



**Transcript: #479 How Glyphosate Destroys Your Ability to Detox Harmful Toxins
with Dr. Stephanie Seneff**

Dr. Wendy Myers:

Hello everyone. Welcome to the Myers Detox Podcast. I'm Dr. Wendy Myers, and today we have one of my favorite guests, Dr. Stephanie Seneff, who is a major researcher and advocate against glyphosate. So glyphosate is an herbicide that is so pervasive in our environment in the United States, in Canada, lesser so in Mexico. Mexico has a ban on glyphosate, and thankfully a lot of our food in the United States comes from Mexico. And I think Russia, I believe, banned it also. And in Europe, many places don't allow its use as well, which is why the food's a lot healthier there.

Dr. Stephanie Seneff, in this podcast, really very clearly outlines the mechanisms by which glyphosate is promoting obesity, causing you to be overweight, to have high blood sugar, diabetes, Crohn's disease, cancers, digestive issues which lead to food sensitivities, and allergies, autoimmune, autism. And there are very clear correlations between the increase in glyphosate use and the almost exact direct correlation between the rises in many of the diseases that I just mentioned, including Alzheimer's, Parkinson's, and dementia as well. Kidney disease, the list goes on and on and on and on. And scarily, glyphosate also disrupts many of the mechanisms in our body, which help us detox other toxins, other fat-soluble toxins. And because it disrupts these toxins is a reason that our body is forced to store them in fat. And so this is why people gain weight, or they have resistant weight loss. They can't lose that last 50, or the last 20, or 10, or 15 pounds, or what have you, and the body is holding onto it because it can't get rid of this stuff. So really, a lot of incredible information.

This is a must-listen podcast, and I know a lot of you guys listening to this show are concerned about your toxic load. You're concerned about the heavy metals and chemicals that you may have in your body. And I created a quiz that you can take at heavymetalsquiz.com. And after you take that, you get a free video series

that answers a lot of your frequently asked questions about how to detox, about how to get rid of this garbage in your body that's throwing a wrench in your metabolism and causing so many health issues. The research is clear. So go check that out at heavymetalsquiz.com.

Our guest today is Dr. Stephanie Seneff. She's a senior research scientist at MIT's Computer Science and Artificial Intelligence Laboratory in Cambridge, Massachusetts, and she has a BS degree from MIT in biology and an MS and EE and Ph.D. from MIT in Electrical Engineering and Computer Science. Her recent interests have focused on the role of toxic chemicals in micronutrient deficiencies in health and disease, with a special emphasis on the pervasive herbicide glyphosate and the mineral sulfur. Since 2008 she has authored over three dozen peer-reviewed journal papers on these topics, and she's the author of a book on glyphosate called Toxic Legacy: How the Weed Killer Glyphosate is Destroying Our Health and the Environment, which was released by Chelsea Green in 2021. And you can learn more about Stephanie Seneff and her work at stephanieseneff.net.

Dr. Seneff, thanks so much for joining the show.

Dr. Stephanie Seneff: Delighted to be here, as always. Thank you.

Dr. Wendy Myers: Actually, my video, my last podcast with you on YouTube, is one of the most watched videos that I have because people are very, very concerned about glyphosate, and you've been researching this for a long, long time. Why don't you, just for anyone who doesn't know about it, what glyphosate is exactly, and where are we being exposed to it?

Dr. Stephanie Seneff: Glyphosate is the active ingredient in the pervasive herbicide Roundup. Most people know what Roundup is, and many people have used it to control dandelions in their yards or weeds in their walkways. Very convenient, supposedly a wonderful herbicide kills all plants except those that have been GMO engineered to be resistant to glyphosate. Other than that, every plant gets killed by it. So a pretty impressive herbicide because most herbicides are specific to certain types of plants. And then, at the same time, it's completely safe for humans, like aspirin.

They're really painting this picture that it's safe, and that is where the lie is because it's not safe. And in my research, I've become extremely alarmed by, I think, huge numbers of conditions that are going up dramatically over time, like obesity, diabetes, autism, and Alzheimer's, that are going up in step with glyphosate usage. It's a pervasive herbicide. It's all over the food supply. It's in the air; it's in the water. You can't avoid it if you live in the United States. And it turns out that it's extremely toxic to humans in a unique, insidious, cumulative way that is hard to catch. I think they've been able to deceive the legislators and the public into thinking that it's safe because, I think, it's a slow kill, and it

doesn't immediately make you have an upset stomach or something, so you don't realize you're being poisoned.

Dr. Wendy Myers: It's interesting. When I first met my brother, who was given up for adoption a long time ago, ironically, of all people, when he first called me, the first phone call I had with him, he's a cotton farmer, and he was mixing glyphosate.

Dr. Stephanie Seneff: Wow.

Dr. Wendy Myers: Mixing chemicals to spray. So luckily, I've taught him about that and everything. I was just really surprised. So tell us, glyphosate is just everywhere. We're getting it in our food. All of the foods that are processed foods have glyphosate in them. Can you talk about where it is in our food? And it's sprayed on our children's parks, the schools, the neighbors are spraying it, the gardeners. I think people don't realize how much exposure they're actually getting.

Dr. Stephanie Seneff: Yes. I think that's true, and that's the thing that really singles it out against other chemicals. I was interested in autism, and I was looking at environmental chemical exposures that might be linked to autism. And I went through a big list, but they needed to be going up dramatically over time because autism rates are going up. And that eliminated a lot of them. And a lot of the herbicides that are considered to be more toxic than glyphosate, their usage has gone down as glyphosate went up because once they had these GMO crops, glyphosate became the herbicide of choice. And so it's used far more than any of the other herbicides, most of which are considered to be more toxic than glyphosate. Probably all of which, actually. All the chemical herbicides are considered to be more toxic than glyphosate, and therefore glyphosate is the herbicide of choice because it's safe. And it's not safe.

And so that's a really, really dangerous combination, and that's why it's so pervasive in our food supply. And I think it's probably the primary cause. I would go out on a limb and say the primary cause is the celiac disease epidemic and gluten intolerance that we're seeing, casein intolerance, these protein sensitivities that we're seeing in lots and lots of people. So many people have food allergies to so many foods that you can't really host a dinner without, you've got all these restrictions, and it's very hard to come up with recipes that can work for everybody when you've got multiple people with different kinds of food allergies. I think glyphosate's a major driver of that epidemic that we're seeing in food allergies.

