Introduction and microbiome overview

Dr. Hawrelak, welcome to the summit is such a pleasure to have you. Thank you for taking the time to do this. I think it's very important for people to hear from you and to understand this piece of the puzzle of the importance of the gut microbiome and its relationship really to everything in the body as more and more research is confirming.

But this piece, this piece of that story around the connection between the gut and mitochondria in particular, is what we're going to be focused on here.

So thank you so much for doing this. You're very welcome. It's lovely to be here and always great to chat to you, too, Ari. And any time I get a chance to talk about the wonders of the microbiome, I will I will take it to someone who's an avid fan in love with the gut microbiome.

I'm just really thankful I chose it as a research topic for my Ph. D. back in the year 2000, because I didn't know what I would be doing now if I didn't presenting this topic.

Thankful I am. So speaking from personal experience. It's not often that I can say for one of the speakers or people that I'm interviewing that I've actually taken a lengthy course with.

But in this case it's true. I've taken one of your courses on gut health and the microbiome and and I've interviewed many, many, many gut health experts over the years.

And I can say for for everybody listening that Dr. Har lack is la creme de la creme. He is he is really among the best of the best microbiome experts in the world.

So what I want to ask of you, given that, is for you to give people a picture of the importance of gut health and the microbiome in overall health. Like how would you go about explaining that from sort of like what?

What's your paradigm for understanding the role of the gut in the microbiome in human health? Yeah, I mean, I think as I'm lucky enough to be doing this for 20 some years, it's been interesting seeing the evolution and the amount of research that has bloomed over that time to in that you go back to when I started my writing my thesis on how wonderful the microbiome was because that was essentially chopped through.

My thesis was looking at, okay, what do we know at that time? And we knew that the even from research in the 1950s and sixties was telling us that it was really important for me, system functionality, that if we gave mice or rats megadoses antibiotics and lock them in like sterile cages and gave them sterile food, essentially, as with the immune system, we get dramatically their thymus gland would shrink, their spleen would shrink their ability, their white blood cells to actually attack invaders, would decrease dramatically.

The number of superior IGA producing cells would decrease by 90%. And this is absolutely huge and then they could essentially expose them to poo and Ellison all this time thymus got to grow again in spleen would grow and that means start functioning normally again.

So some of that that aspect of it was known but not really that widely talked about outside sort of probably microbiota research is certainly it's yes important for, you know, gut diseases.

And that was what we talked about for a while like you know how altered Flora could lead to your bowel syndrome or inflammatory bowel disease. Those things have been known for a fair while to its ability to evolve with digestive processes.

You know, make like when K makes and B vitamins for some of those things were known at that time to add its

capacity to the ecosystem would protect us against foreign invaders, you know, so if we have you exposed to salmonella or giardia, you know, early research found that if we eat, let's say if we if we gave a course of antibiotics to to some people, and then we could give them some an hour or giardia.

And they actually did these studies typically in in prison inmates, I would point out, probably without their consent. But they did these studies and show that, hey, they could give 1/10 the amount of invading pathogen when there's an ecosystem disruption and get these people sick and they could figure for longer.

So we knew was important for that aspect, too. But what's been amazing to see is all the stuff that's come out around actually, you know, microbiome and how our nervous system is working, our brain is functioning, how our mitochondria work, how we age, you know, our level of information or body.

And I think it's been that shift from, I hear the microbes that probably aren't that important in the gut that we can just kill with antibiotics. They don't matter to actually know these are important.

Maybe we should start thinking of these microbes like a microbe organ, like we started like back in the early 2000. People talk about this is the microbe organ.

We have to start taking it seriously. It's really important. We can't just be like killing it willy nilly with different interventions and not think it has consequences in Hollywood so much greater than that.

But I think even what's shifted in the last 20 years is that that conception has gone from here's an important organ in the body, like the liver, to actually you are a being that's made out of microbes, cells and non microbe cells.

How the microbiome shapes overall health

And we are still debating what the ratio of that might be. You know, we've got 100 trillion bacteria in our guts and some people would argue that's like 90% bacteria.

I would argue we're two thirds bacteria when they're not bacteria. But either way, we are mostly bacteria and that you know, that what they do for us is super important and integral to what makes us human and how all everything else works.

And I think what you mentioned before is, is correct, that every single year that comes out, we're going, oh, this is connected to the gut, Flora. This is connected to microbiota.

This is connected the microbiota that is with those fasting last 20 years. I you go back to there's one piece of paper published in 2006 where it was the first one that showed that kind of what we could do when we to we could pass on obesity, you know, amazing study because they essentially took poo from obese rats and gave it to these little, you know, thin, thin rats.

And they were able they essentially went obese despite no change in caloric input or court outputs. They weren't exercising less. They weren't eating more.

Essentially, the change its microbiota is all it took to induce substantial obesity in these animals. And I think that was the paper that really shifted people's brains like, Oh my God, it's not just gut, it's actually we can influence things like that.

Who knows whether we can prove anything really. And I think that's what's come out of it too, is, you know, there's now research showing that that high blood pressure we can take in a poo from people with high blood pressure and give it to rats and they will develop high blood pressure.

Conversely, we can take fecal transplant wise, we can take poo from people with normal blood pressure, even with high blood pressure and their blood pressure normalize for a period of time.

You know, you never would have thought of high blood pressure being associated with the gut microbiota composition. It is as a lot as well, as well as things such as depression and anxiety and obesity and type two diabetes, like a number of different conditions now that we're in and more than that, to quite like heart disease, it has it has cancer.

Cancer in other pre-cancer conditions often have a microbiota component to it and even even more fasting, I think, in some respects is there's now research showing that people who have certain ecosystem compositions will respond differently to cancer, like treatments like chemotherapy or radiotherapy, who give a certain microbiota picture.

