



#554 The Death Metal: The DEVASTATING Effects of Cadmium with Clark Engelbert

Dr. Wendy Myers

Hi, I'm Dr. Wendy Myers. Welcome to the Myers Detox podcast. On the show today, we have my friend Clark Engelbert. He's going to be talking about cadmium, the death metal. A little bit traumatic, but when you listen to this show, you'll understand what we mean. Cadmium causes a lot of different health issues like heart disease, hardening of the arteries, high blood pressure, brain issues, kidney health issues, and even osteopenia and osteoporosis, low ferritin levels, anemia and things like that. Cadmium causes more cancers than all of the other heavy metals combined. This is no joke. So we're going to be talking about what exactly cadmium does to the body and how zinc deficiency can cause you to uptake more cadmium, which is really interesting. We'll talk about where you find cadmium and how you detox cadmium. A lot of really good info in the show today. Stay tuned.

Clark Engelbart is the founder and CEO of Nutritional Analytics, the health consulting company that specializes in using hair tissue mineral analysis or HTMA to set up mineral balancing healing programs for the purpose of heavy metal detoxification and mineral balancing. Clark has a background in nutritional sciences and biochemistry. He studied both disciplines at the University of Arizona and Boise State University, respectively. Clark received his

training in HTMA and mineral balancing through Dr. Lawrence Wilson. He also worked directly with Dr. Wilson, analyzing thousands of air tissue mineral analysis tests. He continues to run his website, nutritionalanalytics.com, where he has helped hundreds of people detoxify their heavy metals and get their lives back. You can work with him and also take his course for practitioners and lay people at nutritionalanalytics.com. Engelbert, thanks so much for coming on the show again.

Clark Engelbert

Thank you, Wendy, so much for having me. It's good to be back with you.

Dr. Wendy Myers

Tell us a little bit about your background and how you became such an expert in heavy metals.

Clark Engelbert

Yeah. So I have a background in nutritional sciences and biochemistry. I went to school for those things, but after that, I trained with Dr. Lawrence Wilson to interpret care tissue mineral analysis tests. That sort of led me into the world of mineral balancing and understanding or trying to understand at least interactions that exist between the minerals, and that led me down this road of understanding heavy metals a little more deeply because, as you know, and I'm sure your audience probably knows that heavy metals and minerals interact in very important ways in the body that define their metabolism and toxicology, basically how those elements interact with each other. So, I've got some background with the schooling, but then also training with Dr. Wilson and then my own research since I started nutritional analytics, many years ago now, that is in 2019. I have just been looking at all of these different interactions, how they play out, what the literature is on that, seeing that play out in myself and my own mineral balancing program, and then seeing that play out in the real world with clients is kind of another level of understanding.

Dr. Wendy Myers

I highly recommend anyone interested in heavy metals, which you might be listening to this show, to go check out Clark's work and nutritionalanalytics.com and his Instagram. You really have a lot of great information and help people make a lot of connections of how minerals and metals act in the body, what they're doing, where you get them and a lot of really good info. I enjoy following you. You're also going through your own detox right now. We're all going through it, folks. We're right there with you. I'm going through my own foot bath detox because I moved from Mexico back to Houston and I'm just like, wow, I guess I ate a lot of pesticides in Mexico. There's not a lot of organic food there, unfortunately. I had to eat something. So I'm having to detox a lot of stuff, but you're also going to a lot of detox stuff yourself, correct?

Clark Engelbert

True and I've been doing mineral balancing now for a while and have gone through metal eliminations in the past and more recently for whatever reason, I don't really know, but I've been going through a pretty big aluminum elimination since the beginning of this year and going through multiple hair tests, seeing that aluminum level steadily rise on the hair test as I'm following the mineral balancing, it's been kind of interesting just to see and understand you could be on a mineral balancing program. You could be on detoxification protocol for a while and still have metals to eliminate and I think that speaks to the pernicious nature of metals, how they're not biodegradable and their half-life in the body is very long. So, providing enough biochemical energy for your detoxification systems consistently over time is really what causes that elimination. It shortens the half-life of the metals, but under normal circumstances, many of the metals have like a half-life of anywhere from 10 to 40 years, depending upon what metal you're looking at.

Dr. Wendy Myers

We have aluminum that's stored in our bones. I think people don't realize that it's a lead and aluminum heaven. It takes a while for that stuff to come out, even if you're really focused on detox like you and I have been for a really long time. I've known you for over 10 years over Facebook and going through this journey, it still surprises me how we're always exposed. Even if you're detoxing, you're still getting exposed every day to toxins, a lot of spring in the air, aluminum, and other metals, and we're always ingesting this stuff and have to get it out.

Clark Engelbert

Yeah. Exactly.

Dr. Wendy Myers

So we're going to focus on cadmium today. I want to do a deep dive into different metals and do a series like this because I think people don't realize where they're picking up this stuff or if they should be worried about it. Why don't we talk about cadmium and why it's the most toxic metal. You even call it death metal.

