

November 2015 Issue | Sidney MacDonald Baker, MD

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Welcome to *Functional Medicine Update* for November 2015. This is the fourth and final installment of our specific focus on the microbiome and what a remarkable first three parts we've had in this series to introduce this extraordinary diverse biological community and its interrelationship to the gut immune system and health through the lens of three experts. Now we are at that threshold of our fourth and final contribution to the series with who we would consider—those of us in functional medicine—our master teacher, Dr. Sidney MacDonald Baker.

What have we learned over the years from Dr. Baker? Elie Metchnikoff won the Nobel Prize in medicine and physiology at the turn of the last century. Metchnikoff's contribution as the Director of the Pasteur Institute was to really understand, at the fundamental observational level, innate immunity. From that, then, he started to talk about the relationship of living organisms in our gut—remember he was at the Pasteur Institute at the dawn of the age of microbiology—and the role that these bacteria have in what he later called prolongation of life in a classic book of that title. In that book he talked about the use of probiotic therapy—utilizing organisms to recolonize the gut with friendly critters and the impact that would have on human health. As we have moved over the last century, we have seen an incredible advancement in the understanding of the role that the microbiome plays in human health, but we've also started to kind of [go] back to the future and recognize that some of these early observations that were made on a descriptive level, as we've gotten more into the mechanistic understanding really have support in terms of being reproducible and being actually clinically accessible. And it's that particular part of the story that we want to really focus on in this fourth of our four-part series because we're going to be introduced by Dr. Baker to a new threshold in the area of gut restoration therapy and the modulation of the microbiome and its relationship to immune function. I'm going to allow Dr. Baker to take us down this path to this introduction of this new chapter that is unfolding. It's a chapter that we're starting to see clinical application and ability to access this information, but it's a chapter that was actually started to be written some nearly 20 to 30 years ago with observations that were being made at an epidemiological level between helminth infections (worm infections) in children and the absence of atopic disease in those children, and that is things like asthma and allergy and other atopic-type of conditions that had to do with skin disorders.

When we start to really look at this evolving connection of the gut to the immune system, we need to recognize that the gut microbiome is much more than just thousands of different types of bacteria. It is yeasts, it is viruses, it is archaea, and it is also these things that are members of the helminth family. So it is with that in mind that we move into our extraordinary discussion—our fourth and final part in this 4-part

series—with Dr. Sidney MacDonald Baker.

INTERVIEW TRANSCRIPT

Clinician/Researcher of the Month

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Dr. Baker, as you well know having been in this field at all, is an individual who has, over four-plus decades, made extraordinary contributions to the development of what I call the best medicine. We like to think it is part of functional medicine—whatever you want to call it, it's good medicine. He is a former assistant clinical professor of medicine at Yale. He was also one of the early developers of medical informatics in the computer science area, showing his breadth of skills and talents. Also an extraordinary contributor and developer in the field of child behavior-related issues as Director of the Gesell Institute and actively involved for four decades in autism research and clinical development. Just an amazing bibliography and biography of extraordinary accomplishments. But it is this last discussion of the microbiome that we've been engaged in that I really want to jump off with Dr. Baker, because once again he is ahead of the pack and leading us, and he's leading us in the area that I'll let him describe to you, but I think you'll find this is the perfect next vision of where intervention is going in what we call gastrointestinal restoration and how we speak to the immune system of the gut in effective ways to reduce that imbalance between the gut immune system and the outside environment that often ends up, in the gut inflammation being the result (systemic inflammation).

Dr. Baker, thanks so much once again for being a contributor to Functional Medicine Update. You've been a tireless contributor both in clinical development, but also to FMU over the last three decades. This is our 34th year and I can say your contributions over those 34 years on a number of occasions have been some of the high points in our history, so thanks once again for being available.

Clinical Experience with Taurine Supplementation

SB: Well, it's been a pleasure and of course an honor and an extraordinary pleasure to have you as a friend, Jeff. And I would like to begin what we have to talk about with a little reminiscence that relates to me driving down Dixwell Avenue, just about to go underneath the bridges that carry the Wilbur Cross and Merritt Parkway through Connecticut and on my seat next to me was Jeff Bland on audio telling me about taurine. I had a patient who had had her gallbladder removed after years of birth control pills for endometriosis. She was one of the youngest people to get endometriosis in those days. She started out this problem with yeast treatment and magnesium, but then she ended up with the gallbladder trouble, and she had pain persisting after her gallbladder was out. After hearing you speak about taurine I said, "Take

some taurine,” and she was thereafter completely free of symptoms. I have tried this with people with post-gallbladder pain over and over in the years since then, always saluting you for your input on taurine. Most recently I had a little boy and I was going through this story with him—a little autistic boy—and I was going through the clue of him having light-colored stools and how it would be an important test—not a treatment but a test—to see if his stools darkened on taurine. What else might happen?

