoglobin and hematocrit, okay? Both of these things have to do with red blood cells. Hemoglobin refers to the amount of hemoglobin on your red blood cells, and the hematocrit is the percentage of your blood that is occupied by red blood cells.

Dr. Andy Galpin

So both indicators of kind of oxygen-carrying capacity and endurance capacity and cardiovascular health, okay? You want to think of it like that. So imagine in scenario one, 27-year-old female, 5K runner, and her hematocrit comes back at 47%, and her hemoglobin comes back at 14.3 grams per deciliter. Okay? In both those scenarios, I would say those

numbers aren't great. In fact, if you're a high-level runner, you probably want your hematocrit being a little bit higher, maybe okay, 47 might be okay. I'm not going to over-interpret one marker, remember. And her hemoglobin's okay as well. Maybe I'm okay there, maybe I'm not super loving that. However, exact same girl, same body weight, same body composition, everything else standard, right? And now that girl, instead of trying to optimize for 5K running, is trying to optimize for being a shot put thrower. In that particular case, instead of the hematocrit being 47%, if the hematocrit's 43%, so 4% lower, I might actually be fine.

Dr. Andy Galpin

Why? Energetic and oxygen demands of a shot putter are significantly lower than a 5K runner. So even though her hematocrit's lower, I might still go, "You know what? That's optimal for you. That's okay." I'm not worried about that at all. Same thing with the hemoglobin, 14.3 in our distance runner, and now 12.8 in our thrower. Again, a lower number, which lower is generally worse, I might go, "This is great. You're fine here." I don't need to worry about ratcheting this up. I can't guarantee you that if we increased your hematocrit from 43 to 47 in your thrower, that this will help your performance at all in the short or long term. Okay? But the endurance athlete who's actually better may not actually be high enough. I hope that made sense, right? What I'm trying to get at is the context of your interpretation is everything. You can't simply go over basic numbers. You have to understand more about the physiology and the demands and the activity of what they're trying to optimize for.

Dr. Andy Galpin

The same thing could be done for training. So let's just go back and say, okay, we got the exact same scenario, same exact numbers. I may look at the endurance athlete, and I may watch that, and let's say we did her blood work pre, and then maybe even post-season or mid-season. I would expect that hematocrit and hemoglobin, certainly hemoglobin, hematocrit may or may not, just for technical issues. In fact, we covered these in the cardiovascular episode. You can go back and check that out. But certainly, I would expect hemoglobin increase. Right? So if I didn't see that increase, I might start going, "Hmm, maybe the training's not working. Maybe we got some nutrition stuff going on, recovery." I'm starting to wonder. Same way, exact same situation, I would be stunned if the shot putter saw any increase in either one of those markers. That would give me no indication about whether or not the training was working.

Dr. Andy Galpin

The shot putter could be adding 10 feet to her distance in her throw. All of her training could be going perfect, and I would not expect any change in her hematocrit or hemoglobin. That's not the system that's being challenged. I don't expect adaptations. So again, it's the context that matters, right? So not only are we looking at the baseline values, but the progression over time. We have to understand expectations about what should change and what shouldn't change, and

what's a marker of, hey, we maybe have some suboptimal training or nutrition, versus there's no reason to have concern here. This marker shouldn't change in this environment. In addition to the training context, we need to pay attention to other factors that influence physiology. Take as one example, sleep. So one of the most common adaptations to endurance exercise is an increase in total blood volume. Again, go back and listen to our cardiovascular and heart episodes, and you learn more about what that is.

Dr. Andy Galpin

And so if you get in more cardiovascular shape, and your fitness improves, you would expect an increase in hemoglobin and hematocrit, again, most specifically hemoglobin, because you have more total blood volume, and therefore, you got to bring in more total water to make sure your blood's not too viscous. So normal, common adaptation is to have more total blood. Well, another thing to consider here is sleep. So now we've covered this in our sleep episode, so go check there, but a large percentage, somewhere between 4% and 13% of athletes, depending on the database you pull from, are going through obstructive sleep apnea. We know that in response to that, you will also upregulate or increase hematocrit and hemoglobin. Yeah, you heard that correct. Both endurance training and sleep apnea, a medical condition and a positive thing for your health, will increase these same markers. And these things are common in athletes and exercisers.

Dr. Andy Galpin

And we also know that if someone with OSA uses what's called a CPAP machine, so this is a mask that brings in airflow to them that they wear at night, that will bring your hematocrit and hemoglobin back down. Now, this is a good thing, right? Because what's happening in the case of OSA is you're basically going through short periods of hypoxia, or you're stopping breathing at night, and so your body responds by increasing your oxygen-carrying capacity. I know some of you may be thinking, "I'll just do that as a hack to improve my..." No, do not do that. Right? That is a bad thing. This is a great example, and we'll get into more of these examples in one second here, of the same exact thing happening could be a medical problem, also could be a sign of advanced and increasing fitness. Okay, so that's why we always separate these two things, right? So nonetheless, here's what's going on, right?

Dr. Andy Galpin

So imagine you got an athlete or a non-athlete, right? You're engaging in endurance exercise. You're supposed to be trying to increase blood volume, hematocrit, or hemoglobin, but at the same time, you're going through OSA, and then maybe you're using a CPAP, which is bringing it back down, and now all of a sudden, you went through all this training, you worked super hard, you feel fit, you're running faster, you're recovering better, and now your hemoglobin went down, and now your hematocrit went down, and you're like, "What the hell? Oh my God, my program

isn't working." Well, hold on. Time out now. Maybe it is working. In fact, a recent paper that I just saw indicated that CPAP, on average, will drop hemoglobin by around 3.75 grams per deciliter, and hematocrit from 60 or so percent to 45%. That's just an average. Could be different for individual people. But the point is, it's a pretty significant reduction.

