Introduction to Dr. Hsu and Metabolic Cancer

Hi and Welcome back to the Breast Cancer Breakthroughs Summit. I have something and someone so very special for you coming up next. I am delighted to have my next guest here.

This is Dr. William Hsu and his presence in the space of endocrinology, of metabolic disease and now with fasting is enormous. He has a wealth of information.

He is currently the chief medical officer at L-Nutra and prior to that, he was at the Harvard's Joslin Diabetes Center He has been and on the advisory board for the American Diabetes Association.

And he has been involved in research in the area of fasting and breast cancer. And so he has a lot of important information for us to get to today. So let's just get started.

Dove right in and welcome Dr. Hsu. Dr. Simmons. Thank you so much for having me on your show. Yeah, I'm I'm so delighted to have you here, because this audience really needs to hear from you and they really need the information that you have at your fingertips.

So let's first start with what I talk about all the time, that breast cancer is a metabolic disease. So can you talk about what's happening from a metabolic standpoint in terms of cancer promotion, cancer growth and that kind of thing?

That that's a really interesting angle. It's not always been this point of view, right? So for many years, the medical community think cancer has mutations of these cancer cells and so when you think about like what I mean, these cells go to grow.

Every living things have to have nutrients. They have to have signal to grow. And so you're absolutely right now, pioneering science has begun to look at all cancer types.

It has it underpinning. And the mechanism that is inseparable from all the metabolic milieu, all the mono influences, the influences that either set the cancer up or promote cancer growth.

And so this is really a very timing topic. Yeah, absolutely. So in many ways, the same kind of metabolic dysfunction that's happening in diabetes is happening with people with breast cancer.

And so often when I see these people who are really not getting flagged as being pre-diabetic and yet I test them and their fasting glucose is 95 or a hundred or 105 and they're fasting insulin.

Or even if they're fasting glucose as normal, their fasting insulin is in the twenties and thirties, well above what we would consider healthy. So can you talk a little bit about fasting, glucose, fasting insulin where you where you would like to see it and what does it all mean?

What does that whole process look like as you approach prediabetes and diabetes?

Insulin Resistance, Prediabetes, and Cancer Risk

It's really interesting. It's not a surprise. But when you look at people with living with type two diabetes, mainly we're talking about and that's the prevalent form of diabetes in our society.

We're talking about maybe about 38 million people with diabetes here living in the US, one hallmark of the majority of people with type two diabetes is elevated glucose, right?

So but also elevated instant, as you mentioned. And what that means is it takes more insulin to do the same amount of work and getting rid of the glucose from your body.

So we have a specific term for that. It's called insulin resistance. And so let's say, you know, one unit of insulin generally can move X amount of glucose out from the bloodstream into the tissue.

Somebody with insulin resistance now takes one and a half times more insulin to do the same work, twice the amount to do the same work. And if you think about it almost in terms of of like fuel efficiency, when you look at vehicles, big trucks, big cars, they have terrible fuel efficiency.

And same thing that people with our body size gets bigger. We call that insulin resistance because it takes more instant to instantly the same amount of work.

Now, when you look at people like that, people with type two diabetes, with obesity, with insulin resistance, very interestingly, they also have higher level of cancer.

Risks will tend other words, people with diabetes. It depends on what kind of cancer it is, but they have may have anywhere from 2 to 3 times their risk of developing some form of cancer.

So that relationship is not coincidental. There is actually a hardwired relationship behind them. The links cancer growth to to metabolism. And why do you think it is that it's not universally accepted to check people's fasting insulin?

Because I would think that we would want to know who is becoming insulin resistant. And that is really the clinical indicator of who is becoming insulin resistant, right?

Yeah. I think also I think it has to do also with the division of labor that we have in our health care system. By the time you see an oncologist oncologist, that means that person is already diagnosed with cancer.

And so the focus is now on getting rid of cancer, killing the cancer cells. The people who who really ought to be looking for this are not part of that that ecosystem.

And I think it has to do with such a fragmented health care system we have in our country. Right. The ones that are that's been taking care of you for many years to help with prevention is in thinking about the cancer risk, if you will, with elevated insulin level.

And so what they should be thinking about blood sugar balance, they should be thinking about insulin resistance. I mean, that's that's under the purview of the primary care physician.

