Speaker 1: Bulletproof Radio, a state of high performance.

Dave: You're listening to Bulletproof Radio with Dave Asbury. Today's cool fact of the day is about your knuckles. Scientist have disagreed for like a century over why cracking your knuckles makes noise. And they mostly talk about bubbles. Maybe there's things there's some low pressure somewhere, and it's been a lot of argument. But in 2015, a new paper showed that the bubbled don't fully implode. Instead they persist in your joints for 20 minutes after you crack them, which says it's not the collapse of the bubble that makes the noise, but it's the forming of the bubble.

 But it wasn't clear how a bubble's debut could make those sounds that are audible across a room. So engineers from Stanford and a French university whose name I will badly mispronounce, even though I live in Canada, called Ecole or something, set out to solve the mystery. And they found out that weird sound your knuckles make may come from bubbles that collapse only partially. And they actually did a mathematical simulation of a partial bubble collapse to explain the dominant frequency and volume. Why the heck do you need to know this? Well, you probably shouldn't crack your knuckles, but we still don't even know if that's really bad for you.

 But this is the level of complexity that's going on in our biology, and if someone says that can't happen, therefore it didn't happen, and something did happen in your biology, well here's the deal. We only know about maybe two percent of what's really going on in there. Maybe it's five percent. I don't know, but we're constantly learning more. And if it takes mathematicians in France and Stanford to figure out how we crack our knuckles, when you get to things like cancer, mitochondrial function, and living to 180, there's some room for improvement.

 And speaking of things like cancer and mitochondrial function, today we're going to be talking about some really cool stuff, specifically in those areas. We're going to talk with Dr. Kris Smith, who's a neurosurgeon at the Barrow Neurological Institute in Phoenix. And Barrow's the world's largest neurological disease treatment and research institution, and is ranked as one of the best neurosurgical training centers in the U.S. And Dr. Kris Smith obtained a medical degree in Nevada, top of his class, and is a full on radio neurosurgeon, and actually studied at the Karolinska Institute in Stockholm where my wife studied.

 So Dr. Smith had done more than 10,000 surgeries and is Director of the Gamma Knife and Cyber Knife Radio Surgery Program for about 20 years. In other words, he's a surgical, neurosurgical badass. But what's interesting is that now he's paying a lot of attention to ketogenic diets and what happens even with epilepsy and brain cancer, and things like that. So Dr. Smith, welcome to the show.

Kris: Thank you. It's an honor to be here.

Dave: All right. I gotta just ask you. Surgeons are, and I'm gonna just have to say this. Surgeons are the most arrogant of all the professions in medicine. Maybe not you personally, but on average, right? And you're the top of your class. So it's hardest for surgeons to say, "I'm going to look at these weird nutritional approaches that weren't a part of my training in medical school." And here you are, top of your field, doing surgery, saying, "Hey maybe I can add this stuff in." I wanna know what made you decide to even look, because this is unusual.

Kris: Well it's a long story. And I would agree. And I have a son who's a third year medical student and he actually hated his surgical rotation because of the arrogance of the surgeons. And I'm proud of that, that I didn't raise him that way, and I am very very proud that my director here, Dr. Robert Spetzler, one of the most famous neurosurgeons ever, taught us in our institution that we couldn't be arrogant. It wasn't right to look down on the quote little people of the hospital. So that's a culture that's changed things here, which I'm very proud of at the Barrow.

 Also, why did I get interested? My wife is a dietician, and honestly, she was taking all these CME courses. At night, I'd go home late for dinner and she'd have some podcast on or some online course. And I started listening, and going, "Is that true? Is that real?" And I started looking at references and things. And it kinda opened my mind a little bit. And that was, so I give her great credit for that. And I also wanna give a shout out to my daughter Rachel, who's an actress and has gone to your Bulletproof Café in Santa Monica, taken us there, and seen your Bulletproof Labs, and was really interested in that.

Dave: Rachel's a friend. I follow her on Instagram. Rachel Brooks Smith is how she goes. I chatted with her, and she actually said, "You gotta talk to my dad." I'm like, "Really? Who's you dad?" And it turns out, you know, there just aren't a lot of top surgeons who are on ketogenic diets and things like that. So I was like, "This is great." So that was how we got connected.

Kris: That's great. Yeah. She has this whole disruptive movement of disruptive apparel.com I wanna get a plug for that, where she, it's be disruptive for positive change. So she's been quite influential, and got me kind of interested in the whole fitness area. I've been a real fitness nut my whole life, honestly, and I've run marathons, and done things. And one of our residents, our chief resident this year, Mike Nanaszko, he's a legend here, 'cause he's an ultra marathoner on top of being a neurosurgeon. He ran the Monument Valley 62 mile, it's like a 50 mile race, something like that. And he won the race. I call him the king of the cult of keto here at the Barrow, because he started many of us, including me and some of my partners on the ketogenic diet because of his tremendous athletic performances he's done being keto adapted.

 So he ran this race in Monument Valley, on the border of Arizona and Utah. And not only did he run the race all on ketones, but he was an amateur athlete, as a real training neurosurgeon with very little time, he managed to win this race, and they accused him of cheating by missing a lap. He had to pull out his Garmin watch and show them the route that he completed the whole thing. And they said, "We're sorry." And he actually won it, won the race.