Dr. Andy Galpin

And so you don't actually know what's happening here. You could be in any scenario. This interaction could be causing those markers to not change at all. It could be causing them to actually go down. It may go down a little bit, but actually, the benefits of exercise make it go up. You don't know is my point. And so you really do need to think about other potential interactions and physiology of what's happening before we over-interpret interactions or changes, or lack thereof. Right? So understanding other factors is critical. I've referenced this idea multiple times now, but it's time for us to get into some direct examples of how this medical versus performance blood work stuff can manifest itself. The best example I can give you is actually directly from my academic past. I was really fortunate during my PhD program that I spent one of the academic courses, so just a single one, in actually medical school.

Dr. Andy Galpin

So our physiology class was taught in the medical school, so I would leave our lab every day, walk over, and go through physiology with all the medical students. They went on to become real doctors, and then I would go back to my lab and finish my PhD. So experiencing that was fun, but it was also infuriating because I felt like I was permanently confused, given the fact that everything that they were talking about, it felt like anyways, that was a sign of a medical problem, was the same exact sign of great physiology. Total blood volume is a good example of that. So we would go through scenarios and numbers and reading charts, and I would see total blood volumes and hematocrits and hemoglobin numbers, and I'm like, "Man, this person's really, really fit, in excellent shape." And then the med students were like, "Oh, yeah, this person's about to have a heart attack." I'm like, "Damn! I missed it again."

Dr. Andy Galpin

Because someone who's got a lot of blood volume, it's really high, is probably going to be put on a diuretic to lower that blood volume because that's going to lower blood pressure and is obviously the right medical decision there. But you see my point here. So these things can be confusing if you're not really paying attention. Other things that I think are really good examples of the medicine versus performance blood markers, and that is creatinine and creatine kinase. So my favorite story here comes from actually the guy I mentioned earlier, Dr. Tommy Wood, neuroscientist from University of Washington, who's an MD and a PhD. But Tommy has this wonderful story of going down to Costa Rica and being bitten by a snake and spending 11 days in the hospital. Sorry, Tommy, you didn't give me permission to tell this story, but I'm going to tell

it anyways because it's my show. Shouldn't have told me the story if you didn't want me to repeat it.

Dr. Andy Galpin

But Tommy spent 11 days in the hospital, mainly because the situation sucked, but a large part of why he stood there is because the doctors wouldn't release him because his creatinine levels were not normal. Now, Tommy, being an MD and a PhD who's got exceptional experience and knowledge in this area of blood chemistry, was like, "No, I'm fine." Tommy knows that creatinine actually goes up a lot. It is highly associated with muscle mass and creatine intake. And Tommy's a big guy. He lifts lots of weights, and he takes creatine. He told me one time, he's like, "Man, I kept telling the doctors, like, 'No, I'm fine.'" Creatinine is associated with kidney breakdown, and so they were concerned that he was going through kidney issues. He's like, "No, no, I'm telling you, I just lift weights a lot. I have a lot of muscle, and I take creatine." And so that's actually a question I've gotten a ton of times on Instagram and Twitter is, "Hey, would my creatinine go up if I take creatine?"

Dr. Andy Galpin

The answer is very probably yes. And so whether or not this is an acute marker of actually kidney disease, this is where actually something like cystatin C comes in. So if you're concerned about this and your creatinine numbers are high, and you're wondering whether or not your kidneys are an issue, just go check cystatin C, and that'll tell you, because that's not influenced by these things. So nonetheless, it is not crazy to see people above 1.35 milligrams per deciliter here, especially people with lots of muscle and those that lift weights and/or take creatine. So really, really common one that the, again, the medical community will be seeing a lot of the times, and if they're not used to seeing high performers or athletes or people that train a lot, take creatine and stuff, sometimes they get freaked out about this number. And I'll be totally blunt with you here. I don't think I've ever seen anybody, ever, that I've analyzed that didn't have higher than normal creatinine.

Dr. Andy Galpin

It just is 100% assumed, so much to our group, where I'm like, I'm just never really that concerned about it because it's just always the case that it's going to be above that normative value. Creatine kinase is a very similar thing. So creatine kinase is a marker of, quote-unquote, "muscle damage." Resting numbers typically for women is a little bit lower generally because they have less muscle mass. But you're seeing a number that I'd say probably on average 30 to 150, what's called international units per liter, so IUs per liter, is pretty normal. Oftentimes maybe a little bit lower than that, but plus or minus.

Dr. Andy Galpin

24 to 72 hours post-exercise, though, that can be as high as 500 to 1,000. So it goes up, and it

goes up by a lot. In fact, it can go way up. So remember, baseline, we'll just call it 100, right, to make the math easier. It'll 10X with normal exercise. 100 to 1,000 like that. Remember when we were talking about sensitive versus resilient markers? That's why I said, hey, creatine kinase, if you even exercise three days before, this number's going to be up, no question. In fact, there are papers that I found in preparing for this show that found in cases of what's called rhabdomyolysis, so this excessive breakdown that you often see this happen in athletes who do incredibly hard, really insane workouts, like off-season programs. Strength and conditioning coaches have been fired because they've taken whole teams through just grueling workouts and given a couple of people rhabdo. This is when you're actually legitimately having now breakdown of your kidneys, so this becomes a problem.

