

Shedding Light on the Toxins Lurking in Your Pet's Food as Well as Yours

A Special Interview With Dr. David Turner

By Dr. Karen Shaw Becker

Dr. Karen Becker:

Hello, I'm Dr. Karen Becker. And as a part of bark & whiskers' head to tail week, I'm so excited to have my friend and colleague, Dr. David Turner, with me. He has been a guest previously on bark & whiskers. He has really spent the bulk of his career focusing on AGEs (advanced glycation end products), and we'll have Dr. Turner explain what AGEs are. Many of you that have been following bark & whiskers for the last decade, or Healthy Pets prior to that, you already know what advanced glycation end products are, but some of you have not ever heard that term. So, I have the world's foremost researcher and, certainly, expert on this particular topic. And I appreciate you, Dr. Turner, for joining us today.

Dr. David Turner:

You are very welcome. Yes, I enjoy our conversations. It's stimulating in a lot of different ways.

Dr. Karen Becker:

So, Dr. Turner, back up. I have heard this story before, but tell our listeners and readers a little bit about how you became so passionate about studying the high-heat byproducts of – we're going to focus on food today, more so than body, the endogenous formation of AGEs. But you probably at some point didn't know about this topic, and then you became very aware. Walk us through how you discovered that this was a passion in your heart, and then how your career pivoted after this discovery.

Dr. David Turner:

Yeah, sure. First of all, AGEs are advanced glycation end products, and they're produced in the body as we produce energy. So basically, what happens is sugar comes into contact with a protein. When they come together, there's a rearrangement of the chemical bonds and it forms these advanced glycation end products. The issue is that these are quite toxic to the body, and normally, they're removed from the body when we go to the restroom, basically. So, it's about 15 years ago now, I was working with transcription factors in cancer at the time, and I was just reading a paper and I came across this word, "advanced glycation end products," and I thought, "Well, what's one of them?" And what we've found is that hardly anybody knows what one of them is. And that's even within the research institute itself.

Most people have not heard of these advanced glycation end products. So, I was reading, and the more I read them, the more that I was realizing that these are part of our everyday lives. Most things we eat contain advanced glycation end products to different levels depending on the type of food. So, I thought, "What is known about this in cancer?" So, I did some reading and there

was very little there. So, once I found out how bad they are, how little they're understood, I decided that that's what my research was going to do. So, we've been basically looking at the role of dietary advanced glycation end products for about 10 years now. And we've found some really significant things within humans, and how they can really promote cancers to be more aggressive once they form.

And then obviously I'm a pet owner. I've loved dogs. I've had them all my life. And we got thinking that these processed foods that they have, which are one of the highest foods that contain AGEs, they're really jampacked full of these things. So, we've had a little bit of a look at them, and the data is showing that the dog foods have a hundred times more AGE content than human foods. And we'd already shown in humans that these things really promote all chronic diseases, [such as] diabetes, cardiovascular disease, neurodegenerative disorder and cancer. So, we thought these must be having a big effect within our dogs and all our pets that we're having. And that's basically what we've found.

Dr. Karen Becker:

I was shocked. Now looking back, I guess having AGEs a hundred times more than average human foods – or when we measure dogs' and cats' bodies, I was like, “Oh my gosh.” But if you think about it, they are eating ultraprocessed food. Most pets are eating ultraprocessed food, canned or kibble, from the time that they wean off of mom until the time that they die. 100% of their calories are coming from the equivalent of fast food or ultraprocessed food for the human space. Whereas humans, hopefully, eat some less processed or minimally processed foods, animals are oftentimes not given the choice to eat less processed foods. So, here's a question for you. I have to assume that you probably looked around at your colleagues as well as tried to educate those around you pertaining to this topic.

It has to be hard because ultraprocessed foods – I just saw a paper a few days ago that said that nutritionists in the U.S. were able to create a diet made from 91% ultraprocessed foods to be nutritionally complete for humans. Basically, what junk foods can you combine to create a nutritionally complete diet for humans? That's kind of the space, recognizing that so many people in modern countries get their calories from junk food. Pets are in the same situation. I have to assume that your work isn't necessarily wildly popular because so much of the industry is funded from junk food companies. Are you finding your work to be an uphill battle?

