## Introduction to Precision Medicine

most chronic disease are caused by more than one factor. The practice of medicine hasn't necessarily evolved to say if there are multiple causes, let's actually treat those causes at the same time.

And the beauty about doing lifestyle medicine as the foundation is so much of healing can be improved by just getting that foundation right. If you get clean food, clean living, that will make a huge difference.

And then the precision part is understanding what are the pathways that are being identified. Then I think that there is a hierarchy and sequence to affecting those pathways and importantly, There's a way of recommending treatments that align with the patient's values and judgment, resources, biases, and getting that to work exactly right.

So you're trying to get that personalized for the individual person. Welcome back to the Think Well, Age Well podcast. I am your host, Dr. Heather Sandison.

And today I have the pleasure of introducing you to Dr Craig Tonio. He's a physician whose work sits at the intersection of internal medicine, brain health, longevity, and precision medicine.

So I reached out to Dr. Taneo as kind of a fangirl. He comes very highly recommended by Dr Bredesen. Dr Redesen speaks of him and the results he's getting in his clinic in Florida often.

And so, you know, I am often on those calls with Dr Rettison and he is bringing up these amazing results Craig is getting and Florida and you should talk to him.

So finally, we have the opportunity to talk shop here on this podcast and have you, our listeners, listen in. I'm excited to learn from him. He is the co-founder of Resolier Health, where he leads a clinical team caring for patients with chronic complex conditions, often these conditions that are poorly addressed through conventional medicine.

His work includes supporting people with cognitive decline, of course, neurodegenerative disease, but also chronic fatigue syndrome, long COVID, environmentally acquired illnesses, autoimmune conditions.

And of, course he's focused on healthy aging. His focus is also on root causes, like us always, practical options and patient-centered care. He's trained at UCLA, UCSF, Penn and Wharton, and he's held major leadership roles across medicine and health care systems.

he has even served as the chairman of Maryland's Health Care Commission and chief medical officer of GenCare Senior Medical Center. to partner at McKenzie's healthcare practice.

## Aventhea Trial and Cognitive Decline Research

I mean, you have worked in so many different places when I've been chatting with you. It's like you really do integrate. You have this perspective of where insurance and the practical implications of what payers need and what patients need, where all of that comes together.

And I think you and I both share this deep desire to make sure that patients who are suffering with dementia, with Lyme disease, chronic fatigue, where they fall through the cracks typically in those insurance-based systems, how can we get them what they need?

Dr. Taneo is also a co-investigator in the EVENTHEA trial that has been led by Dr Dale Bredesen. exploring the effects of precision medicine on reversing cognitive decline.

And he's a principal investigator in active registry studies examining real-world outcomes in patients with cognitive declines. So Dr. Taneo, I think everybody gets why I'm so excited to talk to you today.

Welcome. I am so glad you're here. Thank you, Heather. Thanks for that kind introduction. And I think we really do both share this intrinsic desire to get health care to work for our patients.

There are just so many systemic barriers that need to be removed. But when they can be moved, the results are really magical and impressive. And so sometimes it has to be done at the individual level.

But hopefully, as we all work together collaboratively, we can start to accelerate the change so that many more people can get access to this type of care.

Well, it's a super exciting time because we have data that can start to drive that shift in what gets covered by insurance. And whether the powers that be, how we present it, and the hoops we need to jump through, that is still to be determined.

But I think it still is this really exciting where we can point to some of the data and say, hey, look, this has the potential to not only reduce suffering, but reduce societal level cost.

I want to start because speaking of this data, you have been very involved in collecting some of it recently. Can you catch us up on where things stand with the Evans-Sia trial and why you think this is such an important part of that broader conversation about how we approach cognitive decline?

Yes, I think the Aventhea trial, is going to be really looked at as a historical landmark in the care of patients with cognitive impairment, because it is really the first randomized clinical trial of a comprehensive precision medicine approach to care.

And as you know, Dale has been discussing this approach to precision medicine the whole time, but it's been a challenge to get the funding to actually do the trial.

And so where we are right now is that the the uh trial has in pre-print and that pre print is available for everybody and it is in the process of peer review.

right now, and so hopefully it will get through peer review rapidly and will be out in a final publication, you know, perhaps at the end of spring or early summer.

But I think we can talk about the trial in couple of ways. You know I, think the first is that it was, there was a control group. And so there is a group about one out of every three patients got the standard of care.

What was the standard of care? Well, you look at up-to-date or you at the neurology guidelines and say, we'll make sure that those patients get that level of testing.

And then they will get what the guidelines have said. So that was clearly an issue. You want to recruit people who are excited about doing the work. They needed to have a partner with them to do the And then you have to say, well, one out of three people, you'll have wait for nine months and do nothing, or just do what the standard of care is, which is essentially nothing.

