Dave: Hey, it's Dave Asprey. Before we get to today's episode let's talk a little bit about Ting. Ting is a kickass company working to disrupt a really broken mobile industry where consumers don't have choice, freedom, or transparency from the big corporate players. Your phone is a powerful tool to use in performance hacking and you shouldn't be restricted by a contract or have to choose from a long list of daunting phone plans especially around the holidays. Wouldn't it be simpler to just pay for what you use? Here's how it works with Ting. Use less one month and you pay less. Use more and you pay more. It's as simple as that.

Ting now has two nationwide networks to choose from. They can do Sprint, T-Mobile or GSM service, which means if you have great Sprint or T-Mobile coverage you'll have the exact same coverage with Ting. Go to bulletproof.ting.com and get $25 in service credit if you bring your phone to Ting, or get $25 off select phones on Ting shop page. I use Ting, people on my team use Ting and rave about it. Not sure what Ting will cost you? Grab your existing bill and test out the savings calculator located at bulletproof.ting.com. No contracts even in time without a penalty. Go to bulletproof.ting.com and save some money. You deserve it.

Announcer: Bulletproof Radio, a state of high performance.

Dave: Hey, it's Dave Asprey with Bulletproof Radio. Today's cool fact of the day is that in a study of rats whose genes were mutated so that they lacked sweet taste receptors the rats still heavily preferred drinking sugar water to plain water. That's definitely not just due to taste because the same results didn't occur when they put sucralose in the water which is also sweet. The researchers think that the rats experience dopamine spikes in their brain only after having the real sugar water. That means that the calories may be psychologically rather than just sensory delicious. In other words, you feel like you want those calories.

Today before we get going on the show let's talk for a minute about Brain Octane Oil. This is not MCT Oil. MCT Oil is four kinds of oils mixed together and each of them has a different physiological effect. Brain Octane Oil is the rarest usable of the medium triglyceride oils and it's fundamentally different and it is much more powerful and it's also less irritating to the gut. Try some Brain Octane Oil, not just in Bulletproof Coffee but I put it on every meal. I just put a little bit there because it helps me to drive my ketones up so I always have some ketones present. If you were at the Bulletproof Conference this year, I gave a whole talk about how low levels of ketones can affect the brain and affect your hunger hormone levels.

That's totally relevant because today's guest is all about cravings. His new book is called "Always Hungry? Conquer Cravings, Retrain Your Fat Cells, and Lose Weight Permanently." That's coming out January of 2016. His name is David Ludwig. He's a MD, a PhD, a practicing pediatrician and researcher at Boston Children's Hospital. He's also a professor of pediatrics at the Harvard Medical School and professor of nutrition at the Harvard School of Public Health. Technically I think this makes him a total nutrition bad ass. Is that actually the case Dr. Ludwig?

David: I'll defer to you as the expert on bad ass, but thank you, it's a pleasure to be with you today.

Dave: Thanks for coming on the show. I'm really excited because it's not so common to get people who are practicing and researching and looking at nutrition and full medical work. It's a really cool combination of things that you've got going on.

David: It's a really great gig. I like my day job.

Dave: How did you get into that strange mix of things? It's a very useful mix but it's unusual. How did you get there?

David: I've always been very sensitive and aware of food, although I was raised in the 60s and 70s as a kid when fortunately diets weren't as bad as they are today for kids, but after school the ice cream truck would come along and we were already getting candies and sweets that had long lists of artificial ingredients. I ate them like everybody else, but I just always sensed that I never felt really good about that.

I also come from a very politically active family. My parents and some of my earliest recollections were being taken to civil rights demonstrations and to war protests. I also became very politically aware. I got interested in science and medicine. All of these interests converged after I finished my training as an endocrinologist. Because it turns out that food has fundamental relevance to our biology of course.

It's also a highly political issue. Every time we eat we are making a powerful political statement to the food industry as to what we want and what we don't want. I've really found that my day job can include both clinical medicine, seeing patients, relevant to nutrition and health, research, politics and public health adv … Why am I having trouble with that word? Advocacy. An advocate has to actually be able to pronounce the word. It's really I feel like that's in my genes.

Dave: It's in your genes and you selected medicine. You did medicine first then nutrition or you did them at the same time?

David: I started … Initially I was thinking I was going to be a straight scientist. Then I got interested in medicine, went to medical school, and at the same time being a glutton for punishment I got a doctorate as well. Then got interested in endocrinology. Endocrinology is a field which doesn't incorporate any of the standard assumptions of nutrition. I wasn't taught as an endocrinologist to think of food as a delivery system of calories and nutrients. I became interested in how food affects our hormones, which are powerful. Every time we eat, hormones, not just insulin but dozens of other hormones and related substances change in profoundly different ways. These hormones in turn alter our metabolism and literally the expression of our genes.

The notion of food as medicine is quite literally true because virtually every pathway that exists in the body that can be exploited for drugs were there originally in a direct or indirect fashion to integrate food with our physiology.

Dave: Wow. That really does blow the line between food and drugs, doesn't it?

David: We can use food as a drug for better and for worse. We did a study relating to the study you announced at the beginning of the hour. We looked at … This was a double blind study which is difficult to do in nutrition because typically people and the researchers see what's being eaten. In this case we made two milkshakes that had the same calories, the same protein, fat, and carbohydrate. In one case it was fast acting carbohydrate and the other case slow digesting carbohydrate.

We gave these milkshakes in random order to our participants on separate days, followed their blood sugar, and is expected so that they had higher blood sugar initially after the fast acting carbohydrate shake. Blood sugar tended to crash a few hours later. At that point the participants reported feeling hungrier. Then we did brain scans.

The results were really remarkable. I'm not a neuroscientist. It turned out that one area, and I didn't know what this area was at first, lit up like a laser in every single subject. It lit up after the fast acting or high glycemic index shake but not after the low. In fact, it was so consistent that we had astronomically strong statistical power. That area is the nucleus accumbens. For the rest of your audience who they aren't neuroscientists, that's the center of the dopamienergic reward pleasure center of the brain. It's considered ground zero for the classic addictions of cocaine, heroin, alcoholism and the like, raising a provocative idea that certainly we need food to live.