Dr. David Turner:

Yeah, in a lot of different ways. One of the ways is trying to get funding for this type of research, for whatever reason, is not the easiest thing to do. And especially the research that I've been doing within pets has been actually from philanthropy money rather than the official money from, say, the FDA (Food and Drug Administration), the NIH (National Institutes of Health), or anything like that. We have lots of funding looking at cancer in these AGEs, and we've tried to put some grants in, but it's not an easy area to get funding in. And whatever that reason is, well, it's not for me to say, but it shouldn't be that way. Like I said, we saw these AGEs are associated with most chronic diseases. We now have the processed foods, the modern – the ultraprocessed foods are jampacked full of these AGEs. So, we're throwing more of these things in our bodies than we ever have done before.

And it's increasing because we're eating more and more of these processed foods. So, we know that these AGEs cause cancer, are involved in diabetes, are involved in most chronic diseases because they increase inflammation in the body. So basically, if you increase inflammation in the body, it's damaging your body. You're growing older. You're making your organs grow a lot older, a lot quicker. So, you might have a chronological age of, say, 36, but if you've been exposing yourself a lot to these AGEs, your organ age, the age of the organs inside your body could be 40, could be 50. And so, it's basically accelerating this. And within humans, it's shown – we're seeing diabetes in teenagers, even younger kids and things, and we never used to see that. Cancer, in my field, we're seeing it in 20-year-olds more and more.

And a lot of that, and it's not the only reason, but a lot of that is because our organs are growing older quicker. Cancer is a disease associated with older age. So, if our organs are growing older, we're getting these diseases earlier. And I think this processed food has a lot to do with that. And extrapolating that to our dogs is that – Prostate cancer was unheard of in dogs. Now, we're actually diagnosing prostate cancer in dogs. We're seeing sugar deficiencies in the dogs. Diabetes [and] all these diseases. Lymphoma, especially, is one of the real cancers in dogs that has really increased over these 10 years. And I truly believe these advanced glycation end products are playing a role in that. They're not the only thing. Lack of exercise and everything from that point of view also adds to all this. But these advanced glycation end products, just because of what we actually feed our dogs, I believe are definitely having an effect on this.

Dr. Karen Becker:

When I did some research – when I first learned about this topic about five years ago, and we had our very first conversation, I said, “Listen, I am shocked and overwhelmed that this is probably a massive contributing factor to early degeneration and many of what we call lifestyle-related diseases.” Young puppies and kittens are not born with organ failure. They develop it over time. And when I started thinking about not just the cancer aspect, Dr. Turner, I started thinking about how we have so many – the number one reason people take their animals to the vet. For dogs, they have GI (gastrointestinal) issues. So, I just started diving into the research that was done on lab animals and humans. IBD (inflammatory bowel disease), IBS (irritable bowel syndrome) [and] chronic colitis for humans and lab animals have been established. Chronic pancreatitis has been established, [as well as as] heart disease, kidney disease, autoimmune disease [and] neurodegenerative diseases. I could find papers on AGEs, and almost every degenerative disease out there for humans, I found papers.

Now, we haven't done that research in animals because of funding. And that's just what it is. I'm thankful for people that can and will make donations for additional animal funding. It's very hard. But mammals are mammals. And as a molecular biologist, this reaction that's occurring occurs in all warm-bodied creatures when protein and sugar meet each other. So, can you talk about how – so ultraprocessed pet foods, let's just say dog and cat foods, canned and kibble foods. The average bag of extruded kibble has had raw materials that have been high-heat processed four times. Does that make kibble contain four times more AGEs? Is that a logical thought process or is that not how it works?

Dr. David Turner:

Yeah, no, that's logical because it all depends on how much fats, protein and sugar there is in the food when they process it. Because you have the fats [and] the sugar, [and] when they come together with the proteins – when you add heat, or when you add pressure, or when you irradiate, it makes that reaction happen a lot quicker. So basically, it's going back to humans, but if you have, say, 3 ounces of steak and you actually stew that. You put it into a moist heat and you actually make a stew with the beef, and you look at the AGEs in that. So, the raw steak has around 800 AGE units. When you look at it after we boiled it, that goes to about 2,000 AGE units. But if we fry that meat, that high dry heat drives that reaction I've been talking about, and it goes up to 8,000 AGE units. Just the way we cook our foods.