Dr. Andy Galpin

In those cases, you see numbers as high as 20,000, and I saw actually in the literature over 200,000. Remember, baseline is 100, and so these markers are up to 200,000. And there's a really, really classic paper I love to talk about here. Actually somewhat recent. I can't remember the year. It's just a couple of years old, I think. It was a case study, so just one individual. I think it was a 35-year-old female, and she had done a, we'll just say, multi-day, high-intensity, multiple exercise competition event. The individual had a normal creatinine kinase assumed at rest. They didn't have resting. But what happened is the individual had done, I believe, the first day of a three-day competition. I don't exactly remember, but it's something like this. Did the first day, and then wasn't feeling great, and so got checked out, and 24 hours later, the creatinine kinase was at 43,000. So really, really high.

Dr. Andy Galpin

However, she waited three days, was feeling really bad, I think called an ambulance or checked into an urgent care or something like this, and now creatinine kinase was at 75 and a half-- Sorry, 77.5 thousand. Remember, baseline is 100, okay? So 24 hours later was at 43,000, but 72 hours had almost doubled again. Ten days later, it was still as high as almost or just about 3,000, and 25 days later was still at 1,250. So you're still talking almost a 10 X over baseline about a month after this competition. So the point is, these numbers get astronomical. I have actually measured creatine kinase every day for probably four or more years in individual athletes. We've done this in NFL players in season. We've done it sort of before the game, halfway through the week, and then at the end. And it is not uncommon at all, after a major sporting event like an NFL game, to see these guys at 14,000, 20,000.

Dr. Andy Galpin

Those are actually not, and I say that those are pretty standard numbers, and it would be really common for those folks to be back to baseline by Saturday. And so they'll be at, say, they're typically higher than 100. They're oftentimes like at 200 to maybe 300 is like a baseline.

Twenty-four to 40, maybe 72 hours after the game, they are all the way up to 20,000, 25,000, and then a couple of days later, they'll be all the way back down to baseline, right? Their body's pretty used to this, and they come back to it, but these are really standard magnitudes and numbers where had you seen 20,000 and you didn't know the context, I don't even want to say medical, because it's not their fault, it's just the context, right? So if somebody looks at a CK value and sees it at 20,000, they might be like, "Oh my gosh, you have rhabdo. This is crazy. Kidney." Well, which could be true. It also could be like, oh, this is actually pretty normal for a 275-pound individual, or a 230-pound individual that just went through a strongman competition, or a jujitsu competition over the weekend, or wrestling, or something like that, where it's just going to be a lot of not only exercise, but physical stress, contact, collision, and just a lot of breakdown.

Dr. Andy Galpin

Those are pretty typical numbers. One more time, if you think at all you have issues, please consult your medical professional. I don't want to be indicating even remotely, "Don't worry about your doctor. Don't worry about these..." That's not at all what I'm suggesting. I'm just trying to highlight a little more context for all of us to learn more about what are kind of typical things that happen with exercise that may or may not be known about in a medical setting. The other set of kind of twin markers that are really, really commonly elevated or altered in exercisers, even at rest versus non-exercisers, are what are called ALT and AST. Now, AST is released from muscle, and so actually one of the things that you'll see pretty commonly is this will go up with training, and it's not necessarily a bad thing. In fact, it's kind of a nice marker of total muscle mass, to be totally honest with you.

Dr. Andy Galpin

ALT is actually released from the liver. So these amino acids have this really interesting interaction. Here's what happens when AST is higher than ALT, when ALT is higher than AST, and when they both go up at the same time, okay? Because this can get confusing to interpret if you don't know what you're looking at. Now, if AST is higher than ALT, remember ALT being the L for liver, that's easier, okay? So if AST is higher than ALT, you could be in any number of scenarios. One of them could be you simply have an athlete on your hands. Remember, AST goes up with muscle. So that is higher than ALT, it could just be the fact that they have more muscle. Also, it could indicate non-alcoholic fatty acid liver disease. So you got to know context is my point here, right? If the opposite happens, ALT is higher than AST, and you also have increase in what's called GGT. Now, this is the equivalent of me saying, "Check out cytochrome C for kidney."

Dr. Andy Galpin

GGT is a thing you want to take a look at if you think something's going on with the liver, but

you've got this confounding factor of additional muscle. So if ALT is higher than AST, and you've then cross-referenced and gone and checked GGT, and this is increased, then you potentially have a liver problem, right? So every cell in your body has GGT, and if ALT and GGT go up, but AST doesn't, then that tells you both markers of liver, but not marker of muscle mass went up, then you have pretty good idea to refer out if you're not using a medical doctor already that says, "Hey, there is maybe potentially something happening with the liver. Let's do get this medically checked out, and then work with a qualified person to do that." The third scenario actually is when both ALT and AST go up. So the proportion or ratio may not have changed, but both are elevated. This could be any one of three things.