It's in surprising places because a lot of people think, "If I buy non-GMO, I'll be safe." And that's not true at all. Some of the highest levels of glyphosate are found in non-GMO foods, particularly, for example, wheat. And that's why I think wheat is linked to the celiac problem. Gluten intolerance, that's wheat. And what is commonly sprayed with glyphosate shortly before the harvest in order to dry out the crop. So it's intentionally trying to kill the plant, but it grabs the seeds before it dies, and the plant actually goes to seed when it gets hit with this

toxin. It goes to seed, it increases the yield, but it pushes the toxin right into the seeds. And so you get very high levels of glyphosate in wheat-based products. And then oats are similar. Oats are also sprayed right before harvest. So oatmeal cookies, oat cereals, Cheerios, Oreo cookies, and goldfish crackers are some of the foods that have been found to have high levels of glyphosate in them. They are very popular foods with the kids, which is very disturbing to me.

When people get gluten intolerance and casein intolerance, they start to look at other foods, and they go to oats. Oats don't have gluten. And then you get beans, garbanzo beans, chickpeas, and legumes. Those have had some of the highest levels. Canada did a big study where they tested over 8,000 food samples, both imported and Canadian, for glyphosate levels and found it in lots and lots of foods, consistently found significantly higher levels in foods from US and Canada compared to Europe, any kind of European imports, and also compared to Mexico. I was quite surprised and pleased to see that Mexico had significantly lower levels of Mexican imports compared to foods grown in the United States and Canada. So those two countries are really loaded with glyphosate, and it's reflected in our health. We have such a huge obesity epidemic, diabetes, autism, and Alzheimer's. All those diseases that are going up dramatically are very well represented in America. Huge numbers of people are suffering from these conditions that I think are driven by this chronic glyphosate exposure.

Dr. Wendy Myers: And that's why I just really commend the work that you're doing to get the word out about this and being such a huge voice for this. You were interviewed in my upcoming Heavy docuseries, where we're talking about how all these toxins promote obesity and diabetes, and other health issues. And people, they just don't know. They have no idea what they're doing to themselves and the predatory practices of Big Food. And it's crazy. There's a battleground in Mexico, where I am right now. The company that makes glyphosate is trying really hard to get their products used more widely here.

Dr. Stephanie Seneff: I know. Mexico has a great story that I've been following. And I just read an article about a beekeeper, a small woman in Mexico, a beekeeper who really fought hard against glyphosate and the bees because the bees were being killed. I'm quite certain that the epidemic that we're seeing, this bee colony collapse syndrome, and this panic that the bees are going to disappear. They play an important role in fertilizing certain crops. That's a huge problem that we're facing. For a long time, I have felt glyphosate is a major contributor. They point to the insecticides, which obviously are bad for the bees, but I think glyphosate was an overlooked factor in the bee colony collapse. And this woman saw that.

She made honey from the bees, and she found that when glyphosate was being used nearby, her bees were hurting. And so she became very vocal against glyphosate. And that's probably part of the whole momentum behind Mexico deciding to ban glyphosate, period, in Mexico. I was so thrilled when I first heard that, and now I've been seeing articles that talk about the United States working

hard to try to get Mexico to cancel that idea. The US is very unhappy that Mexico is banning glyphosate. I, of course, am thrilled because I think if our next-door neighbor bans glyphosate, we can't continue to just pretend that it's fine. I hope so. I don't know what it's going to take to reverse our government. They don't care. They don't think it's harmful. They don't measure it in the food supply. They're just completely reckless about glyphosate, our government.

Dr. Wendy Myers: And it's amazing. So when I was growing up, I would notice. Eventually, it dawned on me that when I would eat foods that contain wheat, my stomach would hurt really bad. I'd have inflammation, obviously. I love eating Goldfish and foods like that. But when I would go to Europe, I would just eat wheat all day long. And I ate the croissants, and pizza, and pasta, and whatnot, and no stomach ache at all. And I always thought, why is that? It's not wheat for a lot of people. It's the pesticides. It's the herbicides and glyphosate in the wheat that are causing so many problems for people here in the US.

Dr. Stephanie Seneff: In fact, there was a study that was done where they compared the modern wheat used with glyphosate chemicals against organic heirloom wheat. And they had a controlled study where they had these people, I think they had inflammatory bowel disease, which is another one that's going up exactly in step. It's different from gluten intolerance and celiac disease, but it's also very uncomfortable. And these people gave them a period of time when they ate the organic heirloom wheat and then another period when they ate the regular US wheat, and they showed that their inflammatory bowel condition became much, much better when they were eating the heirloom wheat. But they pointed out the change in strain, the evolution of the wheat, and how we've manipulated it to make something, and the genome is different. And they considered that to be the reason, ignoring the fact that this other wheat was organic, which really was a big difference. And they didn't pick up on that in the article, which I found ridiculous. I get frustrated when people don't see that connection.

Dr. Wendy Myers: And let's talk about some of the health issues that are caused by glyphosate. So let's talk about the gut first because you made a lot of really revolutionary discoveries about what exactly is going on in the gut when you eat glyphosate. Let's discuss that.

Dr. Stephanie Seneff: In fact, I want to show you my book Toxic Legacy because I worked really, really hard on that gut chapter. That might have been the hardest chapter that I wrote. I had to read so many papers. There are lots and lots of papers about the gut, and they have these pretty pictures of all these colors and all these different microbes. It's so complicated. It's not an easy thing to figure out. But glyphosate is definitely disrupting the gut microbiome, and that is really central to many diseases. They've linked gut dysbiosis to lots of surprising places like rheumatoid arthritis and, of course, autism and, Alzheimer's, Parkinson's disease. These diseases trace back to gut dysbiosis, many of them do, and autoimmune diseases. And it's very interesting.

I finally really felt like I worked out a story that made sense to me and that was consistent with all the data I was seeing. And it's quite interesting because glyphosate severely damages critical microbes that normally inhabit the infant's gut. When the infant's born, it has predominantly Bifidobacteria and Lactobacillus. They really take hold. Lactobacillus, of course, digests milk. It's very important to help digest the milk with enzymes that the Lactobacillus produces for the host. So our own human cells are actually quite deficient in their capabilities, and the Lactobacillus produces many enzymes that help to digest both milk and wheat. So both gluten intolerance and casein intolerance, I think, can be traced to an insufficient supply of Lactobacillus and even disruption of the enzymes that Lactobacillus uses to digest those proteins. So that's one thing is the loss of Lactobacillus.

