Dr. Jill

Your Functional Medicine Expert®

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#74: Dr Jill interviews Mackay Rippey about BPA and Heart Disease

Dr. Jill 00:12

Welcome today. I'm so glad to have you join us with Mackay Rippey. I will introduce him here in just a moment. Just a little background: You can find me, the blogs, and all the free resources at JillCarnahan.com. Feel free to pop on there anytime for free resources, blogs, etc. DrJillHealth.com is the retail store if you want to purchase any products. Then, finally, there is the YouTube channel with 70+ hours of interviews with experts like Mackay here today. This episode will be live there as well. I encourage you to go there; feel free to browse and peruse them. They're all free. If you want to subscribe, that way you won't miss any episodes.

Dr. Jill 00:52

Okay, so now I will introduce, instead of being silent, my guest, Mackay Rippey. He's the co-founder of Beyond Protocols, an educational and mentoring community for functional medicine practitioners. Its mission is to transform medicine from medicine 1.0 to [medicine] 2.0. I love that because so often we talk about medicine in this box, and with the functional medicine lens, we have a large toolbox. We have more that we can do, looking at the root cause, and we're going to talk about some of that today. He's been practicing acupuncture for more than 30 years and was one of the first acupuncturists in the country to earn a master's degree in acupuncture. Mackay and I connected through the NutriGenetic Research Institute, where he has taught, presented, and formulates consumer and professional products. Additionally, he serves as a medical advisor for Zona Health. Welcome, Mackay! I'm so glad to have you here. Tell us a little bit about your personal story and your journey into acupuncture and functional medicine.

Mackay Rippey 01:54

Acupuncture is a funny story because I got started more than 30 years ago. I was still in college. When I first applied to the school, they said, "Please come back when you're a little bit older because you're too young." I was a senior in college at the time. They explained it by saying: "You're going to be talking to old ladies about their hemorrhoids, and you look like you just got out of high school, so you need to

mature a little bit." Long story short, I come back the next year, and they say: "Oh, hello again. You're still on the young side, but if you stay an extra year, we'll let you in." And I said, "No problem," because I was committed to acupuncture. I didn't get my finances quite together.

Mackay Rippey 02:40
Fast forward another year—the third year—and now the admissions board is saying: "Oh, it's you again." And they said, "You can come in now." By that time, I'd gotten married early, so maybe that was a little proof that I was a little bit mature. And I'm still married, so maybe that was a good thing after all. So that's how I got into acupuncture school. How I got into it was a complete accident. My father was patient; he had some material lying around the house and [I] started reading it, and [I] just decided one afternoon: "This is for me. I have to go study this." This is back when you would say acupuncture and half the people would say, "What's that?"

Dr. Jill 03:22
I was back in the day when "alternative medicine" was the only term that was used. I never liked that because it was like, "Alternative to what?" I hated that term, and I really, really fought against it. In fact, when I was at Loyola Medical School, we created an integrative medical club. It was the first of its kind in the medical-allopathic school. So I remember way back then being like: "No, this isn't an alternative. It's like, both and… " Right?

Mackay Rippey 03:45
Yes. The faculty and staff at the school attempted to get "complementary" as the word being used. "Alternative" stuck, though, so we were kind of stuck with it. Fast forward: I'm doing my own podcast, Lyme Ninja Radio, for people with Lyme disease, and I come across Bob Miller. Somebody said, "You have to go interview Bob Miller!" So I interviewed Bob Miller. He was the first nutritionist that I heard that sounded somewhat like a Chinese medicine practitioner because he talked about systems and not "Take this supplement for this genetic variant" or "This supplement for this condition," but [rather that] you have to take a wider view and look at the systems that are going on. So I fell in love with Bob. And at least he wasn't repulsed by me. He took me under his wing a little bit, and we've been friends since then. I've helped him with some research and some supplements. And we keep in touch pretty regularly.

Dr. Jill 04:51
Yes, fantastic. I love that. I love Bob Miller. He's been a guest more than anyone else on my show. I love his background as an electrical engineer who takes the system pathways and now applies them because I love to think of things that way too; they're so complex. And I feel like the more we can go into personalized approaches, the better we are because every single human being is its own entity and has its own set of risk factors, genetics, etc.

Mackay Rippey 05:19
That's really medicine 2.0, isn't it?

Dr. Jill 05:20
Yes. Yes, yes, yes. I love it. So let's talk about BPA. What is it? Feel free to share slides if you'd like. I think you have a set on that.

