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INTERVIEW TRANSCRIPT

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Those of you who have been long-term supporters of Functional Medicine Update recognize that we have done the remarkable. We've just transitioned from our 33 years of monthly editions into a new format, which is a format that is taking it live to the world through a non-subscription-based service that we're quite excited about that allows this extraordinary resource that we've developed of speaking to so many remarkable leaders in the field of biomedicine and healthcare for their contributions historically to be better well-known and to be more accessible. There was no one that I really thought could better exemplify what we're trying to do in this new format than our clinician and leader for this first edition, Dr. Ingrid Kohlstadt.

Let me tell you a little bit about Ingrid. She and I have had a collegial friendship now for the better part of 20-plus years. She is an MD and an MPH graduate of Johns Hopkins School of Medicine, and faculty associated with Johns Hopkins at the Bloomberg School of Public Health, and as you probably know if you follow this field her voice is widely circulated, her opinions are sought after as her double board both in preventive medicine and nutrition. She earned a Master's degree in public health and epidemiology, an undergraduate degree in biochemistry, and is a Fellow of the American College of Nutrition and the American College of Preventive Medicine. She has recently completed a two-year appointment in the US Food and Drug Administration (the Office of the Commissioner in the Office of Pediatric Therapeutics), and her goal is to transform the health of children and their families through nutrition and it's profoundly shaped by her clinical public health research and regulatory activity. And she just recently got back—if it was not enough, what I've already said—from a stint in Antarctica, and that's probably a whole other chapter of her life that would be interesting to explore. She's been a world leader in all things that relate to lifestyle management, weight management, nutrition, and in particular her strong support and education as it relates to problems with children in their developing years.

Dr. Kohlstadt, it's just such a pleasure to have you as our lead off in our new *Functional Medicine*

Update format, and I think probably—as would be logical—the first question I might ask you is just by going over your truncated biography you clearly have traveled an interesting road less traveled in your medical experience. How did you get into this area of this wide, diverse series of opportunities, and foci, and what does that mean in terms of your passion and the way that you're taking your career and really making it work for people in improving their health?

Early Research Focus on Trans Fats

IK: Wow, Jeff, thank you for that introduction. Kind and generous as always. Let me just point out that the opportunity that you've given me to talk with you and be the first, as I understand, on your new format for the *Functional Medicine Update*—and congratulations on those 33 years and counting, by the way; it's certainly been an influence in my career—I wanted to make it clear that what I'm sharing are my own opinions right now—that I'm not representing my previous work at the Food and Drug Administration or my role as an Associate at Johns Hopkins Bloomberg School of Public Health, or the NutriBee nonprofit organization that I founded based on my work at the School of Public Health.

I am appreciative of my mentors and also the opportunities early in my career. I think that when you pose the question the sentinel event, if you will, that caused my interest in metabolism and looking at the metabolic underpinnings of disease started in 1989. I was studying biochemistry at the University of Maryland and had received from the Rotary Club an international scholarship—an exchange year—at the University of Tubingen in what was then West Germany. That's also co-located with the Max Planck Institute, and it was there at that institute, they were looking at trans fat and the effect of trans fat from the diet on human health. And this fascinated me, that if someone ate butter or margarine virtually inconsequential that after two or three months you could actually measure changes in that person's biochemistry. You had biomarkers to hang your lab coat on based on those dietary changes, and that fascinated me. But was more intriguing—in fact, I paid so much attention to it—was because later that year in 1989 I went back across the pond back to the US to start medical school, and in the biochemistry class there we were reminded about the overconsumption of saturated animal fats (also true) and that therefore margarine was better than butter.

But as it played out we know a lot more about trans fats today. Other than the naturally occurring ones, which are the much lower concentration than those consumed in our diets from processed food today, they really don't have a place in the diet. And today you can see the effects of that early research from 1989 when you look at the diets in Europe and you look at the diets in the US, to the connection between the basic science and clinical research and public policy, it's a very interesting forum for me. I saw ready application between the science that I was learning and being able to improve the health of the entire public. So that excited me.

