Announcer: Bulletproof Radio, a state of high performance.

Dave: You're listening to Bulletproof Radio with Dave Asprey. Today's cool fact of the day is that those annoying gut bacteria that keep on growing in your gut and maybe doing good things and maybe doing bad things, well, at this point they've been proven to do maybe more good than bad depending on who you are. But if you are an elite athlete it turns out your gut bacteria might help boost your physical performance. That's because scientists just figured out that microbes that grow in the guts of some runners after a marathon boosted the time that lab mice ran on a tread mill. These researchers were from Harvard, which means that they have a cool accent that sounds like they're from Boston, and they published in *Nature Medicine* magazine.

It turns out these bacteria make lactates, which some of the muscles also make during exercise, and they turn lactate into a compound that can help with endurance. What the researchers did and, by the way, I think this is incredibly cool even though it's gross, is they collected stool samples from 15 elite runners for five days before and after they run the 2015 Boston marathon. I want to email what email they sent to the runners like, "Hey, like we're really interested in your poop." But anyway, they found them, and they compared those microbial makeups with that of poop from 10 non-runners. I also want to see those emails, "Hey, is your poop as good as a marathoner's?" I just I don't even know but the marketing for that had to be fun.

Anyway, the runner samples showed a bump in the abundance of bacteria from a genus called Veillonella, and by the way, if I said that wrong, I'm going to get corrected in today's episode by people who really know how to pronounce these lab words. The team also saw an increase in that bacterial species in a group of 87 ultra marathoners and Olympic trial rowers. In other words, if you're doing all this exercise maybe it's just to make the bacteria change, maybe you could just change the bacteria without exercise. Oh, my God, would that be the ultimate bio-act. It would be for me because I'll be like, "Haha, look at you, runners. I just popped a pill and eat some prebiotics or whatever and I'm good to go."

That's my hope, anyway. I'm completely down with cheating and upgrading and actually doing things better than the way we used to do it because it turns out running away from tigers is something we've probably done since before our prefrontal cortex is really fully formed. There's got to be a better way like spaceships or something. Anyway, back to these researchers. They cultured one strain called Veillonella atypica from a runner and fed it to 32 mice. Not all the mice responded to the treatment, which is kind of interesting, but on average, the most that got the bacteria from the runner's poop ran 13% longer in experiments than mice in the control group.

Now, if you're an elite runner, that's kind of something that could be, dare I say, bad ass. See what I did there? All right, sorry. I had to do that. Anyway, this bacteria eat lactates to get the carbon they need to grow and it causes them to make propionate, which is something that raises heart rate and oxygen use in mice. It's also one of the reasons that I tell you and have for a very long time on the Bulletproof Diet eat your vegetables already.

Now, our first guest is Tina Anderson who's a co-founder of Just Thrive Health and she actually was a trial lawyer, which is awesome because I'm going to try and make some attorney jokes during the episode today. After she had her second child, she turned to being an in-house counselor for a family pharmaceutical company and didn't like what she saw and decided that she was going to go the natural health, and is now really focused on fixing people's guts.

She's partnered with Kiran Krishnan who's a research microbiologist, who's really looking at microbiology, something called gut commensal spore bacteria and he's going to really lay down some microbiome bombs, if that's a word about what's really going on in your gut. Also, we're going to talk about something you probably wouldn't imagine but did you know there's a probiotic that can survive being baked. We're going to talk about that one, too. So, Tina, Kirin, welcome to the show.

Kiran: Thank you so much. Thank you for having us.

Tina: Yeah. Thanks, Dave. Great to be here.

Kiran: Beautiful location, by the way. [crosstalk 00:04:25]

Dave: My microbiome is very happy about this place.

Kiran: I can tell right off the bat.

Dave: The 40 Years of Zen is up here in Kenmore, Washington. It's like an idyllic, beautiful place. It's also really peaceful and quiet, which is why it's good for a podcast. There shouldn't be too much background noise or airplanes or anything weird like that.

Kiran: Absolutely.

Dave: All right. Where do we want to get started? Let's start with Tina. All right, there's about a ka-billion probiotic companies. In fact, I've spent at least $100,000 over the last 20 years trying to fix my gut and buying every kind of probiotic out there. Sometimes like I think this works but I don't really know. What led you to think that the world needs yet another probiotic company?

Tina: Right. Well, we were, as you had mentioned in the intro, we were in the pharmaceutical. My husband and I were in the pharmaceutical industry for many years and we just saw all of the abuses. We saw the rampant over-prescribing of drugs. In fact, one story that comes to mind is we had one that's huge bid at one of the largest hospital systems in the country. It was for a cholesterol med. We won this bid and everyone's jumping up and down. They're so excited and the pharmaceutical reps says to my husband, "You know what? What we need to do now is I need to go every single doctor, cardiologist in that hospital system and tell them to lower the number that they prescribe their cholesterol meds to their patients."

We were disgusted. We were like, "This is crazy." We were surprised but yet, when we thought about we weren't that surprised because we saw all of this with different family members and relatives that they would get on one stomach, one medication for their stomach that would lead to another medication for joint pain, which next thing you know in a couple of months they would be on 12 different medications, and they're not getting any better. So we said, "We need to do something that's more in line with who we are and what we want to do."

So we started learning about gut health, we learned about natural health, and focusing more on prevention. What we found is that, like you said, most probiotics really weren't working. They just weren't surviving the gastric system. They weren't doing what our true probiotic was supposed to do. Fortunately, we do a lot of deep thinking and affirmations and prayer and we were able to get the exclusive rights to these strains, these Bacillus strains from London University Royal Holloway, and found out that these strains are actually a completely different category than what we see in 99% of the probiotics in the market.

Dave: So you're the kind of entrepreneur who goes out to what I call real entrepreneurs and finds something, says, "Let me improve that," versus the more common kind of wantrepreneur who says, "Oh, there's something. Let me go do a crappier job and copy someone else's idea and then sort of pollute the business environment with low quality crap." If you don't believe me go to any online market place and look at whether you can tell whether things are good or bad. Unless you're well-educated, you can't because there's a bunch of wantrepreneurs just making cheap crap.

Tina: Exactly.

Dave: So you didn't just packaged up some bacteria. You found something that you thought was better. Why did you think this new kind of probiotic was better than everything else out there? I'm not certain that it is but you have a pretty case for it, which is why you're on the show.

Tina: Right, exactly. Well, because we started delving into the research, and the Human Microbiome Project was recently launched by the National Institutes of Health and told us more about the microbiome than we ever knew before. It also told us that many of these other approach was not working. In order to be a probiotic it needs to arrive alive in the intestines. It needs to actually confer a benefit onto the host, onto the body. Most of these probiotics were just getting into the gut and dying, dying before they ever got into the intestines. So we looked at the research. We found out that these strains have been used in Asia and Europe for over 60 years sometimes as a pharmaceutical and having some really profound results.

Dave: One of the things that really intrigues me is people who are long time followers probably talk about Eye Armor. I'm really into protecting the eyes and that I have a company called True Dark that makes the glasses you always see me wear. But the strain that you use, at least one of the strains, but the patented strain called Bacillus indicus HU36, it makes most of the stuff that's in Eye Armor, which is kind of cool on board. So I'm seeing other strains of bacteria that are out there, I don't know how well

they ... You can make them grow in the gut but they actually make glutathione, which is another stuff that I make.

The idea is wait a minute, I'm all over supplements and I know you guys are supportive of taking supplements as well but if I can cause my bacteria in my gut to make stuff they'll probably make things that aren't in the supplements that are one molecule different but they're also making as needed. So HU36 makes CoQ10, alpha and beta carotene, lycopene, lutein, astaxanthin, and xanthine when it arrives in your intestines. Those are all the eye supporting ingredients that we have here. I like this and this is something that I take, and I also take those ingredients separately because I think having higher levels of those mother nature wants me to have is in my best interest because mother nature wants to kill me because I'm done having kids. Screw you, mother nature.