Dr. Andy Galpin

It could be your non-alcoholic fatty acid liver disease. Another could be insulin resistance, so what's probably happening here is you're increasing the amount of what's called gluconeogenesis, so the making of glucose from non-carbohydrate sources. Or the third scenario is this athlete paradox, right? Alcohol could be happening there, could be liver disease, or you could be getting in great shape. So it's the interpretation and context that matters most here when trying to figure out what these markers mean and understanding what happens in the case of either an athlete, or a hard exerciser, or even somebody who just is exercising consistently or just has more muscle mass. The last point I'd like to make here before we move on is what I call the optimal for what issue. Inflammation is the best example of this. If you simply looked at inflammatory markers, you don't necessarily know if that's good or bad.

Dr. Andy Galpin

Let's assume you did all the things, and you standardized it and all that thing. How do you know how much inflammation's bad? In fact, there is no scientific definition or specific marker or level that defines inflammation. There's no cutoff point there. I can't actually say that this number means you're inflamed, and this number means you're not. It's really just like a colloquial conglomerate of what's generally happening, and we think this is causing problems. But remember, inflammation's not always bad. Think about it like this. If you're trying to cause adaptation, and we talked about this in the muscle episode, we talked about this in the heart episode. If you're trying to cause adaptation, the point is to induce stress into the system. The inflammatory response is critical to that. You're trying to cause disruption. It's that inflammatory signal that then tells your body to adapt. So if you then take a marker from blood at the same time, and you see inflammatory markers are up, that may be exactly what you're trying to do.

Dr. Andy Galpin

So, well, how do you know if you should lower it or take action on it? Well, I don't necessarily know, but the way I typically frame it is, well, what phase of training are we in? What are we trying to do? For example, if I'm in the off-season or a phase of training if you're a non-athlete,

and you're trying to induce adaptation, a little bit of inflammation's okay. How's my symptomology? A lot of joint pain, disruptions to sleep, or other things, well, then maybe inflammation got too high. And where's this inflammation coming from? Oh, it came from exercise? Okay. Or it came from smoking. That's a different thing, right? Clearly, in this case, I don't want to smoke anymore, but that doesn't necessarily mean I need to lower inflammation because I got it from a, we'll just say, healthy avenue. And so all that situation and that context, which I keep repeating, matters a ton. However, exact same marker at the exact same level in the exact same person, and now instead of being in a training phase where we're trying to cause adaptation, we're now trying to peak.

Dr. Andy Galpin

So we are in the Olympic Games, we are in competition season, we are right before when we're trying to perform at our best, when we're peaking and tapering like we've talked about in another episode. That exact same marker I might say is too high. Because now I'm not trying to cause adaptation, I'm trying to maximize recovery and performance, so I might want to lower that inflammation, push up higher on performance in the acute sense, and that exchange is worth it. And so you have to, if you're particularly, again, working with athletes or anyone who is trying to compete over the course of, say, six months to a year or two. This is someone trying to run their first marathon or do their first race, or peaking for hunting season, or whatever it is you're trying to do. If you're really managing them from not just like a day-to-day perspective and you're thinking about their six months and their year at a time like is best to do for them, you'll want to consider this stuff when you're interpreting their "inflammation."

Dr. Andy Galpin

So it's not always good, it's not always bad. It always comes down to context, set and setting, where are we at, where are we trying to go, and what are we trying to optimize for? Let's give you a specific example. Now, I've been fortunate to work with a lot of very high-level professional golfers, both on the PGA Tour, LIV, and other places. And so one of the things that we see happen in that particular case is by the end of the season, which is typically late fall, they're pretty tired. They've played maybe 15 to 25 tournaments, almost always changing multiple states, if not multiple countries, and they've got to peak all year round, and it's a really challenging setup. In this particular example of, say, this professional golfer, I would expect their testosterone level in October, when the end of the season comes and they're pretty fatigued, to be a little bit lower. So in this fictional scenario, maybe that total testosterone is 380 nanograms per deciliter.

Dr. Andy Galpin

Now, let's just say in this scenario, we've got years of data on the person, and that is a little bit lower than normal. Well, we recover, we take the fall off, we have some holidays, we do lots of

protocols to bring them back, and they come back in January, where they're at their freshest of the year, and their testosterone has now risen by 100 points. It's now 480 nanograms per deciliter. I need to be able to understand that that is probably going to happen, and oftentimes, I will communicate that to the athlete. "Hey, there's a good chance when we start the season, by the time we finish the season, that you're going to get a little beat up. You're going to be fatigued and tired, and it would be a normal thing for your testosterone to go down by the end of the season." Obviously, we're going to do our best to make that not happen, but the reality of it is, some athletes in some situations and scenarios, it's just really grueling and there's not much you can do about it.

Dr. Andy Galpin

In fact, a lot of times you're trying to just do damage control. So we're probably not going to elevate it, but we're just really going to do our best to make sure it doesn't get really, really low because of cumulative fatigue, lack of sleep, changing environments, and all the other things that go along with being an elite, high-class athlete. It actually doesn't matter if you're an athlete or not. Just envision yourself in a similar scenario, where you're changing time zones, maybe you're traveling a lot, your workload's high. You're in a physically demanding job. You're a police officer, a firefighter, or a nurse, or a construction worker, or you're doing something where your schedule's not specific or determined, and your output physically is high, then you're exercising on top of that. So I use the athlete examples all the time, but remember, folks, it's the same exact physiological scenario.

