Digesting the Gut - Brain Connection Transcript

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Introduction and Guest Background

Welcome to this episode of the Reverse Alzheimer's Summit. I'm your host, doctor Heather Sanderson, joined now by doctor Tom Fabian. He's a leading expert in the role of the microbiome and health, immune function, chronic disease and aging as a translational scientist.

His primary focus is on the clinical application of microbiome research in the integrative and functional medicine space. He received his PhD in Molecular biology from the University of Colorado at Boulder, and has worked as a biomedical research in the biotech field and more recently as a consultant in the microbiome testing industry.

Currently, Doctor Fabian serves as a consultant and science advisor with Diagnostic Solutions Laboratory, a company that I use frequently in my clinical practice and he's also on the scientific advisory board with the nutraceutical company designs for health.

Doctor Fabian, welcome. Doctor Sanderson, thank you so much. It's great to be here today. So I am excited to give our audience this breakdown of the connection between the gut and the brain.

Right. We hear this over and over and over again. The gut brain connection that is our second brain health begins in the gut. And we have right here, here.

I'm so grateful to have you here to really help us put this in like layman's terms. What does that mean when people say that? So dive right in. Can you talk about the ways to the gut and the brain, influence one another, interact with each other, and impact especially brain health?

Absolutely. Yeah. So it really is a two way interaction. So when you think of gut brain axis, really depending on who you talk to, they may see it more from the brain to gut standpoint, because grain, the brain certainly does have a lot of influence on gut function.

It's really critical for regulating gut function. But the gut itself also has many influences on the brain.

How the Gut-Brain Axis Works

And I think a lot of the research I think that everyone has heard about, more or less in recent years really has to do with the microbiome. So it's just a fascinating area of research in how the microbiome can influence gut health.

And then, for the various ways, influence brain health. So really, to break that down, that comes down to probably four different major areas. So one of them is direct influences on the nervous system.

So we know that the nervous system has a really significant, presence in the gut. So we have the entire nervous system, which is often called the second brain.

And also the vagus nerve. Recent research shows that there's lots of nerve endings, especially in the upper GI tract, that are sensing what's going on and relaying that information back to the brain.

So this is critical information that the brain is taking into account, as it's basically figuring out how to respond to what is detecting in terms of the microbes, in terms of foods, etc..

So it's a really major pathway. Where the brain takes that information and then, really relays that into our overall health and in particular gut function.

So that's partly through the products that are produced by the microbiome. It's also partly through the types of

microbes that are detected there. So that's a really key thing.

And we'll probably get into talking a little bit about gut testing. So there are things that you want to look for in particular tests for these imbalances that can influence a gut brain interaction.

There's also influences on the immune system. So we know that, once again, the types of microbes that are detected, basically by the immune system. So you have the nervous system that can detect microbes in their products.

You have the immune system in particular. That's really important for detecting those microbes and can tell good from bad. Essentially. And then there's also the products that are produced by the microbiome that influence the immune system locally in the gut.

And actually 70 to 80% of our immune system is in the gut. And that's really a big part of it is it's sensing what's going on with what we're taking in from diet, but also the microbes, what microbes are there, what they're producing.

And then the immune system responds to those, differences, in terms of what it's detecting there. Those immune cells then can either produce certain factors called cytokines that can influence the immune system all around the body, including the brain.

So there's really a couple different ways in which the immune system, can then influence brain function. And some of that is also through the immune cells themselves that can actually travel from the gut to other parts of the body, including the brain.

So really, there's a lot of, of different things we could get into here, but it's really at the heart. It has to do with interactions between the microbiome and our gut and the nervous system that's present in the gut, relaying back to the brain.

And then also the immune system, that also has a presence in the gut, but then can also influence the brain. And then the last category, which I know is, incredibly important for healthy aging in general, and also neurodegeneration is overall metabolism, such as insulin, glucose levels, etc..

And we do know that the microbiome actually can influence various aspects of metabolism. So there are various ways in which the microbiome can actually influence that whole gut brain axis.

And it goes it goes the other way around in terms of things like stress, sleep, circadian rhythms that affect gut health. So kind of a long answer to the question, but there's really a lot involved there.

