

# **THE** MODEL **HEALTH** **SHOW**

**EPISODE 599**

## **How Metabolic Health Controls Sexual Function & The Truth About Obesogens**

**With Guest Dr. Casey Means**

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**SHAWN STEVENSON:** Welcome to the Model Health Show, this is fitness and nutrition expert, Shawn Stevenson, and I'm so grateful for you tuning into me today. I'm so pumped about this episode. We're going to be talking about the connection between our metabolism and our sexual health. Our metabolism and our fertility.

And you're going to find out how surprising environmental chemicals are impacting our metabolic health, literally influencing things like our insulin sensitivity, and most people have no idea about these things. We're going to go through some of the latest science, and as mentioned, we're even going to be talking about this connection between our metabolic health and our fertility.

But one of the surprising things that our special guests sent over to me, and this is a paper, this was publishing the journal Diabetes Care, the title of the paper is Fetuses Of Obese Mothers Develop Insulin Resistance In Utero. These issues, our metabolic health is literally affecting children in the womb in some of the most detrimental ways, and again, the public at large does not know about this and does not understand the science.

And so today we're really going to break this stuff down to make it make sense, but we're really going to look at the most empowering portions of this, because there's so much that we can do, but we've got to be aware of these issues and the impact that they're having on our bodies and also on our children, also again on our own fertility.

And what's going on with our environment, what are the upgrades that we can make so that we can have healthier genetic expression and just to be more resilient and healthy in a world that in many ways can be very abnormal. So really, really excited about this episode today.

Now, our guest today is a graduate of Stanford University School of Medicine, and Stanford is actually a hub that's really done some fascinating research into coffee and caffeine. Stanford University recently deduced that caffeine and coffee is able to defend our bodies against age-related inflammation. The research revealed that light to moderate coffee drinkers live longer and more helpfully, thanks in part to the protection that caffeine provides by suppressing genes related to inflammation. That's incredibly powerful.

Another study, and this was published in the journal Practical Neurology, details how regularly drinking coffee has been shown to help to prevent cognitive decline and reduce the risk of developing Alzheimer's and Parkinson's Disease. So, we've got these defenses against age-

related degradation and inflammation from our body in total, but also specifically from our brain.

Now, what if we take this a step further, which is what I did today and what I do every day and combine high quality organic coffee with the tried-and-true peer-reviewed benefits of medicinal mushrooms like Lion's Mane. Lion's Mane in a study published in biomedical research, test subjects with a variety of health complaints, including anxiety and poor sleep quality, were given Lion's Mane or a placebo for four weeks. The participants who utilized the Lion's Mane medicinal mushroom significantly reduced their levels of anxiety and a general irritation than those in the placebo group.

Lion's Mane has also been noted by researchers at the University of Malaya to help the brain to recover from traumatic brain injuries. It has these neuroprotective benefits as well. And I get my organic coffee infused with Lion's Mane and Chaga from Four Sigmatic. They are the originators, and they are the best to do it. Go to [foursigmatic.com/model](https://foursigmatic.com/model), that's F-O-U-R-S-I-G-M-A-T-I-C.com/model, you get 10% off their incredible Lion's Mane coffee blend.

And also, my youngest son, Braden, every morning when I'm making my coffee, I make him the Rishi Hot Cacao from Four Sigmatic as well. So, they got some amazing, amazing elixirs, hot cocoas, organic coffees and so much more. You get 10% off, you get 10% off their entire store. Just go to [foursigmatic.com/model](https://foursigmatic.com/model). And now let's get to the Apple Podcast review of the week.

**ITUNES REVIEW:** Another five-star review titled "The Model Health Show" by Sister Suffragette. "I really enjoyed the show. It's packed with great info and the format is engaging and easy to understand. Love how the show pulls expertise from all corners and is very inclusive of varying perspectives."

**SHAWN STEVENSON:** Awesome, such a great review. Thank you so much for sharing your voice over on Apple Podcast. I appreciate that, immensely. And if you're yet to do so, pop over to Apple Podcast and leave a review for the Model Health Show. And on that note, let's get to our special guest and topic of the day.

Our guest today is Casey Means MD, and she's the chief medical officer and co-founder of the metabolic health company Levels and associate editor of the International Journal of Disease Reversal and Prevention. She also guests lectures at her alma mater, Stanford University.

Her mission is to maximize human potential and reverse the epidemic of preventable chronic disease by empowering individuals with tools that can facilitate deep understanding of our bodies and inform personalized and sustainable dietary and lifestyle choices. Dr. Casey Means has been featured everywhere from the New York Times to the Wall Street Journal, to Men's

Health, Forbes, Business Insider, Entrepreneur Magazine, the journal Metabolism, and so much more.

And yes, this is another powerhouse episode, absolutely filled to the brim with insights, so it's jump in his conversation with the amazing Dr. Casey Means. Dr. Casey Means, welcome back to The Model Health Show

**DR. CASEY MEANS:** It's so good to see you, Shawn. Thank you for having me.

**SHAWN STEVENSON:** It's good to see you as well. We got to hang out the other day, have some delicious-ness together, and it's one of those things that just being able to sit with people, "break bread", hang out. It's just one of the best parts of life really.

**DR. CASEY MEANS:** It is so special. Such a treat. Of course, we did not actually break bread because...

**SHAWN STEVENSON:** Yes, it was a gluten free menu.

**DR. CASEY MEANS:** Glucose monitors involved. Yes, the proverbial bread was broken, and it was just wonderful to, yeah, talk about some of our dreams for the future and the impact we're trying to have on bringing good health to people. It's always exciting to hear what you're working on and very inspiring.

**SHAWN STEVENSON:** Aw, come on. Well, your mission really inspired me as well, because the bigness of it, first of all the audacity, and also the fact that you're really doing something about it. And this is why I'm so grateful to have you back today because there is a really a hidden contributor to our nation's obesity epidemic, and really our struggle with body fat, period. And it's something called obesogens. So, can you talk about that?

**DR. CASEY MEANS:** Absolutely. So, this might be a word that people haven't heard before, "obesogens". And what this means, this is a word that is a type of endocrine disrupting chemical that we now know directly is positively related to obesity and fat storage. So, it used to be that we had a bit more of a correlational link between these chemicals in our air, our water, our food, our personal care products, and what we're seeing with the obesity crisis, we know that some of them have endocrine disrupting properties. But a new paper that came out a couple of months ago, one of the authors was one of the Level's advisors, Dr. Rob Lustig, who's an incredible researcher out of UCSF.

**SHAWN STEVENSON:** He's been on the Model Health Show.

**DR. CASEY MEANS:** He's been on the Model Health Show.

**SHAWN STEVENSON:** We'll put that episode in the show notes.

**DR. CASEY MEANS:** He is incredible, a force to be reckoned with.

**SHAWN STEVENSON:** Definitely.

**DR. CASEY MEANS:** But what they showed in this paper was that these chemicals we now know are actually driving several pathways in the body that directly lead to fat storage. And so, Dr. Lustig actually estimates that 15% of obesity is likely being contributed to by these obesogens. That is not an insignificant number.

I think the average person is not thinking about how chemicals are affecting our metabolic crisis. We've got 88% of American adults with metabolic dysfunction, and of course we're thinking a lot about food and sedentary behavior, some of us have made the link between sleep and stress and metabolic disease. But then it's like, "Chemicals? What? How is this related?"

But what they showed in this paper and what they broke down was two things. First, they really highlighted all the different categories of things that can be obesogens. So, some examples, we're talking about additives in our food, all the different chemicals in our plastic. So even if plastic is BPA-free, there are still chemicals and plastics that can be obesogens. Thermal receipts, the sprays that are put on our furniture and our mattresses, things like flame retardants, we're talking about our personal care products, so things like shampoo, deodorant, lotion, conditioner, fragrances that are added to our products in our laundry detergent and our household cleaners.

It's all across the board, it's in our water, it's things like air pollution from car exhaust, very unavoidable. And these are largely fairly unregulated industrial chemicals, so you can imagine a company's out there trying to figure out how to preserve their food or how to have a mattress that has flame retardant on it, or a child's toy or an electronic that has flame retardant characteristics to it, and they are coming up with chemicals that they're putting in their products that are largely unregulated.

And now there are hundreds of those that have been created over the last 50 to 100 years that are going into our cells, causing dysfunction and making us fat, which we now know, which is why they're called "obesogens". And there are several ways they're doing this, it's not just the endocrine-disrupting element.

So, when we talk about an endocrine-disrupting chemical, we're talking about how a chemical could maybe go in and actually bind to a hormone receptor and change its function, so maybe activate or block the estrogen receptor or something like that, almost act like a chemical, that's what something like EPA can do.