Dave: Wow.

Kris: So he got some very tough competition. So he and my older, my son that's in medical school, we started talking about all these adaptations of being ketogenically adapted for exercise. And for me, I ride my bike to work a lot. I run to work sometimes when I'm doing marathon training, and that's a 13 mile one way thing. And so I'm really interested in trying to improve my athletic performance, and I've known about the ketogenic diet for intractable epilepsy for some time. I'm the epilepsy surgeon, the director of our [inaudible 00:06:43] and epilepsy surgery fellowship here. So I am the primary epilepsy surgeon. And many times, we'll put a patient on the ketogenic diet to control their seizures. And so it just kinda got me interested in wow, maybe there's more to this ketogenic thing than only seizure control.

 So anyways, there's a long, long background of how I got really into this.

Dave: I just wanna say thanks for being aware of what you're doing. My mom has had epilepsy as basically she started having seizures when she was pregnant with me, and growing up, had epilepsy, was on huge doses of epilepsy medicine, and had brain surgery about 20 years ago at Stanford, for epilepsy, that left her without the seizures, but probably a lot worse of neurologically. And the physicians never mentioned nutrition, food, ketogenics, anything like that. Of course, now she's on her Bulletproof coffee, and she is ketogenic. But that was 20 years ago, but the fact that you're incorporating that and surgery for people with really severe problems like that, it's life changing stuff. And it's life changing even if you don't have epilepsy. And that's one of the reasons I wanted to have you on the show. You're doing this as an athlete, and as a neurosurgeon.

Kris: Right. So it's been a fun thing. I really have done it for about a year now, really being on it. We had, one of our researchers, our PhD researchers for brain tumors, her name is Adrian Scheck. She gets quoted a lot in a lot of the publications on this. She's been trying to talk me into this for at least probably five to ten years. And I, as a typical, arrogant surgeon, before I was saying, "What can a diet do? We're treating brain cancer, these glioblastomas, the toughest thing." I honestly think this is not an exaggeration. There's no bigger challenge in medicine than treatment of glioblastoma, the primary brain cancer, because it literally eats the brain from the inside out. You can't take out the tumor without taking out part of the brain with it.

 And a real personal story, my own father had a glioblastoma. And so, in my experience of treating my own father was kind of very instrumental in kinda helping me see the light so to speak, and the treatments that we do for people, we try to treat the cancer, treat the tumor. But at the same time, if their quality of life after treatment is not worth living, then what have we done for that person, right? And so, my dad actually came down and was enrolled in a clinical trial that I actually wrote. It was a very aggressive trial.

 And on a side note, I sponsor this Dbacks race against cancer. We just did it this last weekend, where I actually run with my patients.

Dave: Wow.

Kris: At this 5K race, and we just did this last Saturday morning. And it was really a thrill for me. And I have a patient of mine who's nearly a 14 year survivor now of a glioblastoma. She was on the same research protocol that my father was. She's the only person living still from that trial. One out of 30 people on the trial that's still alive. And it's a real rare thing to have someone really beat that disease. And she actually beat her previous year's time by about three minutes, so that's pretty cool that she's ... And she's not becoming ketogenic. We've talked about it, and trying to prevent her from ever having a recurrence.

 So there's lots of things that we're trying to do. But it's still, these one out of 30 long term survivors. And then even those that do survive, if they've had very aggressive radiation and chemotherapy treatments, and a lot of toxicity from the treatment, then I'm wondering did we really help them at all? We're really trying to learn through molecular profiling analysis and a lot of really epigenetic changes and things about how to still beat the cancer, but not beat the patient's brain in the process. And I really think the ketogenic diet is going to be or hopefully is that part of that magic bullet, the holy grail of treating people with this disease, that we can do things that are less toxic, but also effective in battling the disease.

Dave: So for people listening, you might say why do I care about glioblastoma. But not only is is the most common brain cancer, the glial cells in your brain, and you're a neurosurgeon, and I'm a biohacker, so if I get my percentages wrong, correct me. But they're roughly what, half the cells in the brain, the glial cells? They're smaller than your neurons, a lot smaller. But they're the ones responsible for cleaning up the brain, for pruning synaptic connections, and they're basically the immune system in the brain.

Kris: Correct. There are actually many, many more glial cells than there are neurons in the brain.

Dave: There you go.

Kris: And the glial cells are all the support cells. And unfortunately we don't get any new neurons after we're about 25 or so. But we get a lot of turnover of glial cells. So the fact that they replicate and divide and are susceptible to forming cancers, and susceptible to toxic change and all of that. They're very vital. We're learning more and more about them, all the ability to support synaptic densities, and supporting growth and memory change. And so, again, I'm getting off on many tangents because it's hard to keep focus. There are so many things that have to do with it. So I treat three different diseases with the ketogenic diet at my practice. One of them is just purely obesity related. It's called pseudotumor cerebri, a disease of young women. And it's not that they want to be obese. It's not like they haven't tried to have diets. They've tried things. They just haven't worked.