You have a better, much better outcome. And it's only been the last 12 months that have actually started working with with cancer patients to to optimize their microbiota, to get the best outcomes for their conventional cancer treatments.

And, you know, again, that would not have been something that was on Hillary's radar or even five or ten years ago. So that that aspect, it's been absolutely amazing to see.

Looping back to the first thing, the connection of gut health in the microbiome to health more broadly. We, you know, we've got you know, as you said, there's like all these emerging layers to the story constantly, the gut brain access, the gut skin access, the gut immune axis, the lung access, the gut liver access on and on and on.

And of course, we know there's a gut mitochondria axis. So what's the connection between the gut and mitochondria? Yeah. And this is one of those newer areas and I think we were getting greater clarity.

It was harmony. If we asked this question five years from now, we'll have so much more understanding because I really think it's probably only been the last ten years that people even thought of this at all because again, people really just saw what was in the gut.

Within the gut. But I think now we're looking at I think that to me, the the mitochondrial microbiota axis is mediated for a few different things. And looking at primarily bacterial metabolites and I think it can be been beneficially modified by things like the production of Beta eight, for example, which is the short chain fatty acid.

And then and also some polyphenol transformation products and then also detrimentally impacted by things like the the release of the toxin in the gut as to those are probably the three main ways in which the microbiota can modify what our, you know, systemically found bacteria are actually doing and how they function.

So let's talk about the lipopolysaccharide aspect of the story. So what what are they, first of all, and how are they getting into mitochondria where they're causing damage at that level?

Yeah. So Lipopolysaccharide all of my test LPs for sure, also known as Endotoxin, which I think people might connect a bit better with. Okay, it's something that is a toxin.

But interestingly enough, it's not grown by the bacteria as a toxin. There are bacterial toxins called exo toxin, so the bacteria are releasing intensely to make you unwell or to do some sort of targeted thing.

Endotoxin, some bacteria in your gut grow just like we grow nails, we grow hair, it grows endotoxin. And these bacteria called gram negative bacteria in most people be we're at least vaguely with gram positive gram negative gram negative means you just don't take on a stain, a colored stain by a main tip.

I got a call gram at the center when it was standing. Something took it out, some didn't. And the ones that didn't essentially have lipopolysaccharide in there in their cell wall, and it can make about 80% of the cell walls.

So a lot of that is LP. It's LPs. Just turns out that this stuff is immensely pro-inflammatory. We know can actually damage the gut lining itself and cause like a leaky gut.

We know when it reaches systemic circulation and actually causes inflammation everywhere. You know, we know it can impact negatively blood sugar regulation and insensitivity.

We could damage the blood brain barrier. We know it can change what neurotransmitters our brain produces because of neurological inflammation induced.

And we know it's a key driver of neurodegenerative conditions like Alzheimer's and cognitive decline that's really come to the fore recently. And they can do autopsies of people with Alzheimer's brains and it's full of LPs compared to the healthy controls of the same age.

It's like really pivotal. What's interesting here, though, is that he pulls up the amount of LPs containing bacteria in the gut, dramatically differs per person depending on the composition of the ecosystem.

So and even within that, there are really pro inflammatory types of LPs and less inflammatory. So let's focus primarily on the pro-inflammatory sort that we get from a group of bacteria we call proteobacteria and people we don't know that term, but they we've heard of E coli before or probably salmonella or shigella or campylobacter.

Helicobacter I think you. Can NCL. After e coli and salmonella. Okay. I might add those are all proteobacteria anyway. So you kind of know some of the more familiar ones that those ones they're endotoxin is just immensely pro-inflammatory, immensely so.

And then we have other bacteria that we might some of you may have heard of called like Bacteroides or at least types who are also gram negative. They have lipopolysaccharide but is maybe 100th or when thousands as potent as an inflammatory agent.

So we're going to focus on that on the PROTEOBACTERIA. Now, as I say, it differs how much is in people's guts to typical for a Westerner it's like four or 5% is far less than in a lot of nutritional cultures and people eating, I would say more fiber enhanced plant rich diets.

But you get some patients that I see, I've seen it at 50%, 55% of the ecosystem and I've seen it, you know, 0.2% to give sort of spectrum where they can be.

And that difference is dramatic. So in terms of the amount of this pro-inflammatory compound that's being released, so again, it's not releasing it intentionally, it's just dying bacteria constantly living and dying, living and dying.

So when they're dying that any toxins released in your gut and your body can deal with a bit of endotoxin, it's fine. Your intestinal cells would detoxify it.

Then it gets to your bloodstream, the liver will detoxify it, and you get very little. Generally, if you're eating really well, you've got integrity is good, your bowel transit time is good.

You ecosystem composition is good. You get very little endotoxin certainly in your bloodstream. But that's just not the reality of Western life. We we have poor integrity.

We're ingesting lots of alcohol. We're taking nonsteroidal anti-inflammatory medications for pain relief. And we know like alcohol and into it cause gut weakness and we know other aspects of our diet and less that might cause gut leaking.

Since we get more of that and a toxin coming in. But that Western diet lifestyle also leads to essentially increased numbers of negative proteobacteria in our gut.

Increased proportion. So you get this combination of a lot of end and ultimately release in the gut. You've got a leak, your small bowel, but typically for Westerners too, they have a slow transit time.

Gut endotoxin, leaky gut, and inflammation

So that essentially means that that endotoxin, rather than being put out, you know, 12 hours later is is maybe if you're lucky, put out two, three, four, five, six plus days later.

And there probably is not really much food out by then because it's absorbed. It doesn't just sit there, it will be absorbed and get into your bloodstream.