And not cheat during that time. So that's always a challenge in these studies. Almost always, historically, the control group does get better. I think in our study, the control group got slightly worse and sort of in parallel with historical cohorts.

And that's, I thing, because we did take a lot of time to talk to people and get them to be aligned with what we were

trying to do. And then those people who were in the control group or the standard of care group got the precision medicine approach after nine months.

And the other group, got that precision medical approach. At a high level, what I would say is people should know the following. The study worked. period, end of story.

And then the size of the effect at a high level, pretty similar if not greater than what was done in the pilot. So when you put the control group together, you saw the similar type of an effect.

that was happened a couple of years ago, which is already two really important things. John Ionitis, who studies this at Stanford's, would say probably 70% of medical interventions never get a good corroborating second study.

And this got a different study. The people, the investigators, there were two investigators who were part of the original pilot study, and now there are four additional investigators that came in.

So now you've kind of stress tested this in two different dimensions. And so we call it an approach rather than a protocol because I think that there are some important decisions that happen in the creation of the trial.

The piece around lifestyle, which was pretty standardized. So it's a number of the dimensions which you've talked about and what Dale has talked, about in others, you know, getting exactly diet right, Getting into ketosis, and getting movement and exercise exactly right.

Stress management, the right sleep, The right level of brain exercises. All of those things were very standardized. And there was a standard list of labs that were looked at and to investigate to look for root causes.

So things like the Genova Nutrival and the GI FX and testing for toxicants. All of those were very standardized, but the investigators were allowed to use their judgment.

because actually aligning on a protocol, as you know, that could be very controversial around that. And I think there were choices made that there was variability.

Then in some sites, there some heterogeneity in doing what I'm happy to talk about further, which we call intensive neuromodulatory therapy, things that can really help the brain accelerate healing, including hyperbarics and photobiomidulation or laser light therapy and neurofeedback.

And if we can kind of put these together guided by the QEG, how does that actually look like? And so, but it's a precision medicine approach. And, so when you think about trials, usually trials are very cookie cutter.

## Why Complex Diseases Need Multi-Target Treatment

If A, then you're doing B. But if biology is such that things need to be personalized, how are we going to really learn about this going forward if there's judgment involved?

And I think it's going tax a lot of the methodologies of doing trials going foward. We're very used to doing trails where there is one intervention being done.

But if the biology of cognitive decline is such that one intervention is not sufficient, or that to heal the brain, you need to hear the body and the mind with multiple interventions, then it's going to be a methodologic challenge.

And that's, I think, what's been the real biggest barrier here is that the science of doing these trials has needed to evolve, and I will think we'll need further evolve with this.

Yeah, this is that concept that medicine at this stage is driven by this idea that a single molecule intervention, we need to limit all the variables except for one, the single-molecule intervention.

And unfortunately, there's these perverse incentives, right, because that It's a single molecule because that's something that can be patented. Now the drug companies have an incentive to do these very expensive trials.

And yet when we look at dementia and Alzheimer's, any neurodegenerative process, there's not usually a And so the challenge becomes how do you create a robust trial that answers this question or seeks to understand around this questions of does this intervention have a positive or negative impact or any impact at all, right?

A null hypothesis, if you will. And how do we design something that has a level of complexity that matches the complexity of the disease? The intervention needs to address the root causes.

It needs address causes, and if a single molecule is what's easy to study, that's what gets studied, even though that might not be the solution. That doesn't really make sense for that to be a solution, right?

Does that explain it in a kind of other words? Yeah, no, I think that's, that is really the essence of this. I mean, if you have a system, and Dale has talked about that multiple times, where you can affect one root cause, two root causes, three root, causes you don't seem to get any change clinically.

And then four, five and six, you start to see that tipping point. The challenge has been clinically, is can you predict that ahead of time accurately?

Now you can use clinical judgment, which means if you listen to your experience and other people's experience, you get a sense of a sequence and a hierarchy of interventions which is really important.

You know, for example, we'll always try to put some of the good things and hormones and nutrition and things that would have very little adverse side effects and put those things first before touching anything that could have bad side-effects like detox or aggressively treating chronic infections too quickly.

So there's a sequence there, but in really getting the right structure, that's tricky because I think you could see the criticism of the study that it would be, well, you haven't figured out exactly what the combination is for everybody.

But I thing the answer would we have a combination that worked for 90% plus of people in the trial. And it's a combination that looks quite significant.

So why wouldn't logical people put more research into this? And then even if, yeah, go ahead. Just especially when the disease can be so torturous. It's just so expensive, so emotionally taxing, and so physically taxine, not just for the patient, but for everyone who loves them.