Clark Engelbert

Yeah, not really getting attention at all, but no, we're not trying to hype any hyperbole here at all whatsoever. But yeah, I called it the death metal when I coined that. So, if you want, I'll take some royalties if we use that, but when it comes to that moniker and that name, I really think of cadmium in that way because it has biological effects at lower doses than most of the other metals. Also, very low doses of cadmium can kill you. An acute lethal dose of cadmium is in the range of anywhere from 140 milligrams to like 350 milligrams. Compare that to what you think you should be getting in a day for magnesium. Most magnesium pills have anywhere from 200 to 400

milligrams of magnesium per day. That's the baseline nutritional requirement on a daily basis for magnesium compared to an acute lethal dose of cadmium, and it's even lower than that in that acute lethal phase. So very small amounts can kill you. Very small amounts in the picogram range can have biological effects, and that's lower than all the other metals.

So, there may be another aspect to this that cadmium's halftime is very long in the body. The estimations on the half-life are anywhere from 17 to 40 years, depending upon what tissue compartment it's in. It's kind of interesting because, in certain studies, there's variation in the same tissue compartment for the same metal in terms of at the halftime, that I think is very interesting as well. The long half-life in the body is very difficult to eliminate. There isn't any known chelating agent that works either for acute or chronic cadmium poisoning. They've been looking at this for like 40 years now and it's pretty wild that they theorize that the reason that cadmium is very hard to chelate is that it's bound to proteins intracellularly really tightly with very strong affinities and avidity. So lots of different reasons why I just tend to think of cadmium as the most toxic of all the metals.

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For anyone listening who really wants to detox their body, go to heavymetalsquiz.com. I created a quiz for you. It only takes a couple of seconds based on some lifestyle questions. You can get your toxicity score and get a free video series that answers all of your frequently asked questions about how to detox your body. Check it out at <http://www.heavymetalsquiz.com>

Dr. Wendy Myers

Yeah, and when you think about the first thing that comes to my mind when I think of Academy Miss smoking cigarettes and marijuana. Those plants can pull that cadmium out of the soil really well and that's why smokers get heart

disease, hardening of the arteries, high blood pressure and things like that. The cadmium literally turns their arteries really hard.

Clark Engelbert

That's a really interesting aspect of cadmium as well. It comes down to its chemical and physical properties, which is that it's very hard and rivetal. It can be used in a lot of different industrial applications to harden softer metals. It works like an auto radiator. They use copper to make or mold the shape of like auto radiators, but they can use cadmium to stiffen the copper up to make sure that it's resistant to mechanical stress. Cadmium's heat tolerance is very high as well. So that's an interesting aspect of cadmium toxicology. Understanding cadmium from the metallurgical perspective can help us understand what happens when it gets in there in the body. We just mentioned that copper is a softer, more malleable element. When it gets into your body, it actually makes you softer, more malleable, more receptive and sometimes more emotional because of its effect on the nervous system, but cadmium actually stiffens up or hardens your tissues, sometimes as compensation for excessive copper.

Dr. Wendy Myers

Where else are we getting cadmium? So anyone that's kind of worried about this, and there's a lot of different ways that we can ingest cadmium. What are some of the places?

Clark Engelbert

So there are a couple of different places that are really important to mention. I think cigarette smoke and marijuana are probably the biggest, most common exposure vectors, like specific ones, but cadmium is in the background or what researchers would call background exposure to a significant degree. This is because of cadmium's presence in phosphate fertilizers, which are used to the tune of 46 million metric tons every single

year globally, right? That's a really high number to fathom. It's the main fertilizer that's used in most crops around the world. What happens with the phosphate fertilizers is that they actually go into mines or phosphate rocks around the world. And because cadmium is geogenic, it's in the earth's crust. You get a certain percentage of cadmium with this phosphate rock. They ground it down and they don't filter that cadmium out of the fertilizers. It's very difficult to do. So at scale, cadmium is in the soils, but there's this background exposure that everyone is getting exposed to on a daily basis.

They've looked at the average intake studies in different countries or different regions around the world. On average, Americans and Europeans are ingesting anywhere from 10 to 30 micrograms of cadmium per day. It's significantly higher in Asia, around 60 to 130 micrograms per day. You're not going to absorb all of that, but absorption rates can vary, and that's a really interesting topic that we can touch on. It speaks to this notion that cadmium is in the soil to a significant degree. So a lot of different foods are loaded with cadmium, but with tobacco, cigarettes, and marijuana, that's related to their status as what we call phytoextractors, which suck up cadmium from the soil a little more readily than other plants do. So it's not fully understood why that happens, but there are certain plants that just seem to suck up metals a little more readily than others. For instance, rice is a phytoextractor for arsenic, and so on and so forth. So cadmium is in the soil.

There's background exposure when cadmium is liberated into the air. So there's a lot of air exposure as well from mining operations and from smelting as well. So cadmium isn't actually in mines specifically. It comes or occurs in ores of lead, copper, and zinc, which we are mining for quite a bit for all of those elements because they're so useful for all of these different industrial applications. That's maybe another important point for people to understand about cadmium and metals. That's a portal into understanding metals a little more deeply, which is that metals are extraordinarily useful for thousands of

different processes. Thank you very much. And so we're mining them. They're not elements that we can create or destroy, so we have to mine them on the earth. And so cadmium is getting aerosolized, it's getting into the air, through mining and smelting operations. It's also in the oceans. This is a really interesting thing that I came across recently in doing some prep work for this. Cadmium is actually nutritionally essential for certain microorganisms in the ocean. As a consequence of this, there's a differential concentration threshold in the oceans for cadmium. There's going to be actually higher concentrations of cadmium the deeper you go into the oceans. This is because it helps to feed some of these microorganisms that are a little deeper in the oceans, but this explains why certain fish, shellfish and oysters are actually pretty high in cadmium.