And as I said before, your liver can deal with a little bit of it. But you get about that point. It reaches it goes beyond that. And we know that the LPs is the main driver of liver damage in alcoholics.

LPs is a main driver of liver damage in fatty liver. It's not it's just the LPs and bacteria that cause a damage. So it can directly damage that. And we know that it works essentially as a mitochondrial poison.

It can actually cause inflammation and mitochondrial dysfunction. And it's doing that in the liver and it's doing that everywhere in your in your system, including in your sort of neurological system, to enhance leads to all these degenerative nervous system conditions that proceed when more commonly in Western nations.

And for anybody listening, I would encourage you to spend a little time going on PubMed or Google Scholar and just typing in endotoxin media and any disease you can think of.

And there's probably some respect out of it. There's research linked with chronic fatigue syndrome and fibromyalgia, linked with neurodegenerative diseases, linked with heart disease, linked with diabetes, linking obesity, nonalcoholic fatty liver disease, on and on and on.

I mean, pretty much any chronic disease of of civilization, which is 80% of the of the disease burden, is going to have a link there. There's one other layer to this that I want to emphasize.

I think there is a tendency for people to think that there are certain things that cause leaky gut. It's like when I, when I, when I take it, when I take antibiotics or when I take alcohol or when I when I do this thing, then I'm causing leaky gut and then or I do this combination of things and I have leaky gut.

This layer to the story that you're talking about here is the ecosystem of microbes themselves that's in the gut. If there is a big imbalance in the direction, a shift in the direction towards a predominance of these gram negative bacteria, and especially as you emphasize the slow bowel transit time, if you don't poo very often, basically, and I know that's not totally accurate to measure bowel transit time, but people who are maybe taking one poo every three days or something like that.

Yeah. Like, but, but that the presence of these bacteria themselves are producing this endotoxin that is itself driving gut permeability in leaky gut.

Yeah, very much so. And even I've recently been looking into the celiac disease literature too, and is now being linked to, you know, it's not just gluten, it's gluten with lots of proteobacteria that's tend to result in the gut damage that and it seems to be a core prerequisite for celiac disease to develop in people with the right genetics. It's not just eating gluten.

It's like Ashley actually inhabit this Biotics mobile ecosystem with these prairie bacteria present, which leads to the gut damage that it develops. So so yes, it is really a key thing that that the composition of the gut and remembering that it's at that balanced level of quality back to the way you determine.

And then even in these other conditions like alcohol induced damage, we know that. And even we can look at not through anti-inflammatories like ibuprofen and we know, okay, yes, these costs got damage, but they don't cause gut damage in a germ free mice and rats.

So if you've got mice and rats with no bacteria present in their guts, you can megadoses them of NSAIDs and they know gut damage. Wow. Yeah. But if they have gram negative bacteria there, you can give them a tiny dose and they get severe damage.

So it is even as agent we see as being got damaging, it's still mediated a lot through the microbiota too. So you can think of that almost as like the resilience of the gut to insults to to, you know, chemical or environmental insults.

Stresses. Yeah. You know, the ecosystem itself is going to influence whether a particular insult, whether it be alcohol or NSAIDs or gluten or something like that is is going to cause gut permeability or not.

Yes. Which I think is fascinating. And I think you're right. It's not on people's radar about it's that and it's it's it's a huge thing. And I think even though I again I've been looking at the research on SIBO literature, Q&A, even that thinking of being too much bacteria growing in the small bowel was actually changing to being the wrong types of bacteria overgrowing in the small bowel.

Again, it's coming back to mostly around proteobacteria. So you feel that that's a shift in the thinking, the paradigm around SIBO? Yeah, I don't know if it's filtered out yet, but I think if you start looking at the research around it, it seemed like, okay, you can have higher levels of some bacteria.

It does seem to be problematic, but this definitely seems to be associated with symptom spend and it got damage when you have more gram negative bacteria being present and it's seen as around diversity and also explains why there was a study where they gave fecal transplant in capsule form to treat SIBO and they had amazingly successful rates of cheating.

See, about six months afterwards, you know cured and vast majority people giving a fecal transplant by capsule and the thinking was it was let's change.

We know that the ecosystem in the small bowel with SIBO is less diverse and is more proteobacteria. Let's see if we can introduce more diversity in health ecosystem and one study so far.

But I think it was just pivotal in shifting people's thinking about the condition or starting to anyway. Very interesting. Okay. So there's a couple other layers to this story of the gut mitochondria connection that you mentioned and you go where you want to take this.

There's you know, as we talked about before, before we started recording, there's the the the ellagic acid and you're all within a part of the story. There's the Polley Amin's part of the story, and then there's the short chain fatty acid.

So tell us where what kind of some of the other layers of the gut mitochondria connection. Yeah. And I think, I think Peter, it makes sense to go to this because I think this is a key, key thing and, and it's one of the things that our, our Eastern can make force in.

And I think this is also pivotal to know too that that and maybe it's a stepping back to short chain fatty acids. What are they? So when we consume foods, probably fibers, but even I would say to some degree, you know, protein Asia's foods to reproduce these things called shorts, car or bacteria, ferment them or beautify them depending on whether it's protein or fiber carbohydrate compounds to short chain fatty acids predominately as the main end product. Yeah.

And that, there's three main ones, there's acetate, there's papaya and then there's great majority of people with most mostly acetate that they produce in a relative difference in proportion of, of the spine and, and brain.

So people don't make much better rate at all. And this is there's a couple of factors that can determine that. One, the levels of B, they're producing bacteria you have in your gut into what you eat.

And that's probably the people thing that determines number one anyway, for the most part. And again, looking at at what proportion of your ecosystem might be B composed B rate producing species, you know, the lowest I've seen is none, absolutely zero, which is someone who didn't get a long term antibiotic.