So I feel like, you know, usually this is a a ten year process, just like breast cancer is a ten year process. And if we would have arrested the metabolic dysfunction years before, we probably wouldn't have gotten to the point where we have a cancer diagnosis.

I think that that is a very good accusation of how medicine has becoming more about treating the results right than the root cause. And yeah, I could not agree with you more.

We ought to be spending more of our awareness and our efforts and our dollars by our early detection. And that's exactly what educational session like yours, I think can help to to change.

So let's talk about I know that you've looked a lot at fasting and the benefits of fasting in reversing metabolic disease and even in its relationship to cancer.

So can you tell us what's happening in the body with fasting and why it helps to reverse metabolic disease? I think that that part I think the relationship of fasting to metabolism, it's pretty clear when you fast you're not giving your body that constant and stimulus for growth and just like a car that's that's revving up that's driving fast on the road,

that gets to the destination quicker.

You know what's at stake here? Well, it's your wheels. It's your tire. It's your tire track. Over time, it it it gets burned up. It gets used up and same thing with our body.

If the body is always getting these growth signals, constant growth by 24 seven. I mean, essentially, other than the change in where we are sleeping, our society is inundated with with food.

That means the body is constantly growing and wearing out and it actually accelerate our aging process. And no wonder now over the last 20 years, we've seen this epidemic of obesity and diabetes all around the country.

How Fasting Reverses Metabolic Dysfunction

And partly to blame is all the the the sort of excessive nutrient consumption that we have. Fasting does the opposite. Fasting works almost like a pit stop in a in a in a car race or where the engine gets pulled down, the wheels get it's changed.

Right. So you're able to run again. I think if you look at our human natural history of our of of humanity's, there's always been periods of fasting when the sun goes down.

We stop eating. When the sun rises, we start working and eating. But that's changed with refrigeration and light and lighting and knowing, right. Illumination in the eye, but also in the past, there were also periods where where there was just simply no food.

We got to go out and either gather or hunt. And now we have access to to food any time of the day. So we our body never gets time to stop. And that's a problem.

The constant growth signal pushes us to be biologically older, but at the same time sow the seeds for many chronic illnesses to emerge like obesity, diabetes and hypertension.

And cancer. And cancer for sure. So let's let's get even more granular what is happening when people fast. Yeah so a few things so not all fast is the same.

Let me clarify that a little bit, but one of the most common dietary patterns here in the U. S. is what's called intermittent fasting. And a lot of people practices that about 10% of Americans practice some sort of intermittent fasting.

And that simply means that you're either eating less and, you know, you're fasting for less than two days straight. That could be defined as intermittent fasting.

And yet one of the most common things people do is time restricted eating, as the name implies that certain times your of the day where you're restricting yourself to food consumption.

So let's say somebody says 16 a day means 16 hours of fasting, 8 hours of eating, right? So that is very common. So when people do that kind of intermittent fasting metabolism improves, right?

Glucose level goes down, there is a weight loss, right? There's a lot of metabolic benefit with intermittent fasting because it allows the body to rest and allows the liver to rest.

It allows the pancreas not to pump up so much insulin. Right. That drives growth. But there's another type of fasting which I think is very important to differentiate from.

That is the periodic fasting. That is fasting that's greater than two days or more. In fact, this is what nature always kind of prescribes for for all the living organism on earth, because not every day there's food around the animals has had to go to hunt and gather.

And so these prolonged fasting actually does something truly amazing and not only supports a healthy metabolism, but because the stress that's imposed on the cells, the cells actually have to survive after two, three, four or five, six days of no food, the cells says, Hey, where is energy coming from?

The cells have to actually look internally and say, Hey, what? What can I do to burn off so that I can survive? Now the first thing it burns off is never going to be the brain of this of the cell, which is the nucleus, because that will be suicide.

So what it does is that begin to look for cellular organelles. These are structures inside the cells that are more disposable. For example, misfolded protein, dysfunctional mitochondria, things that are ready.

They are older, they are more worn out. And so during that fasting phase, the cells actually chew these plants up a source of energy. But the good news comes when food becomes available again.

Think about what happened. The cells shrink first, right in times of of starvation. But when food becomes available again, now the cells grow those parts better.

Now think about what just happened. You have simply replace those worn out parts of the cells for new parts. And there is a term that describe that process is called altered energy.

That means self-healing. And that process is so important to the survival of all organisms on Earth that are so pivotal to discover this process that the guy who or the researcher that one that described this won the Nobel Prize in 2016.