 And so we're initiating a study of placing these people who've had gastric bypasses, they've had every dietary counsel possible, but they still keep this obesity that causes their central venous pressure to be elevated, which causes their intracranial pressure to be elevated, which causes headaches and they go blind. And I have to treat them with shunts, which is terrible. It's a band aid treatment. What they really need is metabolic therapy so they lose weight healthily and gradually, and get rid of this problem that causes high pressure in their heads. So we're initiating the ketogenic diet to treat them, and I've had a few shunt graduates, where they've actually lost weight, and I can take out their shunt, and they have a life. And it was early on, I had a patient and her mother who looked very similar to her, obese, and not any fault of her own, because of this metabolic syndrome, and carbohydrate intolerance. And she had fibromyalgia as well. And a month later, she come in, literally grabs me in the hospital, gives me a hug, and says, "You have no idea. I've been on this diet for a month, and now I can play with my grandkids. I don't have pain. And that really shocked me. I did not know about the effect of the antiinflammatory response of the ketogenic diet before that. So it's really very influential in many different things.

Dave: I was also diagnosed with fibromyalgia years ago, and there's a pretty common connection with exposure to water damaged buildings, which surprisingly in Phoenix, there are more than you'd expect.

Kris: Okay.

Dave: I grew up in Albuquerque, which is a very similar climate, and it's interesting that people get fibromyalgia or chronic fatigue syndrome, which is a mitochondrial disorder, which is usually triggered by something in the environment, and that makes it sort of epigenetic, and that raises your risk of cancer as well. There's correlative risks there.

 But what's interesting to me though is that you're talking about epigenetics a lot. I've had one expert on the show who says cancer is a genetic disease. And my reading of the literature, which is not as extensive as yours, says maybe 10% of cancers, and maybe 20%. Some percentage are genetic, but it seems like most of them are lifestyle epigenetic things. Where do you fall on that spectrum? What's your current belief given that you've operated on 10,000 people with these kind of things?

Kris: You know, it's changing obviously. I was taught in traditional medical school environment that cancer is a genetic disease, and that it's not one disease. It's hundreds of diseases. And I've actually quoted myself in saying that to people. I hear it. Like a lot of things, we as scientists, as physicians, as laypeople who really study this stuff, I think the natural tendency for us as humans is to wanna think of things as binary, one or the other, black or white. But really everything is is bell shape curves and statistics, and probabilities. There are clearly one spectrum of cancer, like pediatric cancers, and there are people that have onco genes. There are people that clearly have a genetic basis of their oncogenesis. However, I'm tending to agree, as I read more and more about this metabolic theory of cancer, about all the respiratory events and epigenetic cycles that end up developing the risk for reactive oxygen species because they're, your very poor mitochondrial function actually ramp up the glycolytic enzymes. And it's really interesting to me that the number one glioma producing mutation is an IDH1 mutation. IDH1, isocitric dehydrogenase is the enzyme that's in the kreb cycle, and I don't think that's a coincidence anymore, that that's related. I really am learning more and more about it, and there's a lot of research that needs to be done.

Dave: I'm interested in not getting glioblastoma or frankly any other kind of cancer.

Kris: That's right.

Dave: Given what you know, which is more than me. In fact, let me ask you this. What do you do to reduce your odds of getting a brain cancer?

Kris: Right. So I am trying to avoid getting Alzheimer's Disease. I'm trying to avoid getting any degenerative neuro disease, including glioblastoma. That means that I am an avid follower of the ketogenic diet. I'm also an avid exerciser. I think daily exercise clears your mind and helps your health and vitality of your neurons and your glial cells, very much so. Those two things, and trying to get sleep, although that's really hard in my job, that's the one thing I really wish I could do better. Although last night I was operating until 10, almost 11 o'clock at night, and then rode my bike home, and all that stuff. But it clears my brain to commute on my bike, and commute sometimes running. And I feel so much better on the days that I get my daily exercise fix than on those days that I can't do it.

 So those are things. Obviously, I try to be an avid reader and exercise my brain, and do all those things to keep everything functional and using, not try to spend too much time just glaring, looking into an empty tube, into the TV space, and really exercise my brain. So all those things I think are vital in promoting a long term healthy brain life.

Dave: One of the things that the other surgeon friends of mine have talked about is that quite often, unless it's all elective stuff, you can be doing surgery, like you said, 10 o'clock at night. You're under bright operating room lights, and so you're getting a lot of circadian disruption, not from just being up late, but from being under surgical lighting. Do you find that sleep quality is something that you deal with as well as just getting enough of it, just because of your line of work?

Kris: You know, I really don't know that. I do stare into the operating microscope, which is a very bright light, for sometimes 6, 8 hours at a time. And sometimes that can cause obviously retinal fatigue. But I have no trouble falling asleep. I think my quality of sleep is excellent, maybe because I'm just plain exhausted by the time I get home. But I wake up too early. I have a, Phoenix, the sun is bright nearly every day, and I like that. I like the sunshine out here, but boy, as soon as there's any light cracking through the window, it wakes me up. So maybe I need to get some block out shades and get better sleep that way.