In the course of the conversation, which his grandmother was listening to, I covered the question of sensitivity to chlorine, as in swimming pool water. At a subsequent visit the grandmother came back and said, “You know, Dr. Baker, you saved my life. I’ve had all my life—for the last 30 years—a horrible skin condition which doctors have given every possible name and treatment to and it was all a failure, and after you told me about chlorine and water I thought I might be sensitive to that. I started taking taurine, my skin is perfect, and thank you very much.” So, thank you, Jeff, you have saved the lives of many people. There’s a kind of relationship between you and all the people who listen to FMU and to members of our tribe. We owe you a huge debt of gratitude.

This then opens the question that I’d like to provide some context about the HDCs. We’re talking here about small molecules. Taurine is a small molecule; maybe 177 daltons, I think. And in another meeting of functional medicine, we heard Albena Dinkova-Kostova, a member of Paul Talalay’s team from Hopkins, tell us about sulforaphane, another small molecule that comes from plants. And now we come across small molecules like naturopathic treatments for Lyme disease, which are germ killers that come from mixtures of small molecules.

The Individual is the Target of Treatment, Not the Disease: A Core Functional Medicine Principle

The impulse to use them in the case of the little boy and the case of the grandmother came from details of people’s stories which remind us that the target of treatment here is individuals, and in the functional medicine model, individuality is the scientific fundamental principle underneath all of what we do. The individual is the target of treatment, not the disease. And so everything should be particularized to the symptoms of the patient; this is where information technology comes in. But now, in the small molecule department, which includes what I’ve learned to call recently essential oils, we have another paradigm sneaking in on us, which has to do with the worst abomination in medicine—the worst heresy: that you have something that’s good for everything (a cure all). As you know there are certain doctors who publish violently about this issue—that are down on people who have a contrary argument in the field of medicine, that instead of having a particular treatment that’s been given double-blind, placebo-controlled validation for a given disease, here we are—these functional medicine people—giving treatments for individuals. With the HDCs, and I think essential oils, we have the beginning of using small molecules or small ideas to treat just about everything.

At a 2009 meeting of the Ratna-Ling group that was gathered by some of our colleagues (Gordon and others), we heard from Dr. Shoenfeld, Yehuda Shoenfeld, who stood up and the first sentence in his talk was also the first sentence in his big volume called *Infection and Autoimmunity*. And he said: “Until proven otherwise, all chronic illness—all chronic illness—is autoimmune.” Now that puts us under a very generous umbrella that says, well if all chronic illness is autoimmune, gee Sid, what do you have for autoimmunity here? Actually I didn’t want to go to that conference because I thought it would have a lot people who were just into steroids, literally and metaphorically speaking. But when I heard what Shoenfeld said—coming from the 72nd floor of the ivory tower (Shoenfeld is arguably the most influential

immunologist in the world)—is this very simple idea that if all chronic illness is autoimmune, then we have a situation in which restoration of immune tolerance is the byword of what we clinicians are aiming at. And restoration of immune tolerance then becomes suitable for basically everybody who has a chronic illness—not just the ones who have an autoimmune label on them like alopecia or lupus erythematosus or all the other bowel and skin and organ-oriented diseases, but basically he is saying all chronic illness has this feature of representing a loss of immune tolerance, and that’s where I think the HDCs fit in very nicely and after you have something to say I may have a couple of stories that illustrate how I came about turning over this leaf.

JB: I want to acknowledge that you have now piqued the interest of every listener as to—if they haven’t heard, they will in a moment—what is HDCs? We’re going to go through that. I want to do it sequentially because this is a big story that requires big fanfare with big marquee lettering. I’d to walk back slightly to the start of the story before you unload the goods, here, and really tell them about what HDCs are and how are they used. I’d like to go back with you, if you would. You did a little bit of a retrospective with me; I’d like to do the same with you.

When I think back to the extraordinary relationship that I’ve shared with you over the years, which has had many, many different extraordinary and brilliant moments, one of those, which pertains to this discussion, was a meeting that we had at dinner—I’m not sure if I’m calling forth memories that are as clear for you as I because this dinner meeting with Dr. Candace Pert at one of the IFM symposia really had a moment of “ah-ha”-ism for me, because you asked a question of Dr. Pert at that meeting. She was one of our presenters. She was very new after the publication of her book, *Molecules of Emotion*, and was kind of a leader in this whole neurotransmitter ligand receptor connection to behavior function. You asked a question of her. You said something like (I’m quoting as best I can going back these decades now): “Are we are sure that the interactions that occur with these mitigating triggers always occur by direct close proximity relationships between a ligand and a receptor, or whether these things that trigger functional changes within cells might occur at a distance through other mechanisms, presumably electromagnetic or something that doesn’t require physical contact of the ligand with a receptor in order to trigger across membranes and cells and organelles ultimately the change in their function?” I thought that was an extraordinarily profound question because it has to do with so many variables that are in our environment that may influence our function but not actually “touch” the specific receptor for which that activity is seen. And that concept has stood with me all those decades since. We certainly know there are good examples of where receptors and ligands interact tightly or loosely, depending upon their binding coefficient, that then influence function. But you raised some bigger questions for me about the broader array in which the environment can influence function without direct touching. Has that been part of your thinking that has traveled through the years in guiding some of the ways that you’ve looked at your patients and various treatments and therapies?