But there's lots of things it can do. It could hurt the microbiome, which we of course know has a direct link to metabolism. It can also affect genetic pathways, so the sirtuin pathways which we know are involved with longevity, it affects those. It has epigenetic changes. And we're now learning that these obesogens can actually go into our germ cells, which are our sperm and egg, the cells that are actually going to go on to make an embryo and cause epigenetic genetic changes in our germ cells. Meaning that the effects of these chemicals are heritable into the next generation.

So, it can feel like a monumental thing to like, "What do we do? How do we live if it's in our food, water, air and all our products?" but I think awareness is the first step.

**SHAWN STEVENSON:** Yes, always. It's the first domino. We really, just hearing what you just shared, we're stacking conditions against ourselves. We don't really realize it. Obviously, nutrition has been a big part of the conversation recently. Thank goodness, finally. And sleep wellness, stress, movement, like you mentioned, but this is another ingredient that's leading to this out-picturing. If we take a look around our society, you mentioned 88% of our nation's citizens are metabolically unhealthy. It's bananas.

**SHAWN STEVENSON:** I read something from the Environmental Working Group that the average woman puts 168 synthetic chemicals on her body from personal care products and household products, things like that, every single day. Every day. And most of them, as you mentioned, are largely unregulated. It's crazy.

**DR. CASEY MEANS:** It's absolutely crazy. And that's before you even exit your bathroom, right? This is like before 08:00 AM that you're doing that, just coating your body in these things. And you walk into your kitchen, and you pick up food, and it's covered in pesticides, and pesticides are another key class of obesogens. And even if you're buying organic food, there may even still be some pesticide residue on it. So, it's really all over the place. So, we've got to wake up to this and we really need to start advocating for industry companies and the government to do better.

**SHAWN STEVENSON:** You mentioned thermal paper, thermal receipts. That's such a strange thing. What is it about? Is it bisphenols that are in these?

**DR. CASEY MEANS:** Yeah. The chemicals that make up the ink in receipts are known to be endocrine-disrupting chemicals. So, we want to go to...

**SHAWN STEVENSON:** Go paperless.

**DR. CASEY MEANS:** Go paperless, yes. Get your receipts emailed to you. But I think the takeaway here isn't like be petrified of everything, right?

**SHAWN STEVENSON:** "Get that receipt away from me."

**DR. CASEY MEANS:** "Don't touch the receipt." We're talking about day-to-day, like what are the cumulative mountain of exposures that we're having. Perfection is a total myth, we're not going to get to a place where we're not exposed to any of these, and the most beautiful, I think part of biology in the body is that we actually have incredible systems with our body to process a lot of chemicals. We have a liver, that is a detoxification machine, we have a gut that excretes these things in our stool.

And so, a big part of what our job is not only avoid these things, some of which are truly unavoidable living on this planet today, but what we can really focus on is to build our biologic resilience to allow us to process them, to minimize exposures as much as we can, but don't go crazy about it 'cause we're never going to win that battle. We can advocate, we can try, but minimize is the key name of the game, 'cause elimination is actually impossible.

And then focus on what you can do to build your biologic resilience that you can process these things when they go into your body, and a big part of that is optimizing liver function, making sure gut function is working well, and then making sure your vascular system is on point, that you're getting blood flow throughout your body to move things.

**SHAWN STEVENSON:** Yeah, thank you. This is empowering. It's one of our favorite words. If we really think about this rationally because we could try to run, you can run, but you can't hide. We're really existing in a giant snow globe here being on this planet. Or maybe a giant aquarium. But you just want to be like the most bad ass fish in the aquarium, so that you are more top of the food chain, resilient, able to adapt.

And again, it's more so what can we do. It starts with awareness, of course, and I want to talk about this a little bit more, because I mentioned all of the synthetic chemicals that are being put onto our bodies, what we're breathing in our air. What is it specifically about, we'll just say lotion, the average lotion, Johnson & Johnson? Is this something to do with parabens? Can we talk about parabens, or is that something we're going to find in personal care products?



**DR. CASEY MEANS:** Yeah, I think you're going to find parabens. You're going to look at the back of your lotion container and you're going to see a chunk of this many ingredients on it. It's going to be like 50 different ingredients. I think the key thing that we want to focus on is like put products on your body that you understand what the actual words on that label are.

It's just, it boggles the mind that we think that somehow our bodies need this type of synthetic material in order to be, for our skin to soft or whatnot. And so, I tend to really focus on how can we have the minimal amount of ingredients in a product and things that we know what they are and where they come from.

So, if it's cleaning supplies, focus on distilled white vinegar, water and essential oils. It will do all the same stuff that the spray product coming from the store that has 25 synthetic ingredients in it has. If you're talking about lotion, organic jojoba oil. Organic coconut oil maybe.

Or if you want something that's a little bit more of a complex formulation, focus on a brand that has been vetted by the Environmental Working Group, ewg.org, where we actually know based on research the ingredients don't hurt the body, don't act as obesogen. And then for something like soap, get rid of the chemicals, all these anti-bacterial chemicals, it's the soap, water and friction of your hands that is going to do what you need it to do, and so I focus basically on just using castile soap.

Organic castile soap like Dr. Bronner's. I have a giant gallon size bottle of unscented organic castile soap, and I use it for body soap, hand soap and dish soap. And so right there, just by making a couple of those decisions, you can minimize hundreds of chemicals in your life per day.

**SHAWN STEVENSON:** That's so practical, I love that. When I think about the suave body lotion that I used to use growing up, it's just one of the things coming from where I come from, you can't be ashy out here in these streets, alright?

So anyways, but like you said, it's a list of 50 ingredients and 49 of them I have no idea what they are, versus something that is far more effective in many ways and doesn't have a reverse reaction on my skin where my skin requires it in order to live normal. It might have one ingredient, coconut oil. It's just one, one ingredient, coconut oil, versus fill in the blank, all of these other things.

And again, there are so many wonderful companies that are aware of this and coming into the market, and they're creating interesting combinations of things, but they're vetted in a way that is sustainable, in a way that's safe, in a way that's using minimal ingredients.



So, the same thing if you think about our food, we're looking for that. If people are adapting this with their nutrition, we want to eat more whole foods, things you can recognize where they come from. Why wouldn't we do this with our skin? Our skin eats as well. Because this is how many of these compounds are actually getting into our bodies.

**DR. CASEY MEANS:** Oh absolutely. Skin is the biggest organ in our body, it's this gigantic amount of surface area, and we are just coating it and all these things, and it's directly absorbed, a lot of it into our blood stream. And so, I think you're exactly right, we need to focus on skin just like we focus with food, because it's all going inside and affecting our cellular biology, and a lot of it in a negative way.

**SHAWN STEVENSON:** Now, this one really doesn't get a lot of attention, and it's another one in the category of potential obesogens, which is pharmaceutical drugs. Specifically, we talk about the class, the one that jumps to mind for me are antidepressants. It's one of those things it's just kind of normalized like, "Yeah, I gained some weight being on this medication."

Why, what's going on here? What changed with your metabolism as a result of taking this? And again, just to preface this, obviously drugs have their place, but our society's reliance on drugs could be another contributing factor to our obesity epidemic as well.

**DR. CASEY MEANS:** Yeah, this is one that I think is largely unrecognized, and in this paper, they talk about one of the many categories of obesogens, pharmaceutical medications can be one. And so, the one that they really zero in on is antidepressants, and the side effects for antidepressants, it's pretty high.

In one study, 26% of people are having fairly significant side effects when taking these medications, and one of the really big ones is weight gain. So, putting this chemical in your body, you're gaining weight, this definitionally is then an obesogen. And so, I think it's... What it really highlights is that we need to have a much broader conversation about risk and benefit when we're taking these things.

Because you may be putting out this patient on this for a long time and maybe they're having some subtle improvement in their symptoms, maybe they're actually not having that many improvements in their symptoms, and yet they're dealing with these side effects that could ultimately shorten their life and contribute to worse mental health.

Because we know that people with obesity and Type 2 diabetes have higher rates of issues like anxiety and depression. So, it's this vicious cycle and we're not really doing a good job with informed consent with a lot of this. One thing that I think most people are not aware of, which

I think should be front page news, is that there's been research that's shown that 150 minutes per week of aerobic cardiovascular physical activity has identical clinical outcomes to antidepressant use.

And yet, if you look at side effects, you're looking at less than 5% of side effects with the exercise intervention and 26% of people with fairly significant side effects with the pharmaceutical intervention. And so, you're weighing these two options, one that's free, has virtually no side effects, has multifarious other benefits, and is of course also going to contribute to general well-being and health.