Cadmium starts out in the oceans. The microorganisms are consuming this as an essential element but then it biomagnifies. It goes up the food chain as the fish consume those microorganisms. That's the main mechanism that mercury is in a lot of fish now. Fish is a pretty big source of cadmium, I would say, shellfish, oysters, and then some other more common foods. Please don't shoot the messenger on this one, but I know chocolate and actually coffee too, are pretty significant sources of cadmium, but it can vary by region and geographically. If you're in a region with mining and smelting operations for zinc or lead or copper, you might be at higher risk for ambient exposure for that cadmium to get aerosolized and in the air and then put down or it comes down onto the crops.

Dr. Wendy Myers

Where's the heavy metal-free coffee? Where's that? They have mold-free. They've got pesticide-free or cadmium-free coffee. Oh, maybe not. It doesn't exist, but yeah, I think people don't realize that you worry so much about mercury and seafood, but cadmium and lead and other metals, nickel are right there in the seabed as well. It just doesn't get the headline news. I think

also one thing we haven't mentioned is cadmium causes more cancers than all of the other heavy metals combined. And yeah, that's a huge issue. Can you talk about that a little bit?

Clark Engelbert

Yes, this is a very interesting aspect of cadmium as well and I think a lot of the lung cancers that people who smoke have are directly just coming from the cadmium intoxication that they're getting and we can actually sort of put some tangible numbers around this. For instance, a cigarette contains around one to two micrograms of cadmium and then you're absorbing it. The reason why inhalation exposure, smoking cigarettes and marijuana, is so dangerous and so biologically relevant for cadmium exposure is that you're inhaling. When you inhale cadmium, you absorb up to 50 percent of that, whereas, through the GI tract, you're really only absorbing anywhere from 5 to 10, maybe 20 percent in other cases. But when you're smoking, let's say a pack a day, there's 20 cigarettes, that's around 20 micrograms of biologically active cadmium that you're inhaling through your lungs.

Cadmium itself is extremely inflammatory. It's one of the most inflammatory metals. It's recognized even by the government as a class one carcinogen. So they know it causes cancer. They know it causes lung cancer. But there's some really interesting research looking at rats. After one injection of cadmium into their testicles, they cause cancer. That's after one injection of cadmium at very low doses because they don't want to kill the rats. So, that's been demonstrated in animal studies as well and that's part of why the classification exists. Cadmium is very carcinogenic and when trying to think about the effects that metals have, I think it's most useful to understand that where the metals go in the body, the way that they're distributed predicts maybe their effects a little better than just saying, cadmium causes cancer. It's like, okay, well, yes, that's true, but where?. And why does that happen?

And so understanding that the metals and cadmium in particular interact in important ways with a lot of different minerals and minerals are distributed all throughout the body in what we would call a pleiotropic manner. Minerals are used for hundreds of thousands of different processes throughout the body and so wherever the minerals are metals like cadmium can hijack those mineral transport mechanisms and get into cellular compartments and then wreak havoc primarily through initiation of inflammatory pathways. Also, cadmium is really well known to induce genetic effects and inhibit DNA and RNA repair enzymes. That's a potential mechanism where it could cause cancer or at least contribute to it. Another really interesting idea here is that cadmium inhibits DNA and RNA repair and detoxifying enzymes.

I think the mechanism that cadmium is contributing to cancer and other diseases is that it prevents your body's own detoxification systems from being activated. So then when you come into contact with metals post that exposure and that inhibition of your detoxification systems is initiated, you will have a harder time eliminating whatever else you come into contact with over time and that's very damaging because we're chronically exposed. Even if you're very careful, we're chronically exposed to these metals. They don't biodegrade, and then they interact in synergistic ways that are more potent than individual exposures and that sort of speaks to not only do metals and minerals interact, but metals and metals interact with each other, too, which I think is a very interesting aspect to cadmium toxicology.

Some of the other main effects, I would say, certainly cancer causing, but cadmium has a very powerful effect on the kidneys, the bones and when it gets into the brain, it can have very significant effects on your core white plexus, which is really important for the generation or the synthesis of cerebrospinal fluid. That's another sort of way that your body cleans up or detoxifies the brain, right?

Dr. Wendy Myers

Are there any major health conditions that you can talk about that cadmium was an outright contributor or one of the indirect contributors to?