Food addiction is very controversial, but raising the possibility that these highly processed very rapidly digesting industrial foods we're eating today can hijack fundamental pleasure and reward systems of the brain. It's one thing to feel hungry because your blood sugar is dropping, but it's a very, it's a different thing if your nucleus accumbens kicks in. Because then your ability to resist that 500 calorie Bearclaw you see in the pastry shop is going to vanish.

Hunger and cravings are a really difficult combination to fight. I think that the food industry would like to say it's all our personal responsibility to just control our calorie balance that there are no bad foods, but I think there's quite a strong line of investigation to suggest that certain foods profoundly undermine our metabolism in ways that are not all that different to certain classic drugs of addiction.

Dave: There's my favorite fast food processed food marketing slogan ever, "You can't eat just one." You fire up that part of the brain and literally you're going to have that drug like response like, "I've got to eat the whole bag of potato chips, not just one." You found in your study exactly which part of the brain is contributing to that even in the absence of the blood sugar crush, because you're talking about a brain craving that's dopamine based. It's a neurotransmitter, not just a glucose thing.

David: Right. Now that may be responding to the fact that blood sugar, and it's not just sugar but it's also fatty acids and ketones, the total source, and this is really the focus of the book I've written, it's the total concentration of calories in the blood which are critically important. When they drop the brain does something which makes perfect sense from

an evolutionary perspective. I mean the brain is critically dependent upon calories. A brief interruption would lead to loss of consciousness, comma, seizure, and death.

Dave: Tiger is easy, the second you pass out in nature like you're dead.

David: Well either they'll eat you or your brain cells will die and either way it won't matter to you. The brain has very powerful mechanisms to get us to make sure that the brain has enough calories. The first thing it does is make us hungry. The second thing is it starts activating craving centers so our ability to like say no vanishes. Then after that stress hormones start to be secreted, emergency stress hormones that drag calories out of storage sites but do so and that will temporarily solve the problem, but it does so causing great stress to the body. Finally, with these swings and calorie levels and hormones if that continues metabolism will actually slow down.

We did a study of 21 young adults who had high body mass index, brought their weight down by 10 or 15% which we know is a stress. They're going to feel hungry, their metabolism is going to be slowing down the body's defense mechanisms. Then we put them for a month at a time on one of three diets in a randomized fashion. In one side of the equation was a low fat diet, kind of what we've been recommending. Government's been recommending I should say for years, 21% fat, 60% carbs. At the other side was a classic Atkin's diet with a whopping 60% fat content. In the middle was we called it a low glycemic index, sort of a Mediterranean diet with 40% fat, 40% carb.

We gave them the same calories and they had the same weight. It was locked in. Energy expenditure plummeted on the low fat diet. That was expected. On the low carb diet metabolic rate didn't drop at all. It was completely despite the weight loss that low carb diet had completely abolished the negative effects of weight loss. The Mediterranean diet was in the middle. That difference was 325 calories a day. That's a like an hour of moderately vigorous physical activity without lifting a finger.

I think both of these studies are raising or providing support to the notion that all calories aren't alike metabolically and that if you simply focus on calorie restriction with the wrong foods you're going to be setting up a battle between mind and metabolism that you're likely doomed to lose.

Dave: Amen brother. Sorry. That's what happened to me when I weighted 300 pounds. It's not a will power thing. It's not a laziness thing for fat people at all. It's why I'm such a fan of your book and supporting you getting this message out, because you studied this a lot more than I have to be honest and come to more of an academic research based conclusion versus mine which is like, "Okay, I'm going to hack this because I'm tired being fat and tired." What you said there though is different types of calories do different things. What about say different types of protein? Did you get into that at all, where saying like I had tofu versus eggs? Does it matter that much?

David: Let me first come back to the big picture and then go to that. The main premise of my book is simple. Overeating doesn't make you fat. The process of getting fat makes you overeat.

Dave: I love that. That is so good. Say that one more time so people can hear that.

David: Overeating doesn't make you fat, at least over the long term. The process of getting fat makes you overeat. That sounds provocative but there's actually dozens if not a century of research involving literally thousands of articles that support this argument that body weight is controlled more by our biology than our will power. Let's walk through this for a moment. We know that when you cut back on calories, let's say you're doing a nutrition study with human participants. You put them on starvation rations for a few weeks. They're going to lose weight of course. That's the law of physics.

Dave: Famines do that.

David: That's the law of physics. Nothing about this violates physics. But what's going to happen they're going to … What's going to happen next, they're going to get very hungry and their energy expenditure, the calories they burn off are going to plummet because the body fights back increasingly aggressively against the calorie restriction. Once the people in the study, their weight comes right back up to where it started, typically even a little higher.

The opposite is also true. There's been dozens of overfeeding studies where participants are brought into a research unit, locked down, and then basically forced at very high calorie diets. Again, of course they gained weight. That's physics. What also happens they lose all interest in food. They feel very uncomfortable and their metabolism speeds up in an attempt to shed these extra calories. The participants are as unhappy in overfeeding studies, they're as miserable in overfeeding studies as they are in underfeeding studies, because the body has a certain weight it wants to be and in fact that's like body weight set point.

Dave: There's ghrelin that drives that, right? Like one of the craving hunger hormones?

David: Well it's probably many, many hormones. We think of these hormones like ghrelin and leptin as hunger satiety hormones. They all have metabolic effects too. The key actions of leptin some of the downstream actions might be in the body. Leptin results in fat cells disgorging extra calories. We'll see that's why so critically important. Just cutting back on calories fights basic biological systems that have evolved over hundreds of millions of years to control our body weight.