SB: Yes. The image that Candace’s work had put into my brain was of the signaling that takes place between a receptor site and a molecule that is destined to touch it. I thought to myself, well, how does the receptor site become “found,” so to speak, by the ligand? The ligand, as we think of it in some of the imagery of medicine, as floating along in the blood or somewhere in a cellular environment that’s more proximate than in the blood. But still, the size of the molecule and the distance between the molecule that is trying to get to the receptor site...it’s pretty intimidating to think of trying to find the light-switch-in-the-dark kind of thing. I was posing a question that made me ask Candace if she thought there is an interchange that occurs on sort of a vibrational level. That is, the receptor site and its partner (the ligand)

can communicate with each other in a way that allows direction to be established and attraction to be accomplished, and what is the deal with this kind of vibrational or some kind of signaling that takes place on a...when I say vibrational it has to do with the signature that all molecules have, it has to do with electromagnetic energy that is emitted from the molecule even though it isn't glowing in the dark, but something like that. And yes, I think that the thing that impresses me the most about the relationship with small molecules to their function is that they have an extraordinary power. We think of the kind of molecules like enzymes, which are great big molecules that take in a little molecule and do stuff to it to make it happen. But these tiny molecules accomplish their goals even though their molecular mass is way under 200 daltons. They are pretty flimsy little things and yet nature's strong impulse toward being parsimonious—getting a lot done with a little bit of effort—uses these very small molecules to make signals happen in the way that I was talking about in terms of the role of sulforaphane and inducing—that was the word that Albena Dinkova-Kostova used and it just turned the lights on for me: like “inducing” glutathione. We've been talking about “giving” glutathione—you know, rubbing it on your skin and putting it up your rear end or swallowing it. There are all kinds of ways of getting glutathione into people; here what she was talking about was induction of it, which really got me. And then after that I wrote that article about the oceanic disease because all the different specialists were talking in this meeting about different ways of understanding glutathione's function came from different specialties and yet they are all talking about the same glutathione.

So here's this tiny molecule. Sulforaphane has maybe a molecular mass of 125 or so daltons, and yet it can trigger this enormously central feature in all chronic illness, which is making sure you have enough glutathione to deal with oxidative stress. And ditto for all these tiny molecules that occur in what we're calling essential oils now, which, you know, go right back to frankincense, for example. When I started learning about essential oils recently and I saw frankincense, I thought well where do you find frankincense? I'd have to go to the Bible to find that. No, you can find it at the store, and when I banged my head viciously the other day and got a big cut on the corner of my eye I slapped some frankincense on there and, boy, it healed right up. The role of these small molecules, then, I think is something that we need to consider in the context of this other HDC phenomenon, which of course is dealing with small critters. They have a function which is so subtle and yet so powerful. The numbers of HDCs required to turn around a person with a serious chronic illness is just stunning.

JB: Okay, hold just a sec. I don't want us to spill the beans yet. I'm going to walk you down the road, here, for the big fanfare with the drumroll. So where I was going—and you did a beautiful job of taking off and riffing off my question—was if we look at a milieu where there is a tremendous amount of information present that's able to impart different kinds of signals to receptors, either by direct interaction or by vibrational effects at a distance, the gut would certainly be the place because we've got a lot of stuff going on there from the microbiome and from all the complexity of the diet and the immune system, which has both innate and acquired immune system activities going on simultaneously with the MALT and the GALT. And so you've really got a symphonic orchestration going there that is going to signal out to the rest of the body (a first level barrier) what's going on. And you've been, obviously, a leader for many decades in helping us to understand this and how it relates clinically. That takes us to this whole microbiome connection, which is kind of the new buzzword: the “microbiome.” I'm proud to say that those of us in the field of functional medicine have been talking about the microbiome for the better part of three-plus decades, maybe post-Metchnikoff. It certainly has caught the news, caught the wave, and it's really getting focused on today as it relates to a potential source of signals that are creating alternative systemic effects in terms of signs and symptoms, including autoimmune disease.

Helminth Therapy: Implications for the Gut Microbiome

So with that, now I'd like to take the next step down our HDC discussion. I'm going to go back to another IFM symposium. This is 2001, Palm Springs, in which I invited a gentleman, John Croese, to come out from Australia because I'd been following his work, and his work had been—with a variety of other investigators from around the world, particularly developing countries—looking at the relationship of asthma to hygiene in children, and particularly looking at helminth infections and showing that there was an inverse prevalence: decreasing asthma with increasing intestinal worms. At first this was just an epidemiological association, but then the group, which had been looking at this since the late 80s/early 90s, started to really focus in, thinking there was something about these worms that was having some impact upon the etiology of asthma.