Versus a medication that has more side effects, that can promote weight gain, and that in many patients is not very effective. And yet people don't even know that that's an option that they have. They have to find that by reading a book in the functional medicine space or doing their own research. But in my opinion, that should be on billboards.

**SHAWN STEVENSON:** Absolutely, you just said it so perfectly. Or of course, following Dr. Casey Means and learning this stuff.

This is something that we've been talking a lot about recently, that our society has unfortunately medicalized our emotions. And it's one of the most valuable human entities, kind of mechanisms that we have within us to guide our behavior, to demonstrate our values, to help us to make changes, to adjust things.

Because these emotions are giving us biochemical feedback on what we might need to do, but we'll just suppress it because we don't want to feel a thing, and there's a drug for that now, there's a pill for every ill kind of consciousness. Now, obviously again, there's a place for this, but we are not trained as a society.

Which, this should be taught to children, like this should be beginning in middle school, from my opinion, on really being able to... Probably earlier. Let me take that back, because I've been teaching my son this stuff as well but being able to zero in and pay attention to that emotional feedback. What is that emotion trying to signal for me? What is it directing me to do? What is this asking me to do in my life, what kind of attribute might be trying to get expressed?

And for my son, maybe he's having an issue with a friend, you know? And so maybe this is just demonstrating if he's angry with his friend. Maybe it's demonstrating that he values being heard, as much as he's listening. He thinks that other people should maybe do what he's doing, right? So just to be able to zero in and identify the emotion, rather than this being an all-encompassing thing, you are this emotion.

We did a great episode recently with Dr. Susan David on this, psychologist, so we'll put that in the show notes for everybody. But it's such an important conversation to have, because again, we've medicalized so much of natural human health and our functions, instead of getting educated like "Why am I having the symptom?" versus "Here's a drug to suppress the symptom."

So, with that being said, to shift gears just a little bit, I don't want to miss this, you mentioned pesticides as well, being in this category of obesogens. How? What does pesticides have to do with gaining weight?

**DR. CASEY MEANS:** Well, one of the major ways that pesticides can impact our metabolic health and propensity for weight gain is the impact on the microbiome. So, you're putting these synthetic chemicals which are toxic, and that's not a controversial statement, they literally are meant to be insecticides.

**SHAWN STEVENSON:** To kill stuff.

**DR. CASEY MEANS:** To kill stuff. And we have trillions and trillions of bacteria in our gut that are working tirelessly to help support our health, our mental and physical health, and we are putting out an all-out war on them through loading our bodies with these toxic chemicals.

And so, when I'm choosing organic food, I am directly thinking about my microbiome and that it can either be friends or foes, and that's determined by how I treat them, and trying to have pesticide-free food as much as you can, is one way that you can absolutely support that.

**SHAWN STEVENSON:** Yeah, absolutely. I love that so much. In general, what we're trying to do with the pesticide is to disrupt the reproductive cycle of the pest. So generally, they can be estrogenic to kind of make it so that they can't reproduce, or they're neurogenic as well, they can have some detrimental impacts in the nervous system. But again, we see it as like, "Oh, they're just killing this. It's us against them, it's us against these insects."

Which, they were here long before us, and probably long, long after. But you just said it, its all-out war, it's a war going on. And a part of this of course, is our cultivation of these monocrops, these fields and fields and fields of the same thing. Which there is a place for that in agriculture, but we're just destroying the soil.

Which leads us to the second one here that I want to ask you about in the same category, and it's another huge lever of our metabolism that's often overlooked, and its micronutrients. So

of course, we know about the macronutrients, it's a huge part of nutrition, but why are the micronutrients so important for our metabolic health?

**DR. CASEY MEANS:** This is one of my favorite topics, micronutrients. Because just like you said, we focus so much on macronutrients, fat, protein, carbohydrates. And we often are talking about macronutrients in terms of the way that we're restricting them, like restricting fat or restricting carbohydrates. What I always think about is that you don't generate health, you don't build a healthy body by just restricting things.

It's also about what you put in to facilitate the building and functioning of a healthy body. And that's where micronutrients come in. Because micronutrients are the small molecules, the vitamins, minerals and antioxidants that are found in our food, largely in our food, that support all of our cellular processes through several mechanisms.

So, there's three main ways that antioxidants support our biologic function. The first is that they can act as antioxidants, and so these are chemicals that basically bind to reactive oxidant species and to pro-oxidant molecules in the body and actually neutralize that damaging reactive molecule so that it's not going around and creating problems in the body. So, a lot of vitamins, I don't think people realize this, a lot of vitamins in food actually act directly as antioxidants, like selenium, vitamin A, vitamin C.

The second thing that they can do is actually structurally incorporate into other molecules in the body so that they work properly. So, an example of this is selenoproteins. Selenium is a micronutrient found in food, and to create selenoproteins in the body, of course you need to incorporate selenium into that protein.

If you're selenium deficient that could create problems in creating a selenoprotein. And these are a whole class of molecules that are extremely important for longevity, for antioxidant function, and for immune function. And so, this is why we often talk about how selenium is really involved in immune function, it's because it's being incorporated into selenoproteins. And so that's the second way that they are really valuable, is structure and corporation into proteins.

And the third way is that they act as little co-factors that bind to larger proteins and enzymes in the cell and actually act as almost like a lock and key co-factor that basically creates tiny conformational shifts in these proteins that allows them to work the way they're intended to, so to act like a little biologic machine.

So, you can imagine you've got this little... An enzyme in the body is essentially like a little machine that's going to convert A to B. So, if you've got some substrate, it interacts with an

enzyme and then you get this product, and that's basically how the body works, it's like you convert things from one thing to the other and processes happen in the body, and that's kind of what's going on all the time.

For that enzyme to work, it often will need like a mineral or a vitamin to bind to it, and when that binding happens, because we're just the sort of buzzing hive of atoms, what happens is when you have that binding, you get a little teeny-teeny microscopic conformational shift in that, and that is sometimes a thing that can let a ion channel open, let an enzyme do the chemical reaction it needs to do.

I'm kind of always thinking about my body is like this just as like hive, this factory basically of all these little things happening, and when I'm loading my body with micronutrients, I'm facilitating these chemical reactions. So those are the three main ways that micronutrients are important, and unfortunately, because we're eating a largely processed diet that's ultra-refined, we're stripping away so many of these micronutrients from our diet and we're actually depleting these things.

On top of that, because of the issues of mono-cropping and our poor soil health, the soil actually doesn't have as many micronutrients in it. So even if we're eating a whole foods diet and really trying to focus on food quality, we're getting less micronutrients in than we may have 50 or 100 years ago.

And so, this is why I think a really huge focus on regenerating soil health in our country and really getting a lot of that functionality back to the soil is so important if we really want to get on top of this, this micronutrient depleted issue that we have. 50% of Americans are now deplete in at least one critical micronutrient. And so, it's quite important that we start thinking about this in terms of our diet and how it relates to weight, and obesity and metabolic health really comes down to the mitochondria.

So, in the mitochondria, which is the energy factory of our cells, and which is where the final stages of glucose getting converted to cellular energy happens. So fundamentally, we want to get glucose to be converted to ATP, which is this currency in the body that... This currency of energy that the body can actually use.

At the final stages of that process, there's what's called the "electron transport chain", which is four of these sort of protein machines that I'm talking about, enzymes that ultimately transfer electrons in such a way that we generate ATP. Each of those little protein machines in the electron transport chain, which is in the mitochondria, they each require several vitamin and mineral co-factors to function, and some of the key ones for that are B vitamins, manganese, magnesium, zinc, vitamin C. Several others, but those are some of the key ones.

And so, if we are deplete in those, we are literally not able to make energy as effectively in the body, and many of us are deficient. How it is with children these days, like 70% of their calories are coming from ultra-processed foods, so we are literally depriving the body of these tiny little molecular products that are actually going to make our bodies function properly.

You can imagine, it's like if you had a factory with all these machines and there were literally screws that were just not in the machine, it wouldn't work properly, and that is something that we have control over by basically what we're choosing in terms of the food are putting in our mouth.

When I'm at the grocery store, I am frankly on a micronutrient hunt, and the simple way to do that is diversity of foods that you're eating, focusing on whole foods, focusing on foods that were grown with the best possible soil quality, so organic or generally farmed is going to ideally give you better micronutrient quality, and then getting as many colorful foods as you possibly can.

Because color is a sign of there being an abundance of these micronutrients in the food. So, get the purples, get the reds, get the blues, get the white foods like cauliflower, get all sorts of foods. If you at least focus on that diversity of color and really trying to focus on the highest quality whole food you can find, it's a great step towards getting your micronutrient needs met.