Mackay Rippey 05:30
Yes. So let me pull up my slides here. I have to talk my way through it because otherwise, Zoom doesn't work unless you talk to it.

Dr. Jill 05:44
Yes, I get it.

Mackay Rippey 05:51
There we go. I have a little confession to make: We live on a farm, and this is Blueberry, the calf, and [her] mom is Delphinium. So this is our newest calf on the farm, and these are American Milking Devons.

Dr. Jill 06:05
Oh, beautiful! I grew up on a farm in Illinois. We didn't have the cattle, but I love, love, love that. Where are you at in the world?

Mackay Rippey 06:13
We are in central New York. We have the notoriety of being the wettest place in the country, more so than even Washington State.

Dr. Jill 06:23
Wow!

Mackay Rippey 06:24
Yes. So I'd like to begin quoting—you can't go wrong quoting Elon, right? He talks about history and the dinosaurs. But we have risks today that the dinosaurs never thought of and even our parents never thought of. For example, every 2.6 seconds, a new chemical is formulated—a brand new chemical that's never been on the planet before. That means since human beings have been mucking around with chemistry, there are 50 million chemicals that aren't natural floating around our environment. The EPA is in charge of keeping track of these things and their toxicity and doing studies about them. About seven years ago, they got really serious about catching up, clearing the backlog, and figuring out what was going on. If they keep on their current pace, in 300 years they will have cleared the backlog. [laughter] The bottom line is that there's a lot of stuff out there, and we don't know what's going on.

Mackay Rippey 07:36
In addition, here are some more fun facts: Every 40 seconds, somebody has a heart attack. It's a scary statistic. About 18.2 million people have cardiovascular disease. What exactly is cardiovascular disease? It's stroke, arrhythmia, coronary artery disease, heart attacks, heart failure, and high blood pressure. It's linked to Alzheimer's and metabolic syndrome, and the list goes on and on and on. So our hearts are telling us something. Our hearts are trying to send us a message.

Mackay Rippey 08:14
I found this book a few years ago, and it's terrifying. It is called *Heart and Toxins*. It's about 600 pages of all the terrible things that toxicity can do to us through our hearts and cardiovascular disease. Interestingly, they brought out some categories that you don't normally think about. We think about air pollution, especially with all the wildfires these days out west blowing this way and making it hard to breathe for some people or some mast cell people reactivating them even. We think about pesticides. I know you're big on mold personally, out in the world, and industrial chemicals. But do we think about military chemicals that much? Not really. Do we think of medications as toxic and harming our hearts? Not all the time. Of course, [we tend to think of] things like chemotherapy, smoking, and the obvious. And one of those chemicals is BPA.

Dr. Jill 09:11
Yes. And Mackay, I want to just mention really quick: I'm a breast cancer survivor [from] 20 years ago, [and I had] three-drug chemotherapy. I had a particular drug, doxorubicin, that is 100% cardio-toxic. And I was literally calculated: "What's the maximum dose we can give her and not let her heart stop?" I got the maximum lifetime dose. I can never get that drug again because they just wanted to reach that threshold of the maximum dose without causing my heart to stop beating, literally. So I'm very well aware of how toxic... And people don't think about that. Many women who've had breast cancer or other cancers have had calculated doses of these drugs that are incredibly cardiotoxic.

Mackay Rippey 09:52
I have to ask, how good was their calculation? How's your heart?

Dr. Jill 09:57
Well, I know the functional medicine principles. The complete ejection effect—that's normal. I have no cardiovascular disease, but I've done so much work around recovering. I never regret using that drug or choosing it because it might have saved my life, but I feel like I've done 20 years of restoring health because of those toxicities.

Mackay Rippey 10:16
That's an awesome story. I think that's an awesome message as well. Especially with muscles, we can repair muscles, right? They can heal up.

Mackay Rippey 10:25
So this is a study from NIH, and they did a survey. They tested urine, and 93% of people—I think it was like seven years and older, [and] they surveyed about 2,500 people—had BPA in their urine. My question about that is: Is the other 7% unable to excrete BPA?—not that 7% of us don't have it. I imagine everybody has some. BPA has been linked to behavioral changes. We think of all the anxiety these days, as well as depression, cancer, and infertility. We know infertility is an epidemic. Diabetes is another epidemic. Hypertension is another epidemic. PCOS, polycystic ovarian syndrome, liver function problems, and, of course, heart disease. BPA is a serious toxin. It's no joke.