What we recommend is turning dieting on its head. We suggest you forget calories. Calories, they're not a very useful notion. I mean first of all not even the world's most trained dietician could guess calorie balance to within 350 a day accurately. If you are off just by 350 calories between intake and expenditure a day, that would mean the difference between remaining lean or becoming massively obese in about five years. It begs the question, how did human populations managed to maintain stable body weights amidst an abundance of food? We haven't always been living hand to foot. We had plenty of food in America in the 1960s without weight shooting up. How did we manage to maintain our body weight before the very notion of calories was invented?

Forget calories. We argue that the only way to lose weight permanently is to shift metabolism, is to retrain fat cells to open up. The problem with the modern American diet is, especially with all the processed carbohydrate, is that it increases insulin levels and chronic inflammation. Those force fat cells into a feeding frenzy. They suck up too many calories leaving too few for the rest of the body. That's why we get hungry, that's why we get tired. Just cutting calories makes that situation worse. It doesn't address the fundamental problem which is that the fat cells have been on calorie storage overdrive.

Dave: If someone eats a 100 calorie kale salad for lunch and adds 20 calories of low fat dressing on that there just isn't enough calorie in the blood which is going to cause their body to be like I don't have enough energy right now, it's a crisis, and this whole cycle you talked about would happen, versus if they threw a bunch of guacamole on top of it had enough calories and then would actually not have this metabolic disarray happen.

David: Certainly if you just don't get enough calories the body is going to fight back. The problem in America isn't that we're not getting enough. We're obviously getting too much. But they're not staying in our blood stream. The calories that we eat from highly processed carbohydrates, especially if there's not enough fat and protein, they flood our blood stream temporarily for an hour or two after the meal. But insulin shoots up to try to push those calories into storage, and by three or four hours we're worse off than we started. All those calories have been locked away in storage, importantly including fat, and there aren't enough in the blood stream.

Even though we think of obesity as a state of excess I think it's physiologically more akin to a state of starvation. The body is the brain and the rest of the body is starving because fat cells are hoarding more than their fair share of calories. The only way to solve that problem, you can't do it by cutting back calories. That makes the fundamental problem worse. The only way to do that is to change what you're eating in order to lower insulin and calm chronic inflammation. What then happens the fat cells open up, the body floods with calories. The brain says, "Wow." I mean in some cases it's like the brain gets a sense of sufficiency and satiety for the first time in years. It then allows metabolism to speed up and you naturally will eat less but this way with your body's cooperation rather than with your body kicking and screaming.

Dave: Have you ever been fat?

David: I was lean and athletic through my adolescence and 20s. I went to medical school just a little bit later because I had taken off some time, travelled a bit. I started to notice in my late 20s maybe early 30s that I was, I'd been putting on a pound or two a year. For the first few years it didn't much matter because I started out pretty lean, I just got an extra larger pant size or two. But then it kept going. By this point well into my 30s I'd already gotten interested in obesity research, although I was at the point more focused in the basic laboratory doing genetic studies. I reached the BMI of 25. I realized I had a little bit of an identity crisis. I'm an obesity researcher and I'm about to cross the threshold into overweight.

Fortunately, just at that time I came across new theories of carbohydrate including this notion of glycemic index, how carbohydrates digests and affects our hormones. I spent a few months buried in the Countway Library which is Harvard's medical library. Back then it wasn't all online. You went to this musty, this literally dusty floor two floors underground. I found articles that dated back in some cases to the 1800s. I just absorbed it all. I put together theories that had been out there. I put them together in my own way. I'm not suggesting that this is by any means all my creation. This is building on research that has been around for decades, if not a century.

Then I both designed experiment to do in the laboratory, but I also did an n-of-one experiment on myself. I increased the fat content. I'd always eaten pretty healthy from a standard perspective, but I'd eaten a lot of whole grains and not too much sugar. It was a pretty high carbohydrate diet, so I greatly increased fat. I cut back on the refined carbs, I increased protein a bit, and no attempt at all to lose weight. Three months later I dropped 20 pounds and three waist sizes.

Dave: This was without effort, right?

David: No, it's really remarkable. We have testimonials in the book from … We did a pilot, a national pilot of the book's program with over a couple of hundred people for 16 weeks. Most people report the same thing, that before the first pound was shed they experienced the cravings just seemed to vanish. Just like that study, the brain imaging, it's like a metabolic switch is being flipped. Just cravings turn off. People in every story in the book is … I'm a scientist, so I'm not making any of these stories up as sometimes is fashionable. Every story is people's actual experience. We have their first name and last initial, age and location.

You'll see that people describe feeling like their metabolism has shifted. Then the rest is kind of automatic. The body, it's like you've been in an overfeeding study, your body finally recognizes that it's got too many calories and it tries to get rid of those extra calories in the way that it knows how. It diminishes your cravings and it speeds up your metabolism. People find that they can lose weight without the struggle. Now it might be slightly slower than if you restricted calories.

Clearly if you cut back calories 1000 a day you're going to lose weight fast, but then you're going to be struggling for the rest of your life to keep it off. This may be a little slower, although there were some people who lost two to three pounds a week at first. Other people lost a half a pound a week. But they're eating lush satisfying rich foods as much as they want to feel satisfied. They're stacking when they're hungry. So you're reestablishing a collaboration with your body which for many people there's been alienation. The first step is to relink our behavior, our biology, and our diet.

Dave: I have learned when I was obese to value the feeling of hunger, like, "Wow, I'm really hungry," like, "That makes me a good person," which actually it doesn't. It makes you hangry and you're hypoglybitchy or whatever you want to call it, but you're not nice when you're hungry but you're like, "Okay, I'm doing this," like, "I'm going to take one for the team." It's really a self-destructive state, and it's one that's taught because well

by self-denial you're supposed to somehow be helping your biology. But it turns out you're not helping your personality, you're not helping your biology, you're not helping your hormones, and you're burning huge amounts of energy on fighting off cravings, and you lose eventually anyway and then you feel like a failure.