So, all the methods that they use for food processing makes that reaction a lot quicker. The extrusion, the retorting, the irradiation — all of these things. The other aspect of this, and we haven't mentioned this up to now, is AGEs taste fantastic. The charred areas on foods. When you heat sugar, you get all that caramelized area that's jampacked full of AGE and tastes fantastic. So, food companies, and particularly in the pet food industry, actually add AGEs directly or AGE derivatives directly to the dog food to make it more appealing, so that our pets will actually eat it. So, it's a double-edged sword that it really drives the formation of these things.

Dr. Karen Becker:

I had the opportunity to meet the oldest dog in the world. He was 31 years old, he lives in Portugal, and he was declared by Guinness to be the oldest dog. A bunch of verification had to happen, but his owner – they live a very rural basic life and they can't afford commercially available pet food, but they've also never fed their dogs that way. They cook whatever human food they're eating and then they turn it into a stew, a freshly made stew that day for Bobby, the oldest dog in the world. I have a feeling that the fact that he ate such – some of those meats were cooked, but because they were cooked with low heat, with a lot of moisture, that's one way that we can decrease AGE production. Am I right?

Dr. David Turner:

Yeah, that's it exactly. There's the big argument with pet foods — should we give raw, should we give this, should we give the kibble and which areas we do? And we all have our own thoughts on that in one way or another. But basically, the true research that needs to be done to decide this isn't being done, basically. We could actually answer a lot of these questions if we could do the research and actually get the answers. So, raw dog food, yes, 100 years ago. But we domesticated these dogs now, so we don't know particularly what's going to happen when they eat it, what happens to the genetics, which is the same when you look at the processed food. We're starting to look at the effects of the processed food by looking at the genes, seeing how it changes the proteins.

So, we're trying to now set up some studies where we can look at the healthier dogs, the dogs that are on processed foods more often, and really have a look at the genetics and see the differences in that. So basically, yes, my feeling is – a lot of it is common sense when you think about it. And basically, if it's processed, it's sky-high in a lot of bad things, not just AGEs, but AGEs are a predominant factor within these foods. Where [in] home-cooked foods, where it's moist and everything, you keep the AGEs down. Our bodies, our pet's bodies, are just amazing

[in] what they can do. And they can deal with a certain amount of these AGEs. But if you're throwing so many of these things into our bodies, our pets' bodies, our repair systems, our renal clearance of AGEs gets overwhelmed and these things start to accumulate in our bodies a lot quicker than they would normally.

So, it's a lot of common sense that way. The other side of this is physical activity. We all know how that's good for you; it's good for our dogs. That exercise is definitely what they need. We've got a lot of evidence in our research that physical activity can reverse a lot of [the] effects of the AGEs or prevent a lot of their effects. So again, it's a balance between feeding the dogs [and] the exercise of the dogs. And AGEs seem to be related to all of this. They're part of the disease. They're part of the exercise. They're part of the food. They're part of the inflammation that causes most of these things as well. So, they're like a common factor that we can really use to really look at these because they encompass all our dogs' health.

It's not just looking at eating raw foods or eating processed foods. It's looking at the whole thing like a holistic picture, where we can really start to understand that. That's what we're seeing with our human research, and I think it would have even more benefits if we start to get this going with our pets. Working with the veterinarians, working with dog owners, so we can actually do this research. We do a lot of clinical trials with humans to try and find treatments for cancer. Working with the pet owners and the veterinarians, clinical trials with dogs is the way to go. This is not experimenting on dogs by any means whatsoever. This is a bona fide clinical trial where everything is checked out and everything is done. And then working together with veterinarians, people like yourself, the advocates for all the pets, that could really make a big difference.

Dr. Karen Becker:

And I totally agree with you. I know that the Companion Animal Nutritional Wellness Institute, CANWI, which is the nonprofit that I co-founded with board certified veterinary nutritionist, Donna Raditic, she has done one university-based very basic science study looking at basically raw pet food compared to canned and kibble, and got – the results are exactly what you would think: The less processing pet foods have, the less AGEs are included. But you bring up a really good point. All foods have some AGEs. The goal is to minimize our intake of the high levels of AGEs found in some food categories. Exercise — I love the fact that you bring up that exercise is one way that we can detoxify our bodies and our pets' bodies from maybe this massive amount of intake.