So it's such an expensive disease. If we have directionality in terms of what could help solve it, why not run in that direction? Yeah. And I think that what we need to do is the moniker of evidence-based medicine.

That was something that I studied very in-depth in the late 80s and early 90s as a general medicine fellow. And at that point, evidence-based medicine, I think, had a little bit purer motives.

It was just, let's put some structure in science and make sure that's guiding clinical practice. Really what happened, it got hijacked by government regulatory bodies and insurance coverage, and it was used to drive coverage.

But in evidence base, there was always the notion of a clinical judgment. And there is always a notion that you could do N of 1 studies to figure out if a patient did respond.

If so, if it was done in a reasonably rigorous manner, that was good quality evidence. So not everything needed to go through a randomized clinical trial.

You could imagine in the future if we did registries. And I think one of the key outcomes of any of this research is going to be what's only been addressed in one Dale's papers by looking at individual cases.

But if you imagine that we could get 10 or 15 practices together, and we all do a registry, we say we're committed to enrolling 100% of people in there.

And five years later, you say, in the real world, what's happened is we've slowed down decline, and I'm just making it up, two thirds of the people, And they didn't decline.

If you ran that through an economic model, my hypothesis is it would save the health care system money because of the savings of nursing home and caregivers and all of that.

And the open question is, how early do you need to intervene to get that stopping of decline? And that's where the research should go. So some of this could really be real world medicine.

And really what's happening is that the cost of AI and data collection is just dropping and plummeting by 80% year over year. We should be able to do this with enough creativity and will.

And the health care system should excited about doing it. because there are not too many areas where you can actually save money. The health economists would tell you, if you could find something that saves the health care system, that's a 1% event.

It's not, the politicians will talk like it's all around us that we can save the money, but I do believe that influencing cognitive impairment can say the healthcare system real money And really society at large, right, because people can stay in the workforce and there's so many, there are so, the tentacles of this just reach very, very deep when we're talking about cognitive impairment and how many people it affects in that ecosystem.

Oh, no, without a doubt. I mean, I put my economist hat on. But really, as people get older, people want to have quality of life. And quality life is driven by brain health, which affects your cognitive and your emotional health and then your physical health.

## Patient Outcomes, Timing, and Root Causes

Everybody is scared that their cognitive health is going to go down. which is still the major barrier in people coming to see clinicians like you and I, because they are still worried that they're going to get a bad prognosis and not being able to do anything.

Yeah, or have their driver's license taken away and then they're independents and now they can't get to church and to the senior center and into the grocery store.

Yeah. There's so many tangible repercussions of this. You have seen patients, on a hopeful note, you have seeing patients make really significant changes in cognitive outcomes.

I'm curious if you have any patient stories that you'd like to share, and especially if there's shared characteristics or patterns that see amongst those who get the best outcomes.

Yeah, so I happen to just watch your discussion around is it too late earlier this week, which I loved, about the five factors, especially around the belief factor and the timing windows.

I think that, let me answer that question, but let set it up. In doing the study, It was an amazing learning journey for us, as for myself and our team, because we got a chance to really collaborate with other centers and just say, what is the best practice?

So I'll give an example. we try to be driven by outcomes and just look at the data and don't try throw too many emotions around it. And I think we were able to get maybe 65, 70% of patients into ketosis in the first month before we did the study.

All of the dietitians came together and they shared their best practices and hacks, and that was part of their

preparation. They probably all talked together for a good four or five months putting together the protocols.

And I will tell you, in the study, first four weeks, 100% of our patients got into ketosis. I was like, wow, that's really great. This is doable. We can do this.

Yeah, exactly. It is do-able. Exactly. It doesn't matter who had the best practice. Let's just share it and let's develop it. Like we always say internally, we don't need to be the boss.

We just want to in the top tier. There should be no notion of the bass when it comes to healthcare. Everybody should get top-tier care. But the second thing is that My background has been I've always worked with underserved populations.

I ran federally qualified community health centers, and the Medicare Advantage practice was for people in the inner city who didn't have as much care.

And so we tried deliberately to recruit a set of populations that usually could not afford this type of care, And so they got a dose of just the coaching and the handholding and exercise training and that, which they could not have gotten.

And it was just very gratifying to see the response in people. For me, has given me the drive to try to get better coverage because this should not, the only reason that we have cash practices is to have medical freedom.

at this point. And then the second half of the study, our clinic did a lot better than the first half, which to me says there's a learning effect. There's lot of data management.

Even though we have been practicing precision medicine for about 10 years now, is that there is still a that we can do to up our game. So it's an approach, it is a skill.