JB: That is a fantastic example. You know, you have a quote in your writing that I think really exemplifies. It's like a Rorschach test of your diverse and—I think—very impactful opinion and background. I'm going to quote it and this is from you: "Nutrition is much broader than health. It is an expression of the interconnectedness with the earth and future generations with each other and those who have gone before us." Now that is a very interesting definition of food, nutrition, and dietary relationships not only to physiology but to the experience that we call life, both as the individual and as a community. Just through that quote we understand so much about you and your perspective. How does that translate over? That's a very expansive view and for some people it might be, "Oh, my word, that sounds like philosophically so broad. How do you ever make sense of that?" How does that translate over into the way you communicate with patients, the way you do your work, how you see your mission?

Nutrition: From Clinic to Classroom

IK: That's a poignant question when you go about your everyday doings and your research you don't necessarily stop and think about that. Certainly placing a value on the health of our children, the health of our future every day is really important. It's also important for young people to see. It's the "show them" rather than the "teach them" approach. I think when you look at nutrition and metabolism in clinical practice, one of the things we could be doing more and something that I'm really striving to do, and have taken some risks in my career in a hope to achieve them or have an impact on them, is the ability to reach across the aisles. I'm not talking Democrat/Republican. I'm talking about reaching across from the clinic to the classroom. Where clinicians work with families, teachers are working with classrooms. There's very little cross-talk. In fact I know of no forums that bring school teachers and doctors together on a regular basis. So I'm striving for more communication between doctors and teachers.

One thing that influenced me greatly is the Institute of Medicine's report from 2012. It was the findings of the committee tasked with researching childhood obesity. The report was called *Solving the Weight of the Nation*.[1] They said that with a 20-hour hands-on classroom learning in the areas of nutrition and physical activity each year, they measured two effects: they found that this 20-hour intervention improved standardized test scores and they also found that it reduced absenteeism. I thought, well this is just music to the ears of any elementary school principal, so I was excited about working with the National Association of Elementary School Principals. I rented a booth at their national convention in Baltimore a few years ago, only to find that…the only shortcoming with it was that the Institute of Medicine report wasn't known to the school principals. It was only on the medical side, it wasn't on the teaching education side of things. So that's when I formed the NutriBee program. I developed it and researched it at Johns Hopkins. I was inspired by a quote by Yogi Berra, the late Baseball Hall of Fame catcher. He had some great quips and one of them is, "When you come to a fork in the road, take it." I kept saying, "This is the fork!" I mean what you put on your kids' plate and what they fill their fork with—what they put in their mouth—can change their health, so take the fork! And that has been my motto, in a way: Take the fork!

Studying the Use—and Consequences—of Obesogenic Medications in Children

JB: That is a great metaphor. And, you know, your probing mind has taken that into a very interesting place—a place that I had never thought about that was a real ah-ha for me and I'm sure for tens of thousands of other people, and that is your advocacy in the area of medications that children are on, and how that influences their metabolism and their weight, and this concept that 31 percent of 385 products that are drug products can influence a child's weight. You've got a couple of extraordinary publications in this area. One is titled "Clinician Uptake of Obesity-Related Drug Information: A Qualitative Assessment Using Continuing Medical Education Activities."[2] That's in *Nutrition Journal*. And the other is in the *Jacobs Journal of Neurology and Neuroscience* titled "Systematic Review of Drug Labeling Changes That Inform Pediatric Weight Gain."[3] Can you tell us a little about this? This is, I think, for a lot of people real new news.