Dave: That actually changed my life. Up in Canada where I live, during summer, it's just bright all the time. And until I got really good curtains, my sleep quality wasn't as good as it is now. So I hired the curtain designer person, and I said "If I can see any light at all, you will have failed." And she kind of looked at me and said, "Any light?" I'm like, "Yeah. That's what blackout curtains mean." And she was like, "Oh, okay." And so they engineered like extra whatever, an extra strip at the bottom and on the sides, and things like that. So I have like a sleep cave, because if you look at the literature man, around circadian disruption, and what happens to the brain, it turns out it does increase cancer risk pretty substantially, like way more than you'd think. It was a book called Light's Out by TS Wiley, which came out I think in 2001. She was the first person to put all that literature together, and made me start paying attention to the light around me as just part of becoming neurologically more functional. It's a part of the equation. It's certainly not the only one.

 But I always worry about doctors who are up late at night, looking at these things, especially the shift workers, people who work in ERs or nurses and things like that, to the point that some hospitals are now looking at changing the lighting in the hospital so that the patients heal faster, and also so that they staff doesn't just get completely wrecked when they're working nights for a few weeks, and then going back to daytime. So I'm hopeful that some of our medical professionals actually begin living longer because we started putting in better lighting in hospitals, just more natural spectrum and things like that. But at least you have the sunshine in Phoenix, which I think is in your favor on that side.

Kris: I hope so. I hope so.

Dave: What do you do post glioblastoma brain surgery? You've got people on a ketogenic diet. What else do you do to speed healing post surgical? Is that a part of what you talk about, or you're more a proceduralist, kind of go in, get it done, and then the hospital staff works on the recovery side.

Kris: Well you know, it's a challenge because I am a proceduralist. I am a surgeon. But I pride myself in being someone who doesn't just do the surgery and then hand them off to the neuro oncologist or to their people. I follow my patients for their entire life, and which drains me, honestly, emotionally. I really do get involved, and that's why, like I said, this race against cancer is something that's emotional for me and helpful as far as giving them all something to shoot for, like we're gonna do this together next year. We're gonna go. And I really try to be an advocate for helping them to get up and move. And you can imagine, some of these people have problems with mobility, and I try to get them to this lecture, all the time in clinic, to get to the point where you walk at least a mile a day. And these are people that might have hemiparesis, or be on a walker. And I say this is your goal. Do this stuff.

 So I really try to instigate or try to promote a sense of well-being by being outside and being active. There's actually a study done that just owning a dog, for a patient with glioblastoma, improves their survival time. And that's because probably two things, emotional kind of healing. Many people benefit from a therapy dog. But also just the fact you have to get up. You have to take them out. You have to take them for a walk, get them to go do their business out on someone else's lawn. And that can help them just to be up and about. And it was actually proven in a study, to improve the survival of a patient with brain cancer.

Dave: Well, I have to [inaudible 00:21:45] dachshunds as a really awesome affection is great. Some breeds of dogs, so I'm pretty sure that breed of dog causes cancer, 'cause they're just too neurotic. But a good chill dog that makes you take him for a walk, but is also gonna be just loving and nice is a, I think is just good on many different levels. Obviously, I have one of those, so I might be biased.

Kris: Right.

Dave: And taking your person out for a walk is important. And quite often, if you don't have a dog or something like that, having an appointment with a friend, just anything that's gonna make it so at the last minute, well, someone's recovering, or even if they're just working on getting stronger, having someone or something to hold you accountable, so you won't at the last minute say, "You know, it was easier to just watch more Netflix than it was to go for a walk." I think that's something that all of us could benefit from, whether or not we're post surgical.

Kris: I agree.

Dave: You've talked a little bit about using a ketogenic diet and being in ketosis before surgery. And you found that it might be able to help you avoid steroids post op. And steroids are normally used to just quel inflammation, but they come with a big downside in that you can gain weight, and they can mess up your metabolism. So what's going on with post op ketosis, or sorry, pre op ketosis?

Kris: Well, I wish I could give you some actual hard data about how many patients have done this, and what's the effect. And really at this point, it's just a bunch of anecdotal responses, and I haven't quantified it. But it's certainly something I want to do, I'm trying to do. We have about 20 patients actively right now with, in the midst of some phase of treatment of glioblastoma on the ketogenic diet. And we're finding different responses. Those that I find that really adopt it, I really do believe there is an anti-inflammatory effect. And the trouble with the steroids, cortisol based drugs, dexamethasone is the one that's most commonly used in neurosurgery. It's a very powerful anti-inflammatory steroid, but it comes with all kinds of baggage. And I have been against this drug for years, well before I knew of the ketogenic diet. And I think it's the most overused drug.

 And the problems and complications of corticosteroids are they, number one, after this, they kick you out of ketosis. Cortisol is the hormone that makes you burn your own muscle with gluconeogenesis, turn it into sugar, and it makes your body crave sugar. It makes your body's blood sugar level go way up. Anyone who's even a borderline diabetic will have their blood sugar shoot up from 150 to 300 plus when they're taking a high dose corticosteroid. It makes you gain fat in all the wrong places. Anyone who's known anyone with Cushings Disease, they get a moon face, they get a fat tummy, they get skinny legs, they get thin skin that bruises easy and is fragile. It's everything bad that happens to your body, and it happens with the corticosteroid.