Dr. Andy Galpin

A lot of things that are hard, can't always control your food, can't optimize recovery, don't have time for a 90-minute recovery routine every day, and so on and so forth. You get the point here, right? What I'm trying to get at is just the expectation and understanding when you're interpreting these data, we need to know what phase of the season or workload is on the actual individual, and then contextualizing and saying, well, maybe your testosterone, in this case, as just one example isn't "dropping." It's just a reflection of being fatigued by the end of the season. We take a little bit of rest and recovery, we do our off-season work, and this should come bouncing right back. And in honest reality, it almost always does. White blood cells are another great example of this. I talked about this a lot in our discussion on peaking, overtraining, and plateauing. But one of the things that happens with white blood cells is they actually increase with acute exercise.

Dr. Andy Galpin

So you go work out right now, and that white blood cell count will shoot up as an inflammatory and immune response, if you will. However, chronic stress will decrease it. And so another common thing that happens over the course of the season is that white blood cell count will tend

to come down. This is one of the reasons why you will often get sick. My best example of this really routinely happens towards the end of fight camp. Calories are coming down, training load's high, stress, pressure, lights are coming on, that whole thing. White blood cells start to come down, almost always get sick. Not almost always, but more common, more likely to get sick because of that chronic stress. Okay? So when we back off and they recover, it goes shooting back up. So really good example, we got to understand what's going on with the individual and their background, their physical activity, to really properly contextualize what's happening in our white blood cells.

Dr. Andy Galpin

Hopefully, those specific examples helped. What I'd like to do now is actually talk about a couple of other things you can do to help properly interpret and analyze your blood results. The first one I've already mentioned, and that is categorizing these markers into those resilient versus sensitive ones, and then probably focusing more on the resilient side as they're less sensitive to acute changes. The other two things you can do here I have not talked yet about. One of them is a quick resource I'll give you, and the second one is batching into what we call categories. Anyone who's spent a lot of time interpreting blood will almost always do this, whether they know it or not. So what I mean is, rather than going marker by marker, you're really going to batch them together into categories like hydration, energy, sleep, stress, resilience, recovery, so on and so forth. Doing that will give you, say, three to 15 markers per category, some sensitive, some resilient, and then it helps you understand, is this really happening, or am I dealing with a false positive or a false negative?

Dr. Andy Galpin

So I'd like to talk a little bit more about some of these categories, and again, give you some specific numbers and examples. But before we do that, let's jump into a very quick resource. So there's an excellent thing you can use online. It is free and open access. I have no relationship to this company or this paper. But the thing you can Google is what's called Your Results May Vary, the imprecisions of medical measurements. Okay? Now, that is an online calculator, and we'll also link to it directly in the show notes. But in that, you can go in, and you can pick from, I think they have about 20 or 30 common blood markers. It's not all of them, I'm sorry, but it's a good start. And if you'd like, you can actually change what's called the confidence intervals. If you know what that means, great. If not, don't worry about it. The point is, you can go select a marker like testosterone, and what you can enter is your pre- and post-measures.

Dr. Andy Galpin

So what this tool is going to do is allow you to understand if my number is different between my two measures, was it real? Okay? So one of the things that happens is you have a combination of things going on. One of them is called analytical variability. Now, typically, the government

requires that to be less than 5%. That is to say, if you take one vial from me, and you take the exact same sample, and you pipette it once and you put it into your machine, and then you pipette that same exact sample in the machine again, that number should come back almost identical, but it'll never be perfectly identical. The number they're going to give you here is that should be within 5%. So that's the analytical variability of your measure. So if I did 15 samples from the exact same vial of blood from the exact same person, all 15 should come back within 5% of each other. Okay? Now, some markers are a little bit more variable analytically, some are less.

Dr. Andy Galpin

A lot of times, ideally, it's actually less than 3%, but it can be up to 5%. So if you're going and interpreting your blood draw this time compared to your last one or the previous one, and your marker has changed by less than 5%, it's probably not a real change. It's very possibly just because of that's the best accuracy the lab can even get to. Another thing we have to consider here that I've talked about already is your diurnal variation. Now, the percent variance there can range from zero to X. In other words, depending on the marker, some of them are really tight. Some don't change throughout the day. Some, like testosterone or cortisol, change by orders of magnitude throughout the day. So I can't even give you a range there. You really have to understand, is this a marker that's subject to diurnal or daily variations or not? And then the third category, which is called biological. So your testosterone will not be the same every day.

Dr. Andy Galpin

It will not be the same every single day. And so there is just some amount of daily variation that happens. And again, the number there is somewhere between zero and I don't even know, right? It can be really, really, really high. And so the tool I'm referring to, this Your Results May Vary, allows you to go in, and it accounts for all these factors. And so if we keep going back to testosterone, because obviously it's important to a lot of people, and rightfully so, potentially, but it's just easy to get our minds around. So if you get your blood done and you say, "Okay, man, my testosterone was 475, and then I took this supplement," or, "I tried to sleep more," or, "I introduced red light therapy," or whatever you're trying to do, or you changed houses, or you moved, or who knows, whatever you did. And it was 475 before, and now you come back and it's 490. Well, unfortunately, that doesn't mean your intervention worked at all, because that change, 475 to 490, is absolutely within both the analytical, but 100% within the biological variation of testosterone.