**SHAWN STEVENSON:** Absolutely. So, there's an energy crisis going on, it's not just out there externally, it's in our bodies. Truly. And you sent me this paper, this isn't just, again, we're talking about the deficiency in our food because of the problems with our soil and how we've kind of degraded our land, you sent me a paper that literally just broke it down as far as fruits and vegetables being far less nutritious than they used to be, just in the last few decades.

Just that the actual nutrition that you can get from the same food, whether it's a cucumber or an egg plant, which the eggplant is, we'll talk about that later.

We talk about the eggplant emoji, stay tuned. But please understand, one of the ways that we can address this is, yes, pay attention to getting organic food, which is... We've got a few studies demonstrating that they're going to be richer. Not just avoiding the problems, but also have a denser source of micronutrients and also diversity, like you mentioned eating.

That's another thing that's gone down dramatically in the last few decades, is the diversity of foods that we would eat. If we look at hunter-gatherer tribes, they're eating four or five times more different foods. And it might look like we're eating diverse foods, when you go to the

grocery store, because all these aisles, all these different products, but they're largely made from the same 10 to 12 foods, corn in different ways.

If we get into the cereal aisle, which we got to talk about that too. Corn or wheat or soy, just packaged up in these different ways to look like a variety, but it's really, we're eating the same stuff over and over. I want to ask you specifically about ATP. So, the action of the mitochondria.

This is critical, if we're talking about metabolism, because if we're talking about utilizing stored energy on our bodies, we wanting to get rid of the energy that we're carrying around, the excess energy, the exit point is going to be through the mitochondria making it into ATP.

So, you mentioned that micronutrients, specifically antioxidants, they can protect our mitochondria so they're healthy and able to do their jobs right, but also there's a specific micronutrient that's required for ATP to be biologically active. Which one is that?

**DR. CASEY MEANS:** Magnesium. Yeah, so this is really interesting. It's such a great point. And this is definitely something I did not learn in medical school. For ATP, this energy molecule to be biologically active, it has to actually be bound to magnesium, and magnesium has over 400 biologic activities in the human body, ranging from so many metabolic processes, but also to neurotransmitter synthesis and all sorts of things.

I think many people are deficient in magnesium, and it's actually very much our responsibility to actually learn and understand what micronutrients are actually really important for our body to function, and then understand where we get those things, so what are the sources.

For instance, with magnesium, I know I want that to be just on point, and so I've got pumpkin seeds at the ready basically all the time. It's one of my favorite sources of magnesium. There's like you can meet the recommended daily intake of magnesium just by eating a handful basically of pumpkin seeds. So that's like one of my go-tos.

And so, if I'm making a nut milk one week in the Vitamix, I'll throw in some pumpkin seeds. If I'm making a trail mix, I'll through in some pumpkin seeds. There's lots of sources but doing the research to understand some of this stuff, it actually is something we have to do.

**SHAWN STEVENSON:** We have this body, and unfortunately because of the way the system has been designed, the healthcare system and the influence of the pharmaceutical industry and a lot of other complex factors at play, we've unfortunately kind of I think gotten in this cultural mindset that we outsource that type of empowerment or knowledge to other people like, "Oh, they'll tell me what I need to do, they'll tell me what I need to eat." That's not... That's not working.



**DR. CASEY MEANS:** Your doctor is not telling you which micronutrients are super important for your health, even if they are actually critical for particular health issues that you are facing, like obesity and diabetes and heart disease. So fortunately, there's lots of great resources out there now, like your podcast, we have lots of posts about this on the Levels blog, really practical information.

But virtually no one's coming to fix this in your life, you really actually do have to understand this information for yourself and advocate for yourself and learn. And the information is not that complex, we can all do it.

**SHAWN STEVENSON:** You just said it. That's the thing too, is that this can be actually a really fun experience. Because for me, when I was going into my conventional university setting, which again, same here, I was not taught that magnesium was required for ATP to be biologically active. We just taught this process, that ATP, the body's energy currency, whoo, end of story. About 56% of United States citizens are deficient in magnesium. Alright?

**DR. CASEY MEANS:** I didn't even know it was that high. That's incredible. 56%.

**SHAWN STEVENSON:** Yeah. So, we're talking again, the majority of the population. And a big reason why, you just mentioned, it's responsible for hundreds of biochemical processes in the body. What that means, this is going back to your there's some screws loose, some screws missing in that factory, our metabolic factory.

We literally can't do certain process, our body can't do it, or can't do it efficiently, if we're deficient in these key nutrients, magnesium is a big one. And you mentioned the diversity, like magnesium is critical for your cardiovascular system, your immune system, your muscles, just being able to contract and relax your muscles.

And that's the thing too that I want to talk about. Magnesium plays such a huge role in your body's management of stress, like switching from parasympathetic to the sympathetic and back, so that sympathetic fight or flight, to the parasympathetic rest and digest. Magnesium is key in this equation.

And the reason that, number one it's responsible for so much, but the reason we're so deficient is, is just getting zapped. Our body is using so much of it today. We're in stressful conditions, whether we realize it or not. And so being adamant about getting food sources, so you mentioned pumpkin seeds being a great one, anything green really is going to be a decent source of magnesium. Chocolate, funny enough.

Now, what if you combine some of these things together and make some food bars of your own? Dr. Casey's Kitchen, you teach us how to make fun like this. But again, this can be a fun process, it could be joyful, but to go back to my original point, it's really about how we're taught and making it relevant.

We're so inundated with the idea that our health is out of our hands, we're victims. And we're just being indoctrinated with these beliefs that if this problem is going on, I'm just missing a drug. "I've got a drug deficiency. F\*\*k magnesium, I need this prescription."

But again, these are things that our bodies require in order to have healthy function, is basic stuff.

**DR. CASEY MEANS:** Yeah. You brought up such a great point too, which is that these needs aren't static, they're actually very dynamic based on your particular conditions at the time, and I think that's another level of complexity that's actually really important for us to, to tune into as people.

You mentioned that sometimes with stress, you may be deleting your magnesium more quickly as you're trying to adapt to these conditions, so your functional need for optimal function is actually higher than it might be on a day that you're totally chilled out and on vacation. And so, the beauty of food is that it's this tool that we can use to flex up and flex down these substrates that are needed to help us function optimally.

This is one of the reasons I'm so excited about the future of expanded continuous biomonitoring. Because one of the ways that I really think about health, a framework that I think about health, is that it's actually a matching problem. We have this body that's this complex machine, and we have all these things that can go into it, like food and sunlight exposure and exercise, these external things.

And really, when we match what the machine needs in a given moment with what we're putting into it, we have optimal function, and that is health, and that is a minimization of symptoms or disease. But when there's a mismatch between what the machine needs and what you're putting in, that is the root of symptoms and disease. And right now, we have very little visibility into the black box of that body, like what's going on inside of it, and so it's actually a crap shoot to figure out what we should be putting in in any given moment.

This is one of the reasons why I'm so passionate about continuous glucose monitoring and levels, when you think about that type of matching problem, it's like, "Okay, well I just had this breakfast, my glucose went up through the roof, I need to match that with a walk, 'cause I want

to bring that down. I have a particular condition, and so there's something I should do to bring myself back to homeostasis."

But right now, we can't do that for anything else, we can't do it for micronutrients, we can't do it for our stress hormones. If we knew that our cortisol was high in this moment, we could match that with a diaphragmatic breath or a 10-minute meditation app. And so right now we're relying mostly on body awareness, which is a great thing, but a lot of us are missing that. It's not something that we're taught, how to sit still and think about what the body is feeling in a given moment.

But I think when you start just learning some of these basic principles about the dynamic needs of the body and then how to meet some of those needs, it can be really empowering. So, for instance, like you said, if you're in a stressful situation, I'm often thinking about more magnesium, I'm thinking about... So, I'm thinking pumpkin seeds, dark chocolate, leafy greens, and then I'm thinking also about B-vitamins, 'cause those can be depleted when we make some of our stress hormones. So, if we're pumping those out all the time, we may need higher B-vitamins.

So, when I was, for instance, very stressed after losing my mother last year, I totally changed my supplement regimen. I was like my body is in a totally different state right now, and I need to actually supplement with more of these types of things to help with my production of these hormones especially.

And then I think I'm also often thinking about with COVID for instance, it's like okay, I always want my immune system to be super on point, but like zinc, selenium, magnesium, like vitamin D. Make sure that I am just like super dialed in, I'm not on the low end of normal for vitamin D, I'm on the top end of normal.

So, kind of just always in real time adjusting to the realities of our circumstances, trying to do almost intuit what's going on with the biologic dynamic realities, ideally use lab testing to verify that, and then meet those needs with the choices you make through food and lifestyle activities.