Mackay Rippey 11:27

Where is it found? Primarily these days, it's receipts and canned foods—I don't think too many of us chew on eyeglasses—but also food containers, some of the older water bottles, feminine hygiene products, and some of the dental sealants. I think it's like rocket fuel—once it's in the waste stream, it's in our water now, it's in our air, it's all around us. I don't know if we can ever suck these things out of the air. It'd be great if we could do a giant charcoal filter for the world and get some of these things out of the environment.

Mackay Rippey 12:04
For example, with soup cans, you don't think about soup, but the lining that prevents the can from rusting is BPA. That's got BPA in it. If you have just one serving of soup—I know some of you out there are probably more controlled than I am, but I always eat the entire can of soup, so I don't know if that's two or three servings—just one serving of soup for five days in a row and your BPA being excreted goes up 1,000%. That just tells you the levels of consumption and how you have to be careful. And we think of something like tuna fish: "Oh, the mercury in the tuna, we've got to be worried about that." We don't think about the BPA in the can. All the paper cups that we have now from Dunkin Donuts and everywhere else that are "earth-friendly" are lined with BPA as well. Otherwise, it would just seep through the sides. So it's everywhere.

Mackay Rippey 13:01
Let's pause BPA. That's a pretty good helicopter view of BPA. I want to talk about a molecule called nitric oxide. I know, Dr. Jill, that you know what nitric oxide is, so let me just briefly go over what it does. It won the Nobel Prize about 25 to 30 years ago. It was discovered to be the mysterious endothelial relaxing factor. It was a mystery. They did not think it could be a gas because they knew nitric oxide from air pollution, but to think that the body was making a gas and using it to signal... And then they started studying it. It was like, "Oh my goodness, it's doing all these other things!"

Mackay Rippey 13:46
Nitric oxide is a signaling molecule. Primarily, what it's known for is signaling smooth muscles—those are our arteries and our veins—to relax. And that's what modulates blood pressure to a great extent—how flexible these are. Now, they can become diseased and hardened. That's another story, too. But nitric oxide is related

to that. It's a big part of our immune system. There's a lot of research going on with nitric oxide and COVID—inhaling it. It seems to kill the virus early on and also prevent it from entering the cells through the spike protein and the ACE receptor. It's also involved with memory formation and sleep. It's everywhere you look.

Mackay Rippey 14:36
One of my favorite things to do, since I love this molecule, is when I'm at a conference—like when we were speaking together at the [inaudible] conference—I'll sit there with my laptop. Somebody will bring up an interesting topic, and I'll type whatever they mentioned, like "mold and nitric oxide," and there'll be 50 articles that pop up. It's involved in everything.

Mackay Rippey 14:59
There are lots of different ways our body makes nitric oxide. This is my fun little way of introducing people to nitric oxide and the team of synthases that make it, as well as a couple of extra pathways. I'm just going to go over this quickly. Basically, three enzymes make it in the body, but your body can also make it through your digestive system. The acid in your stomach turns nitrite into nitric oxide, which then gets transported. I view that as a rescue system. So if your body's struggling, that's another way you can get it. We also make it when we're out in the sunshine, [absorbing] UVA rays—not [ultraviolet] B. The ones that burn us, unfortunately, also make nitric oxide. Maybe that's one reason why when people retire down south, they feel better. Their bodies are making more nitric oxide. It helps control their blood pressure.

Mackay Rippey 15:51
Exercise—there are some breathing exercises you can do to increase the body's natural production. But we're going to focus on endothelial nitric oxide. That is the synthase that primarily resides in the endothelium—a fancy way of saying these sensory cells that line the inside of vessels—so, inside the arteries, inside veins, inside the lymphatic system, and anywhere you think of things being blocked. I'm sure with the toxicity, you talk about dry brushing and other ways to move lymph [fluid]. If you're lacking in nitric oxide, the lymphatic system is going to be a little bit sluggish because those lymph vessels are contracted. It's something to think about.

Mackay Rippey 16:36
Let's look at the enzyme itself. This is super complicated. Don't worry. I'm not going to get into it. This is for my technical people. This is the enzyme and how it's structured. It takes L-arginine, which is an amino acid, and turns it into nitric oxide. That's like an hour-[long] lecture right there, but we're going to pass right over it. Now, there's something called NOS uncoupling. We're particularly interested in endothelial NOS uncoupling. Again, normally, it's L-arginine to nitric oxide; however, in the uncoupling, that doesn't happen. Instead, oxygen gets an extra electron, and it turns into something called superoxide.

