The Power of Probiotics:

A Special Interview with Dr. Greg Leyer

By Dr. Joseph Mercola

DM: Dr. Joseph Mercola

GL: Dr. Greg Leyer

DM: There doesn't seem to be a day that goes by that there's not some type of announcement in the media on the importance of our gut flora to our health. Hi, this is Dr. Mercola, helping you take control of your health. Today I am joined by Dr. Greg Leyer, who is going to enlighten us about this topic, specifically when it comes to taking supplemental beneficial bacteria. Welcome and thank you for joining us today.

GL: It's my pleasure. Thank you for having me.

DM: Why don't you give our viewers a summary of your professional experience, so they'd understand where you're coming from?

GL: Sure. I'd be happy to. I got interested in microbiology and spent my graduate research career looking at pathogenic bacteria, those bacteria we want to avoid and that make us sick. In the course of doing those studies, I became aware that not all bacteria are bad and became intrigued in this whole concept of probiotics. I was very fortunate then that my first post-graduate job was in the area of developing probiotics for infant nutrition. That was 21 years ago. I've been in the probiotic research development field ever since then and have seen the research in the market just explode.

DM: Terrific. Where are you working at now?

GL: I work for a company, United Agricultural Services (UAS) Laboratories. We're a probiotic-dedicated manufacturer. We're passionate about probiotics, and it's all we do.

DM: Okay. For those who are still unfamiliar with the topic that we're going to discuss, maybe you can highlight some of the important concerns or issues from your perspective.

GL: The topic today is probiotics. For your listeners, probiotics are those healthy bacteria that generally reside in our gut, which is where we have the largest concentration of our commensal bacteria. The reality is that bacteria reside anywhere on our body that's exposed to the environment. There'll be bacteria that reside in our mouth, on our skin, and, as I mentioned earlier, the largest concentration will be in our gastrointestinal tract. And there are different bacteria that live in different locations in our gastrointestinal tract.

What's driving kind of the continued interest in probiotics are not only the successes that people have when they take them and the clinical evidence that's driving new applications, but also the millions of dollars that are being funneled into trying to understand the role of bacteria in health and disease.

DM: Thank you for that. From my review, understanding, and experience with this, the central component seems to be, before we take a supplement, to really optimize the conditions where these

beneficial bacteria can grow. Because most likely one of the ways that eating a healthy diet is able to influence your health is through modifying and optimizing the beneficial bacteria in your gut and decreasing the pathogenic or disease-causing bacteria, fungi, and yeast.

That basically amounts to simple strategies like eating real food, which means avoiding processed foods and staying away from sugars, because sugars will definitely fertilize and accelerate the growth of these pathogenic microbes. Maybe you can comment on the importance of that from your perspective.

GL: Yes. It is very true. In studies that are done in people all over the world, you'll see different microbial communities residing in people that have different dietary intakes. You want to provide foods that are going to nourish this healthy community of bacteria in your gastrointestinal tract.

As you mentioned, sugars aren't selective. Bacteria like sugars, but the bad bacteria love sugars. Eating real food, complex carbohydrates, fibers, and things like that are more selective. By that, I mean the pathogenic bacteria don't like them as much. It's more difficult for them to utilize them as an energy source.

Our good bacteria – the bacteria that we want to feed, nourish, and keep at high levels – appreciate that kind of dietary regimen. You can do a lot in maintaining your health obviously through nutrition. Nutrition, as we understand things more and more, a large component to that is not only nourishing the human body, but nourishing this kind of large organ of bacteria that are residing within us.

DM: Now, unfortunately, one of the challenges with the US Food and Drug Administration (FDA) in telling something true about a product that they prevent you from doing is that the topic seems to be hot, but for them, it's what you do after or while you're taking antibiotics, because they're commonly prescribed. Most people watching this realize that even though they're prescribed to humans, 80 percent of antibiotics are actually given to animals and wind up in our food supply if we're not careful on eating real food. The end result is you're exposed to these things.

I'm wondering – let me just finish the thought. The FDA doesn't allow anyone to market their probiotics saying, "This is useful to take after an antibiotic," because it implies that antibiotics might harm you in some way. Maybe you can talk about that issue of the between our gut microbes and antibiotics.