Clark Engelbert

Idiopathic high blood pressure, and that's because cadmium primarily accumulates in the kidneys. They've done postmortem studies, and anywhere from 40 to 60 percent of the total body burden of cadmium is found in the kidneys. The kidneys act as a biological endpoint for cadmium, where when you absorb cadmium, it gets sent to the liver first. The liver has a really easier time synthesizing metallothionein, which is this protein that helps buffer or protect you against cadmium. As the cadmium is bound to metallothionein in the liver, it's then sent to the kidneys where it's then presumably sent there to be excreted. Sometimes that doesn't always happen. The kidneys really accumulate cadmium more so than any other organ. And so we can have these high blood pressure effects, but it can also disrupt vitamin D metabolism and have second and third order bone effects as well. It can cause osteomalacia and osteoporosis. It inhibits vitamin D absorption because of the way that it messes with the kidneys structurally and functionally, which is vitamin D absorption and feedback mechanisms are occurring in the gut, but also in the kidneys. So anything associated with low vitamin D, right? And that's how many different diseases are associated with low vitamin D.

Dr. Wendy Myers

How many people are taking 10,000 IU or more of vitamin D and their levels are not improving?

Clark Engelbert

I would say that lead and cadmium are the biggest. If you have significant burdens of lead and cadmium, you presumably wouldn't respond to vitamin D supplementation or even get vitamin D from the sun. So that's maybe something to look into if you have that issue. So, bone effects, cancer, it can cause anemia in multiple different ways. It can affect the peripheral red blood cells. Cadmium precipitates or accumulates sometimes in the bone marrow itself, where it inhibits the production of the RBCs. So, a lot of different things. I've had some interesting cases of developmental delays and cadmium toxicity and we've done a lot to reverse or ameliorate that after those children with these developmental delays eliminate cadmium. But those are the primary ones, right? It's going to be cancer-causing in the various tissues, bone effects, osteomalacia, osteoporosis, kidney problems, high blood pressure, sometimes cadmium can accumulate in the pancreas and at least contribute to diabetes as well and to the extent that the cadmium will substitute for zinc in the pancreas. Zinc is very important for extending the action of insulin in the pancreas. So if cadmium is substituted for zinc there, it can cause glucose regulation problems, and that can also happen as a result of issues in the kidneys. So there are multiple different ways that it can sort of converge and cause blood sugar problems as well.

Dr. Wendy Myers

So you guys listening, you understand why I'm focusing, or we are focusing on heavy metals and toxins because just removing this stuff can allow your body to function properly. They're one of the primary ways that our bodies go haywire and we start having all these different symptoms and health issues and fatigue and all the other things that you mentioned. So let's talk about minerals. You mentioned that zinc is very much interfered with because of cadmium toxicity. Can you expand on that a little bit?

Clark Engelbert

So this is a really interesting idea that minerals would interact in biological systems goes back to like the early 1970s with the work of these two researchers by the name of Hill and Matroux. These guys proposed that elements with similar physicochemical characteristics would interact in biological systems and absorption would be inhibited when the presence of those two elements were sort of at equimolar concentrations at the same time. That was a theory, but they actually demonstrated that in a lot of experimental data that they produced. That's where this notion comes from, that the elements interact with each other and can be either synergistic or antagonistic. And to that end, cadmium and zinc are very physico chemically similar. They exist in the body in the same oxidation state. Their electron configuration is very similar. Their coordination numbers are the same. Electronegativity is very similar. So a lot of the physical and chemical characteristics of these elements are very similar. So, when you are exposed to cadmium, your body can confuse cadmium for zinc in certain situations, and because metals are not under homeostatic control, they have to gain access to cellular compartments in some way. Primarily they use mineral channels and transporters to get into tissue compartments. Once the metals get into these tissue compartments, they bind to enzyme-binding sites really powerfully. Lead and cadmium can bind really powerfully to zinc-binding sites.

It's interesting that cadmium is not the only metal that interferes with zinc. Lead can interfere with zinc. They've elaborated on the binding affinity that lead has for zinc versus calcium, which I think is interesting and related tangentially to cadmium because cadmium also interferes with lead or interferes with zinc and calcium. When we get into this a little more deeply and how we're really actually exposed to the metals, we're exposed to metals, not in individual exposures. You don't just accumulate cadmium from food. Usually it's a little bit of cadmium. It's a little bit of lead. It's a little bit of arsenic, a little bit of mercury. It plays out that way in the real world. But I'd say zinc

and cadmium are probably more similar than almost any other two elements on the entire periodic table, which is weird and interesting when you realize how essential and important zinc is and how toxic cadmium is. It makes you go, well, what's going on there with nature and evolution, right? There's a similar comparison that you can make between silica and aluminum, where silica is nutritionally quite essential. They're still elaborating on that, but aluminum and silica are quite similar. Aluminum is toxic but silica is not. So it makes you wonder what's going on with that a little bit.

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I want to give thanks to one of our sponsors, caramel collagen by Everbella. Collagen, as you know, is a very vital building block for our skin, hair, nails, joints, and bones, but starting in our thirties, our collagen levels start to levitate. They started going on the decline. We need collagen to prevent sagging and to give us that plump youthful look, that glow. What you may not know is that most collagen supplements are full of toxins and fillers like glyphosate, arsenic and other heavy metals that actually disrupt your body's ability to regenerate collagen altogether. That's why I love Caramel Collagen by EverBella. Not only is it rigorously tested to be free of toxic metals but also uses a unique liposomal delivery technology to improve absorption, and it's absolutely delicious. I love taking this. I put it in my coffee in the mornings. Right now you can try EverBella's Caramel collagen for 30 percent off. Just head over to everbella.com and use the code Wendy30 to get your discount.