Mackay Rippey 17:19
Superoxide is super important. Think about what's happening: Your body needs to make this nitric oxide to relax blood vessels, keep your blood pressure low, and allow oxygen to get to the tissues where it needs to go. If your blood vessels are tight, your brain's not getting enough oxygen, your muscles aren't getting enough oxygen, etc. So it's super, super important. Instead of making a nitric oxide molecule that's going to relax, it's going to create superoxide, but it's a double whammy because superoxide has a love affair with nitric oxide.

Mackay Rippey 17:56
If you'll see on the left here—I forgot to put my big cursor on, so sorry, I'll move it around a little bit—here's your nitric oxide molecule, and here's your superoxide molecule. Dr. Jill, you'll understand, it's a rate-limited reaction. That basically means as much nitric oxide is made and as much superoxide is made, they will combine every single time and nothing will outcompete them to create peroxynitrite, which is a major oxidant force, even more so than nitric oxide and superoxide. So we lost the nitric oxide because the enzymes shifted from making nitric oxide to superoxide, and then we lost a second molecule because the superoxide [that was] created combined with free nitric oxide. It scavenged the nitric oxide to create superoxide. And this is why NOS uncoupling is a big deal, so I hope you followed that along.

Mackay Rippey 18:56
This next study connects this all together. They fed poor little mice BPA—just a little bit in their water—and sure enough, the little mice developed high blood pressure.

And the mechanism is the uncoupling of NOS, which I just went over. So I thought I'd show you the mechanism and then tell you [about] the study of how that's happening.

Dr. Jill 19:21
It's so fascinating. I have to ask a question really quick here because I happen to be one of those super producers—the upregulated NOS enzymes—which means I make too much nitric oxide. But it sounds like that whole peroxynitrite pathway could be the problem end of this—I probably make a ton of free radicals.

Mackay Rippey 19:40
It's possible. Do you know which synthases you're upregulated on?

Dr. Jill 19:45
I think multiple. We can consult Bob on that one.

Mackay Rippey 19:48
Okay. He's very interested in that right now. And we're going to digress here a little bit for you. Endothelial nitric oxide and neuronal nitric oxide are dependent on calcium influx into the cell. They send out little puffs of nitric oxide—poof, poof—and they have to reset before they do another one. They're making nanomolar amounts of nitric oxide—just teeny tiny amounts in a neighborhood. The inducible nitric oxide, the innate immune system nitric oxide, produces a thousand times as much. It's making micromolar amounts. It's not calcium-dependent. Once it's switched on, it's just cranking it out. You need to take a look at those two as two separate mechanisms. They're almost different conditions completely. You can't compare. It's apples and oranges. It's important to know. Now, they're interrelated, but let's move on.

Mackay Rippey 21:05
All right. So what this study essentially says is—that's a BPA molecule—BPA itself increases the expression of angiotensin II. We all know that angiotensin II is involved with high blood pressure because a lot of you out there, I'm sure, know somebody or are on an ACE2 inhibitor.

Mackay Rippey 21:30
BPA by itself increases the amount of enzyme that is transcribed from the genes in

our cells. There is a 1.7 increase in exposure to BPA through water. They're not injecting it. They're just letting the mice drink it—the normal way we would be exposed to it. There's a 2.5-fold increase in calcium/calmodulin-[dependent protein] kinase II alpha (CaMKIIα). That's a mouthful. All you need to know is that it's an intermediary between angiotensin and nitric oxide. It's a controlling enzyme. It helps coordinate what's going on in the cell. Under oxidative stress, it tells the cell to make more endothelial nitric oxide synthases, the enzymes themselves.

Mackay Rippey 22:20
As a result of both angiotensin and this CaMKIIα, there's an 8.7 increase in eNOS. If you already have an upregulation in endothelial nitric oxide, you have that multiplied even more. Normally, you'd say: "Yay! More endothelial nitric oxide synthase; I'm making more nitric oxide"—except if it's uncoupled and you're making the superoxide. [In that case], you're then decreasing the amount of nitric oxide that's available. Your blood vessels aren't able to expand when your heart pumps harder and your muscles need more oxygen. They stay tight. It's not a good thing. That's what this study showed. There's more uncoupling. And to sum it all up, BPA causes NOS uncoupling. It raises your blood pressure. As we all know, eventually it is part of the system that starts breaking down, causing cardiovascular disease. I can pause there or I have one more study. It's up to you.