GL: Sure. A couple of things there: one is we are restricted. We are a regulated field. We're restricted in what we can say about a finished dietary supplement product. But it has its purposes, right? You don't want to be false.

DM: Sure. Stated simply: we want to protect the public, or they want to protect the public.

GL: Absolutely. The downside of that is that there's a lot of really exciting research that you're not able to talk about or you kind of have a muzzle when you talk about it. One of them is the role of healthy bacteria when co-prescribed with an antibiotic and the effect it has on maintaining healthy populations in your gut, because antibiotics are selective for bacteria, but they're not terribly selective for a particular bacteria.

Antibiotics – and many studies have shown this – will have a tremendous disruption effect on the overall microbial community. They'll kill the target organism that might be causing your infection. They've saved a lot of lives, right? But they also do a lot of harm to the good bacteria that are there. Studies have shown that when you co-administer probiotics with antibiotics and continue that probiotic administration, you're quickly able to restore that microbial community to the healthy state it has prior to the antibiotic treatment.

To your point about antibiotics in the food supply, it's leading to a lot of interesting theories. You might have read the book *Missing Microbes: How the Overuse of Antibiotics Is Fueling Our Modern Plagues*. There's this theory out there that – and antibiotics again have saved a lot of lives over the course of history –this overuse of antibiotics or this unknowing consumption of antibiotics through the food supply has a harmful disruption effect on the microbiota.

The theory is that this disruption is really kind of leading to a lot of these modern lifestyle kind of plagues – the type 2 diabetes, the obesity epidemic, and the immunological disorders that we're seeing in a preponderant effect in the Westernized world where we're kind of being onslaught with these antibiotics unbeknownst to us in many cases. The role of kind of keeping this intestinal microflora healthy, consuming healthy, active probiotic bacteria is a key component to maintaining, in my opinion, our overall health.

DM: Sure. There's no question that antibiotics have certainly helped individuals. But if one was to carefully analyze and objectively determine their true impact, I wouldn't be surprised if they've actually hurt more people than they've helped. In fact, I suspect that's the case.

For those who are taking them though, it's been my understanding clinically that it's sort of useless to take a probiotic while you're taking the antibiotic, because they non-discriminately kill them. I'm wondering if you can comment on that. Also, what I've recommended in the past is giving a therapeutic yeast like Saccharomyces boulardii that would not be affected by the antibiotic, because that's a different mechanism, yet it would still support the microflora.

GL: Good question. In terms of the timing of taking a probiotic, in the clinical studies that I have been involved with that have looked at the disruptive role of antibiotics and the positive role of probiotics, we've just asked people to space out the consumption of them by a few hours. The antibiotics will be up taken by the human body and absorbed, and they're no longer really in the gastrointestinal tract in large part. Whereas if you hit it a couple of hours later or a couple of hours before with your probiotics, you've kind of separated the two.

DM: And that seems to work from your analysis?

GL: It does seem to work. And then the idea of providing yeast, the Saccharomyces yeast, the healthy yeast, there are a lot of studies on it and its role in preventing antibiotic-associated diarrhea.

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The studies that I've seen I'd say anywhere from 15 to 25 percent of people who are taking an antibiotic end up getting an antibiotic-associated diarrhea. Probiotics – I'll include Saccharomyces in this group – have been shown to have tremendous benefits in reducing the risk of developing that kind of secondary complication of antibiotic treatment.

DM: Okay. Great. Basically, it's just defining the optimal window, which is far away from the antibiotics that you're taking. Hopefully, if you're taking a once-a-day antibiotic – and there are a number of them that are available – that's easier. If you're taking two or three, it becomes more of a challenge. Two or three times a day.

I'm wondering, one of the other issues, which is not necessarily related to the gut microbiome although it might be, is the leaky gut or the disruption in the intestinal connections, interconnections, between the cells. That can be a very devastating problem. It's a real problem. I've known a number of people who basically have just about died from that disease.

There's a variety of causes for it, but it seems that whatever the cause, one of the beneficial and perhaps one of the most powerful remedies for it is bone broth, to restore that gut lining. I'm wondering if you're familiar or aware of any research working with bone broth and probiotic supplementation.