It's interesting. You've got people eating as much as they want and not feeling hunger. What I came to believe is that hunger is a powerful useful signal from your body that you're doing something wrong and it's that, "Oh my god you should eat," and you should eat the right stuff, and when you do that your hunger should go away for a long period of time. If the hunger comes back quickly then you did something wrong, because you didn't eat enough, you didn't eat the right stuff. That hunger's really, really useful but it's not something to treasure because it's going to make you thinner. That kind of thinness comes at huge cost biologically and energetically or emotionally.

David: I completely agree with you. We have a five-hour rule. If you eat a meal and you're feeling not over stuffed initially but then not famished several hours later, if your energy remains good, your mental clarity remains good, then you ate the right amount and you ate the right type of food. If not it's a learning, it's just an [inaudible 00:28:54]. You're the biohacker, so that's the opportunity to revise.

One other thing I wanted to add. I guess, I don't know if this is literally true but I heard that the Native Americans have 20 names for corn because that's so important, that was so important to certain Native American societies that were agricultural, and the Inuits in the north had 20 names for snow, all these different subtle gradations. I think we need more words for hunger. Hunger isn't all the same thing. There's a hunger where you're desperately hungry, you're in desperate need for food, you're craving, your energy is crashing, you feel a basic like instability in your core. That's because primal brain areas are being threatened by lack of calories in your bloodstream.

There's another kind of hunger which you get after eating really just the right, you hit that nutrient ratio just right for lunch and maybe you're especially active in the afternoon. Then dinner rolls along and you feel this stimulating interest in food. It's not making you, it's not bringing you down and making you desperate. It's actually waking you up and creating an appetite for good food. Those are profoundly different states. One is a state of good metabolic functioning but your brain's saying, "You know what, now is the time to recharge." The other is saying, "You know what, we've got a medical emergency going."

Dave: David, I'm so glad you said that, especially with your great background in research, because those are fundamentally different states. I never knew that there was the state. I call it the I could eat state. Like the most powerful hunger suppress for breakfast I know of is unquestionably Bulletproof Coffee and there's a fat signaling thing in there. If I do that when lunch time rolls around I get this kind of like, "You know, I could eat." Like it's 1 in the afternoon or something, I've gotten five hours like, "Yeah," but I don't have to, I'm not going to die if I don't eat. I just, I could eat and I'm going to feel good if I eat.

I had never experienced that in my life as a former obese person because every meal was like, “Okay, I think I can make it or maybe I’ll just have three peanut M&Ms or whatever it is, I just have to have something.” That’s why every office has little balls of candy around because people are so broken they can’t do it. Thank you so much. You're the first person I’ve heard put it that way. But the difference in state to feel liberated from the I’m going to die if I don’t eat state, for me I don’t think I ever experienced that until sometime after the age of 30. I’m like, “Wow,” like food is not in control anymore because I’m not constantly thinking about the next meal. You’ve put cravings right in the title or on the cover of your book, and it’s absolutely true. What you're doing with this craving versus hunger, and maybe there’s five more words for hunger that we could like architect or come up with, but man, I’m so glad you said that, so thank you.

David: Thank you.

Dave: What about snacking though, because you said you should be able to go five hours but you can’t snack, but if you need to snack does it mean that you failed and it’s okay or what’s your take on it?

David: Snacking is totally great, especially in the beginning of a new diet or weight change I’m arguing that calories should never be the focus, but we all have different calorie requirements. The question is who’s in control of the calorie balance? Is it our bodies or is it a diet doctor? I argue it should be our bodies. It may take a while to figure out how much food you need and how you match your food amount to different stages of weight loss. During the active stage of weight loss your body is burning storage fat, so you're obviously you're actually I just kind of thought of it, this for the first time, weight loss you're on a high fat diet, your body is burning fat. That rate of weight loss and fat burning will change through different stages of the diet and so your needs are going to change. In addition, physical activity level of course is going to change your needs. There are other variations on physiology that are probably outside our control.

The way we know is not to get a calorie app that tells us when to stop and then abdicate responsibility. It’s to tune into our body and its most important metabolic signals. The hunger is top of the list. If you're hungry eat well. If you find that you really think you probably should’ve lasted longer that’s a good opportunity to reassess the meal but then absolutely snack.

Dave: I agree with you by the way. Absolutely snack if the last meal made you hungry. I’ve gotten my own nutrition dialed in so much that snacking is very, very unusual, and if I do need to snack it’s because I either ate a suspect or there was a food quality issue with the last meal. I find that one of the things that causes a blood sugar crash is if all of a sudden you have some toxin exposure, even paint fumes or something like that, because all the sudden the liver is demanding glucose that would’ve been available for the brain. It’s like, “Hey, I got to oxidize some really bad stuff, get this out of here,” so I’m like, “Okay, I’m walking along, I should’ve had stable energy all afternoon because I ate the right amounts of the right foods,” and I didn’t consciously think about that, I composed the food right, but I ate the amount that my body wanted. I had extra salad if

I wanted extra salad and I didn't feel guilty for it, or extra meat. It doesn't matter. It's what the body wanted.

But then sometimes there's a crash. That's when snacking saves you, because if you don't snack then you go into that deeper and deeper and deeper hunger that you just burn more and more willpower. That's why you're an advocate of snacking. But would you advocate snacking if you're not hungry?

David: No, I mean never, there's no reason to force yourself to eat, but people in the first phase of our program, we have a three phase program. The first phase is high fat, 50% fat because we're asking people not to give up all carbohydrates. This is not an active diet. I think some people actually do need … People, if you've got severe metabolic problems you really may benefit most quickly by severely limiting carbohydrate, but most people I think don't actually have to go to that extreme.

Dave: Some ketones right but not massive ketones. Is that the target?

David: Usually we start out at 50% fat. We ask people to give up for just two weeks all grains, potatoes, and added sugar, except the small amount of added sugar in real dark chocolate, minimum of 70%.

Dave: How could not like that?