And I think a lot that we can potentially focus on. And I think that's maybe why it more often than not, it becomes these soundbites of health starts in the gut or the gut brain connection it because it is complex and so articulating that when you don't have a PhD or an MD or an NDI, can be challenging, but I hope that there will be some really solid takeaways for everyone listening here today so that there's another layer of understanding and that helps so much with the why is when we start to put one thing in our mouths versus another, or when we decide to commit to taking that probiotic or whatever it is that that intervention is, I think understanding this, that a little bit more nuanced level helps as to be, inspired to follow through on some of the interventions.

So you describe three kind of patterns of the most common gut imbalances that affect brain health. And, in particular in the aging population. There are some that come up more than others.

So go into those three patterns, if you will. Absolutely. Yeah. So these are patterns that we see commonly in a really wide variety of patients. So particularly those with chronic conditions, chronic diseases.

And of course increase in incidence with aging. And then there's the underlying aging process itself, that we know can also influence gut health, etc..

So when it comes to gut testing and the patterns that we primarily see, I'll just kind of back up for a moment and talk about, the patterns that involve the microbes.

So gut testing, really often involves assessing the microbiome and then pathogens or bad guys that may be present. So one of the key patterns is an overgrowth of certain type of the bad ones that we refer to as inflammatory type dysbiosis.

So these are microbes that participating in contributing to inflammation. But it's a two way interaction sort of like the gut brain axis as a whole where we know inflammation caused by various things, including diet, actually can then change the microbiome.

In a way that favors these, bad guys. Essentially, the thing I want to just jump in is when you say diet can create inflammation. From your perspective, what are the most inflammatory foods?

It's a great question. So certainly processed foods would be at the top of the list because certain, additives that are often present in processed foods have been shown to, for example, increased damage to the intestinal barrier.

So that would be things like emulsifiers that are often found in certain processed foods, etc.. And then sugar. We also know there's a lot of studies showing that sugars directly feed the bad bacteria.

So that can throw off the balance. And, so really, when you're considering the carbohydrate part of diet, fiber is very important in those sort of longer chain, more complex carbohydrates that take longer to digest.

Three Common Gut Imbalance Patterns

And in many cases, our own gut can't really break them down. So the microbes break them down in the gut, and then they break them down and turn them into beneficial products.

So it's really, kind of considering all of the components of the diet itself, but, excess levels of certain things like proteins, high protein diets have their place therapeutically, but, it has been shown in a number of studies that excess protein in the diet also can favor these bad guys under certain circumstances.

And also a high fat diet as well. But, so it really depends, of course, on the details and the types of fats and healthy fats versus the less than healthy fats.

So really all of those main components of the diet, there is some details there that can influence the balance between the good guys and the bad guys and the gut.

And so this is that overgrowth kind of idea that if we're eating things that are packaged and processed in the middle of the grocery store, right, like going up and down those aisles of everything in the boxes and the bags and wrapped in plastic 18 times.

Those are the things that are going to typically contribute to an overgrowth of the wrong gut bugs, the bad guys. So that's that's kind of pattern one.

What's the next pattern? The next pattern would be essentially kind of the opposite. It's lack of the good guys in the microbiome. So they're really the they're supposed to be the predominant ones in a healthy microbiome.

We know that they thrive on certain components of foods, like fibers. Another category of plant components, that's present in fruits and vegetables. Some of you may have heard of this polyphenols, that are very common, again, in fruits and vegetables, but also, great category of supplements that can be helpful for the microbiome as well.

So they really thrive primarily on fiber and polyphenols. Which also helps then to create a healthy gut environment. So there's a lot of interaction between the healthy microbes and the physiology in your gut.

So they really help to, promote both aspects of that. And then the third pattern has to do really with poor digestion. So it's an overgrowth type pattern.

It can overlap with that inflammatory pattern that I mentioned. But it's usually a different set of microbes that we often see elevated in our tests. And that really syncs up with what we know from research that actually poor digestion is one of the most common, drivers or factors that can cause imbalances in the gut.

So it's something that's often overlooked because we think of diet as being number one, and it is very important. But of course, you also have to digest your food optimally so that you get the nutrients and the microbes out.

So this is that idea of we are what we eat. And if we are taking in good foods, but then we can't digest and assimilate them, then we're not going to get that benefit of those great nutrients that are in the foods.

And we know that as we age, we actually have a reduction in enzymes and hydrochloric acid that help us to do all of that. The heavy lifting of of digestion, of breaking down the this is the burger you eat.

I hope nobody's eating burgers, or at least not the not the processed ones. But a good, healthy, grass fed maybe. And lots of veggies as we, as we break those down, those veggies that takes work.