GL: I'm not familiar with the evidence behind bone broth, but I am familiar with the evidence behind certain probiotics and their ability to kind of maintain the tight junction or prevent or lessen leaky gut. The issue with leaky gut, as you're well aware, is you're getting things that are circulating between these intestinal cells into the circulation system that aren't really supposed to be there. Much of it is LPS or a component of certain types of bacteria that cause this chronic inflammation.

DM: Excuse me for interrupting. Just for those who don't know, LPS is lipopolysaccharides. It actually is a clinical test, a blood test, which you can have performed, that will show you that you have leaky gut.

GL: Right. LPS is a common component of certain types of bacteria, not probiotic bacteria; these are gram-negative bacteria or a different classification of bacteria. But you're right. It's a diagnostic test to look for leaky gut. What we're finding out is that this kind of subchorionic levels of LPS circulating in the blood causes this chronic inflammation cascade.

Chronic inflammation seems to be at the root of a lot of disease states that we're finding out today. One that is front and center is type 2 diabetes and insulin resistance. There's been some really intriguing work with probiotics maintaining tight-junction barrier, reducing leaky gut, reducing circulating LPS, and affecting insulin sensitivity through kind of downplaying this inflammation that we're seeing.

DM: Okay. Great. Maybe you can go over the mechanism for probiotics – how they're working and some of the newest science that you're familiar with this that addresses these mechanisms.

GL: The mechanisms of probiotics really depend on what probiotic you're talking about and what application you're trying to go after. I think probiotics have been tested, for example, in intestinal conditions like irritable bowel syndrome (IBS), which is a really tough nut to crack, because there's not a really clearly defined mechanism that's rock solid. There are some theories. A lot of these mechanisms will go back to the immune system and go back to inflammation. I think that's one of the potential mechanisms of their benefits in irritable bowel syndrome.

Probiotics have been tested extensively for their immunological functions. By that, it means maybe getting an elderly person's immune system back to optimized function to kind of ward off pathogenic bacteria as well as increasing these immune cells that fight off the cancer cells. The mechanism of that is involving this orchestration of immune chemical messengers called cytokines.

There are some areas in the probiotic science where the mechanisms are becoming better understood. And there are some areas in probiotic science that is more theory than really causal right now. A lot of research goes into understanding this. But the more layers of the onion you peel back, the more you understand this is an incredibly complicated web of information from gut to human, to nervous system to immune system. This complex interplay is not so simple that you can just clearly identify.

DM: I have seen estimates that [say] up to 80 percent of the immune response is actually a result of a healthy gut flora. One of the best ways, of course, to prevent the flu is not to get a flu shot, but to improve the health of your gut flora.

GL: Yeah, [that's] very true. I've done studies where we've looked at children. We just monitored their health and well-being when they're on the probiotic versus their counterparts in a school that weren't taking probiotics. We monitored health and wellness – illness, incidence reduction of cold- and flu-like symptoms – and it has a tremendous effect.

One of the secondary benefits of studies like that is you see a lot less antibiotics being prescribed. The kids are healthier. They're not getting as sick. The doctor doesn't have a major reflex of prescribing an antibiotic that isn't going to affect the virus anyway.

DM: Ideally, I believe that one should be able to obtain most of their nutritional support from the food that they're eating. This is certainly the case with beneficial bacteria, because there are a lot of good fermented foods where you can get that. You wouldn't have to swallow a probiotic product necessarily. But one of my biggest pet peeves about some of these foods is yogurt. We actually funded Cornucopia to produce a report on essentially the junk food component of these yogurts, because most of them are nothing more than creamy junk food. It's probably over 95 percent of them.

Many people are seeking to improve their health and making these choices by consuming commercial yogurts from the grocery store, thinking that they're doing themselves a good job, but the reality is they're not. They'd be far better off swallowing one of these pills and decreasing their exposure to usually high concentrations of sugar and other additives in there that are not even disclosed on the label. Maybe you can comment on that – the fermented foods, yogurt as a junk food, versus taking a probiotic.

GL: Sure. Yogurts – if made properly and not overly sweetened – is a decent nutritional food. But there are a lot of yogurts out there like you mentioned. If you look at the nutritional label, you're getting 25 to 30 grams of sugar, being consumed because most of them feel that Americans like sweet yogurt.

The probiotic component of yogurt is typically even more lacking than the nutritional composition issues that you take umbrage with. On a probiotic perspective, the amount of probiotics that you're consuming in a cup of yogurt is logarithmically levels lower than what you'd get in a quality-made dietary supplement.