That is essentially the framework that I think we all need to focus on for optimal health. It sounds complex, but I think as you know, once you kind of get these principles down, it's actually pretty straight forward to let this play out in your life.

**SHAWN STEVENSON:** Yeah. I don't like the term "getting back to". Because we're... Hear me out, hear me out.

Because we are always evolving, we are constantly moving forward. Unless you've got a time machine, you can't really go back. But what we can do is move forward with greater intelligence to learn from the past. And so, I'm prefacing this statement, which is getting back to, this is what I was going to say, but it's really something for us to use moving forward, being able to really tune in and understand our own bodies and what we need right now.

Which is definitely going to change from day to day, from season to season, and it's a great gift that we have access to right now in this moment, but we're so externally focused, there's so much external stimulation and so many mixed messages. But nobody can really tell you about you like you can. And I don't want to miss this, you said the S-word in there, you said sunlight. How does sunlight affect our metabolic health?

**DR. CASEY MEANS:** Sunlight is, I am so excited to be more a part of the health conversation, and shoutout to Andrew Huberman, who I feel like has been such an amazing person bringing this to the daylight.

The way I think about sunlight is that just like food is molecular information for our bodies, sunlight is energetic information for our bodies. And so, we need to get the right information in at the right times if we want the body to function properly. It's so incredible that we actually have cells that respond to photons, to packets of light energy that have traveled from the sun.

**SHAWN STEVENSON:** Millions of miles.

**DR. CASEY MEANS:** It's so amazing.

**SHAWN STEVENSON:** Bananas.

**DR. CASEY MEANS:** We have cell receptors that can absorb them, and that can make... That energy that they absorb creates again, a tiny physical conformational shift in some proteins that sets off a neuron to fire, and this is happening in our retina. So, the light's going in, traveling millions of miles, binding to our photo receptor cells in our retina, setting off an impulse to our brain, goes to the suprachiasmatic nucleus of the brain, and that's sort of like the internal biologic clock part of the brain, and from there sets off this incredible cascade of events that goes on throughout our entire body.

It essentially tells the body this is what time of day it is, and this is what the body needs to do right now. It's amazing. It's awe-inspiring to me. And unfortunately, a lot of bad news I feel like when we're talking about this stuff, in our modern living, in our modern world, we've totally changed our relationship to sunlight. And that's actually an incredibly modern phenomenon that we can have an entire day go by where we don't go outside.

I mean, this even happens to me sometimes. Wake up, I brush my teeth, I make my coffee, I sit down at my desk. All of a sudden, it's 03:00 PM and I'm like, "S\*\*t, I have not been outside." Which means that my body has not been exposed to the energetic information that will travel to my brain and tell my cells how to work properly.

One of the things that's really important about what's going on with the suprachiasmatic nucleus is that it is basically telling the body which genes to be turned on and off during the day and during the night. So, you're changing gene expression by your exposure to light, you're also changing hormonal pathways, and many metabolic pathways are controlled by circadian rhythms and by sunlight.

So, what's really, I think just like simple takeaway for people is that it is very important for your body to know when it is in the morning, and it's really going to know that most strongly if it actually... If the eyes are exposed to sunlight. So, you need to go outside in the morning, whether it's cloudy or whatever, there's still sunlight coming through, and exposure body to that energetic information.

And so, I now brush my teeth outside every single day. No matter what, I just walk outside, and I do that two or three minutes to make sure, and I stare at the sky, don't wear sunglasses, don't do it through a window, 'cause that will actually block a lot of that sunlight energy, and let your body know what time it is essentially in that energetic way.

I think that's a really big missing piece of the weight and metabolism conversation, 'cause again, we focus so much on food and exercise, but all these things all work together to create homeostasis and we got to lean into them. The micronutrients, avoidance of obesogens, good exposure to sunlight, microbiome optimization, and then of course, sleep, stress management, exercise, and healthy food. Those are really the pillars that we need to think about.

**SHAWN STEVENSON:** Yeah. So, these are all things that our genes expect us to interact with, to have.

**DR. CASEY MEANS:** Exactly.

**SHAWN STEVENSON:** For healthy expression. It's so crazy, you mentioned that this is a modern phenomenon, us being kind of broken up with the sun in a sense, you know? And this relationship is essential. You said something there that really just jumped out at me, which is when our bodies are exposed to sunlight, it's telling our bodies what time it is, and thus what processes need to be happening right now, what your digestion should be doing, what your hormones should be doing, what your immune system should be doing, and specifically even...

Let's just lean into the hormone aspect, for example. That early morning sun exposure is going to influence the production of neurotransmitters and even the dual neurotransmitter hormone, like serotonin for example, there's more and more data coming out on this with sunlight and serotonin production.

One of the most fascinating studies show that even on overcast days or even during the winter, when folks were getting less access to sunlight, they ended up having less production or mobilization of serotonin in their systems. So again, it's just even when there isn't that much sun outside, it's still poking through, the sun has that hang time. Like it's a thing with hair, shoutout to everybody who knows what that is.

So, if you got long hair, you got the hang time. The sun's hang time is immaculate, it's like if the sun was a person, it's like Crystal Gayle, right down to the ankles.

I grew up with country music, I'm sorry. Shoutout to Crystal Gayle and my grandma. But anyway, the sun's hang time, it's going to reach you no matter what, and so getting that exposure on your skin, as you mentioned, being able to absorb it through our eyes. Even our skin, if you think about this, so this is something that's being brought forth a little bit more, but I want to point it back to a logical perspective.

Because our skin having photoreceptors is still kind of, we're still trying to piece that together, but your skin literally changes, the color of your skin changes by the sun's rays touching it. Do you understand? Your skin.

**DR. CASEY MEANS:** So, we know it's light sensitive, right? 'Cause a tan. Yeah.

**SHAWN STEVENSON:** I mean, come on. It's the most obvious thing. And it's turning on programs, and even that's inciting the process of vitamin D production.

**DR. CASEY MEANS:** Exactly.

**SHAWN STEVENSON:** It's just... But now, more so in our society, there is far more fear of the sun than there is fear of not getting sunlight, which that should be the reverse. Now, there's a huge push from certain camps in medicine, which again, it's still meaning well, if we talk about dermatology for example, and just like the sun is going to create all of these issues, it's going to the aging, melanomas, all these different things.

And these things can happen, but we're not looking at what were humans doing literally for hundreds of thousands of years when there wasn't even this distinction of being indoors or

outdoors, we just kind of lived and associated with nature, you're getting sun exposure every day. And today it's just like, what are the components?

Maybe it's because we go from not getting hardly any sunlight at all, to going on a two-week vacation in Florida. Or we go from eating all of these abnormal things, eating a natural diet for our evolution to today, what is our skin made out of? Because isn't our diet affecting how the sun might affect us?

**DR. CASEY MEANS:** Oh absolutely. Something I think about when I've gotten a little bit more sun exposure, and we know that UV rays can cause... That can be mutagenic and can cause DNA damage, but something cool about the body is that it's actually got lots of DNA repair enzymes that actually are like little machines that go around and repair DNA that's been broken or mutated by different mutagens, of which UV rays is one.

And it's like, you think about this again, it's like, well, what gets our genetic pathways to work properly? Well, food is a big one, micronutrients are a big one. These are just little machines that essentially need to be expressed properly, function properly. And so, I'm always thinking about, how do I get my, basically DNA repair enzymes to be working properly?

Again, you obviously, it's same thing as we talked about with obesogens, you want to reduce excessive exposure to things that are harmful, but you also want to focus on the things that your body can do to protect you from the inevitable risks that happen because of living.

We're living in a world right now, unfortunately where we've really started having a very confused relationship with risk, I think, where success criteria is that we have zero risk. And then forget that the flip side of that coin could actually be potentially more damaging, or sometimes more lethal than the steps we're taking to minimize risk. So that's a whole another...

But to focus back on the sunlight question and just sort of that conversation, there's this term that I love, which is essentially talking about what's happening to the modern body, which is we're getting lots of irregular photic signals. And so, what that means is that the light our bodies have evolved over millions of years to experience and to interface with at certain periods of day, we're giving it irregular signals.

So that means no sunlight in the morning and then lots of blue light at night, 'cause we're staring at our screens and looking at... We've got the light bulbs and all this stuff. And so, can you just imagine how confusing that is for our cells? It's like, "Wait a minute. Okay, millions of years, we did sun in the morning and dark at night, and now we're doing dark in the morning and sun at night?" Of course, we're sick.



There's been studies that have looked at how this affects metabolic health, and when you are exposed even for one night to excessive blue light at night, it impairs glucose and insulin function the next day, and this is happening to us every single day. And so, it has this really important impact on our metabolic health.