I think if we all get together, we could all up up game and that can really help patients. But what we have learned over time is that you have to kind of match the interventions to the severity of the condition.

It's that window that you talk about, the timing window. So if somebody has subjective cognitive impairment, for the most part, I think a health coach who works around all of life essentials is going to be perfect.

And you'll get a lot of good change, and that won't be an issue. I think the things that we see clinically is the belief factor can come into play where if somebody has infections and toxicants, and they've been working on trying to optimize everything, but they haven't measured those, they don't know about those and get frustrated, then their mental model is saying, this isn't working.

when the actual answer is we haven't opened up the full aperture to see what all other root causes are. And unfortunately, a lot of the chronic infections and toxicants that we're dealing with are not our fault.

I mean, I'm in South Florida. Our residents can't help if they're dropping pesticides from the air to kill mosquitoes. That's in the matter of public health.

You know, I think there's a lot of, of toxicant issues that are much more in the regulatory side than in individual behavior side. And I've seen a of patients beat themselves up for, you know for toxic and issues.

misguided, but I think the infections and toxicants are, I always think, the most challenging things to deal with, if you will. And in the study, we saw a set of people potentially take a step back where sometimes the driver was that we were detoxing too quick.

So we have to be careful about that. And then what we've learned in the clinical practice is atrophy is an important issue to understand. So on the MRI, when you can see generalized atrophy or focal atrophe, that can be a negative prognostic factor.

But you don't always know with the MRI, are there injured cells or are they dead cells? And so we've used the EEG over time to look at that. And that's really been helpful because what we have been able to do is when there's been atrophy, we can oftentimes see within weeks that the cells are responding to the right therapy.

And you would never be able to see it on MRI, because MRI changes usually take 12 to 18 months. But the beauty of doing the EEG is that you can see those at the bedside.

So it's literally like having a stethoscope for the brain. Once you learn how to use it, you'd be like, why wouldn't we use that for everybody? And we do.

Nice. Yeah, so precision medicine, we've talked about a couple of times, you've mentioned that term. Will you define that for people who are kind of newer to this space?

## Defining Precision Medicine in Practice

And really, if you can compare and contrast, like how that's different from walking into a primary care provider or a conventional neurologist. It's a great question.

So I think precision medicine historically kind of had their roots in genomics and pharmacogenomics, and oncology, which is let's actually understand specifically some of the genetic variants and let us get our drugs to be exactly to meet those particular variants, or it could guide specific chemo.

As the genomic revolution progressed and we could do metabolomics, let's look at all the different metabolites, or transcriptomics. Let's at look all of the messenger RNA.

I think we have a much broader sense of precision medicine and what I would tell your audiences I have a couple of very simple beliefs, but then it just kind of translates into, you know, a different way of practicing.

I think that most chronic disease are caused by more than one factor. So we can simplify it. It had been simplified with cardiac, with atherosclerosis to say, well, it's lipids.

But now that GLP-1s are out, the cardiologists are having conferences about metabolic disease and atherosclerosis. But most people will look at this who are good scientists and say, yeah, there are multiple causes.

But the practice of medicine hasn't necessarily evolved to say if there are multiple causes, let's actually treat those causes at the same time. And the beauty about doing lifestyle medicine as the foundation is so much of healing can be improved by just getting that foundation right.

If you get clean food, clean living, that will make a huge difference. And then the precision part is understanding where what are the pathways that are being identified and then I think that there is a hierarchy and sequence to affecting those pathways and importantly There's a way of recommending treatments that align with the patient's values and judgment, resources, biases, and getting that to work exactly right.

So you're trying to get that personalized for the individual person. And it's practicalities, right? Like I mentioned having your driver's license taken away.

If we start talking to a patient who doesn't, no longer has a driver license because it is not safe to drive, they have access to different things than someone who, you know, is, or even if somebody is in a community or somebody's living in the residential care community, a care home, senior living community.

Very different practical implications for what type of treatment plan is going to suit them. No, that's exactly right. It's got to be personalized to the individual.

But the challenge just becomes in here is that what I believe is precision medicine, there can be a set of principles that guide how we practice. And then what's going to happen year over year is so the how that we do this should

stay the same.

There should be enduring principles. And the what we will do will evolve rapidly as the research and science progresses. I went to UCSF for medical school.

I remember the very first day of med school, we were in the auditorium and they said, half of what you learn is wrong. You just don't know what half. And that was such an important lesson because it was a bit of humility about what your trying to develop as a clinician and as healer and to know that there's limits of your models are.

And so especially here in precision medicine, I don't think that we come in with any arrogance and say, we know exactly the answer here. But I think what we do know is we have a much better mouse trap than what's been heretofore, and that patients shouldn't have to wait to get some of this type of medicine.