So, Jan, that was a long description. But no. No, I love that. So there is a lot of debate about when autophagy kicks in. So what has your research shown, shown you in terms of when autophagy actually starts?

I think a lot of the literature that talks about intermittent fasting, treating autophagy, I happen to belong to a camp that does not believe in that because think about that, you know, to eat your cells, to eat, that's that cell.

The components I don't think can be triggered with 6 hours of fasting. How could it be? I mean, it's not an existential crisis, right? There is risk when you begin to digest intracellular organelles, there is a risk to it.

I think it has to be a existential crisis and that generally takes in humans, I believe probably 3 to 4 days to star in animal models like in rodents.

It's a little earlier because they're smaller in body size and also their rhythm is different. But in humans, I believe probably starts a no no sooner than a day or two.

Autophagy and Longer Fasts

And then I think it picks up probably three or four days and therefore there's room for these longer fasts that is very different and not achievable through intermittent fasting.

So talk to me about where the research around fasting and breast cancer is. Yeah, it's really interesting because it had not been so popular, let's say ten years ago.

People when people think about cancer patients, people think about, you know, losing weight and for appetite. And yeah. And I do want to expand on that a little bit because we we have created a lot of dysfunction around that image right now.

There is such a thing as wasting in terms of end stage cancer, but the vast majority of people who are being diagnosed and treated for cancer are not in that phase. As And that's why there's always this almost this misconception.

Right. And as we said at the onset of the problem, people who are overweight and have diabetes generally are are heavier, right. And they get cancer. So, yeah, that early diagnosis, early treatment, they're not emaciated at all.

They're actually insulin resistant. And there's they're struggling with something called sarcopenia, where they have less muscle mass, although they have a large amount of adipose tissue in their body.

Yes. So even even those people who are overweight. But sarcopenia meaning that they just don't they haven't preserved their muscle mass. Even those people.

Do they benefit from fasting? I think so. We know fasting does several things to the body. And it was one revealing information study that came out in JAMA Oncology a couple of years ago was simply looking at around 2000 women who have the diagnosis of breast cancer and looking at their rate for, for example, breast cancer recurrence.

And it was found that people who who fasted less than 13 hours a day in a in a 24 hour cycle, have about 36% higher chance for breast cancer recurrence.

Now, it's not a randomized control study, but the information like this is very, very interesting in hypothesizes that that not only what you eat, but also the timing of when you eat and not eat could have implications in cancer biology.

And this kind of opened up many kind of new trials and new studies in the field of metabolism in cancer. And so what have you looked at specifically around fasting and breast cancer?

So I currently I work for a company called Neutral stands for Longevity through Nutrition. This is a company that its mission is to drive human longevity or what we call human health span, not just the number of years you live, but also a number of years you live healthily.

Right. So right was the chief medical officer. I am on a task with really driving the clinical evidence to support not only in the area of longevity but also in disease reversal.

So we have about 18 published clinical trials. We have 14 clinical trials ongoing at the moment. I can tell you some of our studies were actually in people with cancer and using a very specific nutritional approach called the fasting mimicking diet or the FDA.

It's really a structured meal kit. Is a five day meal kit and or sometimes is four day depending on the conditions where we're we are we're providing nutrients to people and to help support them through a five day fast.

So the first question your listener may may have is this sounds like an oxymoron. So fasting is just no food for about a year. Right?

Fasting Research in Breast Cancer

Right. Right. And so this is where I wanted to just take a little bit of time explaining this is what we call what we call neutral technology. It's precision nutrition that gives you the benefits of fasting without the suffering of a really fast.

It's right over 25 years of research funded by the National Institutes of Health. So it is possible to provide exact nutrition, the fall below the detection threshold of these nutrient sensors in the cells so that you can actually gain the benefits of fasting without actually fasting, eating water.

That's that's amazing. So I, I know that Dr. Volatile Longo at USC has been looking at fasting through chemotherapy. Can you talk a little bit about that and his work?

So I wanted to first address that. This is part of our research and development pipeline right now. We don't have commercially available service or program for this right now, but hopefully you will.

But so far what we've done is we've tested the FMD in conjunction with standard therapy and we were able to show that people in the in the clinical trials who were on the FMD had better outcomes than people who didn't.