Dr. Wendy Myers

It really concerns me how for so many decades, the American Heart Association has said to not eat red meat, how it's so bad for you. I think that's a huge contributing factor to the zinc deficiency people have and that makes them more susceptible to taking an uptake of cadmium, which leads to heart disease, ironically.

Clark Engelbert

I say the three most important nutritionally essential elements, which protect you against cadmium toxicity. Number one, zinc number two, iron number three, calcium. So any subclinical deficiency in those elements issues with bioavailability, which can happen with iron because copper affects iron bioavailability, but those three nutritionally essential elements, if you have sufficiency of them, will protect you against cadmium toxicity. Let's trace back. What foods are really rich in zinc, iron and calcium, right? Meat and dairy primarily. What are the foods that have been most demonized over the last 30 to 50 years by the nutritional establishment, meat and dairy? So that makes you wonder on some level, are they that incompetent or is there some level of malevolence going on as well at the same time?

Dr. Wendy Myers

Yeah, for sure. I vote for malevolence. I vote both for sure. You really point out that people need to focus on mineralizing their body and balancing their minerals so that they can protect their bodies against the uptake of metals, which are exposed to every single day. I think the focus shouldn't just be out, let's take something and just rip out that metal or a key later, what have you. So, there's also something you can think of as far as protecting your body from absorbing this stuff, because if you're a mineral deficient in all the minerals, which most people are, you're going to be more susceptible to heavy metal toxicity, sitting duck, right?

Clark Engelbert

100%. I think the most important point secondary to that would be, you can't just throw more minerals into the system because they interact with each other. That's where mineral balancing comes in and works really nicely for people trying to figure out, okay, well, I know minerals that are important, but how exactly, or how precisely do we use them so that we know what to take, know what not to take, at what dose, for how long? Those are a lot of open

ended questions in nutritional sciences that are unanswered in that domain. I think mineral balancing has a lot of good answers along those dimensions.

Dr. Wendy Myers

Let's talk about that. So you use a hair mineral analysis, which is a heavy metals and minerals test. It's kind of a roadmap to guide us in addressing mineral deficiencies and imbalance and heavy metal toxicities. Talk about that. Why do you use it?

Clark Engelbert

Hair tissue mineral analysis is a really interesting task for a couple of different reasons. I'd say number one, hair is an extension of the skin tissue, right? So you can think of hair as an active biological tissue and getting a measurement for the minerals and the metals in a tissue is not exactly easy and can be quite invasive. If you consider the other biopsy measurements that exist out there, you can stick a needle into your liver and pull out some liver cells. We can stick a needle into your kidney and pull out some kidney cells and look at the mineral and metal content of those cells. Who's going to do that consistently? Who's going to submit to just getting poked every month or every couple of months to measure the tissue status of those elements. So it's a noninvasive way to get a biopsy reading or cellular reading of the minerals and metals. That's a huge advantage over blood analysis. Not to say that blood doesn't have any validity for measuring things, but the hair is a tissue. You're actually measuring things at the biological site of action of those elements. The hair is a trafficking medium or blood is a trafficking medium where things get moved around in the blood from tissue site to tissue site. All of the action in the body is happening in your tissues. That's what you want to measure to get a sense for the status of those elements and really what's going on inside the body.

The hair is also really interesting because it grows slowly over time. So not only are we getting a cellular reading of these elements, but we're getting a reading of them over time, which is the way that diseases and conditions develop. They're developing slowly over time. It's not like you wake up one day and you have cancer the day before you didn't have it. Cancer takes decades to manifest, essentially. The fact that we can measure these elements over a longer time cycle than blood, which is usually about 24 to 48 hours, that's a huge advantage as well, because we're trying to deal with these long term chronic conditions that people have. You're not going to have a very good time measuring things in a very short time cycle when these conditions develop slowly over time. Those are the main advantages, but I think a little more, maybe not esoteric, but not as well known is that with the hair test, we're sort of doing a measurement of the tissue status of the elements. It's more actually a reading of the entire mineral system all at one time. This is what Dr. Eck was quasi or semi famous for. It's proposing the idea that minerals exist in a system and that their balance within that system and the interactions within that system are a lot more primary than is or was previously known. And those interactions predict in many cases mineral metabolism much better than measuring intake or other tissue compartments. So the hair test is very good as a cellular reading of the minerals and metals. It's very good because it's a long term reading of those elements at the cellular level, but you're also getting a single reading of the mineral system all at one time. That's what we're using at HTMA.

We want to get a full accounting of the mineral system. Mineral balancing is a little bit in the clouds. What does that actually mean? When we get down to it and what that means is that in mineral balancing, we want to get a reading of the mineral system. Then we want to use our knowledge of nutrient and mineral interactions to balance that whole system all at one time. That's at its core, at its essence, what mineral balancing is, and then as you balance your minerals, you innervate your own detoxification systems because so many of

your own detoxification systems, your antioxidant enzymes, your metal binding proteins are all dependent on these minerals, but minerals being in good ratio and relationship to one another as well.