IK: This is an area where we as medical doctors can really have a voice, and I think the work that you have done in functional medicine provides us with very useful and important tools for helping kids reclaim their health following the side effects of medications. What may have influenced me most on this was it was in the mid 90s. I was serving as an itinerant physician, doing locum tenens work in the outer reaches of rural America, including on some American Indian reservations, where the Native American communities have been especially affected by diabetes. I diagnosed two girls in their teens with type 2 diabetes, which at the time was almost unheard of. We thought for sure that there was some type 1 component to it, but in fact it was really genetic, environmental, and epigenetic factors all converging on these kids and it was type 2 diabetes. We didn't know how to treat it. In addition to making the recommendations about healthful lifestyle physical activity, many people advised us to begin teenagers on insulin. While I was at the FDA I had a little more insight into the decision-making process on that and there really were few alternatives to medications for these teenagers. You know the challenge with teenagers and giving them insulin for type 2 diabetes is that insulin promotes appetite, it promotes weight gain, so we were making their appetite less easy to control at the same time we were encouraging them to eat less and exercise more. It was really doing them a disservice. We've come a long way in 20 years. There are so many more ways that we can treat teenagers pharmacologically who have type 2 diabetes. But we also can see the diabetes developing. We can see it coming more like a slow moving train. And one of the more difficult things for medical doctors, in my opinion, has been a blank prescription pad. When we see a child who is struggling with the need for taking obesogenic medications like corticosteroids to manage their asthma and then they gain weight, and then of course the weight gain adds to their obesity, then the obesity in turn adds to the asthma, and the asthma makes it more difficult for them to exercise and then they gain more weight and they need more steroids. This is a vicious cycle that is very difficult to intercept. I think there are non-pharmacologic therapies that can be used in conjunction with pharmacology to have a big impact. That's one of the ways our NutriBee program is working. It's a 20-hour intervention much like those recommended by the Institute of Medicine that can be used in conjunction with medications known to be obesogenic.

Special Concerns about Autism and Atypical Antipsychotics

The articles that you mentioned reference some of my publications on the atypical anti-psychotic medications in kids. These are used for managing symptoms associated with autism. One of the first challenges with the psychotropic medications, and particularly the atypical antipsychotics is that they affect the liver, the ability to take triglycerides from the bloodstream and use them as energy. They essentially interfere with the body's natural metabolism. And if you use these in kids with autism, they're already not able to communicate some of their symptoms—if they have discomfort or they have a craving for a certain food—so they're limited in their ability to say something is going on, something's not right with me. So the medication may be interfering with diagnosing the underlying problem, and it may also accelerate the weight gain and influence what foods and how much food the child takes in.

Sometimes people confuse the symptoms with autism and say, "Oh this is a treatment for autism." It's not a treatment for the underlying problems with autism. It's a way to manage the aggression and some of the other symptoms associated with autism. So I think that's an important distinction. The other concern with autism and the atypical antipsychotics is that clinicians are largely unaware of the metabolic side effects of these medications and aren't screening for them early enough and when they start to see changes in liver function tests, even if they are screening early enough, then they need to back off on the amount of the atypical antipsychotic medications and it may be too low to be within the therapeutic range. In other words, the metabolic side effects may actually prevent the use of the medication or the safe use of the medication going forward, and that can happen within a year or so of the use, or within many years. That depends on multiple factors: the epigenetic factors and different aspects of that individual's metabolism.

I had worked with the Office of Pediatric Therapeutics, which cross centers with the FDA on this issue, and then also the NIH. It was very interesting to look at the challenge from a clinician's perspective, from a parent or care provider's perspective, and also the patient's perspective—to put on those different hats, and what should a regulator do? We soon realized there's not any easy answer for that.

Another group of medications that are increasingly in use now and can influence a weight gain in kids is…there are several but the antihypertensive medications as a whole can do that, and it may be interesting for clinicians to know that the more centrally acting medications tend to be the ones that can alter satiety and hunger centers in the brain. So the more it acts in the central nervous system, the more likely it is to interfere with some of the very many centers in the brain for food preferences as well as satiety.

JB: Well I know one of the things you're a master at is helping children—people, in general—to modify some of their eating habits, and with kids you've particularly done some remarkable things in using the sense of smell and taste of food to guide nutrition and food decisions. Can you tell us a little bit? Because maybe that's some of the antidotes to these other problems we're having the medications, is to get kids to eat right.