Are there any other things we can do, Dr. Turner, besides daily movement therapy to help minimize the negative effects of AGEs on our bodies? Is there anything else? And then feed as less processed food as we can afford to feed. Maybe swap ultraprocessed treats for more treats from the refrigerator. Carrots and blueberries are probably a lot lower [in AGEs] than a lot of those commercially available treats that we are spending a lot of money for. What are some other tips or things we could do to potentially offset AGEs?

Dr. David Turner:

I have two dogs and we actually home-cook. So, we use sweet potato, we put some meat in there and we bring that all in. But we do it in a certain way where we don't increase the AGEs. That

moist heat is what we were talking about. If you cook meats, if you put it into smaller pieces, it'll cook quicker so the AGEs have less time to form. That's an easy one that you can do. And also, ceramic cooking burns at a lot higher temperatures, I've been told, which again, would make these AGEs go along a lot quicker. So, it's a bit different with dogs. With marinades, acidic marinade – so it would take some thought, this one just came into my head – but if you marinate chicken in, say, lemon juice, and then you actually cut and fry that chicken, you can cut down the AGEs that form by half.

So, I said it's around 8,000 AGE units. If you pre-marinade your foods, you can actually bring that down to about 4,000. These are rough figures, but basically what we've seen from the research. So, there are little things you could do like that. But to be honest, we need more research to really understand this reaction, how it all comes together, how the proteins bind with everything else they come across. And once we can understand that more, we can start looking at supplements and things from that way to see where they are effective. Because, basically, AGEs increase inflammation [and] oxidative stress in the body. And then a lot of antioxidants is a big thing. We've done some clinical trials in prostate cancer patients taking a high dose antioxidant, and it did seem to decrease the AGE levels within the circulation of these patients. So, we're actually trying to bring down their inflammation so it doesn't make the cancer worse.

So, there's a lot of potential from that side as well. But again, the research needs to be done. There are a lot of things that we don't want to start doing that actually harms the dogs, if you know what I mean. We really need to understand these AGEs and how they fit with the processed foods and everything, so we can actually do that. But it brings us to another issue: The food manufacturing companies, they could do basic changes to what they're doing to reduce the AGEs in the foods themselves. They use a lot of these high temperatures to sterilize the foods and everything. If they start looking at methods that use moist heats rather than a high dry heat, that could bring it down. Processed foods are being used more and more. Climate change and everything is making it harder and harder to get hold of healthy foods.

I mean, it's just that way. I think it was last month a paper came out and they used artificial intelligence to look at 50,000 food labels, and the artificial intelligence scanned all these food labels and it came out with the fact that 75% of all foods in America are ultraprocessed, which is just an amazing figure. A lot of the studies before that done by humans were saying around 35% to 40%. But this one study, which is a lot more intricate – it is actually looking at a lot of different things – came up with that 75% figure. So, I would love it if they could do the same thing with dog food. I think that would be more like 90%, but that's just my own thoughts.

Dr. Karen Becker:

Yeah. Well, in our estimate – we did that research when we were writing “Forever Dog.” And at that time when I wrote “Forever Dog” during COVID, [in] 2019, the estimates in the literature were that 85% of dogs were deriving 100% of their calories from ultraprocessed foods. And in the U.S. at that time, it was 50% of the calories consumed were from ultraprocessed foods. That has definitely increased. And as this most recent paper demonstrates, humans are headed the way of our pets, which is consuming the vast majority of our calories as unhealthy foods that have these unwanted tag-along byproducts that create degenerative disease quickly. They literally age our body. So, can you talk a little bit about how that happens? My understanding is that our cells

have a receptor for AGEs and that when the AGE hooks into the receptor, that's the beginning of this degenerative process. Am I in the ballpark there?

Dr. David Turner:

Yeah, definitely. So, I talked about that inflammation, that AGEs cause inflammation. That's a bit vague. So basically, on the outside of every cell in our body, which is trillions, there's a receptor for advanced glycation end products. It's a protein and it sits on the surface. And a part of that RAGE protein, we call it, receptor for advanced glycation products, when AGEs bind to that receptor, it sends a signal inside the cell. And what that does [is] it actually switches on a lot of the genes that increase inflammation. And that's basically because this RAGE protein is there to control the immune response when we hurt ourselves. So, if we're scratched [and] we get a lot of red area around the scratch on the skin, that's RAGE sending proteins there to fight infections and everything. So, we need RAGE.