Dr. Andy Galpin

You don't actually know it worked. You'll need to see a much higher change in testosterone to know it actually works. You can just plug those numbers directly into this resource, and they will tell you that. So hopefully, that tool helps you out a lot. Okay, now let's move on and talk about

this idea of creating patterns and categories rather than relying solely upon individual markers. This is by far your biggest value in blood work here, and it just saves you from all those problems of an individual marker, whether it's a sensitive or resilient one. It allows you to create a decision tree or an algorithm in your head where you can check off and correct against false interpretations. Okay? One of the most common ones I use, I'd like to start with here, is hydration. And we'll use this with anybody who's either presenting symptoms of acute or chronic dehydration, so maybe persistent headaches or brain fog, digestive issues, cramping.

Dr. Andy Galpin

Things like this are not always, but commonly associated with hydration issues. Or simply they're involved in an activity where hydration tends to come up as a problem. So with hydration, I like to look at markers like hematocrit and BUN, like we talked about earlier. I also like to look at what's called the BUN to creatinine ratio. So not even just the individual markers there, but their relationship to each other matters a ton. That'll tell you about acute hydration. You throw an albumin there, like we've talked about earlier, and we're getting now that 20, 21-day hydration marker thing, and you could tack that on with a third marker, which is called serum osmolarity. This is the scientific gold standard. It's a combination or a calculation based upon your sodium, BUN, and blood glucose, and again, will tell you a ton about what's going on. So if you did that little thing, you looked at acute, you looked at gold standard, and you looked at chronic, and so now you're getting really good insights of overall hydration.

Dr. Andy Galpin

Another really common category I use is inflammation. We talked about how there's no specific thing here, and I'll give you one example of this. Probably the most common single marker of inflammation is what's called C-reactive protein. Now, this, when it's above 3.0, is associated with a cardiovascular event, so it's not good. However, this thing can go way over 30 with just something like an acute viral infection. And so if you looked at this and that's the only thing you're paying attention to, you may think, "Oh my gosh, my client or athlete is super inflamed," and they may have just gotten sick recently. So it's actually not this big thing you need to go do. You don't have to change their protocol, put them on an anti-inflammatory diet, and add supplements and change their training and all these changes when really they just got sick. Okay? So what you'd want to do is match that with something called ESR.

Dr. Andy Galpin

That's a marker of 14- to 21-day inflammation, and you'd want to, in addition, and this is maybe a little bit off the scientific books, quite candidly here, there's evidence here, but not as well understood or strong, but if you tagged on things like blood lipid and sugar panels, those tend to increase in inflammation. Albumin and vitamin D tend to decrease, and then you match that up with symptoms. Remember, humans, performance, symptomology, subjective over just labs. So

I'm always cross-referencing all these things, and particularly that last point, symptomology. If, though, you're seeing C-reactive protein is a little bit high, ESR is high, blood lipids and blood sugar are up, albumin, vitamin D is down, you don't have to have all those things, but if you saw maybe a couple of those things and you were seeing symptoms, complaints, performance, injury, soreness, joints, things like that, then you might say, "Okay, something's going on here."

Dr. Andy Galpin

But if, in another case, say blood sugar is a little bit high and C-reactive protein's up, but their ESR is fine, albumin, vitamin D is fine, and no symptomology, then hey, maybe they just actually have blood sugar control issues, maybe bad diet or some other stuff going on, and they just got sick. So again, you're looking at multiple clues. You're being a detective here. Make sure you're not accusing the wrong thing and send the wrong person to jail here, the wrong issue, if you will. You can actually play a little bit of a game here. I'm going to try to not lose you. You may pause this, but I actually think this helps learning a lot, so I will go through this. Let's imagine a couple different scenarios where we're just going to play with ESR and CRP. Remember, ESR is that 14- to 21-day inflammatory marker, and CRP is acute. Okay? Remember that. So imagine if ESR is high and CRP is high.

Dr. Andy Galpin

So both high. Well, that tells us we have both acute and chronic inflammation. And you still haven't fixed it. So it's been around a long time, and you haven't done anything about it. You probably need to intervene. Okay? Another scenario. Let's say that ESR is low, but CRP is high. What's that tell us? That tells us you're inflamed right now, but it's something new. So what happened in the last week or less that caused it to go up? Could be that infection, could be training, could be you worked out too close, could be something else happened, but you know it's been acute, and it's still there. Our last scenario here is the opposite now, right? So you'll probably put this together, but ESR is high, but CRP is not. Now, this is a really fun one. Here's what this tells us. You did have chronic inflammation, but you don't anymore. So now I don't need to intervene. Whatever it was that was going on is gone.

Dr. Andy Galpin

You've already fixed it. You've managed it. We don't need to now change anything. This is a great example of a false positive I keep talking about. You don't need to do anything here, most likely. Right? You don't need to go inhaling 10 grams of curcumin or anything like that because the problem's already been corrected. Okay? So just looking at these two markers, understanding what they mean, indicates three completely different lines of action that you would take to get you the best results without over-supplementing or over-adjusting or changing protocols and programs based on what's actually happening and what's not. Other examples that I talked about earlier in the show fit in perfectly here. Remember albumin, how it goes up

with dehydration but down with inflammation? If we see other markers of inflammation and/or dehydration, we now know what's actually happening with albumin. Right?