Food Preferences, Hunger Cues, and the Developing Brain

IK: Oh, you know, that's an excellent point. That's certainly true of the atypical antipsychotic medications. That if you're able to make someone aware that just because your sense of hunger is a sign that you are to eat: you eat when you are hungry and you choose the foods that taste good. But when you receive this medication, you can't rely on those cues anymore. Your body will be hungry even when it does not need food. Your body will wish for foods that it does not need. And if you tell the parents or care providers that, and you tell the patients (not necessarily patients with autism; some of them aren't aware enough of that effect), this is a general rule for many medications that you can instruct people. It's especially important to instruct kids because when we say that the brain is developing until age 18, we probably ask what parts of the brain are developing? It appears that the centers for taste and satiety—for food preferences—are some of the last to develop. The developing brain—the teenage brain—is definitely learning, laying down, those lifetime food selection habits, and that makes it an especially vulnerable time. I focused on the ages of 10 to 12, partly because of a conversation years ago with Robert Wood Johnson Foundation when they said that was the area where there were the fewest resources for helping kids make healthful choices, and also because of the Institute of Medicine's concern that the advertising for foods that aren't in the kids' best interest is drifting down beyond the age of 12. (So lower than the age of 12, which had been the agreed upon age for limiting commercials.) I mean, we're affected by commercials in adulthood. We like to think we know better, but advertising is becoming more and more persuasive.

One of the ways I developed successful non-pharmacologic interventions for youth—specifically the NutriBee program—is to draw from the resources of these advertisers. Their research is state-of-the art for behavioral medicine, it's just that people haven't taken that research and applied it to nutrition very often. Some of that research is around the smell and taste, or chemosenses. I wrote an article in *Time* magazine, partly because I felt compelled to as a physician/scientist, and it was called "Coming to Our Senses."[4] I think we really need to aptly do that: come to our senses and recognize that our chemosenses (smell and taste) are underutilized in our society. It may seem obvious when you look at it, but they're really rather subtle changes. Our instruction has become more online instruction, and when we teach using the computer—I'm a big fan of incorporating computer technology, virtual classrooms, webinars—we don't have a way to engage the sense of smell and the sense of taste. So as more curriculum and more instruction is in this visual/auditory realm, we need to consciously promote smell and taste in the classroom when we are in person with people. The other aspect about food is that it is very social, and we take our cues not only from smell and taste but how other people model their interaction with the smells and tastes of food.

One thing we do in the NutriBee program in our very first module on the very first day is we tell the kids, "Thank you for being McCormick Company's taste testers." They're not—this isn't affiliated with McCormick; only that McCormick is a company in Baltimore and I'm born and bred from Baltimore so I incorporated that bit of local history into the curriculum. They taste hot chocolate. They taste hot cocoa.

And they learn the difference between cocoa and chocolate. Cocoa (cacao) is the product that comes from the trees before it meets sugar. Once it meets sugar it's chocolate. They get to taste different spices added to their hot cocoa, different sweeteners added to their hot cocoa. And some people think peppermint is the best, others vanilla sugar—oh, a little bit of vanilla sugar is great. Or cardamom—they've never had cardamom before and now they get to add it to their hot cocoa and see how it tastes.

So we enlist them as taste testers, and by doing that they hear each other's reactions, so this becomes social eating. One of the first things they say is "Yuck" and "You like that? Eww!" And then we remind them, "Don't yuck my yum." That's one of the rules: don't yuck my yum. Why would McCormick Company or any other food companies or spice companies need taste testers if everybody liked the same thing? The employees could just taste it and they'd be done with it and say, "Okay, this one tastes the best." The point of tasting is that it is an individual response. So when food is healthful as in the case of NutriBee—we serve only nourishing foods—then the rule becomes don't yuck someone else's yum. That engenders a discussion that gets a lot of good results among the kids.

I think there's another aspect of smell and taste that really intersects with functional medicine that I'd like to address, and that's the aspect of metals—that minerals are bioactive in the brain. They cross the blood-brain barrier and influence our senses of smell and taste. Could I elaborate on that?

JB: Yes, I wish you would. I think that's very important.