Kiran: She's mean.

Dave: All right. So that was why I want to have you on the show. All right, that's kind of cool. You've got this stuff that's making crazy vitamins that you really ... Actually, they're kind of expensive to take. I don't think they're making quite as much in the gut as I'm getting in my pills. But I think doing both is the right way to do it and there's other benefits that come from this besides just those compounds. You found something unique and different and so I'm going to take that to market, how did you go about getting exclusive rights to something like this. It seems like it's kind of a viable thing.

Kiran: Yeah. So I had a research company and a development company before we started working on Just Thrive. My role was really to do design and conduct and run clinical trials for nutritional companies. That's actually kind of how I got into the probiotics space in the beginning. There was a large multinational company that hired our group to help them develop a new probiotic. They also wanted us to research the other probiotics in the market in terms of the claims and how they design their products.

Do we need 19 strains? Do we need 25 strains? Is it 300 billion? Or is 50 billion adequate? Then what about the refrigerated stuff versus non-refrigerated. What is the right approach? So we started jumping into that pit to try to figure all that stuff out and we came out of it understanding that most of it is just marketing nonsense. There's very little science to any of it. There's no studies that show 200 billion is better than 100 billion. Or 300 billion is better than 50 billion.

Dave: Hold on.

Kiran: Yeah.

Dave: This is America. If something's good for you, you need more. And if something is bad for you, you need zero, and you are not allowed to have a perfect level between zero and infinity.

Kiran: Exactly.

Dave: Just so we can be clear on that.

Kiran: Yes. We have bad guys and good guys, that's it. It's the megalomaniacal society, right? More is better. Here's the thing, and this speaks a lot to what you talked about earlier, this Me, Too industry that predominates in the supplement world. You've got all of these people that come in, they pop up these companies overnight. They've got competitor A that is doing 15 strains and 50 billion so their whole development process is how do we get 17 strains in 75 billion so we can be a little bit better. But it's the same nonsense.

Dave: Half the strains that they put in there are probably dead because they didn't have quality control. They wanted to make it cheap and they put a nice sticker on it. Yeah, it's a problem but it's better than a pharmaceutical industry so don't regulate it already, all right?

Kiran: Right, exactly. So through our research work we started looking at ... And we ask a simple question like where did our ancestors get their probiotics from? Clearly, we have this amazing commensal relationship with bacteria. We've actually offloaded numerous really important functions to microbes like the microbes that you talked about early in the segment with the runners.

Dave: How do I say that, by the way?

Kiran: Sorry, let me look at it, I'll tell you which one it is.

Dave: I promised people that I was going to, and I tell you listeners hold me accountable, it's V-E-I-L-L-O-N-E-L-L-A.

Kiran: Oh, Veillonella.

Dave: Veillonella. That sounds pretty cool.

Kiran: Yeah, yeah, yeah. Absolutely, yeah.

Dave: You all know it, guys. You heard it here first.

Kiran: So then when we looked at all of these things that we've outsourced to bacteria, because we just don't have the genetics to do it, right? We've got 22, 23,000 functional genes that half of what an earthworm has so we're not as cool as we think we are. The reason we are so cool is because we have three million microbial genes in our system so we count on their DNA for most of our metabolic function.

Dave: You're talking about mitochondria.

Kiran: Mitochondria and just our genetic ...

Dave: Gut bacteria.

Kiran: Yeah, gut bacteria. You know, if you look at the human chromosome, we've got somewhere around 22,000 functional genes. That was actually a problem that came out of the Human Genome Project. The whole idea behind the Human Genome Project was we're going to have two or 300,000 functional genes and we're going to find for every disease we have out there, there's going to be a gene that's responsible for it.

Dave: Bad assumption.

Kiran: Bad assumption. Then going through that whole thing, you come to find out that, wait, we barely have enough genetic material in our chromosomes to actually do what we do to be human. So how are we conducting all of these metabolic functions? As it turns out, we have millions of bacterial DNA in our system that we count on and we use to be human.

Dave: When you say in our system you mean in our gut?

Kiran: In our gut. They translate from our gut all the way throughout the rest of our body. But going back to the spores, how we discovered it, we asked a simple question, "Where did our-"

Dave: People don't know what spores you are talking about so might as well ...

Kiran: Okay. So leading into that-

Dave: This is one of the four strains you guys use. So talk about why do you use spore formers.

Kiran: So the idea there is we were looking at what microbes exists in the natural world that have developed a unique capability of surviving through our gastric system. You know, a lot of people don't understand that our stomach is called a gastric barrier. One of its important roles is to kill stuff that's going through. Our stomach acid is so intense that if we were able to touch it with our finger, we would burn off the tips of our fingers. It's that intense and it kills microbes. That's one of its really important jobs. So all of these other probiotics we're dumping into our system aren't designed to survive through that gastric system.

Then after you get past the stomach acid, the next step is bile salts. Bile salts are really antimicrobials. Then after that, you've got pancreatic enzymes that are also antimicrobials. So you've got this gauntlet that microbes have to get through when they go through the oral cavity in order to be alive and function in the gut. So our question was, are there microbes that can naturally do that? If they do naturally do that, then evolution has intended them to perhaps survive through our gastric system and maybe function in the digestive tract.

Dave: I'm going to ask sort of a disgusting question here but if it's that hard to get in through the mouth, could you just stick a probiotic up your ass and just be done with it?

Kiran: So you could, however, in the small intestine, there's a really important section called the ilium, which has the Peyer's patches. The Peyer's patches are the control center for your immune system. That immune system within the Peyer's patches requires interaction with microbes in order to function appropriately. So if you do it rectally, you will get microbes into the distal bowel but you won't see any benefits from the small bowel and the end the front part of the distal bowel.

Dave: So it's just like, you know, you got to be right in the middle. You can't be on either end?

Kiran: Exactly. Right, yeah. You got to get all the way through. That's the sweet spot in there. So in looking for bacteria that had that capability of surviving through this gauntlet that nature has created, we found that these spores, these bacterial endospores, you call them, actually have developed capabilities of surviving through that harsh gastric environment. So basically, when they leave the body, so they're commensal bacteria, they live naturally in the gut. But when they leave the body, they cover themselves in a protein calcified armor and they can sit in the outside world indefinitely. In fact, the oldest one that was found was over 200 million years old.

Dave: Still alive?

Kiran: Still alive. They could still plate it. In Southern California, they went into deep recesses of these caves, they found salt crystals, which they then melted out and they found bacteria in there. They could still plate the bacteria, it was 250 million years old. These were the Bacillus endospores. So they've been here way before we ever existed and they've kind of helped write the rules of how multicellular organisms communicate. Here's another component of that, this is from space to your gut. So there's this idea like people have been trying to figure out where did the initial building blocks of life come from on earth? That stuff that's in the primordial soup that-

Dave: Panspermia? Are we going again over there?

Kiran: Panspermia. We're going panspermia. I tell you what, so Bacillus subtilis, the main strain that we have in here, there is a study where they took it out in outer space for seven years and Bacillus subtilis can survive in the vacuum and cold of outer space for seven years and survive reentry into the earth and has a lot of those same components that are thought to be the initial building blocks of life on Earth.

Dave: Wow. That idea of panspermia, that maybe the first life forms arrived on a comet or an asteroid or something hit the Earth, no one's probably ever going to prove that but maybe it was one of the spore formers. So you chose this type because of the armor plating. What makes the armor come off of this species so that it'll grow at the right place in the gut?