DM: Okay. Now, science people would know what that would mean. It's a good term "logarithmically." But let's talk to the person who really hasn't taken Math or understands what logarithms are.

GL: What we mean by that is if you're taking a yogurt, you might be… Let's say, you're getting a million probiotic cells, which sounds like a lot. But if you're taking a quality-made dietary supplement, you're having tens of billions of quality probiotics being consumed. You have to take 10, 20, 30, to 40 cups of yogurt or more to equal what you get in one capsule of a quality-made dietary supplement. That's kind of a good way to look at it. I mean, if you're consuming a food…

DM: Millions versus billions, probably you'd need I think a thousand cups or maybe like a truckload.

GL: I wanted to make a logarithmic analogy, but you're right. There's a thousand-fold difference between millions versus billions

DM: Yeah. That's three orders of magnitude.

GL: It is. It's three orders of magnitude. And I've seen fundamental advertisements for people who advertise their dietary supplements as compared to a yogurt. You need truckloads of yogurts versus one.

DM: Which is the more cost-effective and easier solution?

GL: Right. It's clearly the supplement. And then you control what's there. The other thing that you have to consider is that in a yogurt, you've got a very acidic condition that's degrading the quality of the probiotics over the course of the shelf life of that yogurt. In a quality-made dietary supplement, these probiotics are essentially in suspended animation or dormant until you consume them, and then they – voila – come back to life when you swallow the capsule.

DM: Maybe you can address the issue of how frequently you need to take them with respect to… The confusion I think that exists in many people's minds is that these bacteria implant… It's like planting seeds in your garden. They grow, reproduce, and you basically need to seed and feed them, and that's it.

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GL: Right.

DM: But that doesn't appear to be the case. Maybe you can expand on that.

GL: Yeah, it does not appear to be the case with the probiotics. A couple of things to remember: the intestinal tract has thousands of different bacterial types, not to mention fungi and virus that might be there as well. It's a very tough and difficult to reside in that ecosystem. It's a challenging environment.

Probiotics have developed the ability to withstand normal concentrations of stomach acid and bile in the small intestine, and live there. But they don't live there forever. When you're trying to implant something into somebody taking a probiotic, when you stop taking the probiotics, studies will show that you start seeing less and less and less of that probiotic residing there. It will kind of decline to this baseline level of before you started taking a probiotic supplement. So, it's really important.

On the immune side, there are studies that show that immune benefits decline within a few days after stopping taking the probiotics. It's really important that it's a continual onslaught of these healthy bacteria. I'm sure you've educated people on this point.

But it makes sense. If you think about how our bodies have evolved to be. I mean, today the way we eat is very different from the way our bodies have kind of adapted. Our bodies expect to see these natural bacteria. You mentioned fermented foods grow here – the sauerkrauts, the kombuchas, and the kimchis, excellent sources of naturally occurring lactic acid bacteria.

Our bodies expect to see that. Our immune system expects to see that. It develops tolerance by seeing these healthy bacteria. Through supplementation, I think it's really important to continue to provide these high-quality, mixed-culture probiotic supplements, so our immune system is always sensing this.

DM: We're providing some compelling arguments here for people to consider availing themselves of the benefits that we're describing and taking a probiotic supplement. In light of that consideration, I'm wondering if you could address some of the variables and factors that they may be looking at to identify a high-quality probiotic supplement, because there's a wide range of products on the market.

GL: There is. I actually have some sympathy for the consumer, because when you go into a store or you're shopping online, there are a lot of products. How in the world will you make a good choice? A couple of things that I could give out as recommendations: a reputable brand. If you trust the products made by a company, perhaps they're doing a great job making their probiotics as well. But specifically with regards to probiotics, my recommendation would be to look for a decent count. That can be anything up and over, I'd say 50 billion or higher.

DM: That count is typically colony forming units (CFUs), right?

GL: Exactly. That's represented by capital C-F-U, exactly as you mentioned. It's also what people talk about as potency counts. It's all the same things. The number of bacteria that are being delivered in that capsule.