How Metals in Minerals Influence Smell and Taste Senses

IK: Good. My interest in this was piqued by Richard Anderson. He is an excellent scientist/researcher at the USDA Agricultural Research Service in Beltsville, and he researched chromium. Now chromium is taken up by the same transport molecule as iron, and what interests me about iron deficiency was that it causes people to eat unusual foods. They actually crave ice and dirt, and I witnessed this firsthand, especially in my clinical work in developing countries. It's given a name; it's called pica. There are several problems with pica—the dirt can then cause kids to develop worms and other illness, so it's complicated from a medical side. But just that iron can interact with something in the brain and we still don't know what that something is. Now PET scans are giving us a clue. You do the spec, the MRIs that can help you locate active parts of the brain, and you get a little more idea of what's going on. But chromium influences food choices also and most of that literature comes from livestock, so agricultural research, and it does apply to people as well. The problem with looking at blood and serum levels of chromium is that you're trying to identify a penny in a million dollars worth of pennies. It's a picagram level, so we can't really measure it. If we can't measure it we tend to put less emphasis on it.

But what about other metals in minerals? What about zinc? Oral rehydration salts contain zinc. Pedialyte, the most commonly prescribed one, does. I've seen people go from yum to yuck within a day with Pedialyte. First they drink it and if they really need the zinc particularly: "Oh, you gave me some water and it tastes a little different and it tastes good" to "Oh my goodness, what did you give me?!" They spit it out and if you spit it out your body doesn't need it. So we're not really assessing zinc and chromium or using smell and taste to measure minerals, but if you think about smell and taste as being mass spectrometers that are within our body—our own personal individualized mass spectrometers—I think you start paying more attention to smell and taste.

JB: Yes, I think that that is a hugely interesting topic. I recall many years ago—in fact, in Functional Medicine Update back in the 1980s—we interviewed Dr. K. Michael Hambidge, a pediatrician/researcher at the University of Colorado, who was studying Hispanic children who were short in stature for age. What he did is he was assessing the threshold of the taste of sweet and salt and found out there was a functional zinc insufficiency, and when these children were repleted with zinc that suddenly they started tasting sweet and sugar much more effectively at much lower concentrations. Their diet improved and they grew in stature. I mean, these kids were actually in a functional nutritional deprived state, and as their appetite and chemosensory perception improved so did their growth and their development. So I think what you're saying is extraordinarily important.

It also reminds me—as you were talking about the taste and the variety of things that come through spices—if we look back historically at what drove Europeans to travel over the oceans and put their lives in jeopardy and put their lives in jeopardy in sailing ships, a lot of that was really created by the desire for spices and the exploration of the Spice Islands. Magellan, actually for his three ships it was their objective to go out and to fill the ships with spices—the cinnamon, the cardamom, the cloves, black pepper. This was more than worth its weight in gold at the time. Clearly this is a big driver for us to find these tastes, or the economics of food would be entirely different without the exploring new territories in the world.

I think that there are a lot of extraordinary compelling reasons, sociologically, to get in touch with our senses, and how that then influences our eating habit which then influences our whole body's physiology, so I think you've really done a fantastic job of weaving that together for us.

Let me, if I can, just close with a last question, and that is you have referred on a number of occasions to this extraordinary program, NutriBee, that you put together. Can you give us a summary? It sounds like something that people should know more about and come to the website to learn about.

NutriBee: A Program to Engage Children in Healthful Nutrition

IK: Oh great. I'd like to see us, as doctors, equipped with more non-pharmacologic therapies, even ones that we can use with pharmacologic therapies, so a program that I developed was the heartbeat, the vision, of the Institute of Medicine. It's a 20-hour program to engage 10-to-12 year olds in healthful nutrition, and it takes some unique approaches to engage them. First of all, in model, it brings teachers and physicians together; they co-instruct this program. And for most participating instructors, the teachers and the doctors haven't had an opportunity to bridge the classroom and the clinic in this way. We implement it in clubs (after school clubs) and summer camps, so that the 10-to-12 year olds who have asthma or have a food allergy or some chronic condition associated with hypertension or weight gain isn't saying, "I'm tired of going to the clinic. I want to be a 'normal' kid." What we tried to do is move it from a "have-to" (the clinic and the classroom feel like have-tos most of the time, those settings do to 10-to-12 years olds). So we tried to move it into a "get to," like at camp: "Oh, I get to go kayaking and learn something about nutrition. I get to hang out at Girl Scouts [one of our partners]. We get to work together and play together, and oh, I'm going to learn about nutrition." So moving it into the space from "have to" to "get to" is really vital because we're trying to communicate and educate the kids on life-long skills, but 80 percent of memory is volitional. So if kids are sitting there—"I don't want to be here. This isn't interesting. This isn't relevant to my life at this time."—they're only going to remember 20 percent of it because 80 percent of memory is what we decide we want to learn. We do several things to move the kids along into wanting to do this, and one of them is having their teacher role model learning from the clinician about nutrition, so you have their teachers modeling learning also. We have high school students who participate in developing online resources. They actually help make the curriculum and they link diverse interests, from making pottery and berry bowls to sports broadcasting to musical instruments to geocaching—interests you would not think at all related to nutrition on the surface, they explain how they're excited about that and how knowing something about nutrition helps them better with their game. So peers—especially cross-age peers—can advance younger peers interests in a way that no one else can. That's been a very popular and effective component of our NutriBee program.