When I look at the present Pub Med publications, and this is where we're going to jump off to HDCs, it's interesting with regard to fecal transplant, which we've talked about in a previous edition of this four-part series on the microbiome and gastrointestinal restoration, which now is also a therapy that is getting attention. As strange as it might have seemed five years ago, now it's kind of getting the approval of medicine that we can do this fecal transplant of microbiota from healthy people's feces, basically, into individuals who have a variety of metabolic disturbances, and there are about 1633 Pub Med-cited publications presently that talk about the use of fecal transplant.

Now, if we compare that to what John Croese was starting to help us to understand when he spoke at the IFM symposium in 2001, which is helminth therapy, which is going to take us right into our discussion of HDCs and your extraordinary work, if I go to Pub Med—the same Pub Med that has 1633 citations for fecal transplant—has 20,434 publications cited on helminth therapy for various forms of both localized intestinal inflammatory diseases ranging from inflammatory bowel disease and IBS to systemic problems related to arthritis, atopy, eczema, and asthma in children. The question is how does this work? And what is this all about? And can it really be contained into a regimen that can actually deliver reproducible success? And that is the extraordinary breakthrough that Sid Baker is once again helping us to cross that threshold. I don't know if you remember John Croese back in 2001, Sid, but you have—with HDCs—now taken us to a whole other level of clinical specificity. So tell us how you, then, got into the *Hymenolepis diminuta* cysticercoids (HDC) organism. I probably pronounced it wrong and you can help me. How did we get there?

Introducing *Hymenolepis diminuta* cysticercoids (HDCs)

SB: It took me a little while to roll that off my tongue, but you came very close. *Hymenolepis diminuta* cysticercoids. I got there by having a patient about 15 years ago—I don't remember how long now—with inflammatory bowel disease. And I had told the mom of this boy that I knew that a publication by Joel Weinstock was out there and he could use these TSO (*trichuris suis*—"suis" for pig—ova) to restore immune tolerance in people.[1] When I read that paper I said to myself, "Wow, this is an amazing thing and where am I going to get TSO eggs?" He had done this in Iowa, where there are a lot of pigs, and you know what? It comes out of pigs. But soon after that, this very crafty mom said, "You know, you can get these now. You can order them from Germany." And within the next couple of months they became available on the web. So I started using TSO very early in the game in the United States, and immediately developed an experience that was really stunning to see people with very complex, very serious illness get better with the TSO. These were rather expensive—you had to order them on the internet—but they

were very effective. The first time I took a dose just for seeing what it tasted like—I wasn't at all expecting anything of it because my health is quite good—my allergies, which had been present in my existence forever (my summer allergies—since I was six years old at camp years ago I've had a handkerchief and a lot of sneezing and running nose all my life), they went away four days later after one dose of TSO. It caught my attention, and I can tell you more stories about TSO, but having done this for a few years I was having dinner after a meeting when we were both talking with William Parker, who is a professor of surgery at Duke and is really the person that we all owe a tremendous debt of gratitude to for refining this concept in a way that gave him an answer to my question, which was: "Gee, William, I think that in the long run the kind of worm that we'll end up with as the best one for doing what we're trying to do here, right?" "No," he said. "Tapeworm, for sure." Because he had looked into it with his keen, keen mind and experiments. He's a professor of surgery at Duke, but he's a biologist and not a surgeon (he does cancer research). I said, "Well, tell me all about it." So then we corresponded for about a year and he finally said, "Look, there is this thing called an HDC and we think this is a good bet for now. Ultimately there will be something that can be put in the human diet like iodized salt that will spread this influence throughout the population and stop this epidemic of autoimmune disease." That's his dream, but my dream, of course, was to help my patients. I flew down and spent some time with him and he showed me how this was done and he has written it up and I can provide to people who are listening a copy of his notes on this.[2] And I came home and I got a microscope and started raising these beetles and getting the little HDCs and giving them to my patients. And right away I had the joy that clinicians can have from time to time of seeing people with really dreadful things wrong with them get better in ways that made it perfectly clear that this was what was needed, and this was not just autistic children but people with all sorts of autoimmune problems. I can give you a couple of stories in a minute when it's my turn again.