Dr. Andy Galpin

That explains why it's "normal." I also mentioned something called mean corpuscular volumes. This is the average size of your blood cells. Remember, that goes up with vitamin B12 and B6 deficiency. But remember, measuring B12 is really, really hard. So you don't necessarily even know if that's the right thing there. And it's pulled down with inflammation or iron deficiency. But you don't know why. So now you're actually going on a further detective mission. You've got some clues here. What you would really want to do here is, this is when something like RDW would come in, and you would check that, and that would actually tell you what's happening, as an honest answer or not. But that higher MCV doesn't necessarily mean it's good for athletes, and that's maybe a discussion for another time. But mean corpuscular volume is another great example, like albumin, like some of the other things, of really paying attention to the interaction and looking at other markers to properly interpret and thus contextualize what's happening, which would then determine and influence your course of action.

Dr. Andy Galpin

I know that was a lot to go over. I tried to use specific examples there. I hope you don't take any of those too literally or directly, but rather just a way to highlight how these things can operate. I do hope you took away some actionable, useful information there and you got better, but that's the most we can get into today. And perhaps if this is an area of interest, we can cover this topic or similar topics in specific individual deep dives in further seasons. But at this point, I'd like to move on to our final I, which is intervene, so we can discuss now what to do about some of these markers when they are a little bit off-kilter. As you got the sense, interpreting blood work can be cumbersome and complicated, and so determining your intervention gives you a couple of options. First and foremost, you can certainly work with your doctor, and that's always a good idea. Second is to work specifically with companies that provide this type of analysis for you.

Dr. Andy Galpin

Obviously, I am a co-founder and so work heavily with Vitality Blueprint. They're a sponsor for the show, and they provide this service. But many other companies do as well. You're welcome and encouraged to work with anyone that fits your interest and price mode, it's covered by your insurance, or whatever fits best for you and your scenario. The third option, and one I want to spend more time on, though, is what can you take action on right now based on only the understanding we have at this time. If you're going to go with option three, I recommend the following, and that's starting with what I call the big solutions first. I've got a handful of them here, and we're going to go into some of the details as the conversation evolves. What I mean by big solutions is things like what we've talked about so far. Work with humans rather than labs.

So pay attention to big human factors. Lifestyle is more important than supplementation.

Dr. Andy Galpin

We want fresh air and good water, great relationships, sunlight, movement, so on and so forth. I know it doesn't sound sexy, and the whole point you're probably listening to this is to try to figure out these magical, super specific micronutrient solutions for your individual markers, and that is a thing. That's real. I'll get into that as much as I can here, but I can't cover every situation and scenario, every solution possible. And more importantly, though, the honest reality is the big lifestyle stuff not only works, but it is a hammer compared to these tiny nails of other solutions. You really will solve a huge majority of your problems in your labs by just really doing these big things, sleeping better, more exercise, and so on and so forth. Friends, I've done thousands of blood work panels on high performers, and I can really honestly tell you from experience that big stuff will make the biggest impact by a mile.

Dr. Andy Galpin

So start with the big solutions, humans, lifestyle over supplements, so on and so forth. We also want to think about the idea of passports versus individual tests. So maybe what this means is you don't do anything after your first test. Unless something's alarmingly off, you do not much of anything. We get a second or a third test before we start worrying about, well, maybe that was just a weird test. Maybe that was off. What's normal for me? That's not what I do personally, to be honest, candidly. But it's not a terrible thing to say, "Hey, look, I'm not going to overreact here. Let me get a couple of tests first, see what's normal for me before I start making some of these big changes." That's absolutely reasonable. Additionally, you're going to want to think about when you want to target the direct markers versus going at our systemic solutions. Sometimes you want to actually enhance or decrease the marker itself.

Dr. Andy Galpin

Other times, that's not the target. We generally refer to these as specific versus systemic solutions. So in the case of specific, let's think about anemia. Now, in that, you may see blood markers like B12, iron, and folate are low, and that's causing the anemia, which is causing the problems. Therefore, if you take B12, iron, and/or folate, and you increase those concentrations, you will remove or improve the problem and therefore improve and remove the symptoms. The marker is low. You want to bring that marker up. Problem solved. That's not always the case, though. In fact, the other example would be something more like fatigue. Okay, so in fatigue, you might look at markers like your cortisol to DHEA ratio. You might also look at your sodium to potassium ratio. In those cases, those markers will be off, and that will indicate why you're having fatigue. However, you don't want to go take more of those supplements.

Dr. Andy Galpin

You don't want to go take more sodium or potassium. And if you do, and we'll get into this later,

that's not actually what's causing the problem. In this case, you're fatigued, and those are indicators of systemic fatigue. It's not the local number that matters. It's not the sodium or potassium. These are a response to something else. In this case, the response is to systemic whole-body fatigue. Therefore, you need a whole-body solution. If you go do that, you will see the fatigue dissipate, reduce, or go away entirely. And then in response to that, those markers, cortisol to DHEA ratio or your sodium-potassium ratio, will resolve themselves without even taking any additional DHEA, cortisol, sodium, or potassium. Okay, so these things are signals rather than the actual cause itself. So here's an example of how this could look on the full coaching spectrum. And to be honest with you, this is an actual, real example of an individual, not an athlete.

Dr. Andy Galpin

This was a, we'll say, high-performing executive, to say the least, client. Okay, so here we go. Symptomology was fatigue, right? Fatigue, sleepiness, didn't feel refreshed throughout the day, energy lulls, so on and so forth. So that's the symptom. What was the cause? Trouble sleeping. So we ran our sleep analysis and found out, okay, yes, sleep quality was poor. Well, why was sleep poor? Well, we took a look at the labs, and we saw that insulin was low, sex hormone binding globulin was high, and free testosterone was also low. Now, the false problem or the physiological response was the low testosterone. Many people would've stopped right there. "Ah, I know why you're tired. Your testosterone is low." Well, it was low, but that's not what the cause was. The real problem was low carbohydrate intake. What do you mean? Well, here's what you may or may not realize.