 So if, and I say that if with a very positive hopeful if, the ketogenic diet can help people reverse that and not need to be on steroids, it's a huge plus. So we have a protocol where we're implanting this focal delivery radiation seed device directly into the tumor bed after we resect it. And again, there's a balance between using radiation to kill tumors that have already occurred versus the idea of preventing tumors from happening. But anyway, as we implant these, usually it would cause a big response. I've had a few patients that have been on the ketogenic diet with these seeds in place and have literally had no inflammation, no swelling at all afterwards, and I think that's impressive. But it's a very small numbers, a few anecdotes. We'll really have to quantify it to make sure that it's reportable data.

Dave: I would ask you to gather blood ketone markers pre and post surgery. I have a sneaking suspicion that you don't need to be in massive ketosis. My guess is the number is .5 on the blood stick.

Kris: Right.

Dave: And there's a couple studies that show when you can get to .38 and .48, that that is what changes levels of CCK and ghrelin, which are two hormones that are useful for controlling hunger, but are basically upstream hormones for a lot of other things that happen in the brain. And I've found I can get to that level even if I have carbs if I'm using the oil that we make. And that's because it converts directly to ketones. But there's a, I'm just gonna say a cult of people out there who are sort of like comparing, my ketone readings are higher than yours.

Kris: Right.

Dave: And in my metabolic mind, I'm like, well, would we compare, look my blood sugar's higher than yours? If you're good at burning ketones, your levels should be kind of low, and if you're good at burning sugar, your levels should be kind of low. So it seems like there must be a Goldilocks number for people who, you must be at this level in order to get the benefits before surgery or before any major trauma, maybe even before going out on a professional football field, in case you get hit in the head. But like, if this is protective, we need to know the minimum protective level to target instead of saying "I want a ketone level of 12." Maybe there's some metabolic dysregulation if you're doing that as well. Any thoughts or experience on that?

Kris: Yeah. So it's interesting. When we were first becoming into this ketone, we have a little breathalyzer, and we'd go up at a family vacation, we'd kinda go out and compete with each other. Who can blow the highest ketone number today? And it was really kind of laughable because it's really not about that. If you have a high number, it's probably because you're early on in the experience, and you're inefficient at utilizing the ketones. So what happens when people try to use urine sticks to measure at first, it's like, oh it'll turn purple, you've got massive ketones. But after a while it's like, "Wait, what happened? I'm doing the diet even better." It's like, "It's because your body actually saves them. You're burning them now. You're utilizing them for fuel." So that's why urine sticks don't have any efficacy or any applicability after a few weeks.

 So yes, I think there's a sweet spot, a magic number that just shows, yes, you're in general nutritional ketosis. And I think a .5 is probably very accurate, just as a goal. And it is different, the idea of being in nutritional ketosis for health and doing athletic performance, and things like that is probably a different ballgame than using it as a ketogenic metabolic therapeutic treatment of cancer. And I don't know that for sure, but that's my intuition that it's better to really be a little more strict and keep the carbs down to probably under 20 grams, and that type of thing, to really not bounce in and out. And having tried this diet on many people and seeing the road blocks that happen, there's many things that get in the way. These people have usually some cognitive impairment or cognitive dissonance at least, and that's new in their lives. They can be older. Old adage of can't teach an old dog new tricks is very true. And there are many, many challenges, roadblocks to get people in this, and to stay ketotic.

 I had one patient, who I thought was doing really well on it. He had these anti-inflammatory spots. Then all of a sudden the family decided well, he's not getting all these nutrients and vitamin C, so they started juicing, and having all kinds of sugar. And sure enough, the next scan was inflammatory, and just swelling. He had to have another operation. And again, I don't know for sure, that patient, if that would've happened anyway. I really don't know that. But I found it at least an interesting anecdote that he had been doing really well when he was on it, and then crashed with something that people thought was healthy and thought was good for them. And sugar in juice is just not good for us.

Dave: It's tough with juicing too, because I've found those, about four classes of nature derived toxins that cause inflammation in different people in different ways. And depending on what they're juicing, you could be giving a histamine effect if the vegetables aren't particularly good. Excess histamine equals inflammation. You could be getting oxalic acid from a lot of raw kale and collard and things like that. And that can be inflammatory in certain people. In fact, there's people looking at autism in that. And then you've got the plant lectins, which are part of the Bulletproof diet, where if they're juicing bell peppers and the person's sensitive to nitrates, that's gonna be a game over kind of scenario for someone who's dealing with chronic inflammation in their brain. Not to mention you could just have sugars, and also micro toxins are also implicated in glioblastoma specifically, where if you're eating these, "Well those look like they're pretty fresh." So these are like mother nature derived, and then you've got all the manmade toxins and mercury and things like that. All of them are like a little bit, they're all problems.

Kris: Right.

Dave: And for some people they're bigger than others. But if you take someone who's already on the edge, and then you stack some of these up, and you don't know which ones make them weak, it seems to me that all of those are things you should watch out for when you're trying to recover from a major procedure, whether it's brain or some other procedure. Do you buy that line of thinking? Please disagree if there's something there that doesn't match your experience.

Kris: Right, well honestly it's just a foreign field to me, and I think that that's what's tough. We've, as a traditional medical doctor, you kind of have this cynicism about all toxins and things like that. And oh, detoxifying and all these zen retreat places, and things like that. And then you kind of, with a little bit more open mind think well maybe these things are popular because they do help people in some way, and there is something to it.