JB: Thank you, and I think that now we're crossing an extraordinary threshold because on the surface of these specific helminths are certain kinds of mucopolysaccharides and other molecules that they elaborate from their own metabolism that have immune active effects and whether they work directly by membrane-binding ligand, direct-receptor activity or other effects that we talked about earlier to modulate signaling that is associated with the gene expression of inflammatory cassettes of genes. I don't think we fully understand that mechanism, but we certainly clinically understand the benefit. In fact, John Croese himself was a co-author of a recent paper from the Royal Society. This is a London publication. This was a 2015 publication titled "Suppression of Inflammation by Helminths: A Role for the Gut Microbiota." [3] In this paper he goes on to say: "Recent investigations have highlighted the promise of helminth-based therapies for the treatment of inflammatory disorders." These have direct effects on lowering inflammatory gene expression and shifting M1 to M2 macrophage activities and putting the proper balance in between proinflammatory and anti-inflammatory mediators. And this was, as I said, just published in the Royal Society Journal in 2015, and it's one of twenty thousand-plus citations over this evolving last three decades that have really talked about the important role that these specific worms have in modulating immune function through gut signaling. Where you are taking us is across a threshold of a new way of looking at the microbiome in a more complex way; it's not just bacteria and primitive organisms, but it is also helminths and has influence on the signaling processes.

You talked about "raising" HDCs from beetles. That's probably a story that in itself is kind of interesting for our listeners. Can you tell us a little bit about that?

History and Background on the Presence of Worms in the Human Food Supply

SB: Yes. At some point to say a little bit about to help patients cross the threshold you just described, because as soon as the word “worm” gets used, obviously you’ve introduced much more of barrier than a lubricant to the idea that you’re trying to put across. The pamphlet that William has produced gave me the guidelines to go out and find the necessary tools to do this. It’s important to understand that what we’re talking about is something that is already in the food supply. Human beings began to raise grains ten thousand years ago, and I’m sure right away that if you’re going to store it for a while you can’t let it get wet. A grainery has to be extremely dry. When I was in Africa and if you go to a little village—and maybe the architecture in different villages in different parts of Chad where I was a Peace Corps volunteer and a doctor for a couple of years in the 1960s—it’s quite different from place to place, but everybody has a way of building a grainery where they can store their millet so it doesn’t get wet.

Now, the other thing that they need to have not get in the grain is rats. When people started raising this kind of stuff (grains), rats caught hold and rats became, now, as you probably know, more numerous in New York City than people (and that’s just in New York City, nevermind the countryside where we grow crops and rats like to eat). So rats get into graineries; no matter what, you can’t keep them out. Even if you get Monsanto in there to spray it all and ruin the food you still couldn’t get it out. So the rats are in there, and as I just said it has to be really dry. There’s another kind of critter that likes grain, and that’s grain beetles. And we all know what grain beetles are like as a general genus, so to speak, because in your pantry from time to time you see these little moths flying around and it turns out you have a box of something on the shelf that’s been there for three years and has developed from the eggs that were in there—stray eggs that were in the grain that was used to make the Wheaties of whatever is in the box—and these critters that are in grain, they live there but it’s very dry in there. But what do they have in the grain, but rat poops, which are just moist enough to satisfy the thirst of various kinds of small organisms in the beetle family that live there. Now one of these beetles is the so-called grain beetle. There’s a particular one of them that is suitable for what we’re talking about, which is having in its flesh the eggs of the rat tapeworm. So the rats are in the grain to eat the grain, they poop and they have the tapeworm eggs in there. The rat tapeworm has a deal with the rats, which is first come first served, so a rat has only one tapeworm. And then these tapeworm eggs get into the grain and then the beetles eat the poop to get the moisture out of it and they get infected with—or they get a gift, you might say—these eggs. Now these eggs don’t develop into worms in the beetles. There certainly isn’t enough room in a beetle for a worm. Instead they develop into this very cute little organism that has a little round head with two dots in it that looks a lot like eyes (of course they’re not, but it’s very anthropomorphic in a way). It has a little line between the eyes that looks like a nose, and it has a tail on it which lengthens with the health and the age of the HDC, which takes a few weeks to develop in the beetle. It’s in the flesh of the beetle.

So I put the beetle down on the dissecting microscope. I take off his head so he doesn’t suffer too much, and I dissect out (under saline) these little critters. And these things, if you put them in a little vial, which we do for shipping—we’ve just finished now shipping these boxes of things to people on ice—if you hold the vial up and look through it under a certain light you can just barely see these little flecks of white, like the smallest fish you ever saw. We serve them up in doses of 1, 2, 3, 4, 5, 10, maybe 20. There’s a certain knack to raising them. I’ve been doing it now for nearly two years and learning all the way. I have now finished building a clean room, and it is a lot of fun, and the stories that I get back are just great. Now I’ve taught another doctor in our tribe how to do this and he’s going to get started soon. In the meantime I have been supplying HDCs to his patients under his consultation, because I don’t want to be sending these things to people around the country who aren’t my patients but I can send them to other doctors’ patients.