Dr. Wendy Myers

Yes, and that's why it's so important to do something like a hair mineral analysis and this mineral balancing and do it with an expert like Clark because it's just doing a hair. I think there's a lot of practitioners out there and doctors that might kind of poo poo hair testing because they just don't know how to read it. It's complex to read it and learn how to do that correctly, but it's a gold mine of information for people who do understand it and know how to utilize this to facilitate.

Clark Engelbert

That's a really important point too, about HTMA. It's pretty complicated to understand when you understand it correctly, it's not straightforward, not just measuring individual readings of the minerals. What a lot of other people and other practitioners do is they'll look at just calcium and they think of calcium as a sort of discrete entity from magnesium. They just look at the magnesium level and go, oh, that's high or low. Magnesium is low. Let's give you magnesium, and that will go on for all the different elements that we're measuring. But that doesn't take into account all the interactions, the hormonal effects that are present on the minerals. All of those things play into that.

Even in the literature, this is a hotly contested issue. There was a review done in 2018 looking at the validity of hair analysis and what these researchers found was something very interesting and in my opinion, disturbing, which was that a lot of the prior research done on hair analysis basically considered hair in a similar light to blood in terms of the distribution of the minerals. In the blood volume, minerals are uniformly distributed. In the hair, that's not the

case at all. It's a very different tissue. So mineral values can vary to a much more significant degree, but the distribution of the minerals in the hair tissue along the hair shaft is not uniform at all. If you do a blood draw from your arm and a blood draw from your foot, right in a vein down there, you're roughly going to get the same values if that blood sample is drawn at the same time. If you get a hair sample from right at the scalp versus towards the end of the hair, the minerals are much more distributed with much higher variance and much more variability. A lot of the bulk of the hair analysis research, even the researchers didn't consider this important fact. So they would be sending off samples to labs from different areas along the hair shaft and saying, Oh, well, these are wildly different. They don't match up. Hair analysis must not be valid. I see this argument made amongst a lot of influencers now to this day when they're taking the line from the CDC and other regulatory bodies, which also don't understand hair analysis along this dimension and they're saying, well, it's invalid. We can't measure it. The measurements don't match up between labs within the same lab. And it's like, well, the sampling procedure is really important. It's a sensitive test.

Dr. Wendy Myers

Yeah, I have a couple of clients, a handful of clients that try to get real cute and send different samples of hair to the lab and just see what happens or send them to different labs at the same time to test it. I totally understand that, but it is very good, aside from all these problems, because there's no perfect heavy metals test. It doesn't exist. These metals are deep in our tissues and, but it gives you a very good roadmap to design a heavy metal program, regardless of its issues, its pros and cons, et cetera. The urine testing that a lot of doctors do with chelating agents has a host of issues. Some metals come out in the hair. Some come out in the urine, some on the stool lead. It's kind of good to see in the blood, but they all have their problems.

Clark Engelbert

Right, exactly. When you know how to interpret the hair test correctly, I would think of it like the most advanced biomarker type of tests for the metals. That's because when you understand how the metals and minerals interact, you can correlate mineral ratios being out of balance with the presence of a toxic metal, because it's known that cadmium and mercury can skew the zinc to copper ratio. So where there is significant perturbation in like the zinc and copper ratio, you can do a probabilistic determination of your cadmium status. That's what we're using it for. We can see cadmium directly in the hair tissue, and there are markers of very high cadmium or very low cadmium that would predict cadmium toxicity in the body. We're sort of putting a lot of pieces together with the hair analysis, like the ratios, the status of certain elements which directly interact with cadmium, let's say in this example. Then your past exposure history as well. We're doing a sort of probabilistic determination of the cadmium status in your body based on looking at this one single test. If I were to choose one test to assess your cadmium status, I would probably do either the hair test or the urine challenge test because cadmium predominantly is routed or distributed to the kidney tissue. That might be another interesting thing that we could talk about. How do you assess cadmium status in the body?

Dr. Wendy Myers

Now, I'm thinking it's tough because people can have a ton of cadmium in their tissues and it doesn't show up on tests. So that begs the question of why you need to do detox as a lifestyle and you need to do testing on a regular basis. How often do you think people should do a hair mineral analysis?

Clark Engelbert

Usually around three months, so a quarterly test, right? If you're on mineral balancing, that's what we recommend mineral balancing and using the hair tests. Using the retest is really interesting because we get to see the mineral patterns shift in accordance with what we're giving you supplementally. We

can also see eliminations happen in real time over that three to four month period, which we're testing. That's a huge advantage. I think of air testing because it's non-invasive. You can do it pretty easily every couple months and get a sense for, Oh, I'm going through like an aluminum elimination if the aluminum level pops up. Or I'm going through a cadmium elimination if the cadmium level shoots up in the hair. So using it in that way is kind of a unique way that we're using it, which a lot of people are not necessarily aware of. You're right, we're engaging in what we would call biomarkers, which is using these tests to gather circumstantial evidence of toxicity of these elements. You can use biomarkers in the urine like metallothionein, mRNA. There are very few tests that are directly measuring tissue status. The urine is still like a biomarker for the kidneys. Do you really want to take out your bone tissue and measure that for cadmium? That seems sort of insane. No, no one is.

Ads 00:42:59

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Dr. Wendy Myers

I would love to, but, you know.