Kiran: Yeah, so that's a really important question. So they make it past the stomach acid, they get to the small intestine. Once they slightly pass the bile salts when they're in the first part of the stomach, the intestine called the duodenum, they do what I call a molecular handshake with mucosal receptors. So in our mucosa, that mucus lining on our intestinal

wall, there are receptors that we actually express to welcome them in. That molecular handshake that they do with our receptors tells them that they're in the gut and then they break out of this shell within 20 minutes. So imagine one of these spores and there's probably, we're surrounded by them in this beautiful outdoor area around [crosstalk 00:19:19]

Dave: You guys take your own supplements and I'm assuming both of you fart. It was probably ... Not to be rude about it, but it was a *Wired* article that says, "You are surrounded by a cloud of skin and fart bacteria to the point that they can identify who you were two hours after you left the room by sequencing the DNA of the bacteria in the room. So that's kind of gross, but like, hey.

Kiran: It's everywhere. If we have time, we'll talk about the microbiome cloud that exists in people's households that are really important. But you know, when you look at nature around us and we have these spores all around, you could go for a hike in the woods here, come across one of these spores, hopefully, get it on your hands and get it into your mouth, it could have been sitting in the dirt for a million years inactive in that spore form. 20 minutes within getting into your gut, it'll break out of the shell and go to work for you as a probiotic.

Dave: Wow. There's a bunch of studies back we've done some about forest bathing. All right, we have these crazy armor plated immortal bacteria that are beneficial, but I mean, isn't there a downside? I look at how much of my life I spent with the ability to clear a room because of stuff going on in my gut that was truly, truly unnatural. So I dealt with that and my gut was wrecked. Which is why I became such an aficionado of different probiotics and ways to fix the gut. So clearly, things can go bad in the gut. How do you know that the species you're using are the right ones and that other ones won't make something, maybe it's called SIBO, small intestinal bacterial overgrowth, which a good number of listeners have and some know about?

Kiran: The only way to know is to study it. So we can't make assumptions when it comes to microbes and these really complex microbial communities. So we've done about 16 trials so far. We just published one yesterday on IBS, actually. So we're putting a lot of effort into the science to understand microbial communities, microbial community structures and how they work together. As it turns out, these particular microbes in the Just Thrive probiotic have a policing effect in the microbiome.

So we published a study about a month ago that showed that when you add these Just Thrive probiotics into the microbiome, you actually increase the diversity of the microbiome by almost 45%. So we're taking a microbiome that is less diverse. We know, diversity within the microbiome is paramount to health and wellness and even longevity.

So what's so interesting is that you could put four strains into your system and before you put them in there, you have all these undetectable levels of all of these different bacteria, three weeks after putting them in there and now you have growth of all of these species that you previously couldn't detect, who are at such low levels that they were completely nonfunctional. So these bacteria act almost like orchestrators of the

microbiome. We've outsourced that job to them in large part because there's no way for us to indigenously do that outside of diet changes, lifestyle changes, and then introducing the right microbes.

Dave: So if the diet is completely consistent and you just take the Just Thrive combination here, your studies show a 43% increase in diversity?

Kiran: Absolutely. In as little as three weeks.

Dave: Without any increase in fiber?

Kiran: Without any increase in fiber.

Dave: Man, wish I had known that in Super Human.

Kiran: Here's the other part of it. So when you look at diversity, there's two components to diversity that confer health. The first component is the number of species, that's the richness in your microbial pool. The second one is uniformity. Uniformity is also really important. So there's a couple of indexes that measure diversity is called the Simpson's reciprocal index. All of those have uniformity in the component as well, because uniformity is very important. So you could have lots of different bacteria but if 20% of them make up 80% of the actual number of cells or volume of bacteria, then you're still not achieving total diversity the way you should.

Dave: Because it wasn't spread out the way it should be.

Kiran: It wasn't spread out.

Dave: Yeah, the fact that it's present doesn't really matter if it's only 0.1% of what's [crosstalk 00:23:31]

Kiran: Exactly, yeah. Because then its functionality is attenuated enough where it's not really contributing to your overall function. So one of the things that we saw with the Just Thrive bacteria is that they get in there and they also create uniformity, which is so important in the microbiome.

Dave: Okay. So to make sure you have high diversity and equal representation, well, maybe not equal but appropriate representation.

Kiran: Yes, exactly.

Dave: Okay. Got it. All right. That's pretty incredible. I mentioned earlier what attracted me to the Just Thrive formula was the ability to make all those carotenoids, those red colored compounds, like the same stuff that you'd find in shrimp or in krill, which is in the omega three formula.

Kiran: [crosstalk 00:24:14] discovered that.

Dave: In krill?

Kiran: Yeah. In shrimp, krill, in salmon, and trout. So the idea was this, and this was done through a huge European consortium study called the Color Spore Consortium. So it costs somewhere around six and a half million euros, it took about eight years and 80 researchers in different institutes working on this. The idea was where do shrimp get their carotenoids from? Where do salmon get their carotenoids from?

Dave: Supposed to be from algae, though.

Kiran: So that's what they were trying to figure out, right? They were trying to figure out ... Because they don't eat colored fruits and vegetables, you know, so that's clearly not a source ...

Dave: My salmon are eating blueberries.

Kiran: Your salmon probably are. Your salmon are a whole other levels. But the regular people salmon are just ...

Dave: Mine are super salmon.

Kiran: Superhuman salmon. So what they figured out is, they are getting it from algae to a certain degree but they're not absorbing carotenoids from algae. What they're doing is there's actually microbes that will convert metabolites from the algae into carotenoids. So they found that many of the species that express a lot of carotenoids on their skin have bacteria, typically spore-forming bacteria that live in their gut, that produce such high levels of carotenoids that it expresses on the skin and that also denotes health to the species.

Dave: That is blowing my mind because I mean, I'm very well-read on this stuff and I've never heard that and I've never read that anywhere. So it's the bacteria in the salmon that are converting the algae into the carotenoids that causes them to turn, the flesh to turn that nice pink color.

Kiran: It is. Same with flamingos. So flamingos, people know that they become pink when they go to their nesting area before they find a mate. A lot of the mate selection is based on how pink they are. But flamingos are naturally white, but they become pink. Their fathers express that pink color based on how much they feed and they feed off of these little krill kind of, or not krill, but little brine shrimp. These tiny little brine shrimp.

Dave: Sea monkeys.

Kiran: Exactly, sea monkeys. So the brine shrimp inside them have these bacteria. So they're actually using the brine shrimp as a vector for the bacteria to get in and then when the bacteria get in, they express the carotenoids, it makes the flamingos really pink. That is programmed in their mind to denote health and the ability to procreate for the mate selection process.

Dave: Is this sort of horrifying? I mean, if you think about it, there's a whole book and I'm blanking on his name right now. It's like the parasites that control us or some sort of nasty thing. You probably read it. You know I know that.

Kiran: Yes, I know you know.

Dave: It's kind of horrifying because these nasty little single celled bacteria or worms and amoebas and protozoans and whatever, they are controlling us at a really horrifying way. Like one example there, they found that 90% of the fish get eaten by birds of prey are infected with something that causes the fish to swim to the surface so they get eaten so that then the birds will poop the parasite eggs onto a snail somewhere else. But something's controlling their mind. So is it possible that the brine shrimp are actually in-charge of flamingos and they're just ...

Kiran: Absolutely. When we look at biology, what's fascinating is we always confer that control comes from the most highly evolved creatures.

Dave: It's totally not true.

Kiran: It's not true. As you go deeper and deeper and you get down to the cellular level, it's the little stuff that controls everything.

Dave: So we should declare war on brine shrimp.

Kiran: Exactly. Yes. I mean, at least we should put them on the Do Not Fly list at the police.

Dave: How smooth.

Kiran: See, I'm a super nerd that has some humor there as well.

Dave: So I'm looking at the basic algorithms for these things. It seems like the lower you go, the more in control the algorithms are. So now we have a, you know, million-year-olds armor plated immortal spore forming little shithead bacteria that might be controlling everything we do. Does that scare you?

