# Sigma Nutrition Radio - Episode 38

**Hosted by Danny Lennon with special guest Dan Pardi**

**DANNY LENNON:**

Hello and welcome back to Sigma Nutrition Radio. Thank you for listening to the show this week again and this one that I'm so excited to get out. Today on episode 38 we're going to be talking with Dan Pardi of Dansplans.com and Dan is a sleep researcher based in Stanford university over in the U.S. as well as working at Leiden university Netherlands and his researchers mainly focused on sleep neurobiology and cognitive neuroscience. And right now his main interest is researching how speed deficiency alters food choices which is super interesting and we're going to get into that later in show. Dan has also performed research on Diet exercising cancer and so he's got a really broad perspective of all the lifestyle factors we can use to improve our health and that's essentially what he does with Dan's Plans and he finds how we can modify our behaviors to end up living a more healthy lifestyle. It's something that we're going to shortly touch on later in the episodes so I can't wait to get into that.

But some of the ideas that we're going to be talking about in today's show, how sleep deprivation and sleep restrictions really impact our health immediately and then also chronically. We're also going to be looking at circadian rhythms, we're going to look at light dark cycles and just how critical they are for health. All this stuff is areas that I've really been digging into a lot recently because to me I think that's stuff just far outweighs what we can do with basic changes to nutrition. And a lot of it is intertwined, so you already have a poor diet and address one side of your lifestyle but if there is one thing that you really can't ignore is the importance of these light dark cycles and sleep, I think is probably the most important thing for health above any exercise and nutrition your going to do and that might seem like a pretty big statement but as we all hope to get into later in the show there is just so much behind it now on what's so critical. So that's why I was so happy to have Dan on because not only is he without doubt one of the most intelligent guys I've ever got a chance to know and get to talk to but he's also really cool guy and he's great laying this information out in a way that truly

makes sense but without deviating in any way from the very specific and being very clear on what the research says so I really hope this is something that you get listen to. It's not often that I say that this is a must listen to but this episode is one of those so hopefully you do give yourself the chance to be able to get through every single minute of this, whether you have to break up or not think it's just so much good information in this and Dan is really awesome at laying it out. So I won't try and hold the show up any longer we are going to dive into the show now with Dan Pardi. If any of the stuff that we talk about during today's episode resonates with you or you want more information on it. If you head on over to sigmanutrition.com/episode38 there will be the show notes there where we discuss or I'd publish all the links to what we do discuss and there will also be a full transcript of today's show so that you can go over everything that we talk about and you can download that for absolutely free over on that show notes page.

So sigmanutrition.com/episode38. Also if you like the show please feel free to share it or leave a review on iTunes, it really is appreciated. So with that let's dive into this week's episode with Dan Pardi.

Hey Dan welcome to the show!

**DAN PARDI:**

Thank you Danny. Thanks for having me.

**DANNY LENNON:**

No it's my absolute pleasure of being a big fan of your stuff for a long time and I think some of the topics we're going to be talking about today are probably in my opinion some of the most important that the listeners will hear about and it's something that hasn't really been covered in all that much detail yet. So before I get into any of that specific stuff though, perhaps we can start off, can you tell us a bit about the work that you do, your kind of main areas of research that you're interested in and why you've kind of gone down that route?

**DAN PARDI:**

Absolutely. Yeah thanks for that. That's the kind of intros I like to hear. So I'm a sleep researcher and I'm an entrepreneur. I got into a field of sleep serendipitously. I was working in a company that did bioinformatics which is informatics against genomic sequencing. So the idea is you take high powered computers and you try to sequence the genome and around 2002 the human genome hadn't been sequenced yet and so it was a really exciting time, there was a lot of companies in space, they ended up all kind of dismantling because there was the technology was kind of ahead of the market and so when that company dismantled I ended up taking a job at a pharmaceutical company which was really based off of a recommendation from somebody that I had worked with at the bioinformatics company. And that company that I started to work for had a drug or sleep disorders and so it was like an immediate crush as soon as I started to learn about sleep, I found it fascinating and I couldn't wait to just learn more and more. So I started to go to the APSS or the Associated Professional Sleep Society meeting and it was like some of the hardest decisions I had to make. It's like which session should I go to, the one on pain modulation, the one on cognition, the one on body fat regulation? It was just like an embarrassment of ridges going to these conferences. There was just so much good stuff to learn. So I did that for about eight years.

I set up the medical affairs department at the company. Medical affairs to the scientific support on products after they have been approved and so I just found myself in this incredible situation where I was running a research grant program which meant I had to interact with literally the top scientists in sleep from around the world on a daily basis and I would get to go and speak with them, correspond over email and by phone and go visit them in Europe and throughout the United States. And I just learned so much during that time and over the course of that time I also winnowed my own interest, like what was I really, really interested in and it had to do with two different areas which is the regulation of body fat and how sleep relate to weight gain, weight regulation obesity and then also to cognition, mental processing, memory and all that and how those relate.