Clark Engelbert

Yes, there's other interesting research testing, like neutron activation analysis in the liver you can do to directly measure cadmium in the liver, but that's more of a research test and kind of invasive as well. In my mind, if I wanted to really do a full cadmium panel, I would do the hair test number one, the urine test number two, then probably blood cadmium. This is kind of interesting, something I came across recently; measuring your ferritin status correlates with cadmium very tightly and so the lower your ferritin reading is generally what they see is higher blood cadmium and higher cadmium in other sorts of testing in terms of you're in challenge testing. That's due to the relationship between iron and cadmium. At the level of intestinal absorption, cadmium and iron compete for this transport molecule called divalent metal transporter one. What's interesting about this is that cadmium binds with higher affinity to DMT1 than iron does. So even small concentration thresholds of cadmium when ingested, could potentially knock iron down or significantly perturb your iron status and that's reflected by the low ferritin.

Dr. Wendy Myers

Yeah and that's why taking iron does not necessarily raise your ferritin levels. Even when you're anemic, the doctor's like, Oh, it's all these things that interact as you're illustrating so clearly. And it's not as simple. It's like, Oh, low vitamin D, take vitamin D. Low ferritin, let's take some iron. It just doesn't work that way.

Clark Engelbert

I have a really interesting case, pretty recent, a baby who was one year old. Her mom was worried about her because she had sleep problems already, and her ferritin was extremely low. It was like 3 nanograms per deciliter. We got her on a program, and she went through this massive cadmium elimination in the first 6 months. Her ferritin shot up from 3 to 40, no iron supplementation, her mom was weary about supplementing her with iron because she's an infant, and that's a little weird to do that. So we brought her ferritin level up pretty precipitously by virtue of the cadmium elimination.

Actually, my colleague, Dr. Stillman presented this case at a recent conference, I think, at Polyface Farms. I have other examples of cadmium elimination and iron status usually improving quite significantly.

Dr. Wendy Myers

Where would this baby get cadmium from? The mother passed down in utero? I assume the baby is not smoking marijuana. So how else would you detox cadmium? So what else can you do?

Clark Engelbert

I think sauna therapy is extremely powerful here as well. Since the kidneys sort of bioaccumulate cadmium more readily than any other tissue, anything that you can do to relieve the burden of the kidneys, like through the sweat mechanism, will help to facilitate cadmium elimination. Nutrient density in the diet is probably the most important thing and that should be everyone's baseline. If you're going to do mineral balancing or not, it's up to you, whether you do that or not, but you still have to eat. So making sure that you're eating a really nutrient-dense diet is the most important thing by far, but definitely anything that you can do to improve kidney function, red light therapy on the kidneys, sauna therapy, the near infrared type of saunas that Brian makes over at sauna space, I think are phenomenal. There are a couple of other companies out there, but to me, that's probably the most powerful type of sauna because you're getting the light therapy and the heat at the same time. So you're getting the benefits of sweating plus that photobiomodulation at the same time. That's very important in roundabout ways because that near infrared light can stimulate cytochrome C oxidase, which is very important for copper metabolism and cadmium and copper interact in interesting ways as well. So sauna therapy, probably the most potent. I think mineral balancing is by far the most potent modality that you can do, but ensuring nutrient density in the diet, nutrient variety is very important. Sonotherapy, anything that you can do to improve liver function as well, like

coffee enemas can be extremely powerful because the liver is one of the main organs that synthesizes metallothionein, which is one of the main metal binding proteins for cadmium and also glutathione and cadmium bind very tightly. We know that coffee enemas can stimulate glutathione transferase locally in liver cells. So that could be another very potent modality as well.

Dr. Wendy Myers

This all illustrates that it's not as simple as taking an agent and ripping out that cadmium, taking what are called chelating agents that won't grab onto the metal to remove it. I think people typically have that mindset when it comes to going to their doctor that there are amazing doctors out there who are thinking about heavy metals and wanting to remove them. But usually, there is one trick pony where they're just doing the chelation therapy, which is appropriate for some people, but it's destabilizing for a lot of people. It doesn't get deep in the tissues and it's not going to do mineral balancing or mineralize you. Do all these things facilitate detoxification? It's a very simplistic approach that is not going to get people the results in the long term that they're truly looking for. What are your thoughts on chelating agents for cadmium?

Clark Engelbert

Well, this is straight from the horse's mouth, which is this textbook that I have called metal chelation in medicine. These medical researchers admit there is no chelating agent that works very well for acute or chronic cadmium intoxication. So when you're acutely exposed to mercury or lead or other metals, there are chelating agents that I think have a good use case there. If you are getting a lethal dose of mercury or lead or some other toxic metal, that's where chelation is very good. You should use a chelating agent but for most people who are not occupationally exposed, that's extremely rare. So we're more talking about chronic cadmium intoxication. And yeah, there's no chelating agent that's known in the medical literature that works to chelate

cadmium from tissue compartments inside the cells. This is because cadmium is bound so tightly to intracellular proteins. It's just very hard to mobilize. But then, certain of the key leading agents don't actually cross cell membranes either. So you can chelate metal out from in between intracellular and extracellular spaces like the blood. You can do that. If you have an acute cadmium intoxication, you should do that. But, when it comes to cadmium in your brain or cadmium in your pancreas or liver or kidneys or bones, there's no known key leading agent for that.