You mentioned vitamin D, which I think is another really important part of the conversation. Light is required for the vitamin D synthesis process. Vitamin D is just pleiotropic in its effects in the body. We need it for optimal health. And so, if we are just not exposing our bodies to sunlight, we're going to have issues with vitamin D production and you just, you can't have optimal functioning without really adequate vitamin D levels.

The last thing that I really think about a lot when I think about sunlight is that we have chosen to essentially disconnect ourselves to source and to the source energy that gives all things life. And on a bit, more of like a woo-woo or philosophical level, it's like, that can't be good for us to be separated from this life-giving energy.

And so, you think about metabolism. Well, where does glucose come from? Glucose comes from the sun, essentially. Sun interacts with plants and with chloroplast and generate carbohydrates from the reaction and it's like this cycle.

Without the sun there's no glucose, there's no carbohydrates that are created by the plants, and then what do we do? Either the animals eat those things, or we eat those things, and then we then basically are just a secondary conversion process of what the sun has created in plants to create our own ATP.

So, we are so intimately linked to the sun, we are essentially just a downstream manifestation of chemical reactions that started on this star. It's kind of wild to think about, but it helps make me feel more compelled and connected to live in a bit more of a natural way, because when you take away that connection, similar to how I think about the microbiome, the microbiome, the bacteria were here a long time before us, we know that mitochondria are essentially remnant bacteria that eukaryotes... Prokaryotic cells took up to make eukaryotic cells, which are what make up the human body.

And we're poisoning them, we're poisoning these parts of our cell that give us our spark, give us energy, that give us life. And so, I think a lot of the future of health and really reversing our chronic disease epidemic is having respect for where we've come from and what gives us life and gives us energy and stop separating from it and stop poisoning it.

**SHAWN STEVENSON:** Yeah. Man, that's powerful, so powerful. So, to pivot from this relationship that we have with the sun, which is an intimate, powerful relationship, let's talk

about sex, alright? Fertility and metabolic health are tightly linked, and I don't think the average person has any idea about that, so let's dive in and talk about that association.

**DR. CASEY MEANS:** This is a fascinating relationship, because the way I would sum it up is if you care about fertility, sexual function, or sexual pleasure, then it is in your best interest to focus on your metabolic health and metabolic optimization, because they are inextricably linked.

There's a lot in this, this connection, but I think it's actually really important to understand some of the stats around sexual health and sexual function right now, because they're pretty bad. And the research is really showing us that there may be a very direct mechanistic link between the sexual function issues that we're seeing in society, and the underlying metabolic issues that we're seeing in society.

So, looking at sexual function, so you if look at women, around 85% of women after menopause have reported sexual dysfunction symptoms, so this means issues with desire or orgasm. And even before menopause, that number is in about the 40 to 50% range. If you look at men, 52% of men are recording issues with sexual dysfunction, so this is things like erectile dysfunction. And even under the age of 40, that number is still 25%.

So, this is not like 10% of people are having issues with desire or libido, erection. This is like we're talking to the majority of people. It's like What is more evolutionarily vital than our desire and ability to reproduce? And that's under siege right now, essentially, and the evidence suggests that these numbers are going up.

So, then we think about how this could be related to metabolism. Well, first big picture thing, again, metabolism is how we produce energy in the body. And sexual function is a really complex process. The whole body has to be all be firing on all cylinders for this process to happen. 'Cause we are talking about psychological elements, neurologic elements, hormonal elements, and vascular elements.

So vascular, we need blood flow to the penis to have an erection. Hormonal, we need testosterone to make sperm. Psychological, we have to be in a good mood or in a particular mood to want to...

**SHAWN STEVENSON:** A particular mood.

**DR. CASEY MEANS:** A particular mood to want to pursue sex. And neurologic, we need the nerves to actually be going to the penis or the clitoris or whatnot, to not only feel and transmit what's happening, but also to stimulate the nerves to kind of get the function that we need.

So, it's like the body needs to be just like boom, boom, boom, boom, boom, for all of this to work, and how do we get the body to be firing in all cylinders?

Well, we need energy and energy comes from metabolism, and 88% of American adults are metabolically dysfunctional. So that's just kind of big picture there, and then you think about some of the specific links, and you really can break it down into three things where metabolism is directly impairing sexual function, and it comes down to blood flow, hormones, and psychology.

And so, when we talk about blood flow, really metabolism is, often the term "cardiometabolic health" is used, 'cause cardiac health and metabolic health are so inextricably linked. When we have metabolic dysfunction and we are having trouble processing glucose into energy in the body, trouble making energy in the body, this can create oxidative stress and inflammation, both of which can cause issues with the blood vessels, causing them to narrow and thicken and have more difficulty getting blood for where it needs to go in the body.

We talked about this on our last episode, but having something like Type-2 diabetes, this puts us a much higher risk for stroke and heart disease. And these issues where we're having blood flow having trouble getting somewhere in the body. But this is no difference than having trouble getting blood flow to the reproductive organs.

And so, for women to even have adequate lubrication, you need blood flow to that area so that that can actually happen. The clitoris and the penis both are erectile tissues that fill with blood when they are stimulated, so if you're having issues with that process, it's going to have an impact.

The other big piece is nitric oxide. So, insulin resistance, which is the process that ensues towards Type-2 diabetes and pre-diabetes where the body has trouble taking up glucose out of the blood stream and is a sign of a metabolic dysfunction, insulin resistance actually affects the brain in such a way that the brain has trouble setting off the pathway towards creating nitric oxide synthesis in the body. Nitric oxide is this amazing chemical in the body that causes blood vessel dilation.

So, you've got inflammation and oxidative stress that are leading to blood vessel thickening and narrowing, you've got insulin resistance leading to nitric oxide issues, so you're not getting the dilation you need of the blood vessels, and all of this is going to have a huge impact on our ability to feed erectile tissue with blood.

The other thing that nitric oxide does is actually causes... It has an impact on the, on vaginal wall function, it's a relaxer basically. And so, it's going to have an impact on female sexual

function in several different ways. So that's kind of just the blood flow piece right there, and then we've still got hormonal and mood, but kind of just starting to paint the picture that these things mechanistically are very linked, and so we want to optimize metabolic health so we can optimize vascular health, and that of course is going to feed into optimal sexual health.

**SHAWN STEVENSON:** Wow, wow. This is freaking blowing my mind, truly. Because again, we don't put these pieces together, we just kind of feel victimized by a condition and we don't know the origin. And there's so much within our control, again, leaning towards being more metabolically healthy, these things just... These are just normal things; these are normal actions of the body that we don't really have to think much about until something's wrong. That's when we become concerned.

I want to tie this back because a part of part of the humping aspect is fertility, right? I know, I'm just...

There's so many different words that I had scanned there to use. But a part of that process is the biological thrust... "Thrust". Alright.

**DR. CASEY MEANS:** This is going to be... This is good.

**SHAWN STEVENSON:** It is towards reproduction itself, right? And so, we're seeing some really scary things happening with fertility in our culture in the last few decades. So, you sent me over some resources and I've just been jumping in and looking at... "Jumping in". Alright. Alright, I'm done. I'm done.

And looking at some of these papers, one large study found that infertility rates globally have risen 15% from 1900 to 2017, so about 100 years, and that was knocking on the door of almost being half of a percent each year, fertility rates going down. It's like, what the heck is going on? And people are really not talking about this. You also mentioned some of this research on sperm count. Can you talk about the sperm issue and just overall fertility?

**DR. CASEY MEANS:** Absolutely. Evidence suggests that sperm counts are down 50% in the last 30 years, and this is shocking. 'Cause what's the end state of this if this just keeps getting worse?

**SHAWN STEVENSON:** It's crazy.

**DR. CASEY MEANS:** We look at the relationship between metabolism, weight and sperm count, and there's a study out of Harvard that showed that compared to a normal weight man, if you are a man with obesity, you are 80% more likely to have zero sperm in your semen, so like

sperm-free semen. And so, we're now in the country at 74% rate of overweight and obesity, and so you start putting these things together, and it's like we could be... This could be a big problem.

About 50% of infertility that we're dealing with today is male factor infertility, and a lot of this seems to be related to weight. There's also a lot of talk about how these endocrine-disrupting chemicals, like we talked about earlier, may be relating to declining sperm quality and quantity, but in this more systems biology perspective that we talk about, of how these things are all inter-related, you can see how these are not separate issues.

It's like the endocrine-disrupting chemicals, it's affecting sperm, it's affecting metabolism. We've got weight going up that's effecting hormones, and the end result here in this whole milieu is that we have poor sperm count and quality. One of the things that's affecting this is that in men, when you have excess body fat, fat is this amazing organ that I don't think we recognize very often, is actually an endocrine organ.