RAGE is an important protein. But when we throw AGEs in there, we over activate that. We're getting too much of that redness, and we're getting in areas that don't actually need to be repaired there. There's no scratch there in the first place. But because AGEs have upregulated RAGE, that leads to this inflammation in our organs, in all of our tissues and in the cells as well.

Dr. Karen Becker:

I know one of-

Dr. David Turner:

Go on.

Dr. Karen Becker:

One of, I think, the focuses that Dr. Donna Raditic has thought about is cats and kidney disease, [or] cats and diabetes. Diabetes in general. But it feels to me like, at least from the human research, that some tissues either may be more vulnerable to the negative deleterious effects of AGEs or that there could be more receptors. It feels like the pancreas could be a highly susceptible organ.

Dr. David Turner:

Yeah, that's totally right. So, AGEs are cleared from the body, like I said, through renal clearance. So, they tend to accumulate in the digestive tract, in the liver [and] in the kidney. So, they definitely are higher in these organs. But when we're looking in the brain, in the prostate [and] in the breast, we're seeing that there's a pretty even distribution apart from these organs [that] were involved in clearance. So, we're finding that if you throw in too many AGEs into the body, the renal clearance is easily overwhelmed. It just can't cope with that. And what we find is these AGEs are accumulating in the liver, they'll accumulate in the kidney. We're seeing a lot of liver disease [and] kidney disease because of this. These AGEs are actually contributing to this.

So, these are definitely their areas of main accumulation, but we're finding they [also] seem to accumulate everywhere.

I think one of the first diseases was in the eye and cataracts. AGEs are involved in a lot of eye diseases because they bind to the proteins within the eye. They stick them together, and they can't actually do what they're supposed to do. Normally, they're freed around. And that's the same thing with their cardiovascular disease. You hear a lot about the plaque formation within blood vessels and how that can block the blood vessels. AGEs play a major role in that cross-linking that leads to the plaque buildup within the vessel itself, and that goes to cardiovascular disease. And finally, we talked about diabetes a lot. So H1AC (hemoglobin A1C), the actual marker that they use to measure blood glucose level, is actually an AGE product. It is AGE bound to hemoglobin. Because it accumulates over time, it can really indicate what your blood sugar levels are. And obviously that's been used for a long, long time.

Dr. Karen Becker:

And we are starting to use that as a marker for animal wellbeing as well, or the level of glycation occurring in animals, thankfully. It has to be a little bit depressing to you to have read this study demonstrating that over 70% of calories are now coming from ultraprocessed food in humans. As human health continues to deteriorate, and unfortunately same with animals, our companion animals are – we have way more lifestyle-related diseases than we ever have before. That makes this research so much more imperative because although we've identified the problem, other than the common-sense approach, which is feed and eat less processed food, we need to grow more food in our own gardens. We need to feed less food. If we're going to cook our food for our animals, we need to cook it at a low heat with a lot of moisture.

Those are great common-sense steps, but we still don't have the answers as to what we can do once potentially AGEs are in the body and creating mass destruction. It kind of feels like there's no hope, but there could be hope. And I think that that's part of what your research is aiming for. We've identified the problem, now we need some solutions.

Dr. David Turner:

Yeah, definitely. Like I said, we can't avoid AGEs. They accumulate from the day we're born till the day we die. But we can do a lot with what we do in between that. I mean, everybody likes great-tasting food, and a lot of that is due to AGEs. I still eat steak now and then. Not as much as I used to after I've seen some of the results that we have in the lab, but I still eat them. But I make sure – if I'm aware of what they are and what they do, then I can think, “Well, I've had too many AGEs in yesterday's meal, so tomorrow I will have a low AGE meal.” And basically, “Oh, I had a lot of AGEs, so I'm going to go out and do a bit [of] extra exercise this time.” We can go that way.

Like you said, they're the common-sense decisions. One thing that we've been doing is working with some natural product researchers and we've been looking at seaweed and algae and a few different things. There are two or three compounds we've identified [that] could maybe – and it's only a maybe at the moment, but they seem, in our early experiments, to really inhibit that AGE formation, which would be great. Even in processed foods, if you throw these things in while

you're doing the processing, it could maybe stop the formation of these AGEs or at least reduce them. And then that's an easy thing we could do. But the issue being, there's a lot of basic research that's not difficult, it's not complicated, that we could do to give a lot of answers, but we haven't got the funding to do it, and these things are expensive.