Then you get other pathogens to overgrow because they're more resistant to glyphosate. So they get an edge, and they become too many of them, and that ends up causing inflammation. The immune cells come in to try to control these pathogens, and you get the inflammatory gut and all these other problems. And then the interesting thing that I discovered was a pH problem in the gut, and that was really fascinating because I was looking at papers that were showing that back in the day, like 1920, the infant's gut was predominant with Lactobacillus and Bifidobacteria and the pH of the gut was higher. I'm sorry, it was lower: pH has gone up in the lower gut, in the large intestine. The acidity is disappearing; it's becoming too basic. pH is this measure of acid versus base, and the environment really matters as far as which microbes will thrive under those conditions. It's very critical.

The pH is very critical to define which microbes thrive. And when the pH in the colon is too high, the bacteria that make the short-chain fatty acids are broken; they don't work well. And so you have a deficiency in the short-chain fatty acids. And in particular, butyrate is a super important short-chain fatty acid that feeds the colonocytes lining the colon. So those human cells are depending critically on a food resource, that's this butyrate. That's normally produced by these acid-loving bacteria, but they're kind of sick because their pH is too high, and there aren't many of them. There's not enough butyrate, and then those colonocytes are starving. They basically have to eat something else that's not as good for them, and so they get sick. And that's how you can get an inflammatory gut, for example, and injury, actually, leaky gut. You get a leaky gut barrier, all this problem of things leaking out of the gut that is supposed to stay there. That becomes very, very serious. So it's a cascade downward that leads to lots of problems.

And then also, you're not able to digest the proteins, as I mentioned, because you're missing those critical enzymes that are produced by the microbes. And what happens is you have these peptide sequences that are still around. You're supposed to break them down into individual amino acids, and then those can be absorbed through the midgut. In the midgut, those get absorbed, and you can use them to make your own proteins. But if you don't break those proteins

down, first of all, you can't use those amino acids. They're wasted. And those peptide sequences end up in the colon, where they're not supposed to be. And now you've got microbes growing that can break down the peptides and convert them all the way to nitrogen, basically producing ammonia. And ammonia has a very high pH.

So I think part of how that pH problem is happening is because the proteins aren't being properly broken down, which gives you amino acid deficiencies. Even if you're eating those amino acids, you're getting deficiencies, which is critical, of course, for just making proteins, which are the workhorses of the body. So you have these peptides in the lower gut that turn into ammonia, and then the ammonia causes pH to go up, and then you can't make these fatty acids. It's just a cascade of troubles all over the place.

Dr. Wendy Myers: And can you talk about the contribution to autoimmunity? Because you have to have gut dysbiosis, leaky gut, and this overwhelming reaction of your immune system to all these proteins that aren't digested properly that are floating in your bloodstream. Can you talk about that relationship?

Dr. Stephanie Seneff: That's right. In fact, that's the same thing. So you've got these peptide sequences, sequences of amino acids, that are not human. They're foreign, and then they cross that gut barrier because it's leaky. Glyphosate causes a leaky gut. That's been shown in peer-reviewed papers. And so the combination of the leaky gut and the undigested proteins ends up with these peptides getting out into the circulation.

And the immune cells hate these foreign proteins. That's what causes them to produce antibodies. They're trying to get them removed. They recognize this is not human because they've been trained to know themselves versus others. And when they see a peptide sequence that they don't recognize as a human thing, they get worried and want to remove it. They produce the antibodies, and the problem is that those antibodies can end up attacking your own tissues through a process called molecular mimicry. And it's very quite fascinating that when the sequence is similar to but not identical to a sequence in a human protein, the antibody can get confused and bind to the human protein instead. And then that causes all these different autoimmune diseases that have become so prevalent in recent times.

Dr. Wendy Myers: Autoimmunity is the subset that's the fastest growing in the United States. It's crazy. And can you talk a little bit about autism? So this is something that's really concerning. My daughter was diagnosed with autism at one point. And I think it's a diagnosis a lot of kids are getting, but my daughter was able to come out of it. With detoxification and early intervention, there are a lot of children that are dramatically affected by glyphosate in utero and as they're growing as young children and developing. Can you talk about that mechanism where you believe that glyphosate is contributing to the autism epidemic?

Dr. Stephanie Seneff: Yes, and of course, that was a long story, my personal experience, because the reason why I started studying toxic chemicals was autism. I was very concerned back in 2007, 2008, seeing that the autism rates were going up every year, and the message was, "Oh, we're just diagnosing it more. Don't worry about it." And, of course, also, autism is a genetic disease. So we're looking at all these gene sequences and looking for people who have mutations and this and that and is that correlated and looking for the actual gene errors that might be responsible for autism. They were spending very little money looking at environmental factors. And I felt like it's got to be something environmental because it's going up so fast. And that's when I started looking for what things are going up very fast. And it took me quite a while to find glyphosate.

I have been looking for five years. I ruled out Roundup because I thought it was safe. Everyone thinks it's safe; you don't worry about that one. But then I happened to be at a conference where Professor Don Huber gave a two-hour presentation on glyphosate, and this was in 2012. And I didn't know what glyphosate was when I walked into the room, but I figured it was probably something I should know about. I had an epiphany in those two hours. I was like, this is it. I really became very confident that I had found my answer just because he was talking about the kind of damage glyphosate does. And I knew a lot about autism at that point because I'd been reading all about the issues that autistic kids have. And I was looking for something in the food because I was seeing all the gut problems they were having.

And it fits so perfectly that I just thought, this is it. And I went back and found out that glyphosate was going up exactly in step with the rise in autism: 0.99 correlation coefficient, unbelievably well-matched. And then, of course, I hooked up with Anthony Samsel, and we wrote several papers together diving into the mechanisms by which glyphosate could be causing autism. And I believe I have a pretty clear story at this point in my mind, and a central part of it is surprising. People wouldn't realize this, and I think we've talked about this before; I'm sure we have, is the sulfate problem. You and I have talked about the sulfate problem. That was something that I recognized as a problem with autistic kids because I had read the papers by a woman, Rosemary Waring. She was a doctor who treated autistic kids back in the 1990s, and she was looking at their urine to look at what different metabolites might be messed up in their urine compared to their normal controls.