I used the "Bee" because—like the spelling bee or the geography bee—we would like to be able to engage youth. But we had a dilemma in doing that because both the geography bee and the spelling bee, which are widely publicized and widely known here, are also very competitive, and the media is the message. If we tell people to relax and enjoy your food, don't stress, and we're providing a venue that is stressful, then that's a problem. So we compete with teams, and we do this from a behavioral health perspective, too. Sometimes it surprises the teachers that our summary activity, the 20 hours of learning) is not didactic. They don't take any tests. What they do, in fact, is have a game show, and the game show is the summary learning. So we had several teachers say, "Well it's not complete; you don't have some kind of record." I said, "I have the scores to the game. I know what questions they answered and which ones they didn't answer. I can tell a lot from that and mostly I can tell that they wanted to learn what they learned and they're excited about it and now they're going to remember it."

Behavioral Science and Outcome Measures

So that's the difference between education and behavioral science. I partnered with a team at Hopkins whose been working in behavioral science for decades. I think that influenced me greatly to look at the

outcome measures and make sure they are behavioral outcome measures. So our behavioral outcomes are: does this change what they eat? And it does; it changes the diet. And does this change psychosocial parameters, like their interest in nutrition—how relevant they think it is? They feel that they can make a difference and they can make a difference and they can make these changes? Do they feel empowered? And the answer to all of those questions was yes, which is very exciting to me. So right now we've transitioned our research findings into a nonprofit organization, which is focused on disseminating the NutriBee program nationwide. It was very important to us that we encourage kids to aspire to something that they could achieve, so we didn't only want to engage their interest in nutrition, we wanted to say that there is a national program where you compete—in a good way, not like a stressful competitive environment; you work together in teams—to show that you are national leaders in nutrition and that the solution to our nutrition challenges of the future rests on you, the youth. We're going to empower you, because we're not going to be able to solve this challenge with nutrition and all that's gone wrong in metabolism associated with the changes in nutrition over our lifetime. I think we can empower our youth to do that, and that's what I like to see—the sense of empowerment. So we are committed to making sure that kids of all ethnic backgrounds and lower socioeconomic status also feel included in the program and have a way to participate even on the national level—that what they can aspire to they can also achieve.

JB: That is exciting. So where do people find, then, information about NutriBee? Can they go to your website?

IK: NutriBee.org is the program's website and we definitely invite the dialog and the discussion right now, and we're at the early stages of disseminating it nationally and this is great time to partner school teachers and medical doctors and other healthcare providers. People can say they would like a NutriBee program in their area and we will train them and help them launch a program in their community.

JB: This is very exciting. This is really great news to use. Once again I just want to thank you for all your years of service, for the friendship and the scholarship, the leadership, and your commitment to really making a difference. This, I think, left us all with some really great takeaways as to how we're going to be a little bit better as our advocacy in this new health continuum. Thank you so much, Dr. Kohlstadt, and we wish you the very, very best.

IK: Thank you!

Biography

[1] Institute of Medicine. *Accelerating Progress in Obesity Prevention: Solving the Weight of the Nation*. Washington D.C., National Academies Press, 2012. Web. 26 February 2016.

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