They called vancomycin where it just completely there was this no growth to 70% I think it's an decompose would

be very pleasing actually is probably a far extreme end that most people would fit in the sort of 10 to 25% sort of mark.

And I think this group of bacteria is starting to get more acknowledgment. But I think in terms of what names that people each familiar with, are we not so much because we're talking about I think one of the key ones is fecal, the bacterium collecting proximity, which starting to get a bit of a name out into the outside research circles or in medical circles.

But there's other ones like Roseboro and you, Bactrim and stuff, killer granuloma and or diabetes. And just to be back to room in a cocker cocci that most people are.

Yeah, no, nothing. I've never heard of them before and have no idea. That's actually really important. He should really focus on feeding these these guys because you've got the capacity to have these amazing brain pleasing factories in your gut. They're just there.

If they're functioning and working for you or sitting idle in the depends on what you're feeding. And luckily we can feed them up to them. Might only be at 2% now or 10%, but a lot of work I'm doing with patients is, okay, let's go from that 10% up to 40%.

So you're actually increasing the proportion fourfold, increasing that to be reproduced four fold. Yeah. So PDA is an amazing substance. So we know it's immensely important for your for your intestinal integrity.

So if you want to protect yourself against leaky colon, leaky small bowel is ensuring that you're having enough bright being produced. It makes up, I think 70% of the energy needs of your colon cells is from from beat rates.

If you don't make enough beta rate, your colon cells don't function properly to regenerate properly. And that also puts people on it too, because if you're making a small amount of beta eight, every little bit of that is being consumed essentially by your colon cells.

You have to produce enough to feed you call and cells and more so you can actually get some into your circulation where you start getting the systemic benefits out.

Be right. And this is where it's helpful for mitochondrial support. So that the bucket is overflowing enough. There's there's there's excess after the monocytes have used their portion now.

Exactly. The buckets overflowing and now you've got this butyrate going into the bloodstream where it can reach the brain and reach the mitochondria throughout the body. That's right.

Because if you don't get that, you need you don't have enough you just have enough to feed your colon so you don't get the systemic benefits that we're after for my class. So what does he have to have?

What what does it do once it reaches the mitochondria and the brain systemically? Well, we know it can actually help heal the blood brain barrier and it actually can decrease analogical inflammation.

And I just remember in 2016 I paper and I'm like mainstream neurology neurology journal talking about eating a high fiber diet for brain health. It's just like, oh, it's just mind blowing because that would not have been something that was discussed ten years ago, even let alone longer in the past one with any connection of neurologic conditions and got we're eating fiber because I would like to see more fiber to feed beta increasing species.

It was just like it was it's great to see that to get there because we know it's capacity decreased neurological information help regenerate nerve neurogenesis, brain driving or trophic factors is upregulated with with beta eight to decrease in prevent instances to be so actually improves blood sugar regulation as well but also improves mitochondrial function.

It produces I think enhance its capacity to generate ATP, enhances mitochondrial biogenesis and it can actually

reduce the amount of reactive oxygen species that are developed as well.

So you've got this amazing thing that your gut can produce for you.

Short-chain fatty acids and butyrate benefits

If you can nurture those species and curves and to make beat rate for you, that's you know, I love that. Yeah. There's an interesting layer of the story that was that Dr.

Vincent Pedro mentioned to me about the Hadza as well. He said that they found I hope I get this right, but I'm pretty sure he said that they found not certain such high butyrate levels, but they found very high protein levels.

And interesting that they I think that they speculated that it has to do with either the amount of of fasting they do or I think especially the amount this is what it was.

It was the amount of activity, physical activity that they do. And they found that for some reason I don't know the biochemistry, but Propionate was particularly beneficial for them as they're out.

You know, on a hunt all day as compared to on computer, something to that effect. Maybe it's used. I think it's that it's used in energetic pathways more efficiently like to to help support high levels of physical, physiological or physical activity or to suppress hunger or something to that effect.

That interesting. Yeah. Okay, I mean, I know a bit about Propionate, too, but not not a huge amount of in terms of I know that really high levels can be neurologically toxic.

Is that I mean, the models are use or animal models where they kind of inject papaya into the brain and they go, look, they start developing autism like behavior.

So it's a bit of a false model, but I have had it done. The spectrum that I've worked with that have had really hyper piney producing species in their gut and it has been issued for them and decreased per plant levels.

And that's actually improved cognitive capacity and awareness. And the kids are more, more present in here. Now. So I think that there can problematic in large amounts, but I don't think that's impacted kind of quantity appropriate producing bacteria in their gut.

Mm hmm. Okay. So before we get to practical stuff, can you tell us a little bit about the your life in a aspect of the story and and how that relates to the gut mitochondria connection?

Yeah. And maybe we can take it a step further back this around. Polyphenols first and polyphenols are the brightly colored compounds we found in plant foods, natural foods, not the red food dye or blue foods that you can buy in processed foods, but blueberries, eggplants, you know, raspberries, red rice, black rice, those those compounds, polyphenols are pretty ubiquitous among the fat fruits, vegetables, grains, whole grains, whole grains, vegetables, fruits, legumes, nuts, seeds, all in the whole form of varying amount and type of polyphenols.

The interesting thing about the polyphenols is 90 to 95% are completely indigestible and unobservable to us. So they're there. And if you didn't have the gut bacteria and the right got better, you just put them straight out and they would do nothing for us because they're too big.

Molecules are too big that we can't digest them. We don't have digested arms to deal with them, but our gut bacteria do and they can actually they're really important for this conversion of these polyphenols into smaller molecules, which we then absorb.

And in that process, they they get food from it. So it's like a win win situation. So we're, we're eating the polyphenols from blueberries, which taste good to us.