The other thing you want to look for is a declaration of shelf life, which is essentially saying, "We're guaranteeing this count through the shelf life of this product." What you definitely want to avoid are those

products that are still on the market that will say, "We had 10 billion at time of manufacture." That means essentially nothing to the consumer because they all could be dead when they leave the factory. The companies that are doing it right are declaring a shelf life. They've got stability to prove it and they take great care at how they make that finished dietary supplement.

DM: That usually results, if they're going to make that claim at some future date, they typically overcompensate. If they're claiming 50 billion, they'll put in 75 billion. Or maybe you can give a more precise number, because I'm not sure of the overcompensation that's required.

GL: That's true. The overcompensation, or over edge, as we call it in this field, is going to be different depending on what shelf life you want, what storage temperature are you recommending, what organisms are in there, and what else are you putting in with these probiotic organisms. All these things – what capsule are you choosing, what conditions did you use to make the finished product, and if you select them right – contribute to making a very high-quality probiotic product that will have appreciable shelf life stability out of 12, 18, or 24 months, depending on what you're looking for.

There's a lot of science that's brought in that, not only the science of the probiotic organism and what they do in the body, which we've spoken about. There's a lot of science and technology involved in making the finished product, so that the consumer is guaranteed to be consuming a high-quality product.

DM: Okay. Let's continue along the lines of helping the person make a good choice in identifying their probiotic supplement. Maybe you can give some comments on what to look for in the type of organisms, because that's clearly the next big component. There's the wide range of organisms out there. Once you've addressed the stability, the competency of the manufacturer, the guarantee, and then the quantity of the organisms.

GL: Sure. I'm a big fan of multispecies. What I mean by that is there's probably a point of limiting returns in terms of do you want 30 organisms or do you want 10 organisms in a probiotic product? I think diversity is important. The studies where people are looking at human intestinal ecology would show that high diversity seems to be linked with health. Low diversity, you see low diversity. By that, I mean you're not having the variety of microorganisms living in the gastrointestinal tract in certain disease states. We kind of want the opposite of that. We want to be providing a diversity of organisms.

The two easiest recommendations I can make is to look for products that contain species of Lactobacillus and species of Bifidobacteria.

The reason I say that is Lactobacillus species –examples would be Lactobacillus acidophilus and Lactobacillus plantarum – these are types of organisms that predominantly reside in the small intestine or the upper GI. It's important to note also where a lot of these immune-sensing cells are. We referenced the fact that between 60 and 80 percent of our immune cells reside along our gastrointestinal tract. Most of those are in the small intestine. You for sure want to be taking Lactobacillus, so that it's sensing that.

Bifidobacteria, on the other hand, reside in the large intestine or the lower bowel. That's a critical location for the human health as well. Bifidobacteria, I could go on and on about the benefits of that. They like it in the large intestine. What you want is a product that's going to give you kind of a full-spectrum coverage for the upper GI. That's what I would recommend taking products that have species of species of Lactobacillus and species of Bifidobacteria.

DM: Within those, as you mentioned, there are a lot of different subtypes or genus. Is it genus?

GL: Species. Different species.

DM: Different species within the genus like Lactobacillus. How many would you recommend within each one of the Lactobacillus and the Bifidobacteria?

GL: That's a tough question really to quantify. I'd say [inaudible 27:54].

The other thing you have to consider is these microorganisms that are sold as probiotics, they're manufactured they're non-GMO, and they're using all the great manufacturing practices that define them today. But not all of the very unique organisms can be scaled up commercially and provided as finished products.

We have a limitation in Bifidobacteria, especially where there's probably a handful of bacterial species that are available. Bifidobacterium lactis, Bifidobacterium longum, and Bifidobacterium bifidum clearly are very important microorganisms. There are a lot of clinical trials down on these types of species of Bifidobacterium. As far as Lactobacillus acidophilus, it's the acidophilus; it's the rhamnosus; it's the plantarum or perhaps salivarius or paracasei. These names might sound Greek, but they're just different...

DM: Or Latin.

GL: Or Latin. These are microorganisms have a large body of evidence around the benefits of consuming them.

DM: One of the items that we skipped over was on some more of the benefits of taking these types of supplements or making sure you're getting these beneficial bacteria in your diet. Maybe you can discuss some of the gut-brain connection and how they interplay, because there are more connections from the gut to the brain and vice-versa. Many people and experts view the gut as our second brain.

GL: They do.

DM: Can you expand on that?