David: 85% better. To give that up for people who are used to eating a lot of carbohydrate and can't imagine going a day let alone a meal without eating that, eating those processed carbs, that high fat richness really does the trick. People, they used to be craving cookies in the afternoon and they find that it just turns off. Sometimes after a week or two they'll go to a party, they'll pick up a cookie and they'll say, "It's okay, but I'm not sure what I ever saw in this," the brain is changing.

That first phase 50% fat, 25% carbohydrate, 25% protein. Just two weeks. That is a time when a lot of powerful changes are happening in the body. We specifically asked people to snack. You should never force it, but the body has been in a state of starvation, so we want to take the body out of the starvation mode. The best way to do that is to make sure that there are plenty of calories. If anything we want to err on the side of too many calories. I mean what weight loss diet says err on the side of overeating. That's what we recommend.

Dave: It's beautiful to do that because it sets you free from cravings you've had your whole fat life. It's beautiful.

David: That's right. That's just two weeks though and then at phase two we add back whole kernel grains, so unprocessed grains.

Dave: So you're not concerned about gluten or any of the other toxins that come in grains?

David: Yeah, we have options. We have gluten free options for everybody. Grains are not required by any means, and at the same time this is a book for …

Dave: For mainstream.

David: … America. I don't see America as coming off of grains entirely. In fact, I'm just coming from a conference with Boyd Eaton who's the paleo fellow. We all recognize that with 7 billion humans going up to 10 billion pretty soon, we'd eat grains. We're not all going to be hunter gatherers. I think there's a way to incorporate grains in the diet that add to culinary variability but don't undermine your metabolism. I think having gluten free options is really important.

Dave: You have a great point there and thanks for calling that out. By acknowledging the limitations of grains but then using them intelligently we can also start creating grains that are more beneficial for people. Do you know what I'm saying? If we knew the good stuff we can grow more of it, because right now they're all like growing extra high gluten because it's easier or because it tastes better in pastries or something, but we're hybridizing in the wrong direction is what I'm saying.

David: There's so many … I mean, they're really, we think of grains as the modern highly processed wheat, which is bad in every possible way. There have been dietary patterns consistent with great longevity and really good health that have incorporated grains. They're typically minimally processed like Mediterranean diet has all sorts of or in Asia there are parts of Asia with very interesting kinds of brown rice as a whole kernel without gluten. There's quinoa which technically isn't a grain but we treat it like it. It's relatively higher in protein. It's gluten free. Buckwheat is gluten free, teff, amaranth, all sorts of wonderful much more nutritious grains than we know. We are trying to broaden the possibility, but there are both gluten free and grain free options for people throughout.

Then in phase three that's where you can begin to add back a little bit of processed carbohydrate. We just published a study in Obesity, the journal Obesity that looked at what happens to metabolism after a month on a low carbohydrate diet. We find that it seems to reset the beta cells so that the beta cells on a high carbohydrate diet have a hair-trigger. They're ready to fire-

Dave: These are the insulin secreting cells in the pancreas just for people who might not know.

David: They got a hair-trigger to release insulin. After a month on a low carbohydrate diet they seem to calm down and they calm down in a way that lasts even after adding back carbohydrate. They wind up secreting less in response to the same amount of carbohydrate that caused the big response earlier. Some people may be able to then trickle in a little bit, a few treats and sweets. If your body can handle it, well, why not have a pastry when you're travelling in Paris, or a little white pasta when you're travelling in Italy, or ice cream on a special occasion. There are some people for whom their biology is that if they start eating those things it's going to start triggering cravings and a vicious cycle of weight gain. But by that point they've discovered that feeling

good, having control over hunger is so much better than the fleeting pleasure of those processed carbohydrates that it's not hard to just not let-

Dave: It's a priceless feeling like, "Wow, I have resilience today. I can do what I want. My brain will obey me. My energy isn't crashing." Someone offers you a cookie you're like, "I don't care what's in that cookie." At least the process I went through as I was losing the 100 pounds and keeping it off was I used to, I'll just do like a cheat day, Friday night I'll just have like a loaf of bread, the crunchy French bread, which is relatively high glycemic, even though it was whole grain. Then the next day I'd be okay but have these horrible cravings and after a while I'm like, "You know what, it's just not worth it," because my energy bounces around for several days after I do that.

Now, this is years later, grains still, like gluten specifically still causes cravings but I can tolerate sugar, like my metabolism is fixed. I can go to a kid's birthday and have a gluten free slice of a birthday cake. It's probably not the optimal food for stable energy and feeling great and having less inflammation. I might see a little muffin top from some ingredient or whatever, but I can tolerate it without turning into a monster and just …

David: That's important that if we're talking to not just foodies like us and the 1% of the population that biohacks. We want there to be some flexibility, but the key is flexibility according to your individual ability to handle it, which is not going to be the same as somebody else. It's going to vary with age, it's going to vary with your physical activity level, with your genes, with what you've been doing for the last 20 years.

In the phase three of our program, we give people symptom trackers that we plot out. You can then see, "All right, I was able to, I was doing fine when I added this and I was doing fine when I … Op, here, that's where I started … Interesting like I'm now seeing the craving. I'm seeing this and that. Then you just dial it a little bit back. That's not set in stone. Maybe a year later you'll readjust it but if you know for right then that's the right prescription for you.

Dave: We have a lot of commonalities in our thinking about food. One of the things that's free that we use, and I want to get your honest opinion about it, is it's now called Food Detective that I put out there. You track and you type in what you ate, but it looks at changes in your heart rate after you eat for the next 90 minutes. If you eat something that you're sensitive to, which is going to cause an adrenal response which is going to cause cravings via the pathway you just described at the beginning of our conversation, that if you can have this predictable rise in heart rate and you can see which foods do it because you've kept the little journal and then you've got your heart rate, then maybe you should not eat those foods that are triggering the adrenal response. In other words, allow your body to avoid those for a while so you can calm that down. Is there merit to that approach in the things you understand or in conjunction with the symptom tracker that you're working with or is that kind of different?