And that is because of very interesting phenomena like Sonoma phenomena called the differential stress resistance. So what that means is when you fast somebody's going through chemotherapy, what are you doing to the normal cells?

What the cells in the normal cells are saying, hey, I have no food around. I need to it's not time for growth. I need to shut down in a way. I need to kind of put my shield out because there is not time for reproduction, is not time for growth.

So that's actually really important during chemotherapy, right? Because we know chemotherapy works on cells during the cellular replication cycles. So if you arrest or you call this normal cells into this stress, enormous stress resistance state, that's actually protecting the normal cells from the harmful effect of chemotherapy.

All right. So you're making the normal cells stronger, but it's quite the opposite with the cancer cells. The cancer cells cannot regulate whether there's food or not.

It's just grow, grow, grow. So when you give it fasting, mimicking, diet during this this process, the cancer just continued to grow. Right. And in fact, it causes even more damage to the cancer cells when they're exposed to fasting in the presence of chemotherapy.

So now, you know, during this time of treatment, you have two different pathways. One, to make the normal cells stronger and one to make the cancer cells weaker.

And that's been our early studies showing some really promising signs of of changing the way we think about cancer treatment for a long time. We say, well, have a new whatever they want.

But you think about the very thing we do where we're where we're stimulating insulin production was we're elevating the glucose in the patient's body.

These are growth hormones and driving cancer growth. I mean. Yeah, I think that that's what everyone needs to know and remember is that insulin is a growth hormone.

It is absolutely a growth hormone. And so someone who it already has an issue with growth with which essentially that's what cancer is. Why would you give them more growth hormone?

And we all need to make it a priority to be really cognizant of people's insulin levels and how much growth we're promoting. And someone who already has a growth problem and that that message of no matter what you do, don't lose weight.

We need to lose that message. That message is very bad and old information. That's absolutely right. So, you know, you did say that people who utilize the fasting mimicking diet do better when they undergo conventional therapy.

So I want to talk about what that do better looks like. And I also want to talk about what what specifically does that mean to do the fasting mimicking diet while you're getting chemotherapy?

Well, this is where I wanted to to bring caution to to our conversation. It is not a clinical program that we have available at the moment, but our research protocol essentially shows they're they're really they are radiologic evidence of cancer, tumor burden regression with with FMD or fasting mimicking diet compared to the received chemotherapy.

And in fact, we had a recent paper published that showed even in negative, triple, triple negative breast cancer, it's the hardest breast cancer to treat.

We had a a in this subanalysis of the study which we published show an overall survival of around 30 months versus 17 months without FMD. But again, I wanted to just make sure that that our listeners are clear about this.

This is right now still under research protocol, but is promising. It really puts a different it's a different approach to to our standard treatment that we're not saying do this without going through standard therapy.

We're saying in conjunction with standard therapy, we could see. Of course. So what does it look like in terms of how long do you have to fast before you have chemotherapy in order for those cells to go into that kind of resting state?

Yeah, well, we we believe that that means since they're over 100 or more mutations, potential and mutations with cancer, it's hard to have kind of one broad, broad stroke to cover this.

Fasting Mimicking Diet with Chemotherapy

But generally, we think maybe a three or four days of fasting and also covering the date of chemotherapy might be an optimal way. It's always try to balance the efficacy with safety factor.

And that's why I think it really needs to be be tested into different kinds of cancer. Right. Obviously, if someone is already hectic in that they're in that end stage of cancer, that might be someone where you're a little more cautious with the fasting.

But in general, I would think that the same rules that apply to the general population for autophagy apply to this cancer population. And so you're going to want seven days of fasting prior to receiving chemotherapy because you're going to want to get to that state of autophagy which the cancer cells can't get in.

Yeah, the autophagy stories, the interesting because different types of cancer can use starvation as an escape mechanism. And but what fasting does it it shunts it activates these starvation escape pathways for the cancer cells and then which then can be targeted by very specific drugs for that.

So I think the story is nuanced, right? The mechanism of action is complex. But then I worry saying here is the now instead of ignoring metabolism as part of your cancer support, now there is evidence, emerging evidence and even more credible research being done day by day, with more publications showing the intricate relationship between metabolic health and cancer health.

And I'll just say one more mechanism of action that's I think may be of interest to your listeners through fasting. We also found in our publication said through FMD, we also found recruitment of these defensive cells called the T cells.