So yeah, it's a conundrum, but at least thinking about it and going forward and being more sensible. But like I said, nobody has really heard of these things. You go to the FDA site and look for an advanced glycation end product, it doesn't mention them once. There's just nothing in the search history there, which to me is just wrong. I mean, these things are involved in virtually every food we eat. They cause diseases, they cause inflammation, so they should be talked about in more focus. They should be, really, actually being discussed. And basically, we look at things like farm produce now. All the animals are being fed these high-processed foods. We're putting pesticides on all the crops. That increases AGEs as well. Even just breathing in pesticide or cadmium exposure increases AGEs, and it's all related to this inflammation. Because basically AGEs cause inflammation and funny enough, inflammation causes AGEs.

So, you get this feedback loop. It's just chronic inflammation that's self-feeding and keeps going on. And then if we throw in more of these AGEs into our bodies, we're feeding that cycle even more, and that's what's leading our organs to grow older. One of the big things that I get at the moment is, while everybody's living much longer lives than they ever were, if you go back, say, 20 years, the quality of that life was a lot better because we didn't have so much osteoporosis, arthritis [and] Alzheimer's. All the chronic diseases are happening earlier and earlier, like I said before, and that's where these things are making a difference.

We've made great strides in life expectancy. But if we look at the U.S. life expectancy from the last couple of years, it's starting to actually drop for the first time ever. This has never been seen before. The opioid epidemic has a lot to do with that, and I think COVID, when the figures come out soon, is going to have a lot to do with that. But also, lifestyle is one thing. It's starting to drop now. So yeah, it's really controlling our exposure, knowing what they are.

Dr. Karen Becker:

And I appreciate the fact that you have made this your life passion. Will you talk a little bit about your brand-new website? A little plug of what we can find on that website and more about that.

Dr. David Turner:

Yeah, definitely. So, we've started an Anti-AGEs Foundation or Anti A-G-E Foundation, we call this one. And basically, you can go to that site [anti-ages.org], and you can get a lot of information about AGEs. We're just getting this going. We're just self-funded and everything; it's a nonprofit organization. But on there, it has more detail on what AGEs are [and] how they work. We even have a diagram of a human body, and you can click on each one of the organs and it'll tell you what the evidence is for that and why AGEs are bad as it goes around. We do a blog every couple of weeks or so. We recently did one on pet foods and things and how we can actually go with that. So, we keep updating it. But one thing we're really trying to do [is] we're trying to bring together the industry, veterinarians, doctors and everything.

So, we have a lay site for people that don't know what AGEs are. That's up and running. But we're also working with a lot of food companies and we're trying to generate an AGE certification. We've got a few companies that are interested in this, so they can actually say that their food has been certified as low. We've also got a lot of clinicians where they can go and look at the diseases and everything that way. So, we're thinking if we can bring all these people together and then bring experts in from each side of that, we can really make some inroads into bringing this forward.

Dr. Karen Becker:

I appreciate wholeheartedly your commitment to educating all of us about this incredibly important topic. Incredibly important for us to achieve long-term health and wellness. This is a topic that is front and center, and I appreciate your commitment to focusing on this. I would love it if, along with the AGE certification for human foods, we could maybe down the road do a low-AGE certification for pet foods. What an amazing gift for pet parents to be able to see what foods are transparent enough to do some testing and then demonstrate those results. That would be a great gift to the entire pet industry as well.

Dr. David Turner:

We're talking to a couple of pet food companies. I can't say who they are at the moment. We are talking to a couple that are very interested in this.

Dr. Karen Becker:

So good.

Dr. David Turner:

They're really committed to making their foods healthy, which is great to see. But these are not the big conglomerates, by any means.

Dr. Karen Becker:

Yeah, and that's always the case. I think that it will be the small guys that understand the issues and are trying to put out quality products, recognizing that this is an issue. Those are always going to be smaller companies. Dr. Turner, I'm so thankful that you took time today to educate all of us yet again. We'll check back in in maybe a year and just see where that research is going and what is new and different. In the interim, we appreciate all that you are doing, both for humans and animals, not just in terms of identifying the problems, but also working on these important solutions. Thank you so much.

Dr. David Turner:

Absolutely. Anytime.