Dr. Jill 23:28
Yes, go ahead and share.

Mackay Rippey 23:29
Okay, good. A doctor after my own heart. All right. This next study is all theoretical. They take mice. You can't do these studies on humans. We're thinking, "Oh, these poor mice." We can't do this on humans because, ethically, you can't do it. You can't take somebody and just take away some of their genes and say, "Gee, I wonder what's going to happen." We do this with mice to learn what the genes are doing. Poor mice, but at the same time, this is what we need to do.

Mackay Rippey 24:06
They took out all three of the nitric oxide synthases in these mice. This is a confusing graph. But what you need to know is that this is the age of the mice at the bottom, up to 10 months. I looked it up: 10 months is about the equivalent of about a 40-year-old in human years. This is a healthy mouse at 10 months. There's almost a

100% survival rate for just the healthy mice. When they take away one of the nitric oxide synthases, either the endothelial, the neuronal, or the inducible, they start dying from heart disease. And that's what we begin to see here 10 months out, so that's 40 years out. Think about how many people you know at the age of 40 who have died of heart disease. Not very many. There's the odd person. So that's how important nitric oxide synthase is.

Mackay Rippey 25:07
Then they were expecting a little bit more of a problem with it. They said: "That's interesting. Let's take away two of the enzymes." They did the combinations to take away two. At 10 months out, instead of 85–90% surviving, only about 60–70% of the mice survived to 10 years old. This last red line is where they took out all three of the nitric oxide synthases. Essentially, with no nitric oxide, which is a totally artificial [scenario], it's just not going to happen in real life, but that just tells you how important nitric oxide is—when they knocked out all three enzymes, less than 20%, like 17%, survived to 10 months. Essentially, they all died of heart disease.

Mackay Rippey 25:56
They did a little mouse autopsy. On the left, what you see is a healthy mouse heart. This little cutout is a nice little artery that's feeding the heart. You can see how pristine and clear it is. This is a normal, healthy mouse at 10 months. This is a 40-year-old equivalent mouse. This is how our hearts should look. On the right, this is the mouse that had the heart attack. They look for an equivalent-sized artery. As you can see at the bottom, the blue stands for fibrosis. Inside the artery, you can see all the additional smooth muscle cells that have grown in response to the cardiovascular disease. And this tiny little slit in the middle is what's left for the blood to flow through.

Mackay Rippey 26:55
This is what happens to us when we don't have enough nitric oxide. Our vessels become diseased. The body tries to repair them the best that it can. And if this continues over time, the artery closes off—not because cholesterol is clogging it, so to speak, although that's part of the equation. It's the body's desperate attempt to repair itself. That's the problem. That's why it's so important to get to the root cause. If you've got a lot of BPA exposure for whatever reason—say you love tuna fish or soup, Progresso lentil soup, or whatever—and you're constantly ingesting

this, even if you take cholesterol medication and bring your cholesterol… I don't know what your feelings are personally about cholesterol; I didn't know we'd be talking about this. But I've had people come in and say, "Wow, my cholesterol is 150!" I say: "Oh, my God! Are you sure you want to have it that low?"

Dr. Jill 27:52
Oh, yes. There's a spectrum. There's a high spectrum with inflammation, but it's inflammation that drives it and the LDL particle size. But then on the lower end, especially with young people, I'm like, "You need this to make your brain and your hormones."

Mackay Rippey 28:10
Yes. There's a happy medium. Even if you get your cholesterol low, what's driving this whole phenomenon is the toxicity. If you don't get rid of the toxicity, you can bring your cholesterol down to zero—which probably isn't a good idea—and you're still going to have heart disease. Cholesterol is not causing the heart disease.

Mackay Rippey 28:36
This is a flow chart from the same study. That's what they're showing here. If we can walk through this slowly, it'll tie together a lot of interesting things, I think, for you. First of all, a defective NOS system—whatever that means. We're not producing nitric oxide at the levels that we should be. Maybe we're producing superoxide and peroxynitrite. Maybe something else is going on, but the system isn't working as it should. One of the first things that happens directly down underneath is the renin-angiotensin system. The body detects stress. That's the stress system. The body signals the kidneys: Hey, hang on to salt, hang on to water; we might need those. And we all know that that leads to problems down the road. If it's temporary, that's okay.