Dr. Andy Galpin

If you don't eat sufficient carbohydrates, what that number is, you'll have to maybe tune into our nutrition episode, and it's different for everyone. But the point here, if you're not eating enough carbohydrates, this may reduce insulin. There is an inverse association between insulin and sex hormone binding globulin. So when insulin gets low, sex hormone binding globulin can go up. If you have more SHBG, then you're going to be holding on to more of your testosterone. Remember how free testosterone is calculated? So if that is higher, free testosterone is going to be lower, and in this particular case, it actually was dramatically impacting overall testosterone. And so because of that, fatigue, problems sleeping, all these things were being caused not by the low T, that was the response, but by the low carbohydrate intake. In this particular case, the individual was consuming, I think it was about 125 grams of carbohydrate per day, about a 200-pound guy, and was really physically active.

Dr. Andy Galpin

And so in this particular case, and we're not against low carbohydrate at all, I'm just against nutritional interventions and programs that don't work for physiology. In this case, it wasn't

working for his physiology. That's all we're trying to say here. So in this particular case, we added about 75 grams of carbohydrate, and specifically at night. Now, this had a couple of benefits. Number one, when accounting for total calories, this is not going to increase fat mass at all, and it didn't with him, and it hasn't with any of our people we've done this with. But we added that. That increase in carbohydrate intake at night also helps bring cortisol down, helps with sleepiness. The individual was having a hard time getting to sleep. And I think, if I remember correctly, his latency was 25 to 30 minutes on average. And you can go check out our sleep episode to learn more about latency, but that's too high.

Dr. Andy Galpin

It took him too long to fall asleep, and then sleep quality was overall a mess. We know that these carbohydrate plays a role in serotonin production, which helps you fall asleep, and so on, and so on. Those are the lot of things we get into here. But the point was, here's what happened. We added those 75 grams of carbohydrate, took blood, I think it was three months later, and we already knew the answer, by the way, because we saw our sleep monitoring and physical symptoms change very quickly, I think within a week or so. So we kind of knew the answer, but we confirmed it with our blood work. And so we saw, of course, insulin had gone back up a little bit, sex hormone binding globulin had come down. In response to that, sleep got better. That's the key. Sleep got better. So in response to that, testosterone then went back up. That was the real driver, right? The bad sleep was pulling the testosterone down.

Dr. Andy Galpin

So testosterone going up, and then most importantly, on top of all this, the symptomology went away. And that's what we're really after. So really good example of batching, in this case, three markers together for fatigue and understanding the relationship between them, putting this in context to the lifestyle situation, body composition, time of day, exercise habits, sleep technology and assessment, and all those things to really get a comprehensive understanding, which allowed us to come up with a really easy solution. Have him a few more carbohydrates at night. So I think we gave him rice, most specifically. And then bada bing, bada boom. Super simple solution, felt amazing, felt like a million bucks, still feels great to this day. Last thing we want to cover here is the idea is if you're going to tackle these things one by one, I would recommend starting with the most severe ones first.

Dr. Andy Galpin

It's been my experience, having run many people through our coaching program, when you just tackle the severe ones, everything else tends to fall in line, and you oftentimes never even have to go to the moderate or less egregious ones. The physiology tends to just line itself back up once you get those big problems out of the way. At this point in the show, it's been a bit of a journey, and I appreciate you for sticking with us this far, and I know we covered a lot of ground,

and so I'd like to finish with just a small recap of what we went over. I started by talking about the pros and cons of blood work, and I want to reiterate that you don't have to do it. As excited or interesting as you find this field is, as I do, you can have a tremendous amount of success, and most of the success in your personal or coaching careers, however you're listening to this show, by doing the big lifestyle things first.

Dr. Andy Galpin

That should always be your focus. But after that, we went into then discussion about what to measure, which markers to pick, different scenarios and different goals, and then we rolled into how to interpret those data, right? So we talked about making sure that you get good data and that you're collecting stuff appropriately, and how often to get your blood draws done, and then how to contextualize that. Are you using the right reference ranges? Are you understanding markers that are highly variable versus those that aren't? And then really the idea or the strategy of patterning and putting together categories rather than relying only on individual markers. And then we finished up by getting into some of the strategies we use to change or make improvements if your markers are not in the place that you'd like them to be. And I really spent a lot of time, and hopefully it came through, talking about the power of making sure you're targeting systemic solutions when systemic problems exist, and direct targets when direct problems exist.

Dr. Andy Galpin

So I hope you gleaned a ton from this episode. It was one of my favorite for sure. I absolutely love this field and spent honestly quite a bit of time on it. There's power here. I want to finish by letting you know that as much of the information I did cover today, we're missing a lot. There's a lot more to glean in physiology. It's very, very complicated, so I don't want to come off overly confident in these things. There's always room to learn and grow, and when data come out That changes our interpretation. I will absolutely change how we're approaching these things, and I think you should do the same. So there's enough to take action right now, but we always need to leave a large window in this area for new learning and advancements, and be able to change and modify our approach based upon those learnings. So I thank you for your time thus far, and we'll see you next time. Thank you for joining for today's episode.

Dr. Andy Galpin

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