The proteins take work, the fats take work to digest, not just as we chew, but in our stomachs and beyond. And so how, what do you guys see? And what is the pattern that shows up as people age?

That's a great question. So we do tend to see these patterns that are often found in research and predicted by research, where often patients will have a deficiency in their beneficial microbes.

That's probably one of the first things that we tend to see. Excuse me. And that is actually something that is very common to a wide range of age related diseases.

So some of those really key bacteria that are known to be especially important for the gut, and we think of them as a little bit of the canary in the coal mine.

They're sort of the first sign that things are not quite right in the gut. And again, it's because they produce these really beneficial products. So starting to see a decrease in some of those beneficial bacteria, can be an early sign of chronic conditions and also aging.

And that's well documented in the aging research that they tend to be deficient, as aging progresses. At the same time, because they help to keep the bad guys in check, oftentimes you'll actually see that there's an overgrowth of some of the inflammatory type microbes that I mentioned, particularly if they do have a diagnosed condition or autoimmune type condition, you're much more likely to see that.

And then as far as the reduced digestion pattern, we have, on the test, called JMP, from Diagnostics Solutions Lab, that's the company that I work with.

We often see, not only an overgrowth of certain types of microbes that basically overgrow because of these changes in digestion. Part of that is sort of intuitive, because we know if you're not breaking down and absorbing the foods, they end up in your gut, and then the microbes actually enjoy the food that you're not able to break down.

And so they, they can overgrow and then they can produce products, they're not as healthy. But also at the same time, we have markers specifically for digestion.

So, for example, you can see evidence of whether patients have reduced, digestive enzymes in their gut, which is really common. And that's one of the key factors that can reduce the health of the microbiome.

So that's really and we also see some other changes such as reduced fat absorption. That's really important not

only for getting those essential fatty acids, but also for absorbing the really important, fat soluble vitamins like vitamin D, vitamin E, vitamin A, vitamin K, those are very important for general health as well.

So these are patterns that we see. And there's a lot of overlap between healthy aging. And also what we're seeing in patients that have chronic diseases.

So as you age naturally some of these things do tend to change. And likely the rate at which they're changing, will have an effect on your susceptibility to various conditions, with aging.

And if we can intervene and reduce that rate of change, and, and approximate a younger gut, right, then hopefully the rest of our body, including our brain or skin or our organs, everything, our energy levels, all of that, also approximate the younger you.

So gut imbalances. You've talked about bacteria being high or low, the good guys, the bad guys. There's also other things that are tested and GI maps.

I just for all of our listeners, I use GI maps in my practice all the time. I probably look at 50 or 60 of these a month, in my practice, and I can't tell you how valuable the information I get is.

If I could run a GI maps on every single person, I would, because even people who don't have gut complaints, there's sometimes a ton of information that we can get from how, like Doctor Fabian is saying how we process, whether we're digesting what our balances of microbes are, if there's inflammation in the gut, what our immune response is, all of these things are so impactful on our overall health.

So, you've talked about bacteria. Now, you also test on this on this test for viruses and parasites and and also, fungus. So can you talk a little bit about how those are interpreted by the immune system and what their role is in the gut.

Absolutely. Yeah. So they're really, I think they've kind of fulfill the name or the idea of opportunities. So in general, in a healthy gut, you're going to see fewer none of these types, viruses, parasites, etc..

Fungal, fungal overgrowth as well. So it's again important to think of the context, in terms of the bacteria and the beneficial bacteria that are in the gut.

So they're really dominant, in a healthy microbiome.

Diet, Inflammation, and Microbial Overgrowth

And they produce these products that help to keep these opportunities from over growing and being able to sort of colonize and take hold in the gut. So that's really the first thing to look at.

And we see this very frequently. When you see a particular parasite president, you see candida overgrowth. You're looking at that sort of whole picture.

But that's one of the known factors in research. And it's also something we see really frequently in patients, is this lack of normal bacteria. At the same time that we see the parasites and also fungal overgrowth, etc..

As far as their role, it's a little bit mixed depending on whether they're more pathogenic. Certainly, organisms like Giardia, and amoeba histo lytic.

You may have heard of some of these. They can be pretty pathogenic in some patients. Not everyone has significant symptoms. So that's something to consider.

If you see these on the test, it doesn't always mean that it's a serious infection. So that's really where this sort of clinical assessment comes into play.