And she was a really good scientist and a very good detective, and she found that the autistic kids had shockingly high levels of sulfite and thiosulfate in their urine. Way, way out of line compared to the normal kids, hugely more, like a hundred times as much type of thing. And so she identified them, and then she saw they had low sulfate in their blood. So she suspected. She said I think these kids have a defect in the ability to make sulfate. That was her conclusion. And that's how you get these other metabolites that have sulfur in them, but they're not sulfate because they can't be converted to sulfate. Sulfite and thiosulfate can both be converted to sulfate if those enzymes are working. And so she even

identified a potential defect in sulfur transferases as well, which are enzymes that attach sulfate to molecules.

And sulfur transferases are super, super important in biology. People don't know anything about them, and they probably don't even really realize that so many important biologically active molecules are sulfated in transit, and that includes cholesterol and all of its derivatives of vitamin D, the sex hormones, the thyroid hormone, the amino acids: tryptophan, tyrosine, phenylalanine, which are products of the shikimate pathway that glyphosate disrupts. So those are deficient, and then their sulfation is also deficient, and so it makes it hard for them to be transported.

So they become systemically deficient, and they produce many of the neurotransmitters like dopamine, all of them actually: dopamine, serotonin, melatonin, epinephrine, which is adrenaline. All of those come out of that shikimate pathway via these amino acids, tryptophan, tyrosine, and phenylalanine, that are sulfated in transit. So all of that is getting messed up. Both the supply of those precursors and the ability to sulfate them are messed up by glyphosate. And so you get, for example, severe serotonin deficiency as well as melatonin deficiency, so you can't sleep. We have an epidemic in sleep disorders that are going up exactly in step with the rise in glyphosate, and I think that can directly be traced to the problems with serotonin and melatonin production as well as the inability to sulfate them. So that's a double hit.

Dr. Wendy Myers: So many people are having so many issues with sleeping, and I know I did for years. That in itself causes this whole other cascade of health effects as well, including obesity and diabetes, and elevated blood sugar. Can you talk a little bit about dementia? Because this is also growing. Alzheimer's, Parkinson's, and other types of dementia: how is glyphosate contributing to that and just poor brain function?

Dr. Stephanie Seneff: That's a complicated story, and I'm not sure I have the answers, but I certainly have some theories. And one is that glyphosate is a very good metal chelator. Glyphosate binds to minerals very, very tightly to certain minerals. And I found a theoretical paper that talked about how two glyphosate molecules can wrap around an aluminum atom, an aluminum ion, and erase its positive charge. Aluminum is a plus three charge. So because it's positively charged, it's hard for it to get across the gut barrier. Glyphosate sets up a leaky barrier, which makes it easier. But glyphosate also wraps around the aluminum atom, or ion, to cancel out because the glyphosate's negatively charged, and the two molecules of glyphosate will cancel out the plus three charges to make a small neutral molecule that can then easily cross the gut barrier and get out into circulation.

We eat foods that contain aluminum. For example, soy, I think, is one food that's sometimes contaminated with aluminum. And so the aluminum normally stays in the gut because the barrier keeps it out, this combination of the plus three charges and the non-leaky barrier. But once you've got those problems, the

glyphosate picks up the aluminum, carries it past the barrier, carries it in the blood, lands in the brain, and then delivers the aluminum to the brain. And, of course, aluminum is very clearly a factor in Alzheimer's. In fact, they found people who were on dialysis treatment. After a while, many dialysis patients would develop dementia. And they finally traced it to aluminum, naturally found in the water in the dialysis. So they learned to make that water very pure to get the aluminum out in order to prevent that from happening.

So there's a clear connection between aluminum. Also, they see aluminum in the plaque. The plaque that accumulates with Alzheimer's has aluminum in it. So I think one thing is that glyphosate delivers the aluminum very effectively to the brain, and you get into the acidic terminal watershed of the blood at the place where it interfaces with other fluids like saliva, the tears. In the head, those places where the blood interfaces with these other and excretes that water through the saliva, they tend to have a low pH compared to the rest of the blood. So this low pH allows glyphosate to let go of the aluminum atom, and then the aluminum and the glyphosate both become very toxic when they're independent of each other and both of them cause damage.

I also am fascinated by the possibility that glyphosate is actually getting into proteins. This is a critical part of my story in my book, that glyphosate is substituting for glycine during protein synthesis. I believe this is true. And it's a way to explain how one chemical could cause so many different diseases because many, many proteins are getting messed up by glyphosate by virtue of it getting into the protein by mistake in place of the coding amino acid glycine. And that causes these proteins to misbehave. They can't work properly.

And it's extremely fascinating with regard to Alzheimer's because there's the amyloid beta protein that's famously associated with Alzheimer's disease, and that misfolds and gets this plaque. That protein has a characteristic sequence. It's two glycines with three wild cards between them twice. It's a G X X X G X X X G sequence that's in amyloid beta that's been critical. They've identified that sequence as being part of the protein that is causing this misfolding problem. They've identified that's the part. And when you replace any of those glycines with glyphosate, you will cause it to not be able to fold properly into an alpha-helix structure and get into the membrane. It'll break it from being able to do that, and instead, it'll form these beta sheets. They're called beta sheets and precipitate out in the plaque. So I think glyphosate is both providing the aluminum that's messing up the proteins and also causing the amyloid beta to misfold. So that's two different ways that I think it's causing Alzheimer's disease.

Dr. Wendy Myers:

And is it enough to just supplement with glycine? Because that's a solution that some people are coming forth with: just take glycine, and it's going to push out the glyphosate from the proteins. But it seems a little bit hard to believe it's that easy.

Dr. Stephanie Seneff: No, I don't think it's enough, but I do think it may be therapeutic. Unfortunately, it's hard to find organic glycine. If you're buying glycine, you're probably buying glyphosate as well because I think if it's naturally sourced glycine, it's probably going to have glyphosate in it. So you need to worry about that as far as the glycine supplement goes. I would definitely recommend trying to eat. For example, bone broth is a good source of glycine. And so if you can get organic bone broth, that would be a really good thing to take a lot of. I think it's a very healthy food anyway because it has a lot of mineral nutrients, but that can be a good source of glycine. Of course, collagen is also a good source, and you can get organic collagen.