These are kind of the the antitumor immunity gets activated. You have recruitment T cells into the cancer cells and begin to help destroy the cancer cells activated by the fMRI.

That's also very, very interesting because it's not simply just insulin level coming down, glucose level coming down, but there is a huge recruitment of these of these immunity cells in the fight against cancer through activated through FMD.

And that's truly amazing. Yeah, that is very interesting. Yeah. So fasting has the both a Q effect as well as these longer kind of growth modulating effect.

And it's truly just opened our eyes to New areas of therapeutic potentials. I'm curious as to whether or not you guys looked at other side effects of treatment and whether or not fasting had any relevance in the area of immunity.

Like do do people get the same white count drops if they've fasted that they do with with conventional chemotherapy, fatigue, nausea? Does it change any of these other known side effects of chemotherapy?

Yeah, it's it's very interesting because that is the other side of of treatment kind of outcomes that we're looking for. Right. One is cure or treatment.

The other side is tolerance. And we've seen this in our animal studies where a fasting or fasting mimicking day in animal models certainly protects the animal from the side effects of chemotherapy.

I think we're in the process of demonstrating and testing, if that is the same with humans, especially not only for chemotherapy, but also the more ever popular immunotherapy as well.

So I think the jury's still out there, but we're closely looking into it. It makes sense because of the resistance, the differential stress resistance factor that I mentioned earlier. Yeah.

And what about fasting in terms of preventing recurrence? So, you know, we all know that people after breast cancer treatment, I call it the quiet after the storm.

It's like they have surgery and they have you know, some people have chemotherapy, some people have radiation. Some people get on extended endocrine therapy.

But kind of when that acute period of treatment ends, it's everyone's like, okay, bye, see you in six months. And people are left wondering like, Oh my God, what do I do now?

And why is it so quiet? And I feel like I'm not actively doing anything anymore. So is there a role for fasting in terms of preventing recurrence? And I'm so glad you brought up the whole issue of survivorship.

And I think what's more powerful is therapeutics that we have known. That means people are living longer and people have options right now. And I think absolutely.

I mean, at the onset of the program, I quoted a study in JAMA Oncology talking about intermittent fasting being helpful to prevent recurrence. And I think that that story clearly we need we need more studies.

But think about what could be the downside. You know, when you instead of these long fasting period associated with acute, you know, chemotherapy, once you've gone through those periods and into survival, but I think this is when keeping your insulin level down, keeping your glucose level down.

And there's another important marker called the IGF one insulin like growth factor at a reasonable level. Right. That that basically tells the body, hey, you know, don't grow so fast.

You know, take take your time, don't over don't put your your growth engine into overdrive. It in my mind and as shown by some of the studies, that had to be one of the key strategies right, to keep you healthy.

Why give your body a chance to to again, put your growth pattern into overdrive with high insulin, high IGF one and hypo postop? So I would certainly recommend and getting, you know, more plant based approach lower the install level watch what your carb intake and certainly manage the way it's it's it's great for your overall health but maybe specifically also for your cancer health.

Yeah. And you did bring up is it safe? So because I know that people, you know, they inherently have in their head like I need food for fuel, I need food for energy.

So are there any safety concerns with fasting? And in the long term, how frequently should people be doing these extended fasts? You know. I think it I think there's two different conversations when it comes to time restriction eating.

Recurrence Prevention and Survivorship

I think everybody ought to be whether you have cancer or not or whether you're a survivor or not, at least 12, 12. I

mean, that means 12 hours of eating and at least 12 hours of of of window that that has no food in your body.

I think that that's very reasonable. Yeah. I want to say that if you can't go 12 hours without food, you have big problems. Yeah, it is just not healthy.

So at least 12. 12. Yeah, I think 1212 is kind of the basic right. And then if you could push it up the hours from time to time, I think that that also depending on on your unique body needs these extended periodic fasting it's maybe a different story.

So everybody's health condition is different and I don't want to make a generalization, but it's something that you probably ought to discuss with your health care provider, whether you're a Kennedy like this.

Simd was specifically designed to mitigate some of these burdens with prolonged fasting. But again, I would advise that you speak to your health care provider to make sure that a five day fasting, even with some precision nutrition, such as in the FMD, is right for you.

And then in terms of assuming that it is ideally how many times a year in survivorship would you be recommending doing these five day FMP days? Yeah, we, we don't we have yet to have the exact data to show how many psychological so how many years of extended life extension.