That's a win. Those polyphenols reached the colon on the students with pomegranate. It's great as a food delicious food full of of specific polyphenols called the lychee tannins.

Largely tannins aren't broken down by us. They're too big to be absorbed by us, even if they were in our bloodstream. We go, it's an antioxidants grape or we can't get it because it's too big.

Reaches the colon and there it gets actually impacted by by gut bacteria. And they they convert that ellagic and they eat it and break it down to something else.

They get energy to their populations increase, but they release a breakdown product, which then it's typically active and absorbable. And we know that that all these sort of plant foods that have these polyphenols were often entirely dependent on this microbiota conversion to to get the health benefit of it.

And I think that's fascinating, too. But the one specific with with the little veggie tannins in pomegranate, you get them in anything. It's walnuts and pecans to chestnuts.

And chestnuts study to find the foods richest in it. Okay. It was just. Or water chestnuts or something like that. It's yeah. Okay. The big ones that are that are soft, I'm pretty sure they're called chestnuts.

Yeah, yeah, yeah. The winter they tend to roast. Like, I always think it's all English stories about roasting chestnuts for Christmas time. Sort of. Yeah, because they've got a great brown husk on them.

I reckon that's probably high in that particular, you know. That would make sense. Yes. So yeah, it's interesting. I always hear people talk about pomegranate.

Nobody mentions Chestnut, but Chestnut is actually, I think, even slightly richer than than pomegranate. Interesting. Okay. I, I think I love HUMIRA because I'm a herbalist and I eat to that the husk, the skin, which is actually much higher, I must say, in allergy tenants than the fruit anyway.

So if you're after a really hefty dose, the skin wouldn't give you a whole lot more that you eat the full. Peel with it. Yeah. Really? You going? Yeah.

I mean, it doesn't taste good, so, I mean, I think the idea to sit down and just tune on on a whole was like not remotely appealing. I mean, we I've made a common teacher for, for years, but now you can buy it in powder form and in, in niceties need to be capsules with it too because some companies like, oh, there's actually more allergy in the skin than there is a fruit, but it's not really tasty.

So, you know, I have patients who mix it in their smoothies with other things and it can be masked over. Okay, but it's like chewing on is is not an option that you're going to enjoy.

It's really, really strong tasting, but it's much higher in that copper. Yeah. Do you think these polyphenols and flavonoids and things should be put in the category of prebiotics?

I know they're not generally considered to be that, but based on the mechanism you just described, it sounds like they essentially are. Yeah, it probably depends on how narrowly we define the term prebiotic. Yeah.

And I would probably put them in more into the clinic food type category that it feeds a wide diversity of microbes like you'd put a range of fibers in there that you can see and number of things go on.

There might be some and I put pomegranate in this category actually where you tend to get increase in bifidobacteria. So there are like a much more standardized response to you get level decreased levels of pathogenic bacteria increased b reproducing species increased Bifidobacteria is something we see with pomegranate has congestion.

So it's like that to me would fit that that. But I think it would be a different scenario if we were talking around other

types of polyphenols that would feed other species like Slack here or Gordon-Reed or others, which are very important play for transforming the performance of species.

But we're not sure exactly they're they're broader role in health enough to say yeah that would be defined as a as a prebiotic. But I'm being a bit picky with definition.

Okay. Did I get distracted or I just want to make sure we completed this, this part of the story of how these flavonoids and how the large tannins are then being converted by gut microbiome, the gut microbiome, and how this then influences mitochondria.

Did you. Know? We didn't we didn't quite get there. We got to the conversion conversion spot. So the polyphenols reach the colon, they're there, they're consumed in their absorption. So in the case of Ella tannins, for example, from coriander or other other foods, some people, not everybody converted to release in a and I think that is one of the most research on there's also a B variety and some people it doesn't get converted through depending on what species are actually present.

And this is the the nuanced bit of everyone's microbiome be completely unique and like anybody others is that some people will have different sort of pathway to see which that will go through depending on the ratio of rate of number back to the present.

But I think we can also work to encourage that too. Like I think there is one study I read that, you know, initially at baseline 12% of people were produce the a four up variance but then after ingestion for a while was actually up to 40% of people were.

And I think the research suggests with good release and a it's and and other things like if you just eat polyphenols consistently daily for long enough, you will encourage the species that are there in lower numbers to become more prominent.

So you might not be a you release an A producer now, but you might be after six months of consumption. That's a possibility, too. And typically those people that that don't make either other your reason when it comes to you can that's my experience and I tried to delve into can we use other prebiotics to help that ends.

That's an interesting conception that I think hasn't been delved into too much detail yet. But we need to define what species actually consume the compound.

Then we can work at or essentially convert the allergen into your release. And a what species do that? I mean, some research is suggesting it's a bad coordinate factor as being particularly important in this.

So say, how do we encourage that? Well, we don't know besides feeding these these can that it likes eating right which is kind of like you encourage them if you if they're there if you give them food they will grow.

And that's comes the same with with B reproducing species, too. It's like they're there. You feed them, their populations go up, you don't feed them, they go down, you know, by keeping a pet fish or something, you don't feed.

It will eventually die. And if you feed, it will grow. It's too thick. The concept is pretty similar with our gut bacteria. You know, it's just some bacteria are pretty diverse with their their food sources.

Others less so. And Gordon, the doctor, I think is pretty diverse with its source of polyphenol. So it wouldn't have to be only that one. I think if you're eating a wide variety, you probably have a better chance.

I can probably plant based lots of polyphenol, lots of colorful foods. Your chance of having gotten back to there is is far greater than someone eating McDonald's and Kentucky Fried Chicken Daily.