Collagen is a popular supplement these days, and collagen has huge amounts of glycine in it. It has these long, long sequences of G X Y G X Y G X Y, where every third amino acid is glycine, which has a tremendous opportunity for glyphosate to mess it up. And if glyphosate substitutes for one of those glycines, it can cause the protein to misfold. Again, that protein forms this beautiful triple helix structure that's critical for the way that it functions. A structural protein, it's the most common, by far, protein in our body. I think it's like a quarter of our proteins are collagen, and it forms the glue. It's what holds your joints together. It's in your brain, it's everywhere, and there's lots of it, and it's loaded with glycine. So it has a very strong vulnerability to glyphosate toxicity.

And when it misfolds, I think it's causing a lot of these issues with bone pain and joint pain, all of the problems people are having with back pain and hip replacement therapy, and all these issues in the neck. Many people are just suffering from chronic pain due to some kind of joint issue and getting shoulder surgery. It's just incredible how that's also going up. All of those operations to repair the hip, the shoulder, and the knee are going up dramatically over time. And I think, again, it's just more and more as you live longer, you accumulate more and more because it's very hard to get it out of the collagen once it's there.

Dr. Wendy Myers: And are there any other proteins that are really dramatically affected by glyphosate replacing glycine?

Dr. Stephanie Seneff: Well, that's the thing with the sulfur that I found really, really fascinating because when I looked at the enzymes involved in sulfate synthesis, and even in the incorporation of sulfate, there are gut microbes that take inorganic sulfur in the form of sulfate or sulfide, and then they convert it into organic sulfur in the form of methionine. And there was a study that showed that the enzymes that E. coli used to make methionine from inorganic sulfur are busted by glyphosate. So there are lots of problems with that because methionine, of course, is a very critical amino acid. That's another one that people can take as a supplement: N-acetyl methionine. They also take N-acetyl cysteine. Cystine and methionine are cousins. They can be converted to each other back and forth. And cystine is, of course, also very important. It's one of the three amino acids in glutathione.

Glutathione is a very important liver antioxidant, as well as everywhere else in the body. Glutathione deficiency is another thing that's linked to autism. Autistic kids have been shown to have low glutathione, which makes sense because it needs the methionine to make the cystine to make the glutathione, and the methionine is not being properly made. Not enough of it is being made in the gut by the gut microbes because their enzymes are getting disturbed by glyphosate. And I actually traced those enzymes. Sulfite oxidase is another one, and also the sulfotransferases that I mentioned earlier. Both of those enzymes have what I call a glyphosate susceptibility motif, meaning a place in the enzyme where it has a highly conserved glycine residue and binds phosphate. And that's the critical pattern that I see that is very worrisome.

When an enzyme has that profile, it has a very strong likelihood for glyphosate to swap in for the glycine and stick its methyl phosphonate piece into the place where the phosphate of the substrate is supposed to go, blocking the substrate from binding and messing up the enzyme's ability to do its job. And I think that's what's happening in those sulfur systems that are messing them up. And then you have all these problems with the sulfate: insufficient sulfate, insufficient sulfur-containing amino acids, and sulfite toxicity, which is another issue. A lot of people are sensitive to sulfites because they can't be converted to sulfate or converted to methionine. Both ways, they're going to be in trouble. And sulfite is extremely reactive, so many people have sulfur sensitivities. I discovered that after I was talking about, "Oh, you got to get sulfur with autism. It's going to help autism." And they would say, "Well, my autistic son is sensitive to sulfur. I can't feed him sulfur-containing foods." And enough people told me that, I finally figured out there's got to be some problem there.

And it turns out that's what's going to happen if you don't have the enzymes that are working properly. The sulfite is going to be toxic, and you won't be able to eat sulfur-containing foods. And then, of course, you'll have a systemic sulfur deficiency problem. And that's what I think is happening to these autistic kids. It was remarkable with autism what I discovered with respect to heparan sulfate in the brain ventricles. This is very specific that, both in humans and in mice, many studies have shown deficiencies in heparan sulfate in the brain ventricle. So they've been seen in humans postmortem. They've had autistic kids who die. They look at their brain afterward, and they find grossly insufficient heparan sulfate in the brain. And heparan sulfate turns out to be essential for brain development. So I think these kids in utero, in some cases, the mother's eating glyphosate, it's messing up those enzymes.

The fetus is unable to make enough heparan sulfate in the brain, and the heparan sulfate needs to be there to orchestrate the brain development and the actual maturation of the neurons from precursor cells. All of that critically depends on a sufficient amount of heparan sulfate, which is not there in these autistic kids and in autistic mice. They've actually got mice that breed true to

autism. They've done that through genetic engineering. And those mice, they've found, have insufficient heparan sulfate in their brain.

And there was another experiment where they actually exposed mice at birth to a poison in the brain ventricles that disrupted heparan sulfate production. And that was their only defect. They were normal mice except for this problem that was introduced at birth. And they also showed characteristic features of autism just with that one change. So I think it's really, really important. The heparan sulfate is deficient, cholesterol sulfate is deficient, and serotonin sulfate and melatonin sulfate are deficient. All of those critical, critical bioactive molecules become insufficient because of the inability to add the sulfate to the molecule. Really interesting. I talk a lot about that in my book.

Dr. Wendy Myers: And then all of these things you just talked about are going to impede people's ability to detox. So on top of that, they're going to start building up other toxins in their body. The hundred thousand toxins and dozens of heavy metals and they will build up to a point where those will start causing other health issues.

Dr. Stephanie Seneff: Absolutely, and in fact, that's one of the first things I figured out was the liver enzymes. In my first paper with Anthony Samsel, which was my first paper on glyphosate, I talked about cytochrome P450 enzymes in the liver, and I recognized that they were being disrupted by glyphosate. They also have that glyphosate susceptibility motif there, but it's been shown experimentally that glyphosate suppresses them. Those enzymes, they call them CYP enzymes, it's a nickname, super, super important in the liver. One thing they do is make bile acids. So then the bile acids become deficient, and they can't digest fats. They also detoxify other fat-soluble toxic chemicals.

Glyphosate is not fat soluble, but many of the chemicals are. And they need to be hydrolyzed by these cytochrome P450 enzymes in order to be solubilized so they can be converted into water-soluble, and then they can be released by the liver into the blood and delivered to the kidneys, and the kidneys can feed them out. So that whole mechanism is really important for detoxifying fat-soluble chemicals. And also, sulfation is the other step. So often, these chemicals are first hydrolyzed by the cytochrome P450 enzymes and then sulfated by the sulfurtransferase, both of which are busted by glyphosate. So these fat-soluble molecules become extremely toxic as a consequence of the liver's defects in its ability to clear them as a consequence of exposure to glyphosate. So it's really a pretty bad mess.