 So I've tried to learn to have a bit more of an open mind about things. But I will just admit ignorance to it. I just really don't know.

Dave: I appreciate your open mindedness on that. And it's tough. Anytime we have something that could be caused by 10 different things, our natural, your training in medical school, just our natural any scientist is like, "Well, I wanna find the single variable." But when you're dealing with four variables, and each is contributing a small percent, it is really hard for our human brains to put together those things, which is why we have all these statistical techniques, and machine learning, and conjoint analysis, and all these things that we do. But it's gonna be really tough. And my approach evolved over time to get rid of the chronic fatigue and the Lyme Disease, and the arthritis, and all this stuff that I was dealing with, just the brain fog. I don't necessarily have to know which one, but I'm gonna find the most likely offenders, and just minimize them as much as I can. And the results have been pretty good. But I don't know to this day, I can't tell you this one thing was the one thing that was causing the problem.

Kris: Right.

Dave: I think it was a systems problem.

Kris: Right.

Dave: I don't know how to teach that though.

Kris: Right. And that's one of the problems in medicine. You've touched on it very well. I've actually stood up in conferences and we had a brain tumor symposium just a couple months ago, and I gave a speech about how I'm trying to incorporate the ketogenic diet in these things called tumor treatment fields. These are non-toxic therapies that help patients. Because our scientific method has just not done well with glioblastoma. And we look at all of these drug company sponsored trials, and I'm involved in patients with what's called a phase zero slash two trial, where these are all in recurrent disease, and there's been many, many downstream modified genetic aberrations that have occurred in multiple different pathways. And this heterogeneity of the glioblastoma is a huge problem. And so what we do is we will actually give the patient a drug before they have surgery. Then we'll take the tumor out, see if it bounds to the tumor, and see if we're at the smarter way to do a trial. And then if there's efficacy to that, if the molecule adheres and is showing signs of causing apoptosis or death of the cancer cell, then we're saying, "That's a good drug for that patient."

 But unfortunately, it's treating one downstream effect at a time. What's wrong with all these therapies that try one downstream effect at a time is there's 10 others, or at least three or four others that are not being treated. And so my analogy is it's like an avalanche, and the snowball happen. If you got at the very beginning, before it escalated into this massive downward force, spreading out over an entire canyon or mountainside, then maybe you could've done something. But treating one little spot, and protecting one house or one tree from the avalanche, while the rest of it just goes on and destroys everything is not gonna be helpful.

 So I think that we need to have a much more global look at many, many pathways at once, or again, if this metabolic therapy of cancer is really true, and we're treating all these epigenetic effects and preventing these downstream epigenetic events, then I think that's possibly much more likely to treat these people. What I'm struggling with now mostly is that we're dealing with patients who've already had cancer develop. I think ketogenic diet and being in nutritional ketosis, living a healthy lifestyle can prevent disease better than it can probably treat it after the fact. So I'm struggling with treating things after it's happened, and there are all kinds of genetic problems and modifiers that have been modulated and changed, that are turned on. And I've had so much experience with patients that initially did well, and then have a recurrence. And then after it recurs, it's terrible.

 I had, I'll just touch briefly on an experiment we did. So my oldest son actually helped me develop what's called a gamma knife radiation biologic dosimeter. And Adrian Scheck helped me with this research. And what you could do is take cells out of a patient, we remove their tumor, culture the cells out on a little cassette, put that cassette of growing cells from their human glioblastoma tumor, put it inside a gamma knife device in a cassette. In a high dose field, in the first occurrence, every single cell died, and it was just, said, "Yep. Very clear zone." And there's a difference in the size of the field of dose response curve, and different tumors to some degree. But in general, every cell we ever studied, every patient, they all responded.

 The same patient though, after having been treated with radiation, and temozolomide, most common chemotherapy for glioblastoma, that patient's tumor recurs nine months or a year later. You take those cells out, put them in the same exact cassette, grow them in the same way, put them in the gamma knife dosimeter, there are cells, multiple colonies growing even in the high dose field. So you've got, you've had the development of radiation resistance.

Dave: Wow.

Kris: And so that's what I really think is interesting is trying to figure out what made those cells resistant. How is that selected for, and how can we possibly prevent that from happening? And it turns out, there may be some of these epigenetic modifiers in the ketogenic diet that bestows again a radiation sensitivity rather than a radiation resistance. But again, these are things that really need to be better studied. But that experiment was very powerful to me how when we're treating recurrent disease, we're treating a very, very different disease than the initial.

Dave: It's really interesting. I've been reading the autobiography of Candace Burt, and this is a woman who, starting in the 60's, really discovered the opiate receptor in our brain. So she's a neuroscientist, just kind of a hard science person. And throughout the course of her career, she came to the conclusion that well, our immune system is trainable by external things, and cites studies in her book about this, where she basically says that the immune system and the nervous system are a continuous spectrum, and that they're tied together in a certain way, and once you start looking at the fact that you can train the immune system consciously to behave in certain ways. For instance, they would expose dogs to an immune suppressive drug, while giving them like saccharin or something, some strong flavor. And then, after a while, they could stop doing the immunosuppressive drug, and just give saccharine, and the immune system would somehow magically know what was going on, and it would have the same immune suppression, just from the flavor that the dogs got.