Yeah, and I think part of that is that the side effects of this intervention, although it can be expensive, so cost is part if this. If you're buying supplements and paying out of pocket for testing and for providers that are cash-based practices, this is expensive and that's something to absolutely consider.

But the other effects or side effects of it are that blood sugar normalizes, often depression and anxiety calm down, sleep improves. We talked about atherosclerosis and often cardiovascular risk goes down.

And we have patients whose incontinence resolves. So you see that there's Generally speaking, patients who engage in this approach live healthier lives.

And when that's the side effect versus, you know, of course, brain bleeding, and brain swelling, whatever the litany of potential risks with many of the pharmaceutical options, this becomes sort of an obvious choice, at least to have as an option.

No, I think that's right. And I that the challenge has been something like this. For example, on the nutrition side, we know that research around most nutritional studies that are driven by surveys is just not high quality.

you know, the things that sort of make it to the front page of the New York Times. And so, obviously, if you have Dean Ornish's study that's looking at, you now, low fat, and we're looking now at this endothelial trial, which is ketosis, and they're both getting good results, how do you reconcile some of these issues in nutrition?

And I think those would be a great head-to-head study, because my hypothesis is both are so superior to the standard American diet that it's an upgrade.

But the only way to figure that out is to really compare the two. And there may be subtypes that respond to one versus the other. You just have to figured it out.

## Nutrition, Ketosis, and Cyclical Diets

Let's say the cultural bias in conventional medicine has been, I talk to medical students and residents still as sort of being on faculty at two places, and they think about nutrition as just being, okay, let's just go get a healthy diet.

And they don't think that it can all be personalized to the individual. And if we really understand that food is medicine, I mean, you can boil it down very simply to people and just say, eat food, only foods that don't have labels.

That's going to get you 80% of the way there. But there's a lot of individualization of diet that makes such a difference. There's a much better way to do precision medicine with food if we can do head-to-head studies.

And so folks like Terry Walls, I think, have been incredible at getting advances in there by just saying, we're going to good clinical trials around nutrition.

My hypothesis around the kind of vegan diet versus the ketogenic diet, and I don't think anyone should do vegan keto because I do think that's too restrictive and needs to be to limit nutrients, I think probably what will play out in the science now, this hasn't been done, but what's best is to go back and forth.

is to have some periods of ketosis and some period that are plant-based and maybe doing that seasonally, but that the The consistent thing about paleo diets or these ancestral diets was inconsistency.

So it's not that we should be eating the same thing for breakfast, lunch, and dinner day in, day out. It's that, we change that with the seasons and maybe even change out within seasons of our life, right?

And for premenopausal women, the right diet is probably different from a post menopause season that they're in. And so I think when we think about diets, Not only should we do the head-to-head trials, but just, I think, having an openness to variety and to changing up those diets, food for thought, anyways.

No, couldn't agree with you more that the whole notion of cyclicality is critical. over the time we've evolved, you know, some heuristics, which is, we want to get people to the tipping point so that they feel confident that their work is making a difference.

And what's the timeframe? Well, hopefully six months or less, because that just kind of proves to be a practical approach. I think the vast majority of people had made document improvement within the first one to three months.

So change can happen fairly quickly. But if you can get that improvement, then of course you experiment with cyclicality. And I think you see the biggest pain point is oftentimes supplementation.

People are like, do I need to take this much? And the answer is, maybe not. We're going to have to see and we work on that. I there's a huge amount of cyclicality that makes a difference.

We don't detox every day of the week. Maximum is five days, but I think as people get older, we usually do it to four or three because you just can't handle that stress every of day the of week, But it's harder to explain and it is easier to write linear protocols.

Yeah, and certainly the piece around ketosis, because so much of this came up, this conversation came out after the Ornish trial was published in June of 2024. And really, my clinical experience is that there isn't a lever more powerful that you can pull than getting endoketosis.

Yeah. Is that your experience too? I think, yeah, I'm a complete believer in the 80-20 rule, you know, that there's a handful of things that make the majority of difference.

And I'd think my clinical impression has here has been, top two would be hormones and ketosis for women. I think bioidenticals are stronger for women than for men, but those two are definitely the top two.

I Think circulation has really been the next big lever, and I'd think something that can be underappreciated if you're not always looking out for subtle signs of dysautonomia or microvascular issues.

it just makes sense that the brain needs oxygen, needs circulation, and may not be getting it. Yeah. And I think I would put mine, too, is the keto diet and sleep, treating sleep apnea, which maybe fits under your perfusion and circulation.