GL: Yeah, I can expand on that a little bit. The gut is a fascinating area of research, and one that I follow closely, because it's not intuitive. If you look back in time, I don't think people really appreciated the role of a healthy intestinal microbiota or intestinal microbial community and how that affects health.

Initially, if you look at the product studies, we're looking at probiotic benefits in the gut. We're looking at intestinal transit benefits, constipation benefits, pain, bloating, etc. But more and more, as we study the role of microbes in human health and disease, we're realizing that those benefits transcend the gut. The immune system honestly transcends the gut. The immune system and our central nervous system have a constant interplay.

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Some of the more recent work is looking at this gut-brain axis. A lot of the early work is done obviously in animal models, but some human work has been done looking at the role of the microbiota in anxiety, depression, and moods.

There's an interesting study that just came out a month or two ago that kind of looked retrospectively at a study where people gave infants probiotic bacteria for the first two years of their life. They're really looking at the ability of this probiotic to kind of ward off the incidence of atopic eczema or skin rashes.

They followed these kids as they aged. When these kids were aged 13 years old, they went back. They said, "Okay. Let's look at autistic spectrum disorder, attention-deficit hyperactivity disorder (ADHD), and things like this that will be psycho kind of issues." Of the kids that took the probiotic, none of them had

developed any kind of autistic spectrum disorders. And of the children that didn't have the probiotic control group, 17 percent of that group developed an onset of autistic spectrum disorders.

The study wasn't designed to look at ADHD or autism, but it's an interesting way to look back in time and say here's a population of people that were essentially imprinted with probiotic bacteria at a very young age. We're understanding that there's this developmental window in young people that's critically important for probiotics. What effect does that have as we age?

That's another example of this gut-brain axis kind of deriving through the gut its bidirectional communication. But certainly, probiotic bacteria must have the ability to make compounds that interact directly with the brain. They influence the immune system, which has interactions and can cross the blood-brain barrier. It's a fantastic area – and I'm sure you do – to keep tabs of, because I think it's going to transcend medical practices.

DM: Maybe you can also comment on your understanding as to why this is coming out now and not 20, 30, 40, or 50 years ago. It's interesting that one of the first books on the topic directly, especially as it relates to the gut with relation to the gut-brain axis, was a book called *Sugar Blues* by William Dufty. It was written in 1975, 40 years ago. He had a pretty clear evidence that avoiding sugar would have dramatic improvement and influence on the treatment of depression.

I've read the book. It was a while ago obviously. I don't recall that he had a specific mechanism, but now it's very clear that it's a result of its influence on the gut microbiome. You can even take it to the next step, which he did, and consider supplementing with beneficial bacteria.

GL: Right.

DM: It's interesting that there were hints of it, and he was a great example of it. But I'm wondering why we're seeing this in this massive amount of research being published and really the acceptance by even the most conventional clinicians that this is an important influence on health.

GL: It's an interesting question. In other parts of the world, I think the acknowledgement that healthy bacteria have a role in health and disease is well established and probably accepted by the general consuming population as compared in the US. I'm referring to parts of Asia and parts of Europe where it's traditionally practiced. There's a history of naturally fermented food consumption.

Technologies and tools have developed over the last 40 years, which have allowed us to take a closer look. 1970s was the dawn of molecular biology or the ability to look at the genetic potential of microorganisms. The tools have advanced tremendously since then. The genetic sequencing technology. All of these tools are available for researchers now to get a much better handle on who's there. The more we look, the more broader we're finding organisms that we never even knew existed.

Governmental research – the National Institutes of Health (NIH) – and other European and Asian governmental funding groups are pouring millions of dollars into studying the microbiome, which is the study of genetics, the genetic potential of the bacteria that are in our bodies, associating the microbiome of the gut, skin, armpit, and scalp to health and disease, and what role they have. You have this constant funding of research.

When I started in this industry, there was a human clinical trial published two to three a year. It was primarily the big European yogurt manufacturers that were kind of the movers and shakers in the early days of the mid-1990s. Now there's a clinical publication I think almost one a day. Instead of two a year, we're talking over 350 publications a year now on the effects of probiotic intervention. This is continually feeding the interest in probiotic science. We have very basic researchers looking at microbiome – who's there and what role do they have.