Dr. Wendy Myers: And then, guess what happens? The body has to shuttle all this stuff into fat. They're fat-soluble toxins. The body can't have the tools to deal with them, and so we hang on to fat. We produce more fat and gain more weight to store all these toxic chemicals the body can't deal with. So boom.

Dr. Stephanie Seneff: I definitely agree with that. I think that's a major driver of the obesity problem. And, of course, without the bile acids, you can't digest the fat. So you're eating

fats. You can't digest them. You need a place to store these toxins that you can't get rid of, so the easy thing to do is just to get fat. It's the best way to deal with it. Lately, I've been fascinated by the fact that I know people, often autistic kids, who are very picky about food, and they actually just love to eat carbs and especially sugar. They like to eat lots of sweets and carbs, and they don't eat much else. They're really picky eaters. There are many things they don't like, and they're eating tons and tons of carbs. And, of course, we've become very aware of the fact that carbs now make you fat.

They used to be your thought, don't eat fat. Go on a very low-fat diet to try to not gain weight. But the fact that they don't like proteins, they don't like fats. I think the problem is that both the proteins and the fats are compromised by glyphosate because glyphosate is cutting down bile acid production, and bile acid is essential for metabolizing fats. And then glyphosate disrupts protein digestion, as I mentioned earlier because these enzymes are not being produced by the gut microbes. So both the proteins and the fats are problematic, and therefore you're going to be inclined to eat lots of carbs because that's the only food group that you can handle.

And it's very, very easy to digest. Glucose is so simple. We've got that whole mechanism in place with glucose to turn it into ATP and make energy. That's the whole citric acid cycle. The cells know how to do that, although that gets disrupted as well by glyphosate. And in fact, there's an enzyme called PEPCK that I talk about in my book, phosphoenolpyruvate carboxykinase, a very, very important enzyme in the liver and in the pancreas. And I suspect that's connected to the insulin issues. But the PEPCK in the liver is essential for converting fats and proteins into glucose. And so the liver actually kicks in the PEPCK when the blood sugar drops too low. So, of course, if blood sugar gets too low, you can go into a coma, and your body has an immediate reaction to say, "No, no, make some sugar, make some sugar." And the liver will do that with the PEPCK.

But PEPCK is a real target for glyphosate. It has exactly the same setup as the enzyme that glyphosate famously disrupts in the gut. The EPSP synthase is the enzyme in the shikimate pathway that glyphosate famously disrupts. Nobody denies that. They think that's the way it kills the plants. And it also, of course, kills the bacteria in the gut for the same reason, because they have that enzyme. EPSP synthase binds to a molecule called PEP, phosphoenolpyruvate, at a place in the enzyme where it has a highly conserved glycine residue. And if you swap out that glycine for alanine, a very small change for the protein, the glyphosate doesn't hurt that molecule at all. It kills glyphosate's ability to disrupt that enzyme. And that's because glyphosate disrupts it by substituting for that glycine.

Once that glycine is not there, glyphosate can't do anything. That's very clear to me. And I talk about that in my book, as well. That's really strong evidence where the idea that the way glyphosate is disrupting that enzyme is by

substituting for that glycine. So the PEPCK has exactly the same thing, a highly conserved glycine in a place where it binds PEP to the same molecule. So to me, that seems like it has a really tremendously perfect glyphosate susceptibility motif modeled after the enzyme that glyphosate disrupts. And if PEPCK is broken, you can't convert proteins and fats to sugar, which means that when the blood sugar gets low, you're in big trouble because you depend upon that enzyme to bring it back. If the liver starts pouring sugar into the blood to bring it back up, it can't do that.

So now you need to keep the sugar in the blood high all the time because your body's anticipated, "Oh my God, it gets too low. I can't recover. I got to keep it high." Now you end up with this precursor to diabetes, which is just this elevated blood sugar, that so many people have this kind of pre-diabetes state with too much sugar in their blood. Their body needs to do that because it can't allow the blood sugar to get too low because it can't recover quickly because that PEPCK is broken. That's what I think may be going on to cause the excessive consumption of carbohydrates, where you're supplying a continual supply of sugar directly from your food into the blood to keep it high. And then also, of course, diabetes. Diabetes and obesity because of the fat being stored. So all of those things make sense to me as far as why. And these diseases are all going up exactly in step with the rise in glyphosate usage. So the whole pattern, the whole story, just makes a whole lot of sense to me.

Dr. Wendy Myers: You've just illustrated all the mechanisms and all the different health issues that are rising directly in correlation with increasing glyphosate use. There have been 18.9 billion pounds used around the world. And with this direct correlation going up with these many different diseases, many, many, many. And so, what is the solution here? Is there anything that we can do to detox this stuff? Eating organic is an obvious way to prevent glyphosate buildup, but I think even with organic food, you're still going to get some.

Dr. Stephanie Seneff: Yes, that's right. You can't avoid it.

Dr. Wendy Myers: Your pets are being exposed. I think that's why one in 1.6 dogs get cancer.

Dr. Stephanie Seneff: I know.

Dr. Wendy Myers: We didn't even talk about cancer.

Dr. Stephanie Seneff: But cancer's another one. Yes. And in fact, there are several cancers that are going up exactly instead, including thyroid cancer and pancreatic cancer. Now, these are metabolic cancers. Breast cancer is a complicated story, but I think it's also connected to glyphosate. It went down because of hormone replacement therapy being cut back. So it's harder to see with breast cancer. The pattern doesn't work, as it went down and it went back up. I did some tricks to try to remove that problem with the hormone replacement therapy, and then I could produce a version of the breast cancer curve that also matches glyphosate if you

sort of correct for the hormone replacement, which was causing breast cancer rates to go down. But at the same time, glyphosate was causing them to go up. So eventually, it turned around, and now it's going back up again.