I want to dive into these neuromodulary neuromodulatory therapies and because you really are an expert in these things so I want you to share with us how do you decide you know precisely what works for who who's going to try on what and if you wouldn't list them for us again and then just describe you mentioned photobiomudulation there's hyperbaric oxygen therapy you're using a QEEG a neurofeedback so take us through those Tell us who they're a good fit for and give us a little description of what they are.

Yeah. So I think, Thed, let's just start with the QEG. Because I thing what the qEg allows us to do is to measure the

brain's function. You can do that with a PET scan or a functional MRI.

And those are oftentimes what's being done in the research. I think that QEGs had been invented by the psychologists. And so that actually delayed, I thinks, the adoption into MD-driven medicine for about a decade or so.

But now, most of the QAG literature is really being in radiology and the imaging community. It's just seen as another imaging modality. But the benefit is, is that you can, in terms of, it measures brain's electrical signals, and the electrical signal work at different frequencies.

So a slow frequency, for example, delta, we just call it like similar to delta sleep and deep sleep. The brain is working at one to five cycles. And then, you know, beta and high beta where a lot of the cognitive activity is is usually you know, 15 cycles a second to 30 cycles per second and then there can be even gamma above 30 cycle per seconds.

So we're measuring brain wave frequencies and we are doing it through a cap. which has 19 channels, and we're using very sophisticated software so that we can actually localize where there are functional issues.

## QEEG and Hyperbaric Oxygen Therapy

And the software will oftentimes give you the equivalent of an MRI that you can see. And then you can also see networks, and those networks have really been plotted out.

In the Obama administration, there was a very deep set of work guided by the NIH to look at a number of different networks ranging from, you know, what are the major sort of memory networks or attention networks and such.

And so, for example, just in this last month, I had a patient who came in who had very little symptoms and thought it's just for prevention, but it was clear on the volumetric MRI that it looked like posterior cortical atrophy.

But literally, the CNS vitals were all in the 90s. She had no cognitive issues, But she felt something was not quite right. And we could see on the QEG the very distinct pattern of communication that was going through the parietal lobe that interrupted.

And so that looks for things like coherence with the different networks. So the important thing about the qEg is you have an objective measure that can change as you are trying to improve the brain.

And that objective measure can change as quickly as three to five days after doing an intervention. So we've kind of developed our, you know, I spent about two years getting trained by Dr.

Bill Lambos, who I'm super appreciative for all the work that he did. and time to mentor me to get board certified in this area. But once you start to use it, you're like, well, this really just helps me decide what treatments work because it's like being back in the hospital and seeing where some of the more sophisticated labs are.

The downside for a patient is they might have to have a bad hair day. They get a little bit of gel in them. on there and then have to wash that out. The technology hasn't evolved that the dry QEG caps are as precise.

But really when you have a tool that can measure change week by week, you suddenly then can start to be a little bit more precise with interventions. And so how this evolved before the study was hyperbaric oxygen.

We like to follow the literature, and we think that the Israeli researchers, Dr. Afrati and company, have done the best research around hyperbarracks because they created great placebo hyper Barracks.

They had people go into the multichambers, And to have sham hyperbarics, they cranked up the pressure for the first five minutes so everybody felt it in their ears.

And then they dropped it nearly to room atmosphere. Instead of breathing oxygen, you're breathing room air. So you now have, for a procedure, really the gold standard, sham-hyperbaric.

They've shown in a good four, five, six studies now that hyperbarracks does in the brain what it does to the body. which it just, bless you, it treats wounds.

It helps to heal wounds, and those are wounds that can be from traumatic brain injury, but it can also be, from chronic infections, It can from inflammation, toxicants, And so it is just helping the brain heal.

And there was pretty solid data post-COVID that that was an intervention that is helping. So what would happen in practicality is many of those protocols are 60 sessions, two atmospheres, 90 minutes.

And hyperbarics, unfortunately, isn't covered by insurance for cognitive issues. It is in Israel. That's it's gotten great coverage. I think here, the insurance committees have said, well, that's an Israeli study.

We're waiting for the US studies to happen, if you will. And for consumers, do you mind if we just, I want to take a minute here to talk about the chambers because I think it's easy for people to go, oh, there's a chiropractor down the street who's got a hyperbaric chamber.

He's been telling me to get in there, but there is a difference between like the Israeli study was done in hard chambers, like in a hospital, grade where you can go down to two ATMs, whereas the soft chambers, it's not exactly the same thing.

So I'm wondering your thoughts about sort of on this spectrum of hyperbaric therapy. Do we expect the results if we're not getting to 2 ATMS and we are not doing, because I think a lot of it is also some of the hypothesis around what they're doing at Aviv Clinics and in those trials was they are going back and forth.