You have the application sciences that are allowing us to produce terrific products and getting them in the hands of consumers, and people feel the benefit. There's a market poll. There's a research push. Together, it's creating this probiotic community of researchers and consumers that has a very high trajectory in terms of growth.

I don't see it stopping anytime soon. I really feel we're just scratching the surface. If you think of the future and you start talking personalized nutrition, I think there's a lot of potential there for personalized nutrition and probiotic consumption. Because we're all a little bit different in who's in us. But we're a little bit away from commercializing anything there, but I think that's where it's going.

DM: By implication, are you suggesting that sequencing our own genome, which is now about a thousand dollars to do, is going to be lowered to the point where it will be basically free? And by having that data and also analyzing our gut flora or microbiome, we'll be able to customize formulations for us?

GL: I think the potential is there. You can right now get your gut microbiome sequence for 90 dollars roughly. What is the output of that test, and how do you take the output of that test and convert it into changing dietary practices or supplementation practices? I think we're a little bit away from having it be directly causal, but we have to build the database. We have to understand who's there in health and disease, and see what the correlations are. But I think we're moving in that direction.

DM: Yeah. It's interesting. I know Peter Diamandis and J. Craig Venter just started a new company called Human Longevity Inc., which is actually in the process of doing that: actually sequencing thousands and eventually millions of people's genomes and their microbiome, creating this database, using machine intelligence to do a data analysis, and basically developing an understanding at what's going on with all these information.

GL: You can imagine how complicated it is, but it's going to take people like that to have any... I mean, obviously J. Craig Venter is involved in all the evolution of the microbiome for many years. It's a fantastic area to research. I really do think it's going to change our medicinal practices moving forward.

DM: A curious question: the bacteria in our system outnumber us 10 to one. That's just the conventionally accepted numbers. But what I found really intriguing is that there are bacteriophages and viruses outnumber the bacteria 10 to one. There are literally quadrillion of them in our gut if you do the Math. I'm wondering if you have any comment on bacteriophages. Are they modulated by optimizing the gut flora?

GL: That's a really good question. It's an area that, you know. You talk about the explosion of probiotic research and the gut bug research. The virus and the bacteriophage research will follow. I know there's a lot of bacteriophage research as it relates to food protection and pathogen, kind of targeted pathogen killing. But as it relates to human health, that's the second wave in my opinion. And you're right…

DM: Success is coming in the future.

GL: I believe it is. I don't know how we'd interact with it. But I think we got to try to understand it a little bit better. It's not my personal area of expertise but you're right. I mean, it's kind of an area that's underserved in terms of the research community. Right now they're focusing more on bacteria than they are on viruses for sure.

DM: I'm sure it's harder to do also. The numbers are just extraordinary.

GL: It is.

DM: Do you have any other comments you'd like to share with us or any insights on the topic?

GL: I think the only comment that I'll make is in a sense kind of been weaved into the conversation, and that is probiotic consumption for health and wellness is here to stay. There are a lot of compelling reasons for that. We have a tremendous amount of research showing on a daily basis the different areas that are affected by a microbial community.

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The days of "all bacteria are bad" are long gone. In some people's minds, they're still there. But they're slowly being transformed into a "Wait a minute." Eating clean foods and natural foods, nourishing our gut, and having a healthy intestinal community are really at the core of our wellness. The more that message gets out and the more we continue to research and publish these findings, the more this area as a microbiologist gets extremely rewarding, because finally, the invisible bacteria that live within us are getting rightly placed in terms of the role they have in health and wellness.

DM: Terrific. Thank you for sharing this information. Just to highlight and emphasize, we're both equally excited most likely about what's going to happen in the future, as it will help us to customize and refine our thoughts on this even more.

But there's no reason we have to wait for the future, because we know enough now to make a dramatic improvement in our health by applying what's already been found out, that the gut has an enormous influence on our health – on our immune system, on neurological system, and on the way we feel. It's just beyond foolish, from my perspective, or irrational not to apply this information and benefit from it, unless you have some death wish or you want to be sick for the rest of your life.

GL: I agree. I agree 100 percent. There's no reason to wait. It's just going to get better. We know that they have a lot of benefits today.

DM: Sure. All right. Thank you for sharing this with us and for your time. I appreciate all your insights.

GL: Thank you, Dr. Mercola.

[END]