Breast cancer, I think it's causing that, and thyroid cancer, kidney disease and kidney cancer, liver disease, and liver cancer. So it's a really, really, very serious problem. And, of course, non-Hodgkin's lymphoma, which is the one that's allowed all these lawsuits. There were those three lawsuits that were phenomenal, where these people won a very large settlement with a jury trial. And they've been fighting it. The industry doesn't just pay the money and say, "Okay, fine." They fight, and they're still struggling with going to higher courts and all of that, but Monsanto's not succeeding in getting rid of those lawsuits so far. And there are thousands, tens of thousands, maybe even hundreds of thousands at this point, of people waiting for their turn in court with the non-Hodgkin's lymphoma alone. If we can get enough evidence that it's causing autism, I think we can get a lot of lawsuits linking autism to glyphosate, and I think that will really take them down.

Also, I want to say that Monsanto Bayer has decided to stop selling glyphosate-based Roundup to the American population. It's either this year or next year they're going to stop. But they're going to still sell it to the farmers because the lawsuits are not farmers. Because the farmers have so many chemicals they're exposed to, they can never work in court. They can always say, "Well, it was those other chemicals that caused your problem." Whereas these people who had successful lawsuits were only using glyphosate, so it's much clearer. But they're going to stop selling it to the American public just because of all these lawsuits. So that's really a big victory. It's not a political victory. The victory is a consequence of lawsuits. So I'm really starting to appreciate lawyers and the role they can play in helping to get rid of this chemical.

And I think if Mexico succeeds in banning it, and if these lawsuits continue to heat up, I think eventually Bayer may decide to finally just stop selling it because there's too much going on that could really threaten their bottom line. I'm hoping that may happen. And of course, when whole countries ban it, that becomes very visible and makes other countries, other governments, start to think about whether they should ban it too. So I think we've got a good movement going there. The US seems to be very slow to react, which is unfortunate. We can see how sick our population is. To me, it's a no-brainer to think if I were the government, I would want to get rid of this chemical that's causing all these diseases. Our medical system is a mess. We spend much, much more on medical care than any other country, and we have poor results. Our life expectancy is quite a bit lower than in many other industrialized countries. So we are doing extremely badly with our health, and we ought to figure out that the reason is that we're being exposed to too many toxic chemicals.

Dr. Wendy Myers: And I think that Big Agro and Big Food really pay a lot of money to the governments. And my concern in Mexico is money talks, so I just have a big concern there about that ban getting overturned.

Dr. Stephanie Seneff: I know, but they're working really hard. The US government is working really hard to try to get them to overturn it, which just infuriates me. Not only are they not banning it, but they're also trying to prevent other countries from banning it as well, which is just so crazy. So our government needs to straighten up. I think we are in really bad shape, and it's not going to be a happy future for us if we don't straighten up. And, of course, glyphosate also affects future generations. There are some studies that are amazing that are showing up. When you expose a pregnant rat to glyphosate at low doses, that doesn't really seem to affect the rat at all. And even the offspring are fine. But then when they grow up and have their babies and then the next generation, the pups, each generation gets worse.

There's an actual memory of damage to the second generation that happens in utero. It's quite fascinating. Those cells in the fetus that are the next generation cells, the germ cells in the fetus exposed to glyphosate in utero, remember that exposure through and through epigenetic markers. They remember it, and it ends up showing up as a disease in future generations. And I think that's happening in humans now, today. We've got glyphosate around long enough that we're getting to the second and third generations. It's going to get only worse. Even if we stop it today, we're going to have damage showing up in future generations from the preceding time. It just lasts a really long time. That memory of that exposure, it's really hard to get rid of. As far as treating, people are proposing things that I think I can help with.

And in fact, fulvic acid and humic acid are something I hear bantered around a lot. There was a study, and I always like to mention this study on cows. Some time ago, when the cows were sick, they were exposed to glyphosate, they showed glyphosate in their urine, and they fed them fulvic acid, humic acid, sauerkraut juice, and bentonite clay. It's kind of interesting. I guess those were things that they were aware could help remove chemicals that they were thinking of as obvious things to try. And they reported that the glyphosate levels in the urine went down, and the cows got better. So it was kind of a good study that demonstrated this beneficial effect in the cows. And those are all things humans can take. And sauerkraut juice is quite interesting because that's, of course, a fermented food. And so I really advocate that people eat a lot of fermented foods.

We really like organic apple cider vinegar. We make our own salad dressing. We have a salad almost every night. And then, the salad dressing contains apple cider vinegar. There's a microbe in those fermented foods called acetobacter. And there are very few microbes that can fully metabolize glyphosate, but there are some species of acetobacter that can. And I'm sort of hoping that acetobacter in the fermented foods might be able to actually break the

glyphosate down, which is really the best that you want is to break it down, not just to pass it out through your feces or pass it out through your urine. You want to get rid of it. And so it'd be really wonderful if that's true. I don't know if it's true. It hasn't been proven that the acetobacter in the vinegar can actually break down the glyphosate, but you could hope that that might be the case.

I certainly think it's a good idea to eat fermented foods in any case because they're very healthy foods. And, of course, getting plenty of sulfur-containing foods is also important because if you have enough sulfur, if you have enough sulfate, you can detox better than everything else. And, of course, the whole sulfate system is essential, actually, for being able to break down cellular debris in general.

You need sulfate to break down cellular debris. And so a lot of times, people's damaged molecules accumulate in the cells because the cells don't have a good cellular digestive system, you could say. And that can be a consequence of insufficient sulfate. I really like Epsom salt baths. That's something I do regularly, and I think that'd help. I sleep very, very well, and a lot of people my age have a sleep disorder, so I am taking lots of supplements to try to figure out how to sleep better. I don't take anything except these Epsom salt baths, which I really promote as a way to get sulfate. Epsom salt is magnesium sulfate. Magnesium is often deficient as well. So you can get both magnesium and sulfate by just soaking in them. I like to do really hot bath water. I just throw in a handful of Epsom salts and hope that that's going to help to keep your magnesium and sulfate levels high, bypassing the gut, which I think is really useful.

Dr. Wendy Myers: That's so key because I think a lot of people also get deeper sleep. I've had a lot of people show that when they test with their Oura ring, their REM sleep, and deep sleep, they have more deep sleep, significantly more, following doing an Epsom salt bath.

Dr. Stephanie Seneff: Oh, that's really great. That's good to know because I feel like I sleep extremely well, and I have a lot of deep sleep. I don't have one of those devices that finds out, but I suspect it would. And I take these regular Epsom salt baths. I think that's a really good thing to do.