It's almost like a contrast, right? You're getting in and you're out. And they think that some what's happening is the going-back-and-forth from room air to concentrated and at pressure.

So can you talk through some Yes, so what Aviv had done is they looked at the hyperoxia-hypoxia paradox, which is that the brain seems to, and healing responds better when there can be an air break.

So what it works is you are breathing 100% oxygen for 20 minutes, then you take off the mask for five minutes and then put the masks back on. And so I've always believed when it comes to protocols in medicine and in life, if you're going to adopt something, you should just adopt 100% of it to start with.

So I would see oftentimes in other situations, people would say, well, this protocol doesn't work. And you'd say well what did you do? And it'd be like, well, I did these four things, and I changed these two things.

It's like well your interpretation of the protocol didn't work, but you didn' actually try the full protocol. So we went to do a Friday when those protocols got published because we just felt that the evidence was better.

We had been using 1.5 atmosphere hyperbarics, which was the soft chambers. And it was a higher cost to do the 2.0 atmospheres, but I felt the research was better.

My clinical intuition is that that you can get similar effects, let's say, with 1.5 atmospheres, but you have to do it for a longer period of time. And if there's significant atrophy or damage, you may not be able to get the same effect as you would with the higher atmophheres.

The FDA, when looking at hyperbarics when it came to the military in the early teens, you know, they basically said, look, hyperbarrack is a drug. There's two dimensions. There's pressure and there's oxygen and they work completely separate.

You know we think that the pressure actually changes gene expression so that all of the inflammatory genes are

calmed down. And then obviously oxygen can be incredibly helpful.

But for example, in our patients with chronic fatigue, oxygen, it can induce too much oxidative stress. So we've often done hyperbaric chamber with no oxygen because it was too inflammatory in the beginning.

## Photobiomodulation and Neurofeedback

With all of these therapies, you gotta start from the research and then adjust. But I do think that for, let's say, most patients with cognitive impairment, it would be better to get a two-atmosphere treatment, all else being equal.

But if finances are too much of a barrier to that, then I think 1.5 is better than The exercising with oxygen therapy, where do you put that on the spectrum?

You know, so I've used it a lot with Parkinson's because, you know we really want our Parkinson patients to exercise as much as possible because there's such good data showing that The BDNF effects from exercise with Parkinson's makes a huge difference.

And you can see that oxygen just gives that extra burst for intensity that makes difference, but I haven't seen as much data around EWAT in the literature as there is on hyperbarics.

So it's just our practice has gotten more anchored on on high hyperbarracks. And, you know, this is one of those areas where I think we have to do more study and research.

But it does, kind of, come out with some of the technology. What's been very interesting is some the two atmosphere chambers were never available at home until the last year or two, and now you have some these that could be used at homes.

And so the open question is, If it's safe and low cost and you're in your 60s, is it better to just buy one and use one at home for the next 30 years?

That's an open question, if you will. And we've tried to work that out individually. There's not any good literature on that. But if think that hyperbaric heals wounds and a lot of aging prevention is just helping to heal wounds, I mean, there's certainly a biological plausibility here that it could be good for a long period of time.

Okay. This is really fun. I want to get into photobiomodulation before I let you go here. So talk a little bit about red light therapy, how you use that, you know, get in the nitty-gritty, the nanometers, is it hot, all the things that come up as you explain that to patients.

Yeah. So you can see in the literature, first of all, that we use a class four laser with Aspen and Dr. Bob Hedaya and others has been really instrumental in writing some of the initial case studies on response of patients to a higher intensity laser.

But what it does look like is that the higher wavelengths do get through the skull. And that power does make a difference. And what the higher wavelengths do do at the cellular level, it does look like it gives the cell more energy.

I tell patients this a little bit. If we can target it in the right way, its like starting up a battery of a car. And so you can see that those cells are working and that there's an improvement, but you have to help those sales metabolically if they're going to continue to stay active.

So it can be an adjunct, it's a very complimentary adjunt. Neurofeedback is done really as a biofeed back to improve some of the brain wave functions.

And we can look at the networks and we basically teach people how to train their networks better. The timing of that is really important because if the cellular health isn't there, neurofeedback can be very frustrating.

So what we did in the study is we waited till the last three months to do those therapies for people. And so we thought that the worked on lifestyle in first couple months really address root causes through months three through six and got those down and then the three last months would get the more intensive neuromodulatory therapy.

How it works in practice, but we didn't do that in the study, is the addition of IVs. So there's a lot of intravenous therapy that can really help. But again, it's just guided by the notion of In our clinic, what we do is on Monday mornings, we kind of look at the EEGs from Friday and say, did we make progress?