Yeah that the circular sort of bidirectional nature of the body in this regard is always fascinating to me. And I grew

up as an athlete and in the bodybuilding space.

So my background in health wasn't just theoretical, it wasn't just studying concepts, it was self experimentation. So the idea is like it's amazing how obvious and sort of common sense it is for people who have that background in self experimentation but who only study this.

In theory, it's not necessarily obvious, but for me it's like someone saying, Well, how do I get my biceps stronger so that I can lift weights? It's like, well, you, you practice lifting weights.

Polyphenols, ellagic acid, and urolithin A

Yeah. So, so that it's, it's stimulated to grow stronger. And, you know, the same is true here. If you want to grow more of those species that do a particular thing, you got to feed them.

The thing that those, those species like. Yeah. Yeah, yeah. It's very much that way. And I think that's the thing too about being because some researchers aren't clinicians and they just can't take that final leap strikes me how do you convert this into something practically and relevant and helpful for that for people often think it's too early to do that where it's like, okay, well no, we this feed those bugs up in their populations will go on. Right.

I mean they should get that benefit. Yeah. And I think when the cool thing about that you're losing a is it's capacity to work as a mitophagy inducer.

And I think it's a lot of other polyphenols that seem to be good at enhancing pathogenesis or the creation of more mitochondria, which is obviously really important too.

But I think what's really cool is looking at the research around the capacity of those dysfunctional, not particularly well energy producing mitochondria, they're just slightly chugging along.

Well here we can a decent to die by taking this and be replaced by a proper well functioning mitochondria and then you get all the flow and benefits they come from that.

So I think that's that's exciting that we're heating those things out because I think, you know, we would have looked at, you know, what epidemiological studies would have shown that people they're eating lots of polyphenol rich foods have got lower rates of neurotic diseases and cancers and heart disease and all these things.

And now we're just kind of teasing out the whys in more detail. And then we can all obviously play it differently to this. You know, people with chronic fatigue syndrome or fibromyalgia or other neurologic degenerative conditions that are associated with dysfunction are like, okay, well, it's not just improving longevity for eating these polyphenols.

It's actually we can start targeting things that we can try to target things more specifically by potentially using, you know, pomegranate skin as a supplement, for example, or I think they're coming out or have come out with good release in a as a pre form supplement as a way of trying to, you know, directly target dysfunctional mitochondria, right?

Yeah. With the idea that roughly 30% of people don't have they say that that they don't have the species. Again, with the nuance of what you just described, that if you consume that for a period of time, maybe you will have the species.

But the idea is, they say 30% of the people don't have the species to take ellagic tannins and create your lithium, therefore lamenting, limiting directly with your lithium.

This this post biotic product of the bacteria will be beneficial and their studies to support of course that it that it is beneficial. I'm actually personally looking to to to create a supplement formula that has that compound in it because there's so much positive research around it.

Yeah, it is exciting. Dove into that more recently I hope that you know, and I just love it because prescribing pomegranate as a the skin which is high in these compounds to last year to thousands of patients over every years.

And the that's the the unintended benefit that I had no idea what's going on was actually this theory within a decent proportion of these people because I think, yeah, going back to what we were saying before, if you do not had any Gordon, the doctor or any of those species, then, then you can't feed them up.

It's just that if they're in tiny amounts, you can revive that population. And this is what again, we're just the last decade doing this. Oh, you're sound cut out levels.

Oh, Jason, can you repeat that. Your sound cut out briefly there. Yeah. Yeah. Can you hear me now? Yeah. Okay. Yes, it working with other sort of bacterial populations where it's, you know, below detectable level and stool testing like, okay, well, let's see if it's extinct or whether it's recoverable.

Let's feed it. And that's a clear way of seeing. And you do post asking go, has it actually come up or not? And whether it's extinct. And I think thankfully for a lot of people, these species that we see is below detectable threshold aren't actually extinct.

They're just below are the capacity of our technology to see. And then if we continually feed and feed and feed fast for two months or four months, oh, look, it's there.

And I could say that with things like eye commands or bifidobacteria lactobacilli or different beta producing species. I've seen that over the last decade of practice very clearly, and I bet that's going to be the same thing with Gordon. Back to too.

We have to have a test that can tell us that it's there and that's his shotgun. Tests can do that and success tests can do that. And then you'd go cable, it's eat pomegranates and let's see if we can get you there and then you might go, okay, no, you're going to be a person who has to take your snake in his pre-formed amount.

And then there's always going to be a discussion around the amount that gets there too versus, you know, how much pomegranates required to get the same serum levels as, you know, taking capsule of you with an eight that, you know, something needs to be teased out, too.

Okay, Dr. Malek, do you have ten more minutes to spare? I know we're eating lemons. Okay, you're going to be a little annoyed with me, but I'm going to ask you a question or two that I know you could spend five or 10 hours answering, and I'm going to ask you to answer it in a few minutes.

Ouch. Okay. I'll be best. Let's let's talk about how to some practical specifics on how to optimize the microbiome ecosystem, how to reduce levels of LPs and how to increase levels of you mentioned already kind of at a in this in this case of polyphenols and you're both in a how to optimize that consume more of the polyphenols that feed those microbes that produce those post biotic metabolites.

But how do we reduce levels of LPs and how do we increase levels of butyrate producing species, which, as you emphasize, is very important? Yeah. And I think the probably the the biggest takeaway is eat mostly plants, high fiber, nothing processed and processed whole foods that contain a wide diversity of fiber types and colors of the polyphenols that's that we do all of that with a dye like that you'll feed be very pleasing species, you'll lower LP levels in the gut and you will have enough polyphenols to to nurture those species.

That's like the big answer. I think there are some specific things like, you know, with similar ideas here though, because I mean, one of the key bright producing species is fecal bacterium.