Mackay Rippey 29:28
The angiotensin I receptor is upregulated from the system and—let's follow the arrows—it begins to knock down an adipokine—a messaging molecule from the fat cells—so you get hypoadiponectinemia. Adiponectin is a funny messenger. It's related to leptin in some ways. It has a lot to do with our ability to deal with blood sugar, insulin, and even satiety. That's why you see the connection here, then to metabolic syndrome.

Dr. Jill 30:07
Yes, adiponectin is the first marker that goes down in a diabetic. So if someone is headed toward [becoming a] diabetic, we'll see that very early on—lower adiponectin—which is part of this process.

Mackay Rippey 30:19
I would also encourage you to think back and follow this chart up. There's probably also a problem with nitric oxide in those patients. Metabolic syndrome—we're all familiar with that. Dysregulated blood sugar, maybe we were gaining weight, fatigue, the beginning of heart disease—all those things come along with metabolic syndrome. And here's also our LDL increasing. Not because we're eating steaks necessarily or something else; it's because our nitric oxide system isn't working. As part of the compensatory mechanism, the body makes more LDL. Interesting, right?

Mackay Rippey 31:01
I'm going to skip mast cells for a second because I want to come all the way back over here. Not having enough nitric oxide in itself causes vascular dysfunction, causes adiponectin to decrease, increases LDL all by itself, and then [causes] coronary mast cell infiltration. This is the last phase. I don't have hard evidence for this, but I think the mast cells are trying to rescue the heart. They're trying to enter the tissue. They're trying to—because there's not enough nitric oxide—release some histamine, open the blood vessels, and maybe some enzymes to break up some of that tissue that's being formed. But as you know, with mast cell activation, when you have too many mast cells, this is where we get the coronary spasm. This is the actual heart attack. Eventually, there are too many mast cells in the heart itself and you have a heart attack. They're calling it a spontaneous heart attack. But really, it started all the way back up here, and it took the mice 10 months to develop it. There's nothing spontaneous about it. It's been building up for a very long time.

Mackay Rippey 32:18
To sum up BPA toxicity: NOS uncoupling, lots of inflammation, DNA damage, mast cell dysfunction, NAD/NADPH deficiency—that's an electron donor that the body needs all over the place, which gets worn out—and cardiovascular disease. In terms of genetic pathways, things to think about with nitric oxide problems [are] the NOS genes, the glutathione pathways, the recycling pathways as well, and BH4. No BH4, no nitric oxide. BH4 is like a little rescue electron donor in the middle of the

enzyme. Citrulline is critical to creating arginine as a base. Every time a nitric oxide molecule is made, it creates a molecule of citrulline, which gets recycled by the urea cycle. It's a beautiful system, except if there are problems there.

Mackay Rippey 33:15
Of course, SOD and catalase help clear out the extra superoxide when possible. NADPH, the nitric oxide synthase, needs NADPH to donate an electron to get things going. The superoxide pathways, if there are any other generations there. NOx is upregulated. Some immune response or toxicity response where the body's already creating a ton [of NOx]—whether it's EMF exposure or the BPA, [although] I don't have a study here showing it—that also increases the NOx and the superoxide being created by a different enzyme. Heme pathways—no heme, no nitric oxide synthase. And [there are] the detox pathways in general, which, if they're blocked up, you don't get rid of oxidants. A stressed nitric oxide synthase enzyme is not a happy nitric oxide synthase.

Mackay Rippey 34:07
Here's my NOS3 protocol. It's super simple. You need to really talk to somebody like Dr. Jill to get the details of it. I don't know how you feel but my sense is that this nitric oxide peroxynitrite is at the bottom of the drain. There are lots of toxins that end up at the bottom of this drain, causing this similar thing. That's why heart disease is so prevalent. It's not that everybody is just full of BPA. It's BPA and fill in the other 10,000 [inaudible].

Dr. Jill 34:42
I totally agree. Toxic load—I love talking about that because it really is a load [inaudible].

Mackay Rippey 34:46
That's right. Your bucket. You're the bucket.

Dr. Jill 34:48
The bucket, yes. I want to also say, BPA-free, of course. But [concerning] the new BPA alternatives, I think plastic is bad news, period. Don't think your BPA-[free] bottles are just as good or better. I really, really advise avoiding plastics of all types. Someone just wrote in as we were talking: "Is Tupperware safe?" I would say no. Do

not use plastics, even if they say BPA-free. I think time will tell, but I think some of the BPA alternatives may be just as toxic.