You're looking at the context, what else is going on here? But they can be pretty disruptive to gut health. So in particular is really, well studied. So just to give you an example, we know that it produces certain factors that cause leaky gut.

So I would imagine many in your audience have heard of leaky gut. And we can certainly talk more about that in terms of how you can assess that with GMF.

But that's one of the key things that these various opportunities often do is create a leaky gut, that then can stimulate more inflammation, and really stimulate more imbalances that allow them to gain an advantage and, and take hold.

And also with some of them, we do tend to see that they're more likely to be prevalent when patients are not digesting well. So I think you're kind of getting this picture that everything's sort of interconnected.

And that's really how we look at it, as opposed to just looking at one particular pathogen or bad guy by itself. It's really important. And that's really why we offer a test like this that gives you so many different insights into the gut.

Because it really all sort of works together. It's an ecosystem where this combination of leaky gut really starts to contribute to altered immune responses.

And we know that dementia is essentially the product of inflammation in the in the brain. And this response to that inflammation, right. These beta amyloid plaques and how proteins, these are essentially there to protect us.

But there that response is mounted when there is something that drives inflammation in the gut. And that can be an immune response that starts in the gut.

So, so this is again, that gut brain connection that when we have a leaky gut, we can be, basically absorbing pathogens or creating an immune response to foods that aren't well digested in our bloodstream.

And then that has the ability to impact the brain. So will you tell us a little bit more about these immune responses that you can measure? Absolutely. Yeah.

So one of the key ones is a direct measure of inflammation. So that's a frequently, used marker, that you'll see on a lot of tests where they're assessing GI inflammation, gastrointestinal inflammation.

And that's called protecting. So this is a marker that's produced by certain types of inflammatory cells. So when you see it elevated, it's often associated, certainly not necessarily directly diagnostic.

It is something that clinicians will take into account as they're diagnosing, but it will tell you whether you have this particular type of increased inflammatory type response, particularly in the lower GI tract.

So that's one of the key markers that we have on our test. We also have a few others. One of the, the other important markers that really plays an essential role in gut health and is actually considered part of the intestinal lining or intestinal barrier, which is called secretory IGA.

So again, you'll see this on a lot of gut tests including GI map. Some key things to note about this is it's a very protective, aspect of the immune system.

It's in a general category called immunoglobulin, and it's secreted by the immune cells that are just below the gut lining, and that secretes it into sort of what we consider the mucus layer of the gut.

So that's essentially the first protective layer of the gut is this mucus layer. And so Secretary J combined pathogens and prevent them from being able to infect.

Parasites, Fungi, and Leaky Gut

And recent research actually shows that it has kind of a dual effect, that it actually helps to promote the colonization of the beneficial bacteria. So you can start to see that this is such a an important molecule or important component of the gut, because it's really helps play a role in balancing the microbiome.

And once again, research shows that the beneficial products produced by the microbiome from things like fiber actually help promote this secretory IGA, see here is connecting it back to lifestyle factors and diet.

Because when you see the results on the test, it can be a little abstract, and really seeing how that the dots connect back up to diet and lifestyle factors, I think is very helpful.

But, fiber is probably number one. For promoting that particularly healthy aspect of the immune system. The secretary, IGA, I think is such a, really important marker to look at.

And I always explain to patients that, like many things, balance is the key word that you mention there because you don't want too much and you don't want too little.

And so, you know, interpreting that, it's really like talking to your provider and understanding what is too much or too little for you. So having really low secretory IGA could tell the story that you've been under a chronic immune insult.

Basically, maybe there's been a chronic overgrowth or undergrowth of the wrong microbes that has led to a depletion in your secretory IGA, and that's not a great sign.

It's going to be a really heavy lift for you to address those microbial imbalances. If you don't have the support of enough secretory IGA because you've had a really chronic condition, and then on the other side, having really, really high secretory IGA, in my mind, this is almost better than the really low deplete of secretory IGA.

If you have that high level, it tells us that your body is fighting a battle in that gut. And so we want to do everything we can to support it. And you may actually be prepared to be using some antimicrobial agents, may herbal or pharmaceutical, whatever you and your doctor decide, but that that would be a good time to do that because your gut immune response is going to work together with whatever you do to support it.

And then being in the middle tells us that you have that ability. So that's in that normal range on the on the test. If you're in that middle zone, it means that if you do go to Mexico and drink the water or you you know, you do go to a salad bar and there's something there.