It likes eating polyphenols as well. And also fruit oligosaccharides or inulin, which we find in things like onions and garlic. And it also like seeing all the sacrificing legumes.

Yes, we've got legumes, onions, other foods that contain fruit. Socarides Include things like yak on tubers, which are less commonly available, really rich asparagus, clove artichoke, true.

Some artichokes are just some of the foods that are quite high in those compounds which will feed a bacterium. And then you have the resistant starches, which are starches that are resistant to our digestion processes.

So they reach the colon intact and they are they can be consumed by those bugs that have the right machinery to do so. And we tend to get more beat rate decrease.

That's consequence of that. There isn't starches we find, again, in whole grains that aren't milled. And we finally so, you know, a chunky meal is going to be quite different in terms of it.

Fine meal, you find them high in legumes and also what we call retrograde starch, which is the coating called variety. So let's say you bake a potato and you eat cold the next day you're going to get a tremendous amount of resistant starch out of it versus eating it or or particularly you compare it to like a boiled potato, oil, potato, very little resistant starch, steamed is a bit more baked already.

If you're eating hot, you're going to a decent amount of resistant starch. But if even let that cool, you get a substantive increase in that. So I will often eat cooking cool rice, for example, your rice the second day you get more resistant starch, you know, those sort of refried beans you get because you don't eat them up too much.

Just a second. Go. You'll get more resistant starch in them, too. So we can, you know, there's broader principles of what to eat. But then the specific things, the new tricks we can do to enhance resistant starch capacity and encourage a greater amount of produced in the gut.

Okay. I have to ask this. There is certain there's there's a there's always the latest dietary fad trends that that are emerging. And, you know, there's the low fat, there's the low carb, there's the vegan, and there's the paleo and there's the keto.

And now we're in a trend where the opposite of vegan has emerged. I think at this point all foods, other than everything other than water has been demonized by one group or another incur.

And so we've got everything from veganism that all animal foods are trying to kill you to the opposite, that literally there are there are diet gurus now claiming that, hey, you know, animals can can run away from you.

That's their defense mechanism. But plants, they can't run away. So what they evolved is they evolved these plant toxins, which are really poisons that are designed to make anything consuming them ill.

And therefore, all these polyphenols and phytochemicals and things of this nature are really plant toxins that are trying to kill us, and therefore they're bad and therefore you should avoid plants and eat.

Mostly we're nothing but meat. Yeah. From the perspective of being one of the the leading gut microbiome experts in the world and having value having spent decades evaluating that literature, what is your take on those claims and that dietary approach as far as the gut microbiome?

From a gut microbiome perspective is at a show, it's immensely detrimental. Might be the, you know, a nice way of saying it. It comes back to what are you feeding?

What do you not feeding?

Practical ways to support the microbiome

So if all you're eating is meat and fat, what do you feed in the microbes? Old microbes that eating protein and bile. All right. And if you look at the metal byproducts of those ones and they can be gram negative bacteria number one to you tend to blooms in proteobacteria on that diet to 4 to 3 blooms in hydrogen sulfide gas produces specifically

because they eat amino acids and they eat bile.

So they're like they're gorging. They're not having a great time of it. And hydrogen sulfide gas causes gut weakness as well, and in large amounts can be a mitochondrial toxin too.

We know in small amounts it's actually good for us, but interest in large amount is problematic and that diet just encourages overgrowth of those those species.

And then the people that I mentioned before that with like low levels of brain producers, those are people following diets like that. Like I had one woman who's just eating chicken, just chicken, nothing else.

And her beater pieces were 2%. And I was even like somewhat thankful that was any there at all, to be honest. And maybe she just had chicken to last six months, only meat because I do, I think based on animal research, you can eventually starve them out to extinction and then you you can't bring them back bar a fecal transplant.

Yeah. And certainly patients that I've seen post carnivore or similar type diets where it's been almost no plant foods, it's their ecosystem, it's so low in fiber consumers and so low and be very producers and so high in pathogenic bacteria and those sort of negative pathway plants that I mentioned before.

So it's certainly not from a mitochondrial perspective you're not getting it's not be rate being produced at all, not even remotely enough for your colon cells, even let alone for anything.

You know, systemic benefits might come from it and you get it. You find yourself with endotoxin. And we know that particularly saturated fat from lard or butter or ghee or animal products, because sometimes they'll drink heaps of cows, milk, too. And those kind of diets, which I find interesting to see, medically speaking, her rationale for it.

But anyway, we know the saturated fat binds endotoxin and increases its absorption. That is very clear from the data so early. You encouraging environment that's full of bacteria, full of endotoxin, you're encouraging its absorption into your bloodstream at the same time with a dietary approach because what what stops endotoxin being absorbed is fiber polyphenols. That that's clear.

We've got data showing that we can give people a a McDonald's breakfast meal and their bloodstream fills up with endotoxin. But if they take some fruit with that McDonald's meal, they don't get that flooded into toxin.

As a consequence, we can very clearly show that it's the fruit. You know, Food Corp has the polyphenols of fibers that bind to toxins and can help prevent it being absorbed.

Even they are there in the gut, whereas saturated fat encourages absorption through so and those patients and fold that diet during the time are by far the hardest ones to get better.

And I want to put that out there because I think in the short term you can have a reaction to the gas related symptoms of bloating and distension. That can be. Some.

That's what I wanted to say, because there are a number of anecdotal stories you hear from people who I think generally are starting with with a lot of dysbiosis in there, a lot of, you know, bad ecosystem when they then follow recommendations like the ones you're giving to eat more plant food, it's in a bigger diversity of plant foods and fibers.