Kiran: You know, no, because so far they're doing all the right things. So they're helping-

Dave: But they don't want to die.

Kiran: Exactly. We are the host. What's interesting about them is they do something called quorum sensing, these microbes. The way they will use in the prescription world for the last 60 years is ... These drugs are still in the market today, they will use to treat dysentery. Interesting story of how that was discovered. So when the German army in World War II were in North Africa, most of the German soldiers were dying from dysentery rather than the war. They realized that the locals there, when they would get upset stomach, the first thing they would do is they would eat dry camel dung.

Dave: I thought that was fresh camel dung.

Kiran: So what they would do is they would take fresh camel dung and they would dry it.

Dave: They would dry it.

Kiran: They would dry it, yeah. I think that made it more palatable.

Dave: I thought it was a smoothie.

Kiran: Then they would keep stores of dried camel dung.

Dave: It's better than a kale smoothie.

Kiran: I'm in total agreement with that. Certainly no brine shrimp in there. Those damn brine shrimp. But then they would eat that, so then Germans took back the dung and then there was German pharmaceutical company actually isolated Bacillus subtilis, one of the main probiotic strains in this product, as being the antimicrobial bacteria. So the bacteria has the capability of going in, reading the microbial environment ... Every bacteria in your gut and everywhere in the world puts out a chemical signature. They can read the chemical signature of the bacteria. They can find the pathogenic bacteria, go sit next to them, and produce up to 20 different antibiotics in that little area, killing off that bad bacteria. So that's how they were first discovered and used in the pharmaceutical space.

Dave: I also missed that point. I know about the camel dung story because it's sort of like the birth of probiotics. It was close to some British officer going, "How dare the primitives [inaudible 00:30:18]." Everyone else who didn't even died of camel poop. I'll have my little finger up when I do it like that.

Kiran: Look at the savages.

Dave: Yeah. Then I was just noticing what works. But I did not realize that that was where Bacillus subtilis came from, because I read about that in *Super Human*, too. Although you have a specific strain called HU58 in the Just Thrive formula, there's hundreds of hundreds of different strains, how did you arrive at the HU58?

Kiran: Yeah. One of the most important qualities when you're looking for a strain is its ability to colonize in the gut. You can find many different Bacillus subtilis, you know.

Dave: It's all over the place.

Kiran: Yeah, they're all over the place. But what we did is looking at screening many of these strains, many of them don't express the protein to actually bind in the gut lining and exist there. So that is the first fundamental check you have to do. A lot of that work was actually done by Royal Holloway, London University. We worked with Dr. Simon Cutting there, who was like the preeminent spore researcher in the world. The reason why the

strain is called HU is that that stands for Holloway University. Strain number 58. So he had isolated hundreds and hundreds of subtilis strains, screened them all for which one had the best function in the gut, and this one has amazing robust function in the gut.

Dave: Okay. So you basically went deep with the scientists who are looking at these and said, "All right, that's going." That's a pretty good mix of things there and I've definitely started taking it. I have not quantified any changes in my gut bacteria since I started taking it just because I haven't done a poop test recently. I have four Viome test kits at home, I just have to decide to send them in. Okay. That's the fascinating ... You talked about something called quorum sensing and you're saying that the bacteria strains you have here are helping with quorum sensing, somehow.

Kiran: They do. So not only can they read other bacteria signals and figure out what other bacteria are doing, what other bacteria are there, they also facilitate language within the bacteria, communication within the microbes partly to kind of coordinate efforts within the microbiome. So for example, one of the things we tested, which is really important not only to our mitochondrial health and so on, is the production of short-chain fatty acids, butyrate, [crosstalk 00:32:38] acetate.

Dave: I have to pause for one second there. The reason that you care about butyrate specifically, if you listen to this, is butyrate is highly ketogenic. So the two fatty acids that are going to raise your ketones the most are the stuff in Brain Octane, which is caprylic acid that's processed a specific way and butyric acid or butyrate. If you read the Bulletproof Diet, you know how important butyrate is. If you didn't read it, listen to what Kiran's going to say.

Kiran: Butyrate controls everything. Our localized and systemic metabolism. So for example, butyrate turns on the genes that tells your body to improve insulin sensitivity. It turns on something called AMP kinase, which turns on fat burning in all of the cells across your body and it all starts in the gut. So it's so important. Butyrate also is a strong anti-inflammatory. It's also the main fuel source for all of the cells that line your intestinal lining. You know, the enteroceles that line your lining. But one of the things that we want to see is that, you know, big source of butyrate is through your microbiome and so we want to see, can these strains actually increase the coordination of butyrate production by all of the butyrate producers within the microbiome?

Dave: So you're not saying do our probiotics raise butyrate but when you take them, do they cause the system to create butyrate?

Kiran: Exactly.

Dave: That's cool.

Kiran: Here's what's important about that is there's 100 trillion bacteria in the gut, right? Any one species going into that amazing pool, if whatever function they do cannot really have a massive effect, because they're a tiny species in the pool of 100 trillion cells of bacteria. Their real profound effect comes from orchestrating the rest of the

microbiome to also follow suit. So we've tested the butyrate production capability of the strain in Just Thrive probiotic and we've seen that they do produce butyrate.

But when you put them into the microbiome, what you see is about 150% increase in butyrate production in two or three weeks by all the butyrate producers in the gut. By killing bacteria by akkermansia, by ruminococcus, all of these other microbes that are the predominant butyrate producers, all in coordination start increasing the butyrate production in a massive way.

Dave: I tried to convince people at Bulletproof to name our conference rooms after species of gut bacteria, the ones you just mentioned, but no one could spell them so it failed entirely. But you did mention akkermansia in there, that is something that is in the new *Super Human* book. Talk about akkermansia, I probably know you're going to say it because I wrote a chapter that included a bunch but talk about that one and then talk about what the Just Thrive probiotic documents if you have data on it.

Kiran: We do. So that's a study we've published a month ago. It just came out.

Dave: Oh my god. Okay.

Kiran: Hot off the press. Akkermansia is one of those keystone strains. Within the microbiome, there are these players that we call keystone strains or keystone species because their job is so important not only for the human host but also for the maintenance of the rest of the microbiome. One of the things that akkermansia has been studied extensively for is it's inversely correlated to everything under the metabolic syndrome category. You know, diabetes, obesity, heart disease, all different forms of aging, inflamm-aging, which is the whole driving of aging through chronic inflammation, akkermansia is inversely correlated. Meaning high akkermansia, you have protection against all of those things.

Akkermansia is a obligate anaerobe, meaning it cannot breathe in oxygen so you can't grow it in a factory and take it in as a probiotic. So we wanted to see can we actually increase the growth of these keystone strains by adding in these spores because they seem to be orchestrators of the rest of the microbiome. So in our study, we actually looked at akkermansia growth in human subjects and we found that we saw 1,000 fold increase in akkermansia in the four-week period in humans, in healthy human subjects.

Dave: Is that because those healthy humans only had one and it went from one to 1,000? Because 1,000 fold is kind of a big deal.

Kiran: It's huge. It's a three log increase, right?

Dave: People should actually live longer with that big of a change.

Kiran: That's absolutely true. So most of these people were considered to be healthy humans because we didn't pick anyone with any particular disease state but we know what healthy human actually means. Now they came in with pretty low levels of akkermansia.

One of those subjects actually had undetectable levels of akkermansia. Four weeks later now has really high levels of akkermansia.

Dave: Without fasting?

Kiran: Without fasting.

Dave: Because fasting or intermittent fasting is the other ways to raise it and that's a big part of what I read about in Super Human.