 So this association is happening in our bodies. So there's a lot of learning of the system that I think we're just starting to tease out. And it's my great hope that this whole biohacking by itself, just getting data from millions of people, from what's going on in our gut bacteria, what's going on in our mitochondria, what's going on in our cells, we're gonna start seeing these incredible patterns that point out something happening that was just invisible before we had the ability to gather just ridiculous amounts of fine grain data, and throw it into these big correlation engines. And I think it's happening just over the next couple of years, because the data collection is just barely good enough, and the data analysis is just good enough. And I'm hopeful it changes your field pretty dramatically, so you can go into someone and say, "This is precisely the combination of things that's causing problems, given your genes, given where you live, and all this other stuff." And I've never been more hopeful in my life. And I don't know if you share that optimism. Do you?

Kris: No, I do. And that's, I'm naturally a very optimistic person. I have been accused in our department of being the eternal optimist. It takes that optimism to face the same terrible tumor over and over again every day and think, this time we're gonna win.

 I do think we know more than we've ever known before. But I think there's a little bit of medical and scientific blindness that we have to overcome to allow these kinds of ideas to infiltrate general medicine, and that's, someday I think I'll write another book about how to incorporate general medical knowledge into a more wholistic approach, a more globally open approach to medicine.

Dave: It's refreshing to hear a very well established brain surgeon talk about these things. Do you, you mentioned you're already sort of labeled as the optimist. Do you get a lot of push back when you talk about ketones and surgery from others in your field, or has this kind of crossed over to the point where at least it might have enough credibility that a "real scientist doctor" can take a look at it without being laughed out of the medical conference?

Kris: I think it's kind of halfway in between. I think there are people that their initial response is cynicism. They just think like, again, like I was. What can a diet do, right? But then again, when I was giving this talk at this last Barrow brain tumor symposium just a couple months ago, and I mentioned that I really wanna talk about this, and he goes, "Oh yeah. You're gonna talk about ketogenic metabolic therapy. Oh yeah." This is something that is getting more credibility and more knowledge. And when I spoke at this, the conference in Baltimore, the Tripping Over the Truth conference, there were quite a few regular practicing medical oncologists who were on the same panel that I was, that were kind of incorporating this into their practice. So I think it's getting there. I think it's probably just a foot in the door. The door's still pretty closed, but there is a foot in the door that's opening it up.

Dave: And I'm guessing you've come across Dominic D'Agostino's work. He was one of the first-

Kris: Absolutely.

Dave: One of the first guests on Bulletproof Radio, and we're approaching about 500 interviews at this point. He has been one of those very loud voices, and that's a compliment when I say loud, not in a negative way, but just in an impactful way. He's saying, "Hey, you can do stuff with oxygen and ketones and all." And I am so inspired that in, what, the four years or so, five years, however longs it's been since I've been doing the show, that message has percolated throughout medicine way faster than it would have even 10 years ago. So it seems like the speed of acceptance of new thinking of the medical field is accelerating in a way it never has before. But I'm an outsider. Are you seeing that as an insider as well?

Kris: Yes to some degree. I think there are some traditionalists that have a hard time adapting, but with the speed of information processing, and availability of everything over the internet, and things going viral, and information, it's just literally at your fingertips every second on your smartphone. You can look up stuff. And I'm just amazed at my, I have a son and a nephew are both in medical school right now at the University of Arizona. And they're helping me write a paper, and just to do that was fascinating, I stay at my desk at home, and they're both on their phones, just looking stuff up. I say, "My gosh. This would've taken me hours and hours of going to the library and getting up references," and the time it takes to publish a paper, knowledge is almost instantaneously accessible and available now. So when something is really true, and gets out there, it happens fast.

 I just think, as long as we don't suppress it and ignore it, and people are honest in their thinking, they will find these things out quickly.

Dave: Well, I'm equally hopeful. I still remember at the very beginning of my academics, using microfiche, where if you wanna find something, you find a reference, and you walk around, and find a sheet of plastic, and put it in a machine-

Kris: Right.

Dave: You know, people under 35 hear that and go, "Are you kidding? That's worse than a fax machine."

Kris: It's way worse.

Dave: I couldn't have written Headstrong, my last book. I mean, this thing had thousands of references behind it, and I couldn't have even found those references in the amount of time it took me to write the book, much less write the book without all this stuff. So I just feel like the rate of change, not just in medicine, but in nutrition and in every realm of understanding our biology, understanding animals, understanding the environment, all of that is just faster and better than it's ever been, which makes me really hopeful for all of us across pretty much every domain we can think of. So I'm glad you're seeing some of those changes as well.

Kris: Well it is interesting. I think about half of our department of neurosurgeons are actually on the ketogenic diet personally, which is really pretty amazing. And in the hospital itself, this was a huge thing. Hospital food is famous for being bad. But I walk around and see all the vending machines full of just sugar and poison basically for people. And this is what you get in a hospital, right? And so, we had instigators, I'll give a shout out to my nurse practitioner who's on the wards, and listens to me talk to patients about this every day. We just finished rounds earlier this morning talking about ketogenic diet to the new patient I just operated on yesterday. And she's instigated, actually you can order it now, as a click on the order sheet in power plan, a ketogenic diet the dieticians can do.