David: It's an interesting theory. Scientists when I hear an interesting idea my first thought is would be a good thing to test. You may have data on it and or that might be something that we could look at.

Dave: I can send you some of the research. It's based on summaries of an old research like you had, some of the older stuff, when they didn't have some of the very focused looks where you're trying to exclude all these variables whether you're looking at systemic behavioral things. This was one of the first ways to detect food allergies before we had blood panels to do that. I'll send you some notes after we've done because I think there's … It looks like its name is BROCA, BROCA test I want to call it, but I could have this name wrong off the top of my head.

It's an interesting thing and it's something that helped me dial in, "Okay, if I'm having a problem with that food I'll be able to see it," and it's like, "Why am I kind of feeling a little faster," but then you measure it and you go, "Oh there is something going on," but it's just not an obvious thing. In your case you've got a symptom tracker. Is it an online thing or is it a thing in the book?

David: It's in the book. It will be available online for people to download so you can do it electronically. Maybe if somebody wants to do this with us we could make an app, make a symptom tracker app. It's based on five symptoms. You want to look at how those five symptoms change in coordination with what you're eating. Then you also look at what's happening to your weight and all sorts, hunger, cravings, energy level, general sense of well-being, and duration of satiety. You put that all together and you come up with an integrated picture of how what you're eating is actually affecting you.

Dave: It might be interesting to connect you up with Jonathan Bailor who may even have an app like that. He's working with this same thing around satiety and foods. He's been a guest on the show. I can make an email introduction afterwards. There's something to be said here around looking at data. When I first started noticing the changes in my energy, I started out like not looking at my fat, I failed at the fat thing, but I was looking at my brain because I was having such energy crushes and taking smart drugs and just trying to prop up my energy. I started taking notes. I had a work notebook. When you work in Silicon Valley we all use these engineering notebooks because then if there's ever a lawsuit you can see if someone tore out a page. That way you've kind of protected your intellectual property.

In the margins on these books I'd be like "Energy crush 2:00 o'clock. What did I have for lunch?" and I'd write it down. I did this for a long time until I just build this awareness of, wait, I'm causing these. They're not random, and they're not just … Oh, I should pay more attention in this meeting. I can't spend more attention in this meeting because my brain won't do it. It wasn't a personal failing. It was an energy failing. When I finally just got that through my head and figured out, "Oh yeah, if I eat this cookie, three hours later or two days later, whatever the time was the zombie mode is going to happen, that was really important. Here it is. You've got it in a book. That's why I'm such a big supporter about this. I'm just so pleased. I can't wait until this comes out in January.

Now I had a couple other questions for you here. One of them is around a metric that I learned about when I was trying to figure out why I didn't gain weight when I cranked up the butter in my Bulletproof Coffee. I ended up spending a time where I was doing between 4,000 and 4,500 calories a day and my plan was to do overfeeding but to

overfeed and to maybe gain three pounds when the math said I should gain 20 pounds. But like, “Oh wait, why is there such a big disparity?” I was eating very, very low carbohydrates, I was eating tons of Bulletproof Coffee and tons of steak and tons and tons of vegetables, but not starchy vegetables, and I ended up losing weight on that number of calories and it was like, “Okay, what’s going on?”

As I’m digging in on all this I found a metric from the agriculture industry like the feedlot industry. They have a metric called feed efficiency. They found that by administering antibiotics they had a 30% change in feed efficiency that means on exactly the same number of calories the cows got 30% fatter when they had tiny amounts of these drugs. Doesn’t that, the existence of that kind of violate this physics of calories in, calories out?

David: I think we really agree of course that the calorie balance model works well if you're a toaster oven.

Dave: That’s a great tweet right there.

David: But humans aren’t machines. What happens is that we adapt to changes in calories. When calories go down our metabolism slows and when they go up our metabolism speeds up overtime. We adapt to it. We’re not even getting into perhaps an even more interesting question is, what happens to body composition. We did a study with rodents. I don’t like to do a lot of animal studies, but it’s hard to control people’s lifestyles totally. You can’t just lock them up for six months.

Dave: Prisoner diet studies are looked down upon in the West. It’s not cool. Although frankly you might be doing better than what they’re feeding them anyway. That’s a whole another discussion.

David: It’s another discussion. We gave these rodents the same proteins, fats, and carbohydrates, just again one fast acting carbs, the other slow acting carbs, in both cases starches, just fast digesting starches, slow digesting starch. We found that the animals eating the fast digestive starch, they started gaining weight excessively. So what we did was we did what you're supposed to do according to the calorie balance model, which is cut back calories. We did that and we kept the weight gain of the two groups the same. The fast acting carb group gained the same amount of weight with fewer calories which means that its metabolism was slowing down.

Then at the end of the study we analyzed body composition. We used something called tritiated water. It’s a isotope. That goes through aqueous water but not fat. We found that at the same weight the animals that had the fast acting carb had 70% more fat.

Dave: Oh wow.

David: It’s the same weight and you have that much more fat. Guess what you have less of?

Dave: Have less muscle, right?

David: Specifically muscle. This is what has been called TOFI, thin outside fat inside.

Dave: Oh the skinny fat thing.

David: That's right. Even if you have a normal BMI you may be at major risk for weight related complications because of your body composition and your metabolism. This is another way. When we eat calories, do those calories wind up going to muscle and being oxidized? They get oxidized or burned because you're going to be feeling energetic. Even if you don't work out and get on the Stairmaster you're going to be fidgeting, you're going to be wanting to burn off those calories. Or are those calories been directed to fat cells, and are they serving only to cause more obesity, more fat development? That's a really key thing.

None of this is explained by the calorie balance model. It has to do with the metabolic effects of calories. The chief culprit here I think is the refined carbohydrates. Beyond that we want to get the balance of protein, fat, and carbohydrate right, and then we want to bring in some lifestyle supports because other things besides diet affects fat cells, stress, sleep deprivation, and being too sedentary. I don't mean like not getting on a Stairmaster. I just mean spending too much time sitting. We want to get people to get engaged in enjoyable physical activities, not to burn off calories but to tone their metabolism.