Kiran: Which is so important, you know, because not only does intermittent fasting increase akkermansia, it does that because it allows akkermansia to eat the top layer of your mucus. But that eating of the top layer of the mucus stimulates a gene called a mutigene, which causes your goblet cells, some of the cells that produce mucus to produce new mucus. So actually recycling your mucus layer, which is super important to clearing all kinds of toxins and infections and all that from your body, that's the job of akkermansia.

Dave: I just registered upgradedmucus.com. So that is actually a very eloquent explanation of what akkermansia does. Okay, we've got to go a little deeper on LPS. This is another chapter in Super Human.

Kiran: Awesome.

Dave: It's something in the Bulletproof Diet. I read about that extensively. That was like 2014, the first big keto book. The idea there is that lipopolysaccharides are made by the bad bacteria in your gut and then they cross the gut barrier. What do they do when these endotoxins float around the body?

Kiran: Enter the system. So they are incredibly pervasive. So here's some of the things, just the highlights of what they can do. Number one, they can enter the brain. So they cross the blood brain barrier, they can get into places like the amygdala, the hippocampus, they can severely create adverse effects on memory, recall, cognitive function, IQ reduction. They are the perpetuators of the inflammation associated with Alzheimer's. That was a study in September 2017. They showed that the inflammation that starts the process of Alzheimer's comes from LPS from the gut, they can get into your joints and soft tissue and trigger auto immune response, they become the most chronic inflammatory source in your body. That's a low grade chronic inflammation.

Dave: So now do you see why I call it bacteria in the gut little bastards? That's what they do. They're not your friends. Some of them might be your friends, some of the time if it's in their best interest.

Kiran: Exactly.

Dave: They're the most psychopathic friends you've ever had.

Kiran: They're very selfish. Even the things that they do that are beneficial to us, they're really doing it for themselves. We just happen to reap some benefit.

Dave: We get the dregs.

Kiran: Exactly, we do. Then this LPS also gets into your mitochondria, it shuts down mitochondria. It can get into and interfere with dopamine receptors, serotonin receptors and it can [crosstalk 00:39:40], make you depress, make you anxious. Exactly. Then in your gums, it can cause gum disease and gingivitis. It gets everywhere. It's so pervasive and it's coming from your gut leaking through. So our focus was can we stop LPS from leaking from the lumen into the circulatory system? We saw over a 60% reduction in LPS translocation, meaning leaking through in 30 days of just taking the probiotic, not doing anything else. So imagine if you do all the other stuff that you talk about ...

Dave: What was that again? It was ...

Kiran: 60%.

Dave: 60% reduction in all kinds of LPS throughout the body?

Kiran: Absolutely.

Dave: Jesus.

Kiran: And all of the inflammatory markers that LPS upregulates and all of these inflammatory markers are the ones associated with all the chronic illnesses. One really interesting facet that we saw, which we did not expect, but we saw was the function of ghrelin, the hunger hormone. So we took these subjects who had high LPS. They would come in fasted, so we'd measure the hunger hormone levels, and it'd be high, as expected. Then we'd give them a 2,000 calorie meal and the hunger hormone levels would barely drop, which means that the gut and the brain are not communicating and telling the brain, "Stop producing hunger hormones, we got enough calories." 30 days after taking the probiotic, when they would come in fasted, hunger hormones being high, they would get a meal, hunger hormone levels are dropped by 50%. So now we're seeing that restoration-

Dave: [inaudible 00:41:05] do.

Kiran: Absolutely. We're seeing that restoration of the gut-brain communication, where the gut can now tell the brain, "Hey, we've got enough stuff. Stop producing the hunger hormones, stop overeating."

Dave: Wow. But you talked about LPS as well. There's this one kind of MCT oil with eight carbon chains. Again, this is unrelated to anything that Bulletproof may or may not do, that may or may not be in any particular coffee blend that's famous, is it is shown to protect the liver, at least in one study, probably in animals from LPS induced toxicity. So

what's going on here is how do we reduce the formation of lipopolysaccharides in the gut and how do we reduce the absorption of them if they are produced?

Kiran: Yeah. So the important thing about the fatty acids, so one of the ways that that fatty acid works to reduce LPS ...

Dave: We're talking about the CA, caprylic acid. That one?

Kiran: Exactly. Yep, absolutely, which may or may not have been anything we're talking about but ...

Dave: By the way, this show, just so everyone know, this is my show, not Bulletproof show.

Kiran: So it actually creates a surfactant like with bile and that fatty acid, because LPS is a fatty acid, it basically grabs LPS and takes it out of the system.

Dave: Can we rip on keto for a minute here?

Kiran: Yes. Yes.

Dave: Okay. Hey, guys, did you know that if you eat a high fat diet without enough dietary fiber or other binders in the gut, will escort LPS into your system and raise levels dramatically in your brain?

Kiran: Yep. So that's actually how we induce LPS in detoxing in the trial. We feed them a high fat meal and you get a six-fold increase in LPS in the serum within five hours after that meal. A six-fold increase. In fact, the university that we did the previous study where they showed that it took the body almost two weeks to recover from a single meal when they have that kind of LPS translocating.

Dave: So one approach would be going a low fat diet. We know what happens when you do that. Generally, metabolic mayhem because ...

Kiran: Absolutely.

Dave: Wait a minute, aren't all the cells in the body made out of certain kinds of fat?

Kiran: Yeah.

Dave: So then you could say, "All right. Let's talk about what kind of fat because different fats, oh my God, could they do different things?"

Kiran: Right. Yeah, absolutely. You know, and then, like you said, the really important thing is that combining it with the plant-based materials, you know, because the microbes in your large intestine produce protective compounds against all of this dysfunction. You know, the short-chain fatty acids in particular and the upregulation of the tight junction proteins, those junctions that maintain the barrier of the intestinal lining and then the

production of butyrate stimulates the formation of mucus. So that's the biggest source of mucus stimulation with akkermansia is the formation of butyrate. So all of those barriers now function better, and your body can handle some of that fat without increasing LPS translocation.

Dave: All right. So let's pick on Bulletproof coffee for a minute here. I have some theories here but you may different theories and I have no idea what you're going to say. That got some saturated fat in there, it's called butter, right? It's got some Brain Octane, which is technically a saturated fat. Wouldn't that escort LPS into the blood?

Kiran: So it could if your microbiome is unhealthy but people can have a protective microbiome if they have a full diverse diet like you recommend as well.

Dave: So I think it's important, one of the things that just ... I'm actually way more in alignment with vegans than they think because I always like to tease them on the show, even though yes, I have vegan friends and I was a raw vegan for quite a while. It is that I will not eat industrial animal meat, period. I don't do it because it's bad for animals, it's bad for soil, it's bad for water, it's bad for the planet, and there's antibiotics in there, which is bad for me, it's bad for my gut bacteria. So if you're going to say, "I'm going to go eat French fries." Okay. There's a whole bunch of problems there, there's lectins from the potato is going to poke holes in your gut and the fats are super damaged and they're going to escort LPS through.

If you eat those with a nice burger that's made from industrial meat, now you've poisoned your gut bacteria with antibiotics that are present in the meat. Well, who knows what's going to happen? My theory, and this is what I want you to either support or reject with, I'm totally fine with whatever you say here. So I looked at LPS the first time I put butter in a blender and like it was kind of a, "Am I going to die here? [crosstalk 00:45:51] This is good. I just come back from Tibet. I got to try this." I was aware of the LPS thing, but I was also aware of what happens when you use the specific types of fats that protect the liver from LPS.

Also, coffee itself is a plan- based compound. There's a little bit of fiber in there and certain kinds of gut bacteria like to eat polyphenols. This is the bacteroidetes. Firmicutes, they hate fat. So, it turns out the theory, one of the six about why clearly Bulletproof Coffee people have lost like a million pounds according to estimates out there on the Bulletproof diet using Bulletproof coffee and things like that. So clearly, it's doing something that works but is it based on leptin and ghrelin and CCK or is it based on modulating the levels by suppressing gut bacteria using fat and feeding bacteriodetes with polyphenols at the same time? That's the theory I want to test with you. Is that a decent idea or is it something else?