They feel bloating, they feel gas, they they have pain, they have diarrhea, they have they have problems. Then they might try a carnivore diet. They get rid of all the plant foods. They feel better.

They get rid of all those GI symptoms. And then they conclude this. This must be the healthy approach. This must be the best human diet. Yeah. And that's exactly what they what happens in that situation.

But I just know that, yeah, it does reduce symptoms for some of these people in the short term it does. But having

seen people the longer term because you're doing is increasing hydrogen sulfide gas production which actually worsens nerve inflammation in your gut.

Yeah. So it gets worse and worse. And this woman that was just like that, eating a couple of chickens, like she tried, like she she tried to go back onto fiber after a few months off.

And the things she used to tolerate, she did not tolerate now because even the tiniest amount of intestinal gas being produced, because that's, I think protein putrefaction doesn't produce much in the way of hydrogen gas.

You don't get much bulk that comes with it. And any of the hyzon gas gets shunted to hydrogen sulfide gas production due to all the amino acids, and it's sulfur from the bile that's around in that ruminant that any hydrogen gas gets shunted away.

It hides into big bulky gas. Yeah. So not much is produced any way through protein function and what is produced is hydrogen sulfide. So you don't get bloated, you don't get distended from it.

And hydrogen sulfide gas can speed up your transit time, too. So maybe you have station goes from this process after the first week or two of your ecosystem adapting.

And then obviously a lot of H2 has been produced which had been sulfide transit times better bloating, dissension. It's gone pains going up. Oh my god, that's fantastic.

And systematically it is. I won't argue with that. It's just that the negative consequences of that along moderate to long term are immense. And the patients that have the hardest time trying to get back are the ones who's essentially done that for long enough that they're in love with information that God is so great and the level so the intolerance to anything that that produces gas is so great as a consequence.

So how do you feed the species around this hanging in there, the edge of extinction. Is because I just want to emphasize this because of visceral hypersensitivity, because, yes, the nerve cells that sense gas and distension in the intestines become hypersensitive.

And and therefore, those those people then become hypersensitive and very reactive to the the gas and to the signals that are then produced when they reintroduce the plants in the fiber.

That's right. And most of them had that to a certain degree beforehand. Hence they have developed symptoms that they tried. The plant based diet was all right.

You already got that going on. You might also have slow transit time and high methane levels, which slow down. You got in a bunch of other things that very disparate got in a few different ways that if you came to good production beforehand, they could probably address those things you can get in my path.

But in this case they have and you write it since that hygiene stuff I guess, worsens and worsens and worsens that visceral hypersensitivity. So it gets excruciating at the point where they have a small bit of plant food, they get excruciating pain.

So it's really hard to come back and and it's hard to feed their baby pieces when there's 2% or 1% and the other helpful species from that. And I do think at some point they will go extinct from that process, too.

I'm grateful for the extra time that you took to to spend with me here. I want to be respectful of your time. Are there any final words that you want to leave people with and maybe final piece of advice?

As I know you get a lot of nutrition advice. I know that from learning from you and other contacts and having conversations with you, you also talk about other lifestyle elements and and other dimensions beyond nutrition that influence the microbiome.

Anything else you want to mention to wrap up? Well, I think the key takeaway I can give one is love your microbiome. I think that that is key and work to nurture those cells as you see with a loved one or pets.

And I think people often take better care of the pet than they do. And partly that's ignorance because I don't know how important it is for how to do it, but I think it's trying to shift that narrative going.

This is those microbes are immensely important to you and your health. And I think just keeping that in mind when making any kind of dietary decision or lifestyle decision or medication decision, you know is is an imperative for you in your long term health.

You know, I was just reading some research on antibiotics and looking at cognitive function, and they found that two months of cumulative antibiotic use in your like fifties said age, your brain by 3 to 4 years.

And I just thought that was fascinating. You know, it just showing how how we here and yes there's a time and place for and what's unnecessary. I totally agree but so many people are popping them for viral infection and just trying them.

I was trying to anybody because you know what else to do. There are consequences from microbiome perspective and their consequences that flow on from that because, you know, antibiotics are also seen as mitochondrial toxins, too, because what are mitochondria essentially they we've out it's a bacteria joined with us so yeah so I think people being aware of those things too when it comes to to medication choices too, that sometimes there's a choice you don't need to take an antibiotic for viral infection.

You know that the. Yes, for a life threatening bacterial infection. No doubt. But just keeping that in mind to it, but of always putting the importance of the microbiota at the forefront of your health decisions.

Thank you so much, Dr. Hurlock. And let people know where they can follow your work or get in touch with you if they want to work with you. We'll let you know.

What's that? Sorry. Do you want me to let you know or you let them know? You let people know where they can follow your work or get in touch with you if they want to work with you and as.

As a patient of yours. Yes. So I got a few different areas, but I'm a clinician by Goulds Nature Medicine in Hobart, Australia. But I do see virtually patients from all over the world and I run courses to both through my probiotic advisor site where we have a lot of material around optimizing the microbiota and using probiotics properly and evidence based manner.

And through my new site, the microbiome Restoration Center as well, where we're teaching clinicians to essentially optimize microbiota and to treat gastro conditions with the microbiome at the forefront, you know, there's always choices is likely to pass a will damage microbiota path B won't and we're essentially going through a range of gut conditions like, you know, very similar course that you did and trying to focus on, okay, we can treat this but in a way that actually got friendly and and prioritizes the health of the microbiota.

So you get the best long term health outcome out of any microbiota stays healthy through the treatment approach that we're doing. Beautiful. Thank you so much for doing this, my friend.

It is always a pleasure chatting with you. I always come out with new layers of knowledge and I really appreciate your time and your and you sharing your wisdom with our audience.

You're welcome. Always a pleasure chatting to you. Too hard.