What's happened? what are we going to do different? How are going adjust it? And what people want to know many times when they're coming in our practices You know, you looked at the data, just tell me the protocol.

And I say, I wish it was that simple. That, and we're not at that level yet. We can understand safety of these individual things, we can the typical response, but we have to understand how that works in you.

And how are we gonna see it? Well, we're gonna work closely with you to get that done. And the thing that I didn't mention is that the EEG usually has changes 10 to 15 days ahead of symptoms.

## Generalist Thinking, AI, and the Future of Care

This is the critical piece because I realized when that happened that there were so many times I thought something wasn't working necessarily, and it was like, well, you just didn' give it enough time.

And you could see it more physiologically, but there's a whole cascade that happens as cellular changes kind of translate into behavior changes. Yeah, there is an art and science to this, and it's certainly a field that is still evolving.

But you've trained across internal medicine, functional medicine and neurofeedback, environmental medicine chronic infection and more. How is it that that broad training, you know, how can you talk about how important you think that is to thinking about cognitive decline?

Because neurology, I think you go in and you're thinking About cognitive Decline, but you've sort of come from this, You know like generalist into specialist.

Talk through that. Yeah, so when I was running our chief medical officer of practice that was really dedicated to trying to keep patients out of the hospital, we kind of coined this term the expert generalist, which is you're kind comfortable with how the systems are working.

And then the question is what the lens is that you are going to be focused on. I think with brain health, It's very clear that the research is saying you have to fix what's happening in the body to help the brain.

And so that's going to be a challenge for training. Historically, neurology and psychiatry kind of split off from medicine after year one, while cardiology and endocrinology split after a year three.

And we're going have to have a more generalist approach or a collaborative team approach to trying to figure this through. But the good news is that I think that AI and the research is going to come pretty fast and furious with ways to improve things.

And what we're going, we are going be drowning in information and options. A colleague of mine was doing a compendium of research about what data is there for interventions that could affect the brain.

And I think he had gotten to like 500 interventions or whatever that are out there. So the question is not what can we do, but it's a bit what should we and what are the right things to do.

You know, I think that there are some people who like to focus really deeply on one thing, and there're some who people like putter around in lots of fields, And I'm definitely one of those who likes to put her around a little bit more,

you know.

Kind of enjoys, kind of getting out into the big picture, if you will. When you look ahead five years with this lens of AI, just the reality, I feel like I'm having to accept the inevitability of how ingrained AI is about to become in our lives if it hasn't already.

What do you hope will be different? What will it look like? How will medicine more generally understand how to treat cognitive decline? Well, I think that, you know, if you look at like chess, what became very clear as the computers got better is that people with the computer were really the better solution for a long time.

Unfortunately, in the last couple of years, even the computers have kind of gotten better that's there. So I think any of our guesses is going to be a bit wrong after five or 10 years.

But I'm positive that from the perspective of patients, we as clinicians are not going to be irrelevant, if you will. There is so much moral injury in medicine today, because clinicians don't feel like they're doing the right thing, that I think that we can use AI to help us get stuff done that, we haven't been able to before.

And I think that our ability to do that is going to increase. We just have to be in systems that allow us as clinicians to have the freedom to to that.

And now I'm a believer that the healthcare system can't be effective without individual practitioners being independent from the health system. if you will.

We talk about diversity in certain things when it comes to race and ethnicity, but I think we need diversity, in terms of types of clinical practices.

There shouldn't just be one type of practice, and patients need to have that access. And the only way to do that is to really allow the individual practices and preserve private practice.

Right? Yeah, yeah. Not everyone's a right fit. And certainly that patient-doctor relationship is… is so important. There has to be therapeutic alliance.

And one of my early med school moments was this realization of I am not going to everyone's doctor. That is too much responsibility for me. I'm not the right fit for everyone, whether it's my expertise or my approach, my personality, communication style, the way my practice is set up.

All of these things, there's going be preferences and we want for medicine to accessible, we need the This is such a rich conversation, and I feel like we can chat for hours.

And I hope we get the opportunity to continue this conversation offline at conferences in the future. Dr. Taneo, it is a such privilege to chat with you.

Thank you so much for joining me today. I appreciate both the depth of your expertise, but especially the way that you are helping to move this conversion and the science forward.

with the rigor and the curiosity and compassion. There's this human element that definitely shines through whenever I get a chance to chat with you. And I think another big thing that stands out to me is that this work is not just about managing decline, but about asking better questions and looking a little deeper into how we can get patients the meaningful options and outcomes they deserve.

I'm just so grateful for the work that you are doing. And again, just grateful your time today. Thank you. All right, thank you, Heather. It's a pleasure.

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