Kiran: You know, it's really interesting. So when I first learned about Bulletproof Coffee, it was a fascinating combination to me. Because rarely do you get the combination of the caffeine and all the polyphenols that come within the caffeine with that kind of fat in anything.

Dave: It's not a natural combination.

Kiran: Exactly. You don't get it. I've done it myself. I used to be a very competitive cyclist so I used to do it before going out on training rides and racing and all that.

Dave: Did it work?

Kiran: It worked. Absolutely. Because I was very big on not using gel packs during the rides and during races so I wanted to fuel with something else. The effect was really quite significant. I think a big part of it is the caffeine portion of it and what all comes within coffee because one of the big villains in all of this fat metabolism issue are microbes that produce secondary bile salts from bile secretion. But when you have secondary bile salts, that actually dramatically increases inflammation in your gut lining and actually can make your gut more permeable and it creates dysbiosis in your large intestine. You know, the assistance of the coffee, which is really interesting, because the polyphenols and the components within that coffee actually inhibit the production of secondary bile salts.

Dave: I didn't know that either. Wow. I'm kind of well-read on coffee. All right.

Kiran: Then that's one of the really important facets of good organic coffee is that it actually has that mechanism of action of preventing secondary bile salts, which can then reduce the inflammation in the gut and actually allow your body to utilize fat the way it's supposed to. Also, here's the thing, the secondary bile salt producing bacteria are the gram negative bacteria that contain all the LPS. So the coffee in itself can inhibit the LPS-producing bacteria so inherently, you are reducing the amount of LPS that's even there in the small intestine. So you're probably negating the absorption of it in a significant way just by that combo.

Dave: That is a seventh theory about why [crosstalk 00:49:02] that I missed. Goddamn it. Wow. Okay. You just blew my mind on that one entirely. Okay, so secondary bile salt inhibition. The other thing, we didn't know this when I wrote the Bulletproof Diet because the research hadn't come out of UC San Diego yet, but the amount of caffeine in two small cups of coffee doubles ketone production. If you do that, you're saying, "Wait, I got butyric acid in the butter," which also raises ketones and you got Brain Octane that raises ketones, you're sort of thinking, "Okay. If ketones go up to anywhere between 0.38 and 0.5 millimoles in the blood, that lowers ghrelin and raises CCK. That's another theory and you got the bacteria theory. I don't know which one it is, but I was hoping you could tell me. Maybe it's more than one but something cool is going on.

Kiran: Yeah. The butyric acid is huge. The butyric acid is the thing that upregulates the AMPK, which makes every cell in your body burn fat more, it upregulates these peptides called GLP-1, PYY, which increase insulin sensitivity. In fact, the main drug use for insulin for diabetes, Metformin, a couple years ago, they figured out the way Metformin works is by increasing butyrate production.

Dave: Holy crap. I was about to say tell me about AMPK and Metformin and your take on coffee, caffeine, butyric acid, and all that. But you're saying that Metformin increases butyrate production?

Kiran: That's its main method of reaction.

Dave: I thought it was via AMPK stimulation?

Kiran: No. So the Metformin actually changes the microbiome and increases butyrogenic bacteria. However, because of the nature of the synthetic drug, the effect wears off over time.

Dave: It also seems to permanently inhibit your vitamin B12 absorption after you stop taking it, which is bad.

Kiran: Right. So you have temporary benefit from it. That's why doctors who manage diabetics know that when you started Metformin, typically they start around 400 milligrams, and then they have to keep going up and up and up and up. Then as they go up, it creates more dysfunction within the microbiome but the initial help is from the increase in butyrate. So if you're getting your butyrate from your butter or your probiotics like in Just Thrive, you're negating all of that.

Dave: Well, news flash. For cheaper than at least named brands, Metformin, you can buy butyric acid. It smells like nasty cheese and socks. You can take it in capsules. I used to do it quite a bit. I still do it when I fly and things like that, because I know it raises ketones, but it makes your hands smell like socks. So you can measure it, that's I think a $200 test with Viome, or you can take a supplement and say, "Well, the supplement is shown to do this in studies. I would assume it's doing it for me." But stop eating industrial animal meat because it won't work. I don't know if it actually doesn't work. Your stuff might work with that stuff. I don't know.

Kiran: It conferred a protective effect.

Dave: Even if you're eating garbage?

Kiran: Even if you're eating garbage. So the way we stimulate LPS is we give a high fat, high caloric meal but it's a fast food meal. We see this huge increase in LPS in the serum. Then 30 days later, we did the same meal challenge and then the LPS is gone. So even eating that Happy Meal stuff.

Dave: Because you clean out the bad stuff.

Kiran: Exactly. It can be protective but we wouldn't encourage you to eat shitty meals all the time.

Dave: I want to be kind of straightforward. Look, if I can take some sort of genetically engineered crazy human-produced probiotic that doesn't exist today, that would allow

me to eat crap. Like one of those fake meat burgers that's entirely processed food, it's like a Snickers bar but not as good, I would love to be able to ... In fact, that would liberate a lot of humans who just can't afford, grass-fed whatever stuff. Let's create that but at the same time, you simply must not eat industrial animal food because even if your body can handle it because you've hacked your gut bacteria, trust me, the soil and the water and the animals can't handle it so don't do that because it's unethical and it's bad for you.

Kiran: Absolutely. Bad for the world.

Dave: Yeah. We must stop that behavior. Distributed agriculture to build soil, which sucks carbon out of the air, that's what animal poop does and you cannot have your vegan kale salad or whatever, without crap from animals in it and someone has to eat the animal. I'm raising my hand to do that. Sorry.

Kiran: I'm with you.

Dave: All right. Let's talk a little bit about what happens when you eat too much protein.

Kiran: Yeah. I love it. I actually just did a webinar on this too much protein thing. Number one is, protein can be problematic in a few different ways. Protein stimulates a type of fermentation called probiotic fermentation. These microbes that break down protein will create ammonia, they'll create p-Cresol, they'll create aldehydes, and things that are just very toxigenic. In fact, a great example of this type of putrefication fermentation that goes on is in people with a condition called hepatic encephalopathy.

Dave: You mean bodybuilders? Just go to a gym.

Kiran: That's the clinical term for bodybuilders, yes.

Dave: Just kidding.

Kiran: Liver failure. If you're on the road there.

Dave: I was just joking about the high protein diet well-known effects on farting.

Kiran: Exactly. You know, so we did a study, actually, which we just submitted for publication on liver failure patients. What's really interesting about them is if they get two or three grams too much protein in any given day, they can die within hours. The reason for that is their liver is obviously not functioning because they're end stage liver failure. So they get too much protein, which can be just a few grams, ammonia is created in that protein digestion, p-Cresol is created, all this inflammation happens, then it's the job of the liver to clear that ammonia from your body.

But if your liver is not working, they can't clear the ammonia, it's going to get into your blood, and then it seeps into the brain and creates swelling in the brain and they can die very quickly. So we wanted to see, can we use a probiotic to actually bring down that

kind of putrefied fermentation from protein and we saw over 40% reduction in blood ammonia levels in end stage liver failure patients when you take the spores that are just the right probiotic. That's so important because what people do is they hammer their body with protein with the idea that it's just globally good for you.

Dave: Milk protein isolate and ...

Kiran: Exactly. Brand chains this and that, you know.

Dave: It actually sucks the polyphenols that are in coffee and spices and all the good stuff. When you take milk protein isolate in coffee, it binds to the coffee polyphenols, so you cannot absorb them and people are doing that. You should read the manual before you try to make stuff.