If you are exposed to something through your food or water, then you are going to have the ability to mount that response. You're not going to be overly susceptible.

And right now you're you're that the immune system and, and the military is always this imperfect analogy. But I think in this context that makes sense, right?

You have those guys waiting to fight that battle if it's necessary. Absolutely. Yeah. So again, I think it comes back to, taking that whole picture into account.

So of course, clinicians are assessing their patients diet etc.. Diet really is number one. So if you're trying to build up a patient's, intestinal barrier.

So again, we think of leaky gut as sort of those gaps or holes in the intestinal lining. So I think that's something that's fairly common knowledge at this point.

But research shows that other components like the secretory AG are equally important. So that's again where we want to focus on diet. And there are certain things, including for fiber in particular.

I mentioned, the polyphenols have also been shown to help promote the secretory IGA, fat soluble vitamins,

particularly vitamin A and vitamin D. So again, this is where you want to think about those connections.

And if diet, or digestion is not optimal and you're not digesting your fats and your fat soluble vitamins, that also can have an impact on your intestinal lining.

But if you want to really get a comprehensive sort of view of the healthy, the intestinal barrier, but you can kind of boil that down to certain things.

One is the lack of normal bacteria, so they help to repel pathogens themselves, but also they support these other components. So they help prevent leaky gut.

They help support, Secretary RGA. They help support the really important mucus layer. You're also looking at the pathogens and opportunist. Some of these opportunists, like the parasites, can actually secrete enzymes that can break down the secretory IGA.

And then you can also have, other imbalances, such as inflammation that can also have a negative effect on the barrier. So really that's one of the things that we always come back to is just looking at the whole picture and connecting the dots, and then how that connects back to diet.

So there is a test called Zainudin that tests it specifically for leaky gut. There I think is and how does online work. That's a great question. So Zanon actually is a protein produced by the epithelial cells that helps to regulate that gap between the cells.

So normally the the gap is kept, pretty narrow. So only just routine molecules that the body needs can get through. But if that zone you in is increased in response to things like dietary factors like gluten is a big trigger for Zani Lin, stress actually can enhance leaky gut, or just generally a bad diet.

We talked about processed foods and some of the components in the processed foods that can also create an increase in this, particular product. This is the Zainudin alcohol.

And then also, antibiotics can increase leaky gut as well. Right? Absolutely. Yeah. So there's actually a pretty long list of things that can enhance or increase leaky gut.

So it's really, I think a key, component to look for on a test because it is telling you about the state of, that gap between the cells. So essentially the leaky gut itself, technically, it's intestinal permeability.

But that's really something that, this, this particular zone and product plays a major role in, but again, taking that whole picture into account, if you see the secretary itchy, low, etc., that can be very important for the health of the gut.

Immune Markers and Intestinal Barrier Health

And then the functional testing, is available through. Yeah. Can, can look at this through Medicare. How how do we get access to the functional testing like the GI Max.

That's a great question. So, we do offer, insurance coverage for GMA, so it's often something that can be covered. Patients who are not on those types of plans, are going through different, doctors who don't necessarily work with insurance, can pay out of out of pocket the cash price, so you can obtain it either way.

But it's something that is definitely very critical to gut health. And you want to make sure that your patients have this comprehensive picture of their health.

And how is it different from that? Very comprehensive testing. Right? I have a lot of patients. I just went to my gastroenterologist and they ran this really comprehensive test.

I collected my stool three times. How is it different from the type of testing that you would get from either a primary care provider, or maybe even a gastroenterologist?

Most of the testing is offered through primary care facilities. And also through hospital facilities is usually pretty limited. They're normally looking specifically for example, for pathogens.

So you'll see whether or not pathogens are detected based on their particular method that's used. But the key there is you don't have the context typically.

And I've seen this quite a bit in practice where these patients really, come in and they have a previous test. And they basically say, you know, they did or did not have a particular pathogen.

But we're learning more and more about the importance once again, of digestion, the intestinal barrier, etc.. So it's a little hard to assess the context there.

There's more that you can work with therapeutically if you have this additional information. So I think clinicians that have switched over from the traditional, more limited testing to this more comprehensive testing sort of feel like they once they go there, they can't go back because they have so much more information to work with.

I think also another really key component to consider are key aspects, when you're looking at different gut tests that are out there, is the methodology.

I don't want to get into too much technical detail here, but not all tests are the same. Just because something is called a gut test or a like microbiome test, they do use different methods.