Mackay Rippey 35:22
Undoubtedly, and often, they end up being more toxic.

Dr. Jill 35:25
Yes. So avoid plastics, especially if you're eating or cooling, like if you're going to freeze something or microwave it absolutely 100%. If one of the only things that you do is just replace the cookware and your storageware with glass, that's a great way to start.

Mackay Rippey 35:41
I have to admit, I fight with my wife over storing things in the refrigerator because we have these lovely glass containers now. They do have plastic tops, but at least they're just on the top and not in contact [with the food]. If we microwave, we take the top off. But she likes to put things in Ziploc bags and throw them in the refrigerator. And I beg her: "Please just put it in the glass." She says, "I don't want to wash it." I say, "I'll wash it."

Dr. Jill 36:04
Yes, I totally agree. It takes a little extra work, but it's worth it for your body.

Mackay Rippey 36:09
Yes. And then to activate alternative nitric oxide pathways means [the following]: Eat foods with nitrates in them, which sounds funny. I'm not suggesting you go out and eat a thousand hot dogs. If you can handle the oxalates, things like beets and spinach [are great]. If you can't handle the oxalates, arugula is super high in nitrates and doesn't have any oxalates in them. Arugula is like a super-nitric oxide food. Make sure you get a little arugula in your salad mix. There are different things you can do to support the enzymes themselves. There are a million articles. I'm sure you have other experts who've talked about heart-healthy diets and supplements: Garlic, vitamin C, apples, polyphenols—the list just goes on and on and on.

Mackay Rippey 37:04
Lastly, the less stress we're under, whether it's physical or emotional, the better off our body is. Nitric oxide synthase's "start producing superoxide" is one of the stress

messengers in the body. I'm convinced it's part of the cell danger response because once we lose our antioxidant capacity within the cell, one of the first things to flip over is [when] the nitric oxide synthase starts making that superoxide. And I just showed one pathway, the arginine. There are other things that happen as well that switch it over to superoxide.

Mackay Rippey 37:45
The superoxide starts combining with the peroxynitrite and the cell itself gets the message. After that builds up to a certain level, the cell can't get rid of the peroxynitrite within the cell. The cell recognizes that and says: Wait a minute; let's pause. So the cell stops dividing and puts all this energy into repairing. And if it can't do that, then it raises its hand for autophagy and tells the neighboring tissues, the neighboring macrophages: We've aged out. It's time for us to recycle. Let's do this in an orderly fashion. We'll take a number. Wait in line.

Mackay Rippey 38:25
And that's just normal cell replacement cycles, so everything's still as happy as can be. When this gets out of control, then we get this cytokine storm that we've heard so much about in COVID. That's when we get sepsis, and that's when we get inflammation that's out of control. If it's just locally, maybe it's rheumatoid arthritis, or if it's systemic, then it is something like sepsis.

Mackay Rippey 38:51
At this point, your cells can't repair fast enough, the macrophages can't perform autophagy fast enough and we get necrosis. The cell explodes and there's all kinds of stuff in a cell that makes the immune system crazy—ATP and other proteins in there. It doesn't like them outside of a cell and it starts sending up flares. It's like: Danger, danger! We're being invaded. We're about to die. Pull out all the stops. In the movies where the hero calls the bombs down on himself to save the world, that's essentially what these cells are doing. So much destruction happens. It's almost like your chemo; can your body survive the immune system response?

Dr. Jill 39:38
That was tremendous, Mackay! I know that our fans like this high-level stuff and I sure do—it's been fantastic—and the understanding of how BPA can affect the heart. And the toxic load, like you said, is an even bigger thing. The moral of the story is

that whenever you do have a choice to avoid plastic, please don't use BPA water bottles, like canned soups and even receipts. What I'll do is I'll have them sit it down. I'll take a photo of it. I never touch it so then I can just email it to my accountant or whatever I need to do, never having touched it, but I have a record of it. So if you don't touch receipts, that's great. Take a photo of them. Asking them not to print them at all would be even better. And all of these things do make a difference over time.

Mackay Rippey 40:22
All right. Thank you so much! I know you have a hard stop. I think we're there.

Dr. Jill 40:26
I think so. Thank you so much! This has been fantastic. Stay tuned for the next episode and we will let you know when this one is live. Thank you again.