Clinical Availability and Use of HDCs

Now, there's a way to get these things at a website called Biome Restoration. And this is run by a woman named Judy Chinitz; she's the mom of one of my patients. We've been friends for many years, and she took off on this. I introduced her to William Parker and she took on sort of a different model. Mine is a consultative model for people with pretty complex illness, and hers is this is kind of good for everybody (sort of the precursor to what William is thinking about, like this should be in the food supply somehow). Her HDCs come from England. They are much less expensive. Mine are farm fresh, so to speak, and hers are a little bit old and not quite as strong (William says) as mine, but they are effective, and so it's a very accessible thing for patients to try. And the downside of it is...if you look at the basic clinical decision-making formula BROCS (benefit, risk, odds, costs, and stakes), the stakes for the patients that I'm treating are very high. The stakes for the people who are getting this from Biome Restoration can be much lower: just to improve your health or see if your eczema will clear up or so on. And the cost is minimal (bearable, let's say). The odds of success are way over 50-50 for people with chronic illness, so you don't need to dicker too much about that; they're good. And the risk is basically as close to zero as you get in any kind of a doctor's office. And the benefit, then, is huge. So the idea of giving this a try seems attractive.

JB: Last month an article was published. The principal author is the head of gastroenterology and hepatology at the University Hospital of Zurich (Zurich, Switzerland), and the title of the paper, which is in Translational Research, is "Helminth Therapy for Organic Diseases?"[4] I thought the abstract was very timely given what you're talking about. Let me just quickly give the listener the abstract. It goes on to say: "Autoimmune and chronic inflammatory organic diseases represent a 'post-industrial revolution epidemics,' and their frequency has increased dramatically in the last century. Today it is assumed that the increase in hygiene standards reduce the interactions with helminth parasites that co-evolved with the immune system and are crucial for the proper functioning of the immune system. Several helminths have been proposed and tested in search of the ideal therapeutic. In this review the authors summarize translational and clinical studies and review the caveats and solutions for the optimization of helminth therapy." So this pioneering that you're doing, Dr. Baker, is quite interesting because it appears as if right with you or behind you is this extraordinary research that is being published—part of these twenty thousand-plus different citations in this area in Pub Med.

SB: That's a wonderful summary of what we're talking about and what he is saying. You know, when I was in Chad as a Peace Corps volunteer I saw a lot of sick people, and you could see what was called in medical school pathology. You could see pathology just walking around the marketplace or out in the countryside, although most of the people there, I must say, were beautiful, healthy, just stunningly handsome people. But then if you had somebody who had something bad wrong with them it was also visible. And yet over two years there I basically never saw anybody with an autoimmune disease and in speaking to missionaries and others who had been there a long time they would point out how different the health of the Africans was from ours, along the lines that your quote just described. You know, we are all, I think, in our field—those of us a little bit on the older side—are keenly aware of the fact that we see the incidence of autoimmune disease just rising and sometimes in really conspicuous ways. I have a patient, who is the husband of one of my very longstanding patients going back 30 or 40 years, who is a successful businessman, a very active man, and an absolutely champion golfer. For a man of 60 years old he really wins championships in whatever league he's in. And he got Hashimoto's thyroiditis, you know with antibodies and all that, and he was feeling lousy. He's been seeing his doctor in Rhode Island about

this and he finally got around to complaining to Sid about it and he said, “Hey, Sid, can you do anything for me about this because the doctor said there really wasn’t anything to do except take some thyroid medicine” if it got to that point, so to speak. I said, “Yeah, I’ve got something for you.” I gave him some HDCs, and I was speaking with his wife a month or so ago and she said, “George is so happy with the HDCs.” And he hadn’t even bothered to tell me this. But what happened was his golf score really got bad when he was sick with the Hashimoto’s, and for him that was a disaster; I mean, golf was everything to him. You may know some golfers. I’m not a golfer, but you know how it is with golfers. His golf score was everything and it went from low 70s up to 80, and he just thought he was getting maybe too old and the game was over. Once he was on the HDCs he started feeling wonderful and his golf score went to 72, he won the tournament, and his Hashimoto’s antibodies (anti-thyroid antibodies) went away. I mean, there you are. What a thrill that is to see somebody benefit that way.

I’ll give you another one, and this is a good one because it goes through the history of my whole thing about the microbiome. In 1977 I was lecturing in Chicago and another lecturer was Orian Truss, and when he finished talking I thought to myself, “Holy feces. This is really an amazing thing that he said about the role of Candida in people’s health after antibiotics and other reasons.” So I went home and I started working on fixing that part of the microbiome, killing yeast. And that’s been something that I’ve been into for all these years. I owe a tremendous debt to Orian Truss for getting me started with that.

An Anecdotal Case Study of Alopecia

So now just recently—just a year ago, in fact—I had a little girl come to me from Connecticut with alopecia. Well you know hair loss is a really distressing thing for people. Even if it is minor hair loss, especially in women it can be something that is really vexing, and of course if it is the alopecia areata version it is really terrible. Here is purity in autoimmunity. Here is a disease with antibodies in your hair follicles and your hair falls out, and the rest of you can be pretty healthy. So I said to her mom, “You know, for years I’ve been treating alopecia with antifungal drugs. Not because it’s a fungal infection of the scalp, mind you. This is because it’s an autoimmune thing where the yeast problems in the gut are the trigger for this mistaken identity process that we call autoimmunity, and so we should probably give her some antifungal medicines, but I’ve also been using these HDCs now for a little while, and so we should give her that too just to cover the bases both ways and give her the benefit of things. We might get a little confused by success but that’s okay.”