Fat actually can convert testosterone to estrogen. Dr. Ben Bikman, who wrote, Why We Get Sick, he creates this analogy of like fat in a man is basically a giant ovary and it's converting testosterone to estrogen.

**SHAWN STEVENSON:** Aromatization.

**DR. CASEY MEANS:** Aromatization. And this, you need the right balance of testosterone in a man's body in order to produce sperm effectively. So that's kind of what's happening on the male front. And then of course you've got the issues with erectile dysfunction like we just talked about, so that's like getting the sperm out of the body.

**SHAWN STEVENSON:** Right, right. Step one.

**DR. CASEY MEANS:** Step one is make the sperm. Step two, get it out. And it's like both of those issues are having big problems. And, let's not forget, we actually know that men with erectile dysfunction have a 192% higher chance of depression than men without erectile dysfunction.

It's kind of a question of what's the chicken and the egg there, but because we know the relationship between metabolism and depression, we can see how a lot of these things may actually be linked mechanistically by what's going on under the hood. But there are several things that...

**SHAWN STEVENSON:** Under the hood.

**DR. CASEY MEANS:** Under the hood.

**SHAWN STEVENSON:** Alright.

**DR. CASEY MEANS:** But even just things like stress management, getting adequate sleep, aerobic exercise, resistance training, and high-quality nutrient-dense diet, we know that all of those things can help with testosterone production in the body, and specifically weight loss. Even losing 10% of your body weight can have a significant impact on testosterone levels. So that's just... This is all what's going on with men.

Then you look at female fertility, and this... I mean, I don't know, both are so alarming, but with women the leading cause of infertility in the United States is polycystic ovarian syndrome. And polycystic ovarian syndrome is actually fundamentally a metabolic issue. Actually in 2012, the NIH wanted to change the name of PCOS to "multi-system reproductive metabolic syndrome". So really call it what it is, multi-system reproductive metabolic issue.

But instead, we've kept this name that's really difficult to understand, polycystic ovarian syndrome. Not every woman with this disease actually has cystic ovaries, so it's just a strange name. But really what it is, is fundamentally there is a strong mechanistic overlap with insulin resistance and metabolic issues.

The reason for this is because when we have high insulin levels in the body, which is what happens when we are insulin resistant or have metabolic dysfunction, the body overcompensates to this block of being able to get glucose into the cells by producing more insulin to help drive glucose into the cells, to overcome the insulin resistance. We end up with hyperinsulinemia.

**SHAWN STEVENSON:** It's like a diet.

**DR. CASEY MEANS:** Yeah, exactly. End up with high insulin levels, and what do those installs do? They do stuff all over the body, but in the ovary, what they do is they stimulate the ovary to make more testosterone. So now you've got women making more male hormones, androgens, and then that is setting off-menstrual irregularity, issues with infertility, as well as some of the other associated symptoms of PCOS like hirsutism, which is like excess hair growth, more central, obesity storing fat more in the midline, and acne, so these are a lot of the things that people with PCOS deal with.

Insulin also stimulates the ovary to up-regulate the cell type, call the theca cell that make these androgen, so you not only get higher stimulation of androgens, but you get proliferation of this cell type. So that's happening. And what's interesting though is that in the research,

several studies have shown that lowering your insulin levels, improving insulin sensitivity, improving metabolic health, can significantly improve PCOS symptoms and normalize sex hormones.

There was amazing study about two years ago that I loved, that was looking at a ketogenic Mediterranean diet in 14 women for just 12 weeks, and they all had PCOS. The diet was actually... What I loved about this study is it was actually a very healthy diet, it was ketogenic, but not focused on just all animal protein. It was actually unlimited quantities of leafy green vegetables, so there was no restriction, they could have as much of those as they wanted.

A very moderate amount of animal protein. And it had... It was fish and poultry. And then they added in supplements of plant polyphenols, so these plant chemicals that can be very protective. And so, it wasn't restrictive, it included a lot of greens, and it was low... Overall, a low carbohydrate diet. They did this for 12 weeks.

The women lost on average 20 pounds in the study, average. Their insulin levels plummeted, triglycerides plummeted, HGL went up, LDL went down, insulin sensitivity went up, fasting glucose went down. And their sex hormones, by and large, in all the patients went to more normal levels.

And so, it's just like, why again, front page news. It's like, this is not... This is doable. We can do this. I don't think the average woman with infertility knows this, I think there's often just a treadmill that you go on towards hormonal therapy, assistive reproductive technology.

We're doing about 200,000 assisted reproductive technology procedures per year, things like IVF, and we're doing this before we do some of the foundational stuff, like focus on dietary lifestyle habits and think about the true physiology of what might be going in, to some of these issues.

So, I want that to be a message that women hear so they feel empowered to maybe dig into this a little bit more before they go through the pain expense of more interventional fertility paths. And of course, this isn't going to work for everyone, this is... I'm not making universal statements about what's causing infertility, but it's clearly a well-defined link that we should be more aware of.

**SHAWN STEVENSON:** Thank you so much for sharing that, because again, this is putting more power into our hands and understanding again, this is not this all-encompassing thing, but we know that improving our metabolic health as a species is going to lead to all these wonderful outcomes, versus the alternative, which is what we're seeing right now. Something is clearly off.



You just mentioned several notes of how insulin is playing into this equation with infertility, potentially in these various ways. This is something that we have dominion over in so many ways within ourselves, with our lifestyle. Specifically, one of the things that I've found with levels, and we talked about this the last time you were on, was how stress can make my blood sugar a little bit wonky, as compared to any dietary changes.

For me personally, my body is pretty good at sorting out different foods, but if I'm stressed, that can influence what my blood sugar's doing, thus influencing insulin, what glucagon could potentially be doing, there's all these other downstream effects of this. But I can monitor, and I can get a handle on this thing.

Everybody's different. This is the key, this is what I'm leaning into right now, because the way that certain foods affect you is going to be different from the next person. And we have the ability today, this is why I'm so, I'm so grateful for you. I just really am. Because you're doing something about this and you're giving us tools so that we can actually tune in to understand what our body's best nutrition sources are, what our best practices are as far as our exercise and our sleep quality and all these things.

But I can see real-time data. And this is the change that's just recently happened with Levels, is that you can get real-time. Because there is a modality which is still available as well, where you can use your phone and check in and see what your blood sugar is doing, but now there's also real-time data, where it's constantly getting fed to your device so you can know where you stand. It's such a cool innovation.

Also, when you were on last time, there was a waiting list, and it was a huge waiting list to be able to get access. Now the waiting list is over. I believe, right?

**DR. CASEY MEANS:** That's right.

**SHAWN STEVENSON:** Okay. So, people can now get easy access to Levels' continuous glucose monitor. I just got myself a new one. My wife got one actually before we even talked today, she had got herself one, but I just got one of the new ones so I can track the real-time data for myself. It's such a cool opportunity for us, number one.

And by the way, if you want access, you can skip the waiting line, the waiting line is over now. Go to [levels.link/model](https://levels.link/model). Alright, that's L-E-V-E-L-S.[.link/model](https://levels.link/model), and you can get access, special access to Levels today. And if you could, I want to talk about the updates with Levels, and also you got some updates on some of the craziest food, some of the foods that most arrange our blood sugar, that most people have no idea about. So, I want to talk about both of those things.

**DR. CASEY MEANS:** Let's dive in. Yes. So, as you said, we are... The wait list is finally over, it's been almost three years. We are so excited to open the gates to everyone who wants to use it. So, it's a very exciting month for that and for access to this super empowering information. And yeah, the dataset keeps just growing and growing and growing, we have now over two million food logs paired with continuous glucose data and over 200 million glucose data points.

So, we're starting to just see more and more of these relationships between what large populations of people are eating and what type of lifestyle activities they're engaging in, and then what's happening to our glucose levels. I'm always fascinated by seeing within a particular food category what are the worst offenders and which ones are kind of okay.

Because I think... I'm always thinking about that person at the grocery store who wants to be healthy, who wants to lose weight, and I absolutely believe the average person wants to be healthy and wants to make decisions to do so. We're living in a world in which it's very difficult to make healthy decisions 'cause marketing is so strong, we're subsidizing the un-healthiest foods to make them cheaper, they're in our hospitals, they're in our schools, they're everywhere. Even the number one-line item on SNAP, on these government assisted food programs, is soda.

**SHAWN STEVENSON:** Oh my gosh.

**DR. CASEY MEANS:** Because the government is subsidizing the high fructose corn syrup in this. And so, we're up against a lot. And so, I think about this person standing at the grocery store and they're looking at a wall of items to choose from, and they're like, "I have no idea what to choose. What is healthy?" This box says "healthy", this box says "healthy", this box says, "low sugar, low fat, low carb, high fiber". What do you do?