Kiran: Absolutely. Then, of course, you're facilitating this putrefication type of fermentation that, of course, not only in the small bowel but in the large bowel. Then eventually what it does is it creates lower diversity within the microbiome because there's only certain types of bacteria that can metabolize protein that well. So over time with this crazy amounts of protein that people are taking, they end up reducing the diversity within the microbiome, hurting the liver, because the liver has to clear all this stuff that's being made, increasing leaky gut, and creating this toxigenic thing.

Dave: A 400% in increase in all causal mortality when you go over 20% protein. Talk to me about vitamin K2 and how that's formed in the guts and the different flavors of K2. I'm a huge fan of supplementing K2 and making it on board. So how does that work?

Kiran: Well, K2 is such an important vitamin. I actually call it the quintessential vitamin supplement because we don't get enough of it in our diet certainly anymore and supplementing it, getting endogenous production is so important. We started studying, so these Bacillus endospores make very high amounts of K2. In fact-

Dave: These are the ones that are in Just Thrive.

Kiran: In the Just Thrive Probiotic. In fact, the commercially available natural forms of K2-7 come from Bacillus fermentation. So we actually do a fermentation process, extract the K2 out of the fermentation media, and sell that as a commercial source of vitamin K2, and in particular K2-7. So what they make is a seven version. What you find in animal tissue is the four version, you know. So you work with both.

Dave: I mean you can get K1 from kale, which does mean to squat, other than give you kidney stones. No, that's the kale, not the K1. Sorry. I'm like, "I'm just done with kale." Anyway, so there's K1, which doesn't count. Then if you want to get K2, there's K2-4 and K2-7. Apparently, they're both clinically active but the only real nutritional sources that are concentrated are natto and some really aged cheeses. Natto, if you've never had the joy of throwing up in your mouth, it is a traditional Japanese food which some people, including my wife, really like. It's basically like snot mixed with ground nuts.

Kiran: It is.

Dave: It's horrifying. Just horrifying tasting, to the Western palate anyway. I respect you if you can eat it. I do eat fish eggs and all sorts of unusual foods but that is one I'm just, you know, not going to do even though it has health benefits. Other than that aged cheese, natto, where else can you find K2 in food?

Kiran: So the K2-4 form you can find in organ meat. So if you eat grain, if you eat liver, all of those things, you can get that in there. Animal fat has some amount of K2-4.

Dave: Grass-fed, especially. Okay. Then you have the seven, which is bacteria fermentation-based, which is made in the gut.

Kiran: In the gut. Yeah. Well, we sort of studying, "Why is it that bacteria make K2?" Because we know in humans, K2 builds bones, it removes calcium in the arteries, it increases neurological function and so on. What are bacteria using K2-4 for? We actually started studying this about a decade ago. We realized that bacteria use vitamin K2 as an electron transporter in their version of mitochondria. So our question was, "Does K2 function as an electron transporter in our mitochondria?" Because our mitochondria are ancient bacteria.

Dave: We normally use NAD for that.

Kiran: Absolutely. So what we found is we did a study with Texas Tech, there's a machine called a sea horse machine, a very expensive, half a million dollar machine, where you can study individual mitochondria and put all kinds of substrates in and see how it impacts the bio-energetics of the mitochondria. When we put K2 into the mitochondria, we saw a 40% increase in ATP production.

Dave: Holy crap.

Kiran: 40%.

Dave: In our mitochondria?

Kiran: In our mitochondria. We use neuroblastoma cells. So we're blown away by that. Then we dug into the research and as it turns out in the 1950s, a researcher wrote a paper that vitamin K2 facilitates redox reactions in the cell and probably will increase ATP production. Then a decade later, another scientist came out and said, "That's probably nonsense." So nobody looked at it after that, you know. Nobody had the technology to test it then.

Dave: Do you know of a safe upper limit for K2 or should I eat like a half a kilo a day?

Kiran: So we have not found an LD50. So that's a lethal dose 50 for vitamin K2. We've in fact, published two toxicity studies on K2 where we've gone as high as 2,000 times recommended human dose and there's no mortality or adverse event with K2. That's of

course, an animal study. So basically, what's happening is the K2 gets stored in the fat in the body, and either it's used or it's not used. If it's not used, it's just sitting there. It doesn't confer any toxicity in the body.

Dave: There's something else that we haven't talked about that I thought was particularly cool. That is it says in big letters, "No refrigeration needed, no more probiotics diet." I've always wondered, if they die if they're not in the fridge as soon as I put on my gut, they're going to be 98.6. But let's not think about that. That's not to say they can't work, some of them clearly do work. I know people have been cured from all sorts of bad things with this. But it says here that they're stable up to 455. So will they withstand steam?

Kiran: Good question. Steam, yes, because of the calcified armor coating. So steam is pervasive to many bacteria because it can make its way right through the phosphor liquid layer. These guys can withstand steam as well.

Dave: So I don't know if I've ever, you know, come clean about this but I think I was a samurai in the past life. Because if I'm going to drink alcohol, which isn't very often ... I like sake. But I also really like sushi. Everyone knows that. But there's something called mochi. If you're listening to this and go, "Mochi ice cream." I know that. Mochi is actually the layer of rice around the ice cream. In order to make that, you take a special kind of rice and you steam it. You can't boil it, you have to steam it a certain way and then you pound the crap out of it.

So that's what they would make kids do in ancient Japan. So you'd steam it then you have to like hit it for hours with these big wooden pole things. You get this gooey, sticky stuff. Now, we all know that cooked and cooled rice makes resistant starch, which feeds gut bacteria. So what I do is I do that and then I throw in some Brain Octane because hey, that's good stuff and I throw in some extra resistant starch and prebiotic stuff. What I have not been able to do up until now though is because it comes out of this ...

I have a machine that does [inaudible 01:02:43] and make my kids pound it. But I'm really interested in being able to, after I've pounded the rice to actually add the Just Thrive Probiotic to it. Even though I bake them later or do whatever with it, it would still be there and still be active. So I would actually have a source of resistant starch from cooked and cooled rice ... We know if you cook and cool rice with either coconut oil or Brain Octane, it makes extra resistant starch. But what would that actually work? I could bake this stuff along it's under 455?

Kiran: Yeah, absolutely.

Dave: Does it taste like crap? I've never actually opened a capsule.

Kiran: No, it has actually no taste to it at all.

Dave: So guys, listen up. What if you were to just open a probiotic capsule and pour it in whatever you were going to bake or cook? It seems like that might be kind of a cool way to just get it in there.

Tina: Give it to your kids.

Dave: Yeah, your kids ... Okay. The 455 number really caught my attention because I'm thinking, "What can I do that's weird with that?" And that was the weirdest thing I could think of.

Kiran: That's pretty weird but also very awesome anyways.

Dave: All right. Now, can I do lines of it?

Kiran: Well, you know, we can't say this as a supplement but there is a Facebook group dedicated to that, which we did not start but people are doing it.

Dave: Is sounds incredible. Like, "Oh my God. Dave, how could you say that? Now I have to explain to my kids what doing lines is." Children, here's what doing lines is, sometimes adults do stupid stuff and they snort things they shouldn't snort through their nose because there's something called transmucosal delivery. If you are familiar with nasal spray, that's how it works because your mucus absorbs things. Now you can ask your mommy and daddy about what it is they're snorting. But the reason I'm asking is that I grew up with chronic sinus infections. But if these were in your sinuses, because we do breathe probiotics all the time, we're doing it right now, do they break up biofilms or are they otherwise part of the bacterial biome found in the sinuses?

Kiran: Yeah. So I actually did a little bit of research on this because I wanted to understand where all we naturally expose ourselves to these spores. Desert dust that's lifted up from Africa blows through Europe, most of central Asia, contains very high levels of the spores.

Dave: Does it mean it kills coral, too?