The method that we use is something called a quantitative PCR. Not going to get into any of the details here, but it basically allows, clinicians to to see exactly how much is there.

So it's a quantitative type measure versus say, positive negative. The problem with the positive negative test is that they have a particular cutoff level.

So you may be just above that cutoff level and kind of high or you may be really high, but either way they'll just say positive. Same on the low end. If you are just below the cutoff level, that might actually still be clinically significant in some cases.

But you're going to miss it because it it's really not telling you that it's there versus a quantitative test where you can really see is it just a low level that may not be much of a problem.

It's sort of a temporary infection that may go away. Or is it a really high level. And that's really critical information that clinicians need to know to determine.

Is this something that I need to really address? And parasites in particular are notorious for being missed on testing. This is part of why, if you've gone back and forth with the gastroenterologist, they may have asked you to collect your stool three times for one sample is because it's so, so, so easy to miss them and they can be playing such a big role in this gut imbalance picture.

So the way you guys do it makes it a little easier to catch those guys. It does. Yeah. So a really a big advantage of the methodology that I just mentioned is increased sensitivity.

So that allows us to detect things at lower levels that if you're looking at sort of the old fashioned way or the traditional method of microscopy, which still has has its place.

But it can be fairly easy to miss them. And that's one of the key reasons why they often recommend collecting multiple samples over several days, versus using the molecular technology.

Research studies that have compared them have shown that the molecular technology has a very high sensitivity. So that's more convenient for patients because they only have to collect one time.

It's a really concern that somehow they're going to miss it. Certainly they can collect over a couple of days, stored the sample at low temperature. And then they can just submit that after they've collected a couple different times.

But, really the advantage of the method is so that you don't have to go through that inconvenience of collecting over several different days. Yeah. It's not glamorous.

But so much good information comes out of it. Another test you guys run has to do again with this kind of altered immune response. It's the cytokine panel that is relatively new to me, but very, very helpful, particularly when I have patients who we've kind of addressed the gut.

We've got them on a good diet, they're exercising, they're doing everything right, but their symptoms aren't going away. And what this the way I think of the cytokine panel that you guys run, is that it's that runaway inflammation.

It's when we can't when we are not able to interrupt the cycle, then it kind of starts to perpetuate itself. And this is what you were alluding to or actually spoke eloquently about, was this connection between so many things and how once you know, we're not digesting well, well, then that makes the microbes overgrow and under grow and creates inflammation, and then the inflammation kind of leads to more poor digestion, which then leads to more overgrowth or undergrowth.

And this becomes a self-perpetuating cycle. And so we see this in the immune system and in the context of cytokines. So can you tell us a little bit more about the utility of that test.

Absolutely. Yeah. So it's a serum test. So we're looking for these again they're called cytokines in serum. Cytokines essentially are released primarily by immune cells but also other cells as a way to sort of signal to the body what needs to be done, what's being detected.

So a classic example is if you do have an infection in the GI tract, or even if just you have just dysbiosis overgrowth with these inflammatory microbes, your local immune cells are going to detect what's going on there.

And they're going to release these cytokines. And it becomes a bit of a cascade. So then that causes other immune cells then to react to those cytokines and then produce additional cytokines.

So you have this sort of amplified response that can become systemic. And that's when you detect them in serum. So you can have just a minor local issue going on.

And you may not detect that in your blood.

Cytokines, Chronic Inflammation, and Testing Access

But this test is looking at what it what is being detected systemically. And it's a panel of 16 different cytokines that are, sort of at a high level, broken into pro-inflammatory versus anti-inflammatory type cytokines.

And that's, of course, a critical balance that you want to know, do you have an excess pro-inflammatory response? You know, are you not producing a sufficient amount of the anti inflammatory cytokines.

So in a classic sort of infection scenario where you basically become sick and then you recover, you'll see an increase in these pro-inflammatory cytokines.

Then you have the anti-inflammatory ones kicking in to kind of help bring that inflammation down. And that's how the immune system is supposed to work.

But certainly under chronic inflammation conditions, that pro-inflammatory response can stay elevated over a long

period of time. And that's telling you that something is can continue to contribute to that inflammation.

So when I talked about 70 to 80% of the of the immune system being in the gut, that's often a key source. So I can tell you that, that even though the patient might be feeling somewhat better, still symptomatic, and you've done kind of your typical routine protocol, seeing chronically elevated inflammation is telling you there's still something going on.