Dave: Oh wow.

Kris: And I'm not saying they've perfected it yet. It doesn't look super flavorful, and not like the things that my wife and I like to cook together at nights. But it's getting there. We're actually able to order a ketogenic diet on the hospital menu here at St. Joe's Hospital.

Dave: Wow. That is really unusual and groundbreaking. And I look back to when I first lost weight on the ketogenic diet. This was in the mid 90's, 'cause I had 100 pounds of fat I was trying to lose. Talk about metabolic dysregulation right? And exercise and low calorie stuff just didn't work. And I did lose 50 of my 100 pounds in about three months when I did Atkins diet. But what Atkins didn't have right was the type of fat required to put you in ketosis, because some kinds of fat are inflammatory. And he didn't have a problem with any of the artificial sweeteners, and some of the things like MSG and NutraSweet have effects in the brain.

Kris: Right.

Dave: So I'm curious, does your ketogenic diet, does it incorporate good fats versus bad fats, and does it incorporate artificial sweeteners?

Kris: No. Unfortunately there's work to be done. And there's a supplement here you could've ordered like for an epilepsy patient, you could've ordered KetoKal, which is available, but unfortunately uses like safflower or soybean oil as it's main oil or fat, which is obviously not good. So the differences in the macros versus the quality of the fats. So we're working on it, but it's like changing the course of the Titanic. These things have been available for years and years, and to switch that to a real more modern view and more educated view on which fats to use has been a challenge.

Dave: Well I'm still incredibly excited to hear a hospital doing that, and it's fantastic.

 Now, Dr. Smith, we're coming up on the end of the interview, and I've asked this question on every interview, except this one that I forgot. So I'm not gonna forget this time.

Kris: Okay.

Dave: And the question is, if someone came to you tomorrow and said, "I wanna perform better at everything I do as a human being." Just based on your whole life experience, what are the three most important pieces of advice you'd have for that person?

Kris: Number one is to be open-minded and keeping yourself flexible mentally. So I really believe that. I give a shout out to a great book that I read, Jonathan Haidt, The Righteous Mind. It's about how we think, and how we change. And if it weren't for reading that and some influence of my son about really opening up, and not being dogmatic in our thinking, being flexible in our thinking. I think allowing your brain to contemplate many things in different ways helps you to be alive and free, and see things openly instead of so closed and cynical. I think it helps us.

 Number two is to get out and just enjoy outdoor sunshine, and get out and exercise. I really think mental clarity ... I really couldn't survive my job if it weren't for getting my dopamine levels up, and getting my daily fix of endorphins. I really think getting out there and changing your commute from sitting in a car and listening to radio to walking or running or riding your bike, or getting something outside, and just changing your life, so that becomes a daily part of the routine. And mental clarity that I get after I've just cleared my head after a really tough surgery is incredible to me, how that can happen.

 And then, of course, number three, we're talking about is the ketogenic diet, to me, just embracing fats as fuel has made myself just, I'm doing better in every athletic thing that I do. I'm doing better at mental things. I really do believe it's helped me to be more clear, more focused, remember my patient's names, remember multi-tasking, all this stuff we talked about, avoiding the brain fog. I really think embracing fats as fuel is absolutely key.

Dave: Beautiful. Thanks for answering. Thanks for all of your work at the Barrow Brain and Spine Clinic, 'cause you are embodying those things you talked about. And it's just unusual to find someone who's at the top of their field with a set of training saying, "I'm going to branch out. And I'm going to keep doing what I'm best at, but I'm gonna add these other things in." So I appreciate your open mindedness, your willingness to just pay attention to these things, and to talk about the results, 'cause it's not without risk in your career to be a groundbreaker, and you're definitely doing it. So much respect for that. Thank you.

Kris: Thank you very much. It's been an honor to get to talk with you and to get to know you.

Dave: Likewise. Your clinic is BarrowBrainandSpine.com. Any other places people should go to learn more about the stuff you're doing?

Kris: You know, I did write a book. It's called, It's Not Brain Surgery. It's more about the healthcare system and frustrations with it, but it'll help. There's a lot of kind of autobiographical things in there about what made me become who I am, and my background, and that's maybe helpful.

 We do have on our website, there's an interview that's on that has me talking about my approach to treating patients that I take very seriously. I think it came off pretty well, and they can certainly touch that on our website, so I appreciate it.

Dave: Beautiful. If you like today's episode, you know what to do. Head on over to Bulletproof.com/iTunes, which will take you right to the page, where you can leave a review for the show, which helps other people find a show that's worth doing. And while you're at it, check out Dave.Asprey on Instagram, because I post all sorts of interesting and weird pictures about the things a professional biohacker really does, including most recently dipping raw brussel sprouts in chocolate, not because they taste good or it's good for you, but because I was tricking my kids into trying to eat one of those truffles. So if you want a little bit of humor, and a little bit of biohacking all together, Dave.Asprey.

 Thanks for listening to the show, and I look forward to sharing the next one with you.

Kris: Great. Thank you.