So six months later I haven’t heard from her and I’m sending her the HDCs every couple of weeks and I call her up finally. I usually don’t track down my patients, but this time I was so curious to know. I called her and she said, “Oh, her hair is beautiful. It’s all grown in.” And I said, “Gee, I guess now we’re a little confused about whether it was the *Saccharomyces boulardii* that I gave her for the yeast or whether it was the HDCs.” And she said, “Oh, she didn’t take the *Saccharomyces boulardii*. She didn’t like to swallow it and she said Dr. Baker probably wouldn’t mind.” And so she was a pure case of the HDCs for alopecia, and this is something that is not easily treated through any other means, so I would encourage our listeners to tune into that possibility. To get it you can get it from Biome Restoration dot com or call me up or something, but alopecia is a pretty good place to start.

So whether it’s golf scores or alopecia, you’ve got a metric that’s so visible that it takes away some of the mysteries of what we do clinically.

JB: So, what do you think is going on here, Sid. Do you have kind of a hypothesis as to how these specific ova are influencing immunological function? As you said, it's almost a hormetic effect because you've got a very, very small signal having a very, very big physiological effect.

A Concept to Consider: Has the Absence of Certain Pathogens in the Gut Led to an Increase in Autoimmune Disease?

SB: You couldn't have said it more clearly. I think the notion of restoration is a very important word in all this because if people think you're doing something that has never been done before and it's kind of creepy and scary, that's just not the way it is. What's wrong is beautifully wrapped in the title of the book to read, which is *An Epidemic of Absence* by Moises Velasquez-Manhoff.[5] Moises is a science writer and has written this beautiful book that describes all this. The idea is it is an epidemic of absence: this is being caused because we're missing something that we should have. So its presence and the way it has kept the immune system tolerant...that's the baseline. And then you have to say, "Well, how did the loss of it cause intolerance?" Now we have to come back to the point that is the fundamental point in functional medicine: that we understand that health and the biology of health is a systems problem. We live in an environment where hierarchical thinking—and our training has been largely (not necessarily in naturopathic medicine, but I mean in the way I was trained)—is the way that we think. In fact, if you look up in the dictionary for the antonym to hierarchical, there isn't even a word for it in the English language. It's non-hierarchical, right? But we don't have word that embraces this notion of systems thinking, so the system in which human beings have lived has had this precious quality of tolerance. If you look at the two most valuable features in a healthy system, whether it's a political system, an economic system, a biological system, even mechanical systems, tolerance is a very important feature, and the other of course is diversity. So diversity and tolerance are two features of complex systems that need to be preserved. And it happens that when these organisms became absent from the human gut, the human gut lost tolerance.

Now we have to go back to your question, which is what were they doing there that was so good for tolerance? Well, I think that's a tough call because if you look at it from a political standpoint, what were people doing that made them peaceful? If you look at tribes of Native Americans, some of them were peaceful and some of them were war-like. What was it that the peaceful ones had figured out that kept them the way they were? I think that turns out to be a systems problem that is not insoluble, but it would take a lot of data to really get a handle on it. Now, of course, now that people like Yehuda Shoenfeld and others are looking at the biochemistry of this and immunology, they will come up the kinds of compounds that you mentioned that are the messengers of tolerance. But I think to frame it within an understanding of tolerance is a very good way, and I must say for talking with patients about it I think that the first thing that they have to understand is that the immune system is like the customs and immigration at JFK airport or at Los Angeles airport. These people who are passing all these passengers through the gate every day are there to tolerate just about everybody that comes through. It's an enormous tolerance project. Rarely, they catch somebody who has a name, is on a list, and then it usually turns out to be a case of mistaken identity, which is what autoimmunity and allergy is all about. And then rarely they catch a bad guy, which of course their whole reason for being there is to catch bad guys, but really the reason for their being there—the functional reason—is that they're there to tolerate everybody with a passport. And when that goes wrong—when you lose tolerance—you have a real mess, and that's what we are talking about can be restored by adding in these very simple little critters, which are so powerful. I mean the subtlety of it is just so stunning when you see a little girl's hair grow back when she's taking like five HDCs every two

weeks. It's just crazy.