Kiran: Maybe, I don't know.

Dave: Sorry. Sorry to ask.

Kiran: Definitely brine shrimp.

Dave: They deserved it.

Kiran: Exactly. Those damn brine shrimp. So we are breathing these in all the time. And these spores do make an enzyme called alpha amylase and that alpha amylase is a biofilm disruptor, it breaks it up. So that's one of the ways that they go after pathogenic bacteria is they're able to break down the pathogenic biofilms and get at those bacteria themselves. So I would say if they are found in your sinus cavities, as some people have

reported to us that they've somehow found them in their sinus cavities, that it seems to confer some significant benefit in there.

Dave: I'm out of questions but I've blown my mind on six different ways on this. In fact, this is, I think, a more complete and awesome episode than I'd even hoped. Is there anything that I didn't ask you about these cool species you're working with that you think is worthy of people's attention?

Kiran: Yeah, absolutely. One other thing, we just submitted a study to the British Journal of Dermatology. We did an acne study with these spores and we found ...

Dave: Topically or internally?

Kiran: Internally.

Dave: Okay.

Kiran: That it goes back to the gut skin axis, and a lot of that is dependent on the butyrate acetate production in the gut. So we saw a 45% reduction in acne lesions in 30 days of taking the probiotic.

Dave: Holy crap. Does that work in teenagers, too?

Kiran: Absolutely. The average age was 18. Tina has personal proof with her kids. So that is a very exciting area for us right now because we can impact the skin from the gut, from the inside.

Dave: So you're telling me I could hide this stuff in a teenager's junk food and their acne would get better?

Kiran: Yeah, absolutely.

Dave: Dang.

Kiran: Their mood will probably get better as well.

Dave: And they'll grow faster, they'll grow a third eye, and superpowers. I totally heard you. You said all that, right?

Kiran: But no, that gut skin axis component is really important. You know, that's a very exciting study that we just finished.

Dave: One thing that I noticed even as an adult, not to mention, as a teenager, I would get these subterranean pimples. Just like really deep ones, almost like a boil on my face.

Kiran: It's huge, right? They're big.

Dave: Yeah. They were always correlated with gut inflammation. So later, when I figured out what was going on, you put me in a place that has really nasty, stocky [inaudible 01:07:23], the black mold, stuff like that, that stuff causes a shedding of the lining of the gut and gut inflammation, it causes a change in the bacterial biome in the nose and then, three days later, massive pimples. If you talk to the acupuncturist, there's actually meridians on the face where you get pimples in a line that goes along on the side of your jaw, that's where the intestinal meridian is on the face. I'm like, "Maybe this is all just, you know, a bunch of made up stuff and there's no science behind it." Whatever.

It was repeatable, which is scientific method. Observation. That's the first ... Oh, yeah. Okay. Definitely not science. Anyway, I noticed that and it is very clear that when there's gut inflammation, the skin will follow. I believe it's a three-day window most of the time. You might see dryness or something earlier than that, but the pimples are a three-day later effect. You agree with that?

Kiran: Yeah, absolutely.

Dave: Okay? Is my number right? Is it two? Is it four?

Kiran: Three, actually, makes sense. For the translation of the inflammation from the gut all the way to the skin will take that that amount of time, because part of it is the changing of the skin microbiome and then the infection that occurs in the sebaceous gland. Like any other infection, it takes two, three days for it to come to fruition.

Dave: Very cool.

Kiran: One last thing I do want to mention is, I always explain to people that we, as a human species, we are a microbial construct. We are made up of microbes predominantly. And because we're a microbial construct, we have basically shot ourselves in the foot by putting ourselves in an antimicrobial world. Everything around us kills bacteria, especially the stuff like roundup and glyphosate, and all the pesticides and herbicides and all that. So our microbiome and our microbial ecology is constantly under attack by just living in the Western world.

We did a study where we showed that, and this is in a gastrointestinal system where you add in what is acceptable levels of roundup in glyphosate into a human microbiome and it causes all of these measurable disruptions with all of the things we talked about lower diversity, low short-chain fatty acids, all of that in just weeks, higher ammonia, and so on. We put the spores into the system while the roundup is still in there and we started to see reversal of all of that. So I'd like to think of these spores as kind of our daily protection against this toxigenic world that destroys our microbial ecology. That's just a little takeaway for people.

Dave: All right. I love that perspective. When you say safe limits, earlier we talked about sort of the "It's all or nothing." Let's roundup. Sorry, guys, that actually isn't nothing. There is no safe limit. Stop putting billions of pounds to that. It's not just a crime against humanity, it's a crime against nature.

Kiran: Absolutely.

Dave: It's really bad. Way worse than people supposed to be a lot of pathways. We've had other shows based on that but I love it that you have an impact on that. I've got another final question for you guys that's tied in with *Super Human*. Longtime listeners know for the first 500 or so episodes, I asked about human performance and then I wrote a book summarizing all that knowledge. I focused on anti-aging, I'm going to live to at least 180. There's a big *Men's Health* article about that recently. I want to know for you guys. So Tina, I'm going to start with you. You have access to not just the magic powers of a trial attorney, which means you can argue anyone into submission but you now have probiotic superpowers. How long are you going to live?

Tina: I'm going to live until 122.

Dave: 122. That's a cool number. Why?

Tina: The 22 is important number for us and I want to live long. I love life. I love everything about life. Now that I live so healthy, I'm just excited to continue to live that way. So if it's longer ... But 22 is an important number in our family.

Dave: Got it. So you pick that one because you like the number?

Tina: Yeah.

Dave: All right. Works for me.

Tina: All right.

Kiran: So I haven't picked a number but my goal is always been to live long enough to leave a really strong lasting impact on this world. I'm thinking that's going to take at least some 90. Then I want to enjoy the next 20 years after retiring.

Dave: So about 110?

Kiran: Exactly. Yeah. But the goal is, you know, how can I make a huge impact on this world and that takes time.

Dave: You've got to be what? Mid-40s?

Kiran: Yeah. 43, just turned.

Dave: Okay. Good deal. You know, I was supposed to ask people how old they are.

Tina: That's okay. 50.

Dave: Okay. So we're all about the same age range. I'm mid-40s as well. Actually, I'm 29. I actually just had my 25th percent birthday.

Kiran: Nice.

Dave: I'm 46.

Kiran: I love that.

Dave: I'm thinking, "I'm barely in my, you know, my mid-20s."

Kiran: You're an adolescent.

Dave: But you think about that, don't you guys think that all the doctors, all the stuff, don't you think we're going to maybe have some improvements over the next 50 years of your lives? Do you think we can do a little bit better?

Kiran: Oh my god. Yeah. Absolutely.

Tina: Yeah. That's why we're doing what we're doing. That's exactly, yeah.

Dave: You haven't changed your number. Are you not factoring in the hundreds of thousands of scientists working on the aging problem? All the studies you've just done, 1,000 fold increase in akkermansia, all that kind of stuff. Like aren't you just ...

Tina: I haven't read your book yet. I need to read your book.

Kiran: Yeah. Exactly. That's the key.

Dave: I think you guys think it's small. I was hoping you'd say, "I'm going to have probiotics that regenerate my SCOBY in my brain," or something crazy. All right, so I'll interview you again in two years. Double your numbers.

Tina: Deal.

Kiran: After we double our numbers.

Tina: Yeah, after we read the book, yes.

Dave: It's a good deal. Okay. It's been fascinating interviewing you. I learned some stuff I didn't think I was going to learn. Thank you for being on the show. Your website, justthrivehealth.com. We've got all the research and you've got the Just Thrive Probiotics and stuff like that. Once more, wow, I'm kind of mind blown. Thanks.

Kiran: Thank you, Dave. Thank you for having us.

Tina: Thank you, Dave. Really appreciate it.