But I could I could cite some general ideas. If someone is looking for extending their healthy lifespan for healthy aging purpose, which are meant three times a year, so three times a five day fast.

But FMD. Right, that's for healthy longevity and for somebody with very specific metabolic needs to drive down, for example, or a body weight, visceral, fat, we're talking about more frequent and that is often a monthly cycle for a couple of months.

And then for disease reversal, such as the diabetes remission program that we have the currently commercially available call, al-Nusrah Health for Diabetes Program that generally involves six monthly cycles.

Now sounds like a lot, but you're talking about five days of fasting per for the rest of 25 days, you actually go back to living and eating normally. And so for six months you're talking about 30 days of effort.

Although it's eating normally that got you in that position in the first place. So I think we I think we need to be far more mindful about what's normal.

And I, I was just maybe say some of the findings with this monthly approach. So we published a paper about two years ago in people with type two diabetes.

That was truly a result. The results were truly astounding. Five days per month for six months, we show that people lost about £22 with preservation of lean body mass.

So without a loss of of your muscle. At the same time we saw 1.4 drop in a1c, which is a marker for glycemic control for your glucose level. And then what's most mostly what's most amazing was two thirds of the people, about 67% of the people were able to reduce their diabetes medicine at the same time.

And so I think overall, it just shows you the power of extending fast or these periodic fasting, our metabolism. And hopefully in the near future we'll be able to show how approaches like this can be can be a standard practice for people with cancer.

Yeah. And that's really amazing considering that when you look at one of the GOP inhibitors, the like Ozempic or will go B or whatever. And when you look at those people and they're having a 40% reduction in their lean body mass along with their weight loss, and this is going to lead and we're going to see it.

It's going to lead to huge metabolic problems because as we lose that lean body mass, that is the center of our

metabolism. And so these people, even though they're losing weight, they're losing the the part of them that maintains health and longevity.

That's absolutely right. There are only two options, right.

Safety, Frequency, and Long-Term Use

Either you continue on to taking that medicine the minute you stop your weight rebounds and to the worst of all is when when it rebounds, it's all fat, right?

You don't gain those muscle fat. Yeah. So it's either either that or a lifelong dependance on a medicine, which, I don't know, it's a definition of health.

Well, I mean, it's there's no way that their system can sustain it. I think I heard Mark Hyman's podcast where he talked about that the if you if we were only to put the diabetes population on Medicare on that drug, the cost would be like 280 billion and the budget is 140.

So it it's absolutely impossible, not sustainable. And, you know, the studies are too short and we are only now seeing the real implications of putting people on these medicines.

And between pancreatitis and bowel obstruction and gastroparesis, I mean, these have huge, huge, huge implications. And I know that this is not about that.

So we'll we'll move off of that, but only to say that we have to come up with real healthy solutions. And fasting appears to be one of them. And less you think that fasting is very fast and very unfamiliar, I just wanted to to to say that everybody fasts every day.

Yeah. This is not a foreign concept. We fast when we sleep. Yeah, absolutely. If you just take a look around the a nature, every other organism living thing fasts from time to time.

Absolutely. Without question. And you know, we can just take the example from our children. You know, when our children get sick, they don't eat. Right, because they intuitively know that that's not what their body needs.

Their body needs rest and repair. And that's not happening when you're eating. And, you know, once a baby gets to be six or seven weeks old, they they don't even wake up at night to feed anymore.

And if they do, that's on mom and not the baby. So we need to get out of this mentality that we need to feed ourselves constantly because it's literally killing us.

It's literally aging. And so I'm so grateful for the work that your company is doing and for the information that it is providing to our society, because it's really necessary and it's really needed.

And you know, what's old is new. Again, every single religion has passed. We are historically beings that were meant to have periods of starvation and everyone who was alive today is alive because they could tolerate periods of starvation.

We need to get back to that because it's that time when the healing is happening in the body and we all need more healing. Very well said. I think this is this is a time tested message through every culture, every religion, religion.

Now it's back supported more than ever by science. So it's time that we bring this practice back to humanity. Absolutely. Dr. Hsu, thank you so much for joining us today and for providing us with all this information.

And I really look forward to the time when this information is readily available and routinely practiced. And I know that you and your company are going to make a huge difference in this space and in the world.

So I thank you so much for the work that you do. Thank you Dr. Simmons. It's Dr. Jenn. Bye for now.