Dr. Wendy Myers

Yeah, it's just a matter of slow and steady over time, coaxing this stuff out and improving your body's ability to detox. That's the name of the game. And it's not simple. It's not spring cleaning. It's not a once a year, three day detox. It's just like I said, this over and over detox is a lifestyle. You mentioned how cadmium affects the brain. Can you talk about that a little bit?

Clark Engelbert

That's a very interesting aspect of cadmium toxicology. I would say, under normal conditions, cadmium doesn't get across the blood brain barrier. However, there are caveats to that. When you inhale cadmium through the nasal passages, it can bypass the blood brain barrier and go straight into your olfactory bulb. That's number one. Number two, where you have exposure to metals prior that may have degenerated that blood brain barrier, those tight junctional gap cells, you could potentially have cadmium past that blood brain barrier much more readily. Once it's in the brain, they've looked at post mortem brains and cadmium accumulation and some brain tissue. For whatever reason, they find it more often in this region called the choroid plexus, which is responsible for generating and making your cerebrospinal fluid. So cadmium seems to accumulate preferentially in that brain region. When and if it does, it could potentially interfere with the synthesis of your CSF, which is really responsible for cleaning up your brain

and detoxifying a lot of different things, metabolic waste products, other things that you may come into contact with that are toxic. So I think cadmium in an interesting way can inhibit normal detoxification processes in the brain, but wherever zinc is as well, wherever calcium is, wherever iron is in the brain is where cadmium can go as well. This is an area of research that's still in its infancy and they're looking at it. I tend to think of it this way in your brain. The hippocampus concentrates zinc and is very important for learning and memory processes. So cadmium could potentially substitute for zinc in the hippocampus.

Dr. Wendy Myers

Plus learning and memory deficits make you stupid, essentially

Clark Engelbert

Exactly, especially the prefrontal cortex, which is very important for analytical thinking, reasoning, being able to think through your decision making and cadmium can cause impulsive behavior, because you really can't think through a lot of your decision making processes. There's an interesting aspect of brain development that I don't think is talked about, especially with respect to metal toxicity. There's a latency period that metals have once they get into the body. This is particularly relevant with brain development because your brain develops through this very intricate orchestrated sequence over about 25 years. So if you're exposed to a lower level of certain metals, let's say cadmium instance, when you're younger, mom passes on some cadmium to you in utero, maybe when you're a teenager, you're smoking weed or whatever, cigarettes, as brain development proceeds, if you have a little bit of cadmium and say the prefrontal cortex, that can lay dormant until that brain region is called on in development later on, and problems can manifest post that exposure years down the line as that brain region is called on in development. So you could end up with an anxiety disorder or mental health problems or behavioral problems down the line, maybe sometimes a decade

out from that initial exposure because the brain is going through the sequence of development very slowly over time.

Dr. Wendy Myers

Very interesting. I have not heard that before. Metals are very insidious and I think people just don't realize how ubiquitous metals are in our environment and in our daily exposure to them. That's why we do this show. That's why I do this show because I want to really drive these points home, like how important it is to add detoxification to your healthy lifestyle. So tell us where we can work with you. You have a course also for practitioners, correct? Is it for laypeople too? Not just practitioners?

Clark Engelbert

Yes, it's for both. About a year ago, I started working with Dr. Leland Stillman. A lot of people know him from the quantum biology space, but we decided to team up and do not only group coaching for individuals but we also put together an HTMA course called HTMA secrets. It functions along two dimensions where we have a video course with six modules talking about different health conditions and how to look at them through the lens of mineral balancing HTMA and metals toxicology. There's a link in my bio on Instagram where you can go and just purchase that as a standalone course. Then we have group coaching now for individuals or practitioners that we're currently running, probably going to open a new cohort there. I think later in the year, we're going to take a break. We've been running it for a year straight, just doing three-month, 12-week cohorts for each group of people. We've been doing group coaching as well. And then I have the one-to-one side of things where I do work with people one-to-one as well.

Dr. Wendy Myers

Okay, fantastic. What is your website where people can learn all about this and your Instagram?

Clark Engelbert

Instagram is really the place to come if you want to learn more and get my unique perspective on mineral balancing, HTMA, and metals. That's really where you should come to learn. If you want to work with me one-on-one, you can send me an email at clark@nutritionalanalytics.com or just go straight to my website and purchase a package there. When you go to Instagram, the link in the bio has all of these things listed, but you can pick and choose how you want to access me or work with me.

Dr. Wendy Myers

Okay. Fantastic. Well, Clark, thank you so much for coming on the show. It's always a joy interviewing you. You are on my heavy docuseries as well. You guys can check out that interview as well. That's going to be coming out again soon. Don't worry. The heavymovie.com. So again, Clark, thanks for coming on, everyone. I'm Dr. Wendy Myers. Thanks for tuning in every week. It's just really such a pleasure to bring experts from around the world to help you put those missing pieces of the puzzle together in your health journey. For sure, detoxification needs to be a part of that. Thanks for tuning in.

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