Dave: Very, very well said. I don't see you at a standing desk though?

David: I'm fidgeting.

Dave: I use a stand desk, one of those electric ones that goes up and down. I've been helping the company get going. It's funny. I sit down for Bulletproof Radio because we've just built the studio, but I'm thinking about changing it to be a standing studio because sometimes I'll record two of these in a row and I don't want to sit all day because I'm fidgeting too. Because it's important. You cross your legs different ways and you move your body differently. Because if you sit still all the time it's just bad, and it does contribute to weight gain in a way that's independent of exercise. What do you think of standing desks or using treadmill desks and things like that? Like how important is that in the overall scheme of things?

David: A study just came out. I'm new to social media but I actually I'm not sure if I facebooked it or tweeted it. I did one of those two. It was in the New York Times just very recently. What they did was look at people who were given standing desks just as you mentioned. Not unexpectedly their energy expenditure, their calorie burn went up. Their calorie burn went up when they were using the standing desk. But guess what happened later?

Dave: They ate more because …

David: The calorie expenditure … Well, I don't think they looked at it, but they looked at their energy expenditure and it plummeted later in the day. If you're standing more during the day time you're going to be sitting and lying more later. Now why would that be?

Well, it may be just the same as calorie is eating, that if you cut back calories now you're probably going to overeat later, unless you alter the basic fundamental equation.

There are other studies. I actually have a section in the book that reviews this, why exercise doesn't cause weight loss. Exercise is good but for a lot of reasons but short of marathon level weight loss just isn't one of the benefits. That's because when you work out you burn off more calories but then you tend to compensate.

Our activity level like our appetite may be regulated by parts of our brain. The only way around that is to shift the set point. The set point is shifted not by just burning off calories and sticking to the same diet. You have to alter what you eat and these other lifestyle influences on fat cells.

Dave: That makes great sense. It gives me great pleasure that here you are with a lifetime of research and this working with Boston Children's Hospital and working with Harvard and saying things like exercise isn't a great way to lose weight. I grew up thinking, "Well, jeez, if I just can exercise an hour and a half a day six days a week, I'll finally lose this weight," and it never worked and it made me so mad. "And if I go on a low fat diet it's going work." You could lose 20 pounds and gain 30, and lose 30 and gain 40, and all that. So thanks for doing the research and putting this out there.

David: Yeah, thank you. It's also you just think of the human toll that this calorie balance model has taken on us psychologically.

Dave: It's one of the most cruel and evil things you can do, especially if you apply it to kids.

David: If all calories are alike then it's your fault you're fat, for not being able to control your calorie balance. Guess who gets on carte blanche? The food industry because there are no bad foods. They can market junk foods. It's fine to eat chips and cookies and crackers and sugary drinks. Just make sure to balance that and burn it off. Even if you could burn off the calories in a big Coke, very few of us actually can, but even if you could you're still going to be in a worse off metabolic state.

Dave: Yeah, it's not sustainable and it's not a way to live. Getting this out there into our consciousness so that people stop being surprised when you say to the waitress, "I'm sorry, two asparagus spears isn't going to cut it. That's not a side to vegetables, and no I didn't want the quadruple helping of macaroni and cheese that you put on there." Making these shifts so that we're having quality food in the right amounts when it becomes the norm we're going to look like people looked in the 1970s. I loved looking at TV shows from the 70s because everyone, their bodies are shaped differently, and even the people who aren't …

David: Especially children.

Dave: Oh yeah. They're not in shape the way like a super ripped lean muscular kind of steroid dehydrated.

David: Kids looked like rails back then. I mean, really, most kids were just really thin. The heavy kid was the relatively rare exception, unfortunately would often times get bullied and picked on back then just as today-

Dave: Yeah. As that heavy kid I can tell you the heavy kid will sit on you if you bullied them so don't do that but anyway. What were you saying?

David: I think the basic point is we have to reverse the psychological toll taken on people from the calorie balance model. It's not your fault you're fat. That's not a message that you'll ever hear from the food industry, because they want to blame the problem on you and not the massive infusion of industrial processed foods into the American diet. If you are eating these foods, you're going to be programed biologically to gain weight. Even you may be following conventional nutritional recommendations which were wrong.

Dave: They were …

David: It's not your fault that those recommendations were wrong. It's not your fault that you can't stay on a diet, on a calorie restricted diet because it's really more about biology than willpower. I think that this is ultimately a psychologically liberating message. Just like any other medical condition we wouldn't blame someone for fever and just say, "Wait a second, you've got … It's just a question of heat in and heat out, get into a nice bath if you've got a fever and your body temperature will go down." Well it will, but guess what, how many people can do that when they're having fever? You're going to be severely shivering. Your blood vessels would be constricting. You'll feel miserable. You give somebody an aspirin and the fever comes down naturally. Give someone the right diet and a few other supports and body weight comes down naturally.

Dave: It's a great message. The food industry it needs disrupting because it's broken. That's one of the things I'm here to do. I architected the Bulletproof Bar, these protein bars. We have a collagen protein and tons of Brain Octane. I got tired of eating things that made me hungry so I engineered something that is designed to not make me feel hungry. In fact, I'm looking at putting a money back guarantee on them right now and saying, "All right, eat this and if you're still hungry two hours later, like either you just ran a marathon or there's something else going on," because it doesn't happen.

That's the exact opposite of what a food company does if they want to make money. Because a food company okay, 100 calorie, high glycemic bar, you eat that. You'll eat another one an hour later and another one an hour later. Each time it's cha-ching, cha-ching. But if you make a bar that feeds someone for a long period of time then you sell a lot less. I think that that changes the whole economics of the food industry if you sell food that makes you full versus food that makes you hungry.