JB: Well, you know, again I'm probably overemphasizing something, but it takes me once again back to the dinner discussion we had with Candace Pert that evening and your very insightful question. Because maybe a lot of these things we're talking about don't have stoichiometry that comes from simple chemistry and one effector gives rise to one unit of activity, and that there are other things that are going on in this complex milieu that we call physiology that really speaks to the system that you don't get with individual reductionistic piece-part analysis. I mean I don't have the answer to that question, but it certainly raises across a number of different observations that we've made about the difference between complexity and simplicity in terms of whole organism effects. It just keeps coming back to tell us there is lots yet to completely learn about what's now being called the regulome. You know, that's the new term I'm reading: What is the regulome, that is the master orchestrator for all these things that are downstream that we call our functions? This story of HDCs is, to me, a brilliant example of things that we still don't understand completely—this whole concept of action greater than that which we expect, not a linear dose response curve. This hormetic effect is still a very, very big and important part of our physiology.

We all are familiar with the terms probiotics and prebiotics and symbiotics, but now we've got to add to our microbiome terminology a new term: primobiotics. Are you getting some stickiness, to use a Malcolm Gladwell term, for the term "primobiotics"?

Will "Primobiotics" Someday Become a Common Term?

SB: Well, there's a story behind that. I have a patient who is former significant foreign correspondent for a news agency from back in the 1960s who was stationed in Europe, and she had horrible chronic eczema. And when I started treating her with the HDCs, we were calling them HDCs or I also called them "little dudes." That came out of the conversation I had with William Parker and his wife over breakfast and I inquired, "Don't you have something cuter than HDCs to call these things?" And that came out of that conversation. So then my patient said, "Sid, you know, these are very powerful things and 'little dudes' is kind of too cute. You should think of something that is more serious than that. And after all, they're kind of like probiotics, right?" And I said, "Thank you so much for that comment." And I said, "I will think about it." And about ten minutes later I came up with the term "primobiotics." And actually I decided, heck, why not trademark it, and there was nothing like it out there so I trademarked it. Whether that will get around, I don't know, but I think it is a good word because it does have this strong connotation—and realistic connotation—that this really is just another kind of probiotic. Not that probiotics themselves aren't very good, but this is so much simpler and so much more dramatically effective than most of the probiotics that are out there.

I should say that one of the things I've learned from William Parker just recently is that the *Lactobacillus* genus doesn't go well with the HDCs so you need to give them a little bit of distance, and I now have patients take *Lactobacillus*-free probiotics while they're doing the HDCs to get them the most benefit. It won't spoil the deal, but you get a little more bang for your buck if you don't take the *Lactobacillus*-containing probiotics along with them.

JB: Well, I think that where the tire meets the road, here, probably for our listeners, which are always—I like to think—right at the cutting edge of this evolving new field of functional and systems biology in medicine, they probably want to know how would they follow up with you? What's the best way,

knowing you're a very busy guy? What would be your recommendation so they can follow up and learn more about HDCs?

SB: Number one, I would get ahold of Moises Velasquez-Manhoff's book, *An Epidemic of Absence*. It's a very sober and readable book. Patients should read it as well. Let me know and I can send copies of the materials that I had to begin with. And then if you're looking for sources, the website Biome Restoration is accessible. And if you have complex patients and it would be more important to be in sort of a consultative arrangement, then that's also an option. We've finally reached stability in our little farm here so that our production is pretty reliable, but of course I'm just one guy and there's another doctor now who is gearing up to do this, a respectable member of our tribe. He came here and we trained him...I say "we." My assistant is a woman who has taken on the job of being the chief rancher after I trained her and she has taken it many steps beyond what I was able to tell her, so we're setting up to be able to answer people's needs, but our production is limited. I think for people with complex chronic illness there is a consultative role that may be entered into.

JB: That's great, and should they contact you through email?

SB: Yes, email is good: sidneymb@gmail.com is my email address.

JB: Well, Dr. Baker, as always these opportunities we've had over the decades to check in and be reenergized with a vision of where things are going with conversation with you has been inspiring. But I think beyond inspiration there is also this news-to-use component that this is a whole new tool. This is a whole new way of looking at the microbiome as a therapeutic opportunity. I think there couldn't have been a better way in our four-part series on the microbiome to have our clean-up hitter as Dr. Sidney Baker to take us into the 21st century, or maybe back to the future would be a better way of saying this. We thank you again for your tireless work and introspection, vision, and ability to synthesize and then make it all work. Moving from theory to practice is not easy. We might have 20,334 publications in helminth therapy but we only have one Sid Baker helping to guide us forward, so thank you very much.

SB: Thank you, Jeff, and if I could just say as a final word that the thing about this that's alarming to me in a certain way is that here is something that really is a kind of panacea, a kind of cure-all, which as I mentioned before is one of medicine's most awful heresies or abominations, so one has to be careful when walking this walk because there are people in our profession who are ready to pounce on those who claim that they have something that works so well as this, but it certainly is the thing in my whole career that has worked better than anything else and so I'm thrilled to be able to talk about it, I'm grateful to you, Jeff, for all that you've taught me, and for the chance to have this conversation.

JB: Likewise, thank you. The best to you and we'll be following up. Thanks so much, Sid.

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