Often it's in the gut, but you may want to do further testing to see really what's causing that. That inflammation. Right? Right, right. Yes. I we've had this this is one of the refrains of the summit, one of the, the patterns coming up.

In the message is I've heard over and over from people, oh, well, the causes inflammation. And my answer is always, what's causing the inflammation? Right. That's the follow up question that we have to ask.

And so I really appreciate that you guys are looking at inflammation. But going back to why why is that there. What's causing it. So we've talked a bit about the most effective dietary and lifestyle approaches.

You've mentioned fiber. And I think it I'm sure fermented foods are on your list. Are there other diet and lifestyle, dietary and lifestyle approaches or things that you recommend pretty regularly that are good for most people in terms of balancing their gut?

Indeed, yes. So we kind of summarize the key approaches, that are both known for research, but also just what we see apply clinically. Is the four piece.

So we've kind of covered most of them at this point. That would be prebiotics probiotics the polyphenol. So again those are those plant compounds that give plants their fiber and colors.

For example, there's a relatively new category that's just sort of coming out called post biotics. So this is an example where we know that there are these beneficial products produced by the microbiome, probably butyrate, which is, something called the short chain fatty acid, that's produced by the beneficial bacteria in the gut.

So that's something that can be deficient when you don't have enough of these beneficial bacteria. Because it's a product that comes from microbes transforming our diet into these products.

It's called a post biotic. So when you suspect that those are deficient or they can be measured on certain tests, then you potentially can supply that as a supplement.

So butyrate actually is one of the examples. It's widely available. And we're learning more and more about these products. I'm sure that category will increase quite a bit in the coming years.

And research actually shows that these various products can be synergistic. So rather than, say, focusing on just a probiotic or just a prebiotic, research shows that when you combine these four elements and for some patients, if it's the right, combination for that given patient, the results can really be much more effective than just taking one particular approach.

So that's, that's really kind of the key ways to support the microbiome. We talked about digestion, ways to support digestion. Digestive enzymes are common.

Low stomach acid is extremely common. So sometimes clinicians will recommend that their patients take supplemental acid or stimulate acid in other ways through, say, bitters.

And that kind of brings me to the gut brain axis again. So we know that, very, very well documented in research are ways in which stress, lack of sleep, and also disrupted circadian rhythms can affect the gut.

So I would say probably the number one factor that will kind of interfere with the progress of patients, despite taking

all the right supplements, adjusting their diet, etc..

Oftentimes it's the stress and the lack of sleep or disrupted sleep. And that can, of course, be a bit more challenging for some patients to address. But really essential for overall gut health.

Yeah, particularly for many of our caregivers who are listening and who are, you know, dedicating their lives to caring for someone with dementia. It's really challenging to prioritize yourself, and to get that good sleep.

But I hope that Tom here has inspired you all to make gut health a priority and understanding the whys and the how to's of this. It has again inspired you to take some action.

Tom, it's been a pleasure having you, really informative. I've learned a lot, and I want to make sure that everyone knows how they can get access to that GI maps test if they want it.

Absolutely. So it's a test that does need to be ordered through a clinician. So it's not something that can be ordered directly by patients. So if you have a clinician that is able to order the GM app, you can also get information from our website, which is Diagnostic solutions lab.com.

We have a menu of tests. You'll see the GI map on that test. So if you're a physician has not, worked with Cmap, that's something that you can potentially bring that information, to them and see if they're able to order that.

It's primarily a test that's used by functional and integrative medicine. So that would be really key not only for ensuring that you can work with the clinician who can order the test.

But probably even more important is you want to work with a clinician who can properly interpret the test. So as you kind of probably got an idea going through this information here is it can get a little complicated.

And when patients do try to interpret the information themselves, sometimes you'll see that they go online and try to get information there. We strongly recommend working with experienced clinicians so that you get proper interpretation of the test as well.

And you're reticent. Train recode train provider will have access. It should have access to the GI maps. So that should be again pretty simple for them because they have been trained by Doctor Rennison.

And there are entire modules in Recode about the gut brain access and how to interpret tests like this. So, do ask your your Bredesen trained recode train provider to help you with this, with both ordering it, getting it, and then, getting that interpreted.

Tom, thank you so much for joining us again. It's been a pleasure. Really enjoyed having you here. Thank you for taking the time and sharing your expertise.

Thank you so much, Doctor Sanders, and it's been a great pleasure.