There's a dawning awareness of people who are learning what you've just taught in your book, which is that, "Okay, if I experience that craving feeling," the one we talked about before, "I did something," and they're going to look back in your application or in the journal that you give them and they're going to say, "Oh look, I ate the processed food, I had the craving." They're going to put two and two together and then the processed

food that used to be valuable because it's addictive becomes valueless and people will refuse to eat it and then it's no longer a good economic model.

When people get the awareness that you're teaching that it will disrupt the food industry, absolutely will do it, and people will choose foods that they don't need as much off and foods that leave them really satisfied. That will change the entire ecosystem because we'll grow different foods in order to feed people that way. That's what's coming. The big food companies, they don't have a choice about it. It's not theirs anymore.

David: The book is really based on trying to deliver the science in the first part and then a program for people to follow. The epilogue of the book takes on a political and policy issue, it considers our diet and our health as matters of national security. If we don't do something about diet and obesity related diseases, we're looking at massively increasing budget deficits, which I argue is contributing to the political polarization in Washington. Democrats and Republicans are fighting because there's less and less discretionary spending. All those resources are being siphoned off into diet related disease, and that we really have to become all advocates and activists voting with the ballot and also voting with the fork.

Dave: It's amazing what happens when you start paying attention what those things are doing to you. I tend to think there's so much fighting in Congress because they're all eating processed foods, but maybe it is more complex than that. There is …

David: Or maybe it's the people who vote them into office are eating all the processed foods.

Dave: There you go.

David: If we get off … If we raise our consciousness, it's the old saying "People lead, the leaders will follow." Eating well is a radical political act.

Dave: It is indeed.

David: We transform our health. We become role models. We influence the food supply. If enough of us are doing it and starting to demand like why aren't we hearing in the political debates, why aren't we hearing at least one question about food policy …

Dave: I guess I'm just going to have to choose my plate so to speak. It's not okay to see the disconnect between what's recommended and what works. Thanks for taking your huge body of work and just the amount of academic research and credentials that you have and then put writing a book that says incredibly radical things like exercise isn't the best way to lose weight and that one statement, which is that overeating doesn't make you fat, but getting fat makes you overeat, that is seriously radical stuff and it's awesome.

David: Thank you.

Dave: You're very welcome. There's one more question that I want to ask you. This is a question I've asked every guest on the show.

David: Am I in trouble?

Dave: You're not in trouble at all. Given all of the stuff you've learned if someone came to you tomorrow and said, "Look, not just from a nutritional perspective but from a life perspective I want to perform better at everything I do. So I want be able to sleep better, I want to be a better mom, I want to be a better CEO," whatever it is they want to do, "but I want to kick more ass at life," what are the top three recommendations that you would offer for that person?

David: Well as much as my day job and my life revolves around food maybe make that number one, but you also have to realize that the best diet in the world can't fill emotional emptiness. We need to be eating, number one, a whole foods diet that is deeply satisfying to us, nourishing to us, and are going to help our body lose weight and find its natural weight, whatever that happens to be, and can get us out of this endless cycle of fad popular diets and all the suffering that that's created.

I think number two we all really need to manage stress. We're just living and I am guilty as charged. We're all driving very hard, we're putting our bodies into this anabolic state, our fat cells are in an anabolic state from too much insulin. That means it's being forced to store. But that stress is also affecting our fat cells, our brain, so we need to be reducing stress and sleeping better. I know that's a central part of your work.

Then the third part is love and connection and community. We can be really healthy and destressed but life gets pretty lonely at the top of a mountain if you're not an enlightened master. We need to be building supportive relationships. Those relationships not only nourish us but become the network for social change that feeds back and makes our environment even better so that we can eat even better and feel less stress.

Dave: I love it. Thank you for sharing. Where can people find out more about your work?

David: Well, the first place is to have a look at our book, "Always Hungry?" which comes out January 5th.

Dave: January 5th. That will be on Amazon. Can they preorder it today?

David: You can preorder it right away. We have a promotion that provides some extra web specials in advance if you preorder through the website. The website is drdavidludwig.com. Also it can be found on Facebook, David Ludwig MD, and Twitter as well, David Ludwig MD. Another way to reach us is alwayshungrybook.com.

Dave: All right. That sounds like that's the probably the best place to send people. To find out more about the book in our conversation is alwayshungrybook.com. You're going to

have your offers for the book there as well. You give people a bunch of free web content.

Here's a suggestion that I would have for people listening. Given that December 1st the Bulletproof "The Cookbook" comes out. This is something, 125 recipes which I can guarantee will be in alignment with the things that are in your book. When you pick up your coffee … When you pick up your copy, not your coffee, of the Bulletproof Cookbook, why don't you also in exactly the same time and the same shopping cart pick up a copy of "Always Hungry?" because when you do that that will associate those two on Amazon and that way people who are into Bulletproof can understand that "Always Hungry?" has some really cool info about physiology and psychology in there and other people who shop for either the books can find both of them together, because these are books that belong together because they have some really similar philosophies and they're both about this idea of, look, you shouldn't have cravings all the time and there's thing you can do.

Add "The Cookbook" in there because "The Cookbook" is going to help you do the things that are in "Always Hungry?" which are going to help you feel better. You've got your own set of good recipes in there and you'll give away some other free stuff on your website alwayshungry.com.

David: And you can never have too many great recipes.

Dave: Exactly. I'll make sure to send you a copy of "The Cookbook" as well as soon as we get one. Awesome. David, thanks so much for being on Bulletproof Radio. Thanks for your work and thanks for stepping out in a limb and saying these radical statements like food quality matters more than calories, and exercise isn't the best way to lose weight. I very much resonate with what you're saying. My own life has shown me that your research is accurate and that is actionable and it's useful and it's actually something people can implement. Thanks for going out there and thanks for doing it. Have an awesome day.

David: Well thanks for having me and congratulations on your own transformation and your dedication to the health of others as well.

Dave: Thanks.