Dr. Wendy Myers: Is there anything else that you can suggest to people to help with glyphosate or other toxins? Do you recommend infrared sauna use as being helpful, or coffee enemas, or anything like that?

Dr. Stephanie Seneff: Coffee enemas are something that a lot of people have advocated. I have never tried that sort of active detoxing, doing things to detox. I have not tried that myself. I'm very much in favor of nature, as you probably know. The one thing we haven't said yet that I would like to say is sunlight. Sunlight exposure without sunscreen, without sunglasses, even. Take off your sunglasses, get out in the sunlight, and of course, take a walk every day. It's very, very healthy.

I think you need physical motion. It's going to help to keep your circulation going, and that's really important for so many things. So definitely getting exercise, not huge amounts of exercise, but just regular exercise, particularly outdoors and ideally walking the beach. That's one thing I love to do is to walk. Not everybody lives near the ocean but gets in the water, along the edge, and walks the beach. You've got the sunlight, you've got the ocean air, which is also very healthy. It even contains hydrogen sulfide gas, which I think can get converted to sulfate with sunlight. And so that's really, really healthy to walk the beach in the sunlight on a nice sunny day. A really special treat. Not everyone has that option.

Dr. Wendy Myers: This is detox 101, and sometimes you just have to do really basic things that are evolutionarily what everybody was doing a million years ago.

Dr. Stephanie Seneff: I know. The barefoot aspect as well, the barefoot, because I think of the ground. It's funny because I was reading a book, Sinatra. Not Frank Sinatra, but Stephen Sinatra. Sorry about that. He wrote a book on grounding, and I remember I was at a conference in Las Vegas, and at the top of a hotel, it was on EMFs, EMFs, and Grounding. And I was in this hotel way up high, oh, with a whole area below me that was all the slot machines and stuff. There were probably huge amounts of EMFs in this hotel where I was reading this book about how bad EMFs are. I remember feeling like, "Oh my God, I must be over the top exposed right now while I'm reading this book that's telling me I shouldn't be." So it was kind of interesting. It's good if you can stay away from EMFs. I have a lot of friends who are concerned about that. It's not something I've dived into yet. I'm too busy with other topics at the moment, but it would be something I would grab if I had more time.

Dr. Wendy Myers: Sadly, Dr. Stephen Sinatra passed.

Dr. Stephanie Seneff: Oh, I didn't know that. That's sad.

Dr. Wendy Myers: He passed this year, or last year, sadly.

Dr. Stephanie Seneff: Oh no. I'm sorry to hear that.

Dr. Wendy Myers: Well, Dr. Seneff, tell us a little bit about your book. So you've touched on a lot of subjects today that you go into detail with your [book](#), Toxic Legacy. Tell us more about that.'

Dr. Stephanie Seneff: So this is all about glyphosate, and it's focused on autism, but also many other conditions. I have a chapter on the liver, a chapter on the gut, and a chapter on neurological diseases. I don't have a chapter on cancer. That's a harder one to tell the story, but several different topics of autoimmune disease. And I have one chapter that focuses on convincing people that it's substituting for glycine because I think that it's crucial that glyphosate is substituting for glycine during protein synthesis. It's something that many chemists deny. There's controversy

around that idea. They seem to think that it couldn't happen, but I don't see a good reason why it couldn't. And I see tremendous evidence of it happening in the actual data that Monsanto gathered about glyphosate.

It's the best way to explain what they observed. And I mentioned the EPSP synthase and how it has that glycine. If you substitute glycine, it's not sensitive to glyphosate at all. The easiest explanation is that glyphosate is substituted for that glycine. When it's no longer a glycine, the code doesn't match, and glyphosate can't substitute. That's a very straightforward explanation for that observation. Otherwise, it's very hard to explain. And if you accept that, and then you look at the particular proteins that have the appropriate glyphosate susceptibility motif, and you see that in many cases, they've shown that those proteins are suppressed by glyphosate. And then, of course, you see those proteins being defective in association with all these diseases that are going up dramatically in step with glyphosate.

When you piece all of that together, it's like a giant puzzle. And I love puzzles, and this one is really the mother of all puzzles. And I've just really enjoyed linking, connecting the dots, and making that story work for all the different diseases that are going up. For each disease, I would look at the proteins that are defective in association with that disease, like genetic defects. And in fact, for example, glycine substitutions in collagen cause diseases that cause problems with the joints. And so you could think if you substitute glycine with glyphosate, this is a genetic mutation where glycine is substituted with something else like phosphorylate or something, then they can have a severe problem with just one mutation. So if you've got glyphosate there, that protein's not going to work. You can see that from exactly what happens when glycine is substituted with another amino acid that has similar properties to glyphosate.

So I did a lot of digging around, looking for mutations associated with conditions that are associated with glyphosate in terms of going up exactly in step. A giant puzzle that I am trying to solve, and I feel like I've gotten really far in understanding exactly how glyphosate is causing all these diseases. And I can explain it, and that makes me feel very satisfied in believing that glyphosate is, in fact, a huge, huge problem in our society today because of this chronic exposure of the entire population to glyphosate.

Dr. Wendy Myers: Well, Dr. Seneff, we are glad that you like puzzles because this has been a very difficult one to figure out indeed. Since the last time we talked about this, it must have been four or five years ago; you've learned so much more writing this book and have become such a voice for this toxin. I'm just doing this Heavy docuseries interviewing 80 experts on toxins. Every single one is mentioning glyphosate as the number one problem, the number one most.

Dr. Stephanie Seneff: I'm glad to see.

Dr. Wendy Myers: A pervasive toxic chemical that is harming our health and promoting obesity and diabetes and so many things you talked about. So thank you so much for the work that you do. And everyone, go check out, go read Dr. Seneff's [book](#), Toxic Legacy, and get it. Oh, where can we get it?

Dr. Stephanie Seneff: [Amazon](#), of course, but also several other booksellers. My webpage, [stephanieseneff.net/book](#). I have links to all the various booksellers that sell it. And, of course, Chelsea Green is the publisher, and you can buy it from them as well, directly.

Dr. Wendy Myers: Fantastic. Well, everyone, thank you so much for joining me today for the Myers Detox Podcast. I'm Dr. Wendy Myers, interviewing experts around the world to help you upgrade your health and put together those missing pieces of the puzzle that you may not be able to figure out with your doctor and by searching on Dr. Google. So thanks for tuning in.