And so, in the Levels of dataset, we're starting to really see particular brands that are emerging as better than others within a category, so like within the cracker category, it's like I am now very much eating Flackers and Ella's Flats. So Flackers are made of flax seeds, they don't do anything to my blood sugar. I think they're delicious. Ella's Flats are made of nuts seeds and flax seeds, do nothing to my blood sugar. They taste great. I dip them in guacamole and hummus, I get a zero-glucose spike. Go over there and grab some Triscuits, giant spike in terms of across the population data.

I think some people might think like, "Oh, that seems like a... Maybe a healthy choice, some whole grains," but when you look at population level data, you can see across a group of, large group of people, we're actually seeing really large glucose spikes, which we know are not good

for our health, we'll often crash after a glucose spike and feel tired and have cravings, and so we want to keep that glucose more stable.

And then the one that's just like, I think is fascinating is breakfast food, and we talked about this a little bit on the last episode of what kind of constitutes a good or bad breakfast based on glucose data, but I just continually am blown away with what we're seeing with cereals.

Because almost universally, standard cereals in the grocery store are causing some of the biggest glucose spikes in our entire dataset, and actually larger than a lot of candy bars. So, at this point, I'd rather eat a Snickers bar than eat Honey Nut Cheerios, because it's going to taste better and I'm going to have a lower glucose spike and I'm going to get some protein in there at least.

And so, you have Honey Nut Cheerios and Cheerios saying, "Lowers cholesterol, heart healthy," and we're seeing spikes above 50 milligrams per deciliter, with people eating a standard serving of this. And so, what we've seen is that even cereals like Raisin Bran, which I think a lot of people they're making a healthy choice, they probably think they're sacrificing if they're eating Raisin Bran, well above a 40 milligram per deciliter spike. Lucky Charms, Honey Nut Cheerios, regular Cheerios, Life Cereal, all above 40 milligrams per deciliter.

And for context, I'm trying to not really go above 20 milligrams per deciliter from the beginning to the end of a meal. I want to keep things much more of those gentler rolling hills and not big ups and downs. And there are going to be people who listen to this and who write in the comments and say, "Oh, 40-50 milligrams per deciliter, that's no problem. Our body is designed to handle this." That is not true, our body is not designed to handle 40 to 50, to 60 to 70 points spikes several times per day, from 08:00 AM To 10:00 PM at night, where our body is constantly having to produce insulin to bring that down.

That glycemic variability is not what we want for optimal health. One spike here and there, your body can handle it. Doing this constantly day in and day out from six months of age, to when we're 75, not the best strategy.

**SHAWN STEVENSON:** Cereal killers. It's so crazy. It's so crazy to, again, we know this conceptually, and we can see the sugar content there on the boxes, but yet to actually see the data and to see it across the board, like you mentioned, you got 200 million plus data points now. This is what's so remarkable about Levels, is that it's getting fed into this database so that we can start to see these patterns in our society, and to know that cereal is messing people up more so than the average candy bar is just like, that's bananas.

And if you think about this, again, this was probably my favorite thing growing up was the cereal, like Saturday morning cartoons, a big bowl of Fruity Pebbles if we have money, or it would be the off-brand stuff, instead of Trix, we had Fruit Dots. But anyways, that was like a whole vibe, and also because again, it's a flavor explosion and there's nothing, there is literally not a single natural aspect of that meal anymore, it's just been completely de-natured. You can't tell where this food came from.

Even if you think about Raisin Bran, like two scoops of raisins I remember that being framed as that healthy thing, it's got "bran" in the name, Raisin Bran. That is so much sugar, it's absurd. Even the raisins themselves, again, a few raisins may be in some trail mix, whatever, but if we're talking about number one, they've got sugar dusted raisins of course, and the flakes and the raisins. Add all that stuff together, oh my gosh, you got a serious problem there. But it's framed as healthy.

And I love that you mentioned this "heart healthy" label that they were able to manipulate to throw on these cereal boxes. "Lowers cholesterol", that's the framing. It's just, it's ridiculous, it's absurd. But this shows the influence that food manufacturers have over policy, literally government regulation, government policy, and the ability to manipulate marketing, manipulate the minds of customers.

So, man, thank you so much for sharing that information because it's just, it's an affirmation for what we already know. Not to say... This is the side bar here with The Model Health Show of course, if you want to have a bowl of Crunch Berries, so be it. This is not about judgment; this is about education. Do you, but let's stack conditions in our favor.

The same thing goes back to our personal care items. If you are, you've become aware of this now and you're using a much more natural moisturizer, so maybe it's coconut oil, and you're using a shaving cream that doesn't have a bunch of toxins in it, but you decide, "You know what? This so-called natural deodorant has me out here spending like a whole fish walking around here. A fish on wheels." So be it, if you need to use one that has a little bit more of the nefarious items in there, to regulate that. So be it.

It's stacking conditions and adjusting for what fits for you. I love that about your message as well, because it's not just like. "All these things are off-limits," it's like, "Let's stack conditions in our favor."

**DR. CASEY MEANS:** Exactly right. And build the body such that it can respond to these things. If you're going to have that Fruity Pebbles bowl, which might be a huge source of enjoyment for you, take a walk afterwards, potentially. Or have some apple cider vinegar beforehand. There

are other things you can do as well to set your body up for success to process that glucose load. Add a bunch of chia seeds on top of it to add fibers so that you absorb it more slowly.

There's all these tools in our toolbox that we can use. This is, like you said, it's not about deprivation, it's not about shame, it's about awareness and learning all these things you can do to just minimize the collateral damage on our body from choices we make that might make us really, really happy, but that might have some externalities, but we can mitigate those externalities if we have the awareness and the tool box to do so.

**SHAWN STEVENSON:** I love hanging out with you, it's so fun, and I always walk away with some new insights. Can you let everybody know where they can connect with you, learn more about what you're doing, that the Levels blog is amazing. Can you share that with everybody?

**DR. CASEY MEANS:** Yes, absolutely. So at Levels on Instagram and Twitter, and we are at [levelshealth.com](http://levelshealth.com), and you shared the code for how people can get access; [levels.link/model](http://levels.link/model). [Levelshealth.com/blog](http://Levelshealth.com/blog) is an amazing resource that actually has tons of articles on every single thing we've talked about today, so if you want to dig more into micronutrients, obesogens, the impact of sunlight on metabolic health, insights from our dataset, the relationship between sexual health and metabolic health, there's more there.

These are highly researched articles; our Advisory Board weighs in on them. Lots of great resources and then tips about what to do. I'm personally at [drcaseyskitchen](https://www.instagram.com/drcaseyskitchen) on Instagram and Twitter. Dr. Casey's Kitchen. And yeah, that's how to find us.

**SHAWN STEVENSON:** Awesome. Casey, this is amazing. We've covered so much ground here. We've talked about sunlight, to sex, to cereal, and this was just such a juicy, amazing conversation. I just appreciate you so much. Thank you for sharing your wisdom.

**DR. CASEY MEANS:** Thank you so much, Shawn.

**SHAWN STEVENSON:** Awesome. Everybody, Dr. Casey Means. Thank you so much for tuning into the show today, I hope you got a lot of value out of this. This is just stacking layer after layer on the connection between our metabolic health in all aspects of our lives, from our cardiovascular system to our reproductive system, to our cognitive performance. There isn't a single aspect of our biology that isn't impacted by the health of our metabolism, they are all integrated. And this is a call to arms for us to get educated on making ourselves more resilient and improving our metabolic health.

A remarkable tool that we have access to today or real world, real-time feedback is a continuous glucose monitor. This is one of those self-quantification tools that emphasizes self,

because you are different from everyone else. And you can find out how different foods impact you versus someone else, your sleep quality, how does that affect your blood sugar management through the day? The list goes on and on and the data points that you can get from something like Levels. Again, go to [levels.link/model](https://levels.link/model) to get exclusive access to the Levels continuous glucose monitor.

Again, that's [L-E-V-E-L-S.link/model](https://L-E-V-E-L-S.link/model) and get access today. We've got some incredible masterclasses and some epic guests coming your way very, very soon. So, make sure to stay tuned. Take care. Have an amazing day. I'll talk with you soon.

And for more after the show, make sure to head over to [themodelhealthshow.com](https://themodelhealthshow.com), that's where you can find all of the show notes, you could find transcriptions, videos for each episode, and if you got a comment, you can leave me a comment there as well. And please make sure to head over to iTunes and leave us a rating, to let everybody know that the show is awesome, and I appreciate that so much. Take care, I promise to keep giving you more powerful, empowering, great content to help you transform your life. Thanks for tuning in.