So I went back later to start my PhD so an old, old student and at the same time I had from a different part of my career past, I had done research on lifestyle and how lifestyle influenced the progression of prostate cancer and I was really fascinated by that work because it was so practical. It was how do you, the type of research we were doing, was looking at diet, stress management, exercise, inter personal communication between a person and their spouse in these group of men who were prostate cancer patients and then watching the progression of their cancer compared to group that was just doing watch for waiting so they were not doing a specific intervention but anyways that research made me fall in love with lifestyle research and also thinking about applications that help people live a more healthy lifestyle.

So even though I went on to do other things in my career for a little while and in sleep for the longest period I was always thinking about how do I get back to creating applications to doing research in this area that helps people live and maintain a healthier living pattern. So right around 2009 I developed a behaviour model. It's called the Loop Model to Sustain Health Behaviors and that model leverages...the way I went about it is that I looked at all of the most...I wouldn't say popular but the behavior models that have a lot of science behind them that are talked about in the literature that are utilized in scientific applications and clinical trials and I dissected each one of them and to these kind of fundamental parts and I looked at where they interacted or excuse me between these different models, what were similarities, what were differences and I ended up constructing my own and so this model basically says what are all the different things that will influence whether or not somebody does or doesn't do something and I try to capitalize on all of the opportunities to affect how somebody lives in this model.

So I developed that and that was basically the template of kind of like the secret sauce behind the generation of my company. So at the same time I started my PhD I also started a company called Dan's Plan which was named by a friend who was just kind of looking at my work because I was interacting with a lot of people, doing a lot of interviews and help kind of doing individual health coaching as a way to do customer development, like see what people are interested in and what kind of questions they had and so that was the genesis and now I still do both.

So I do research, I work with the departments of neurology and endocrinology at Leiden in the Netherlands, Leiden University and I work with behavioral sciences at Stanford and my research looks at how, not chronic sleep deprivation but acute sleep restriction, so not getting a full amount of sleep. Let's just say you didn't get, you usually get eight hours but last night you got six or last time you got four or five, how does that affect decision making particularly around food choice. So that's what I'm currently focused on. About a year ago I was looking at the effects of certain chronic sleep conditions on hormone regulation, like **leptin** and **ghrelin,** these are hormones that will affect energy regulation and food intake. And then with my business it's again just the application of this behavior model to then try and help people live a healthier lifestyle which involves education and it involves tools that help people be mindful and get feedback on what they are doing and all sorts of stuff, so that's a long winded explanation as to kind of who I am and how I got here and what I'm doing now.

**DANNY LENNON:**

No that's perfect Dan. I think it really sets up some context for people about what we're going to dive into and I definitely want to get into some of those specifics that you talked about within your research on sleep restriction and secondary effects to that. But before we get into more of those underlying mechanisms maybe we can pull back and do a very broad generic sweep for people and lay out some of the main effects of sleep restrictions or suboptimal sleep if we can.

Like I mean a really good challenge for someone is probably to go into the scientific literature and try and find *any* aspect of health that sleep restriction or deprivation just does not negatively affect right? I mean it's pretty insane how it influences literally everything. So before we get into those specifics around the sleep process, what can we sum up as the main cliff notes I suppose of why poor sleep and or sleep restrictions are just so damn bad?

**DAN PARDI:**

I think that you absolutely nailed it when you say that when we're not getting the sleep that our body wants then there is no system in the body that is protected. And how poor sleep in an individual's life might manifest has a lot to do with who that individual is and what their vulnerabilities are and we don't really have a perfect knowledge about... well you know, “if you don't sleep this much for this long then this is going to happen at this time” but we do see the co-occurrence of all sorts of major, major issues.

Basically you can kind of break down the effects of sleep loss into two big categories. There are physiological effects, so you'll have like temperature disruption, heart problems, immune problems, greater sensitivity to pain, increased cancer risks and then you'll also have behavioral mood problems. So this is coordination problems and decreased productivity, decreased learning, altered mood and then also increased risks for accidents. So whether that's tripping and falling on your face or if it's getting into an accident in your car and killing yourself or somebody else or seriously injuring someone, that's a big major societal cost that we're now facing. Is the amount of accidents that are taking place because somebody has subdued alertness which means that they basically will...even though you're driving your car your reaction time to the various obstacles or various things that you are facing when your driving is just slowed down. You start to miss certain signals that would make you usually react a certain way and basically you start to become a different person, alright in how you are behaving, how your thinking and even your body and depending on how long you exist in that stage or the degree to which you kind of put yourself in a sleep deprived condition and the length of time that you exist within that condition, again is going to be kind of an individual consequence.

So there is an immediate behavioral consequences and then there is an immediate physiological consequences but then there's also the heightened risk of really significant serious, chronic, life threatening issues.

**DANNY LENNON:**

Yeah, and I think that's a great point to make for people because so often when you point out to people just how important sleep is, there tends to be this idea of *"well if I'm not getting enough sleep or I'm only sleeping five hours a night maybe in thirty or forty years that might catch up with me"* but we can see that these changes do not need to be on a long term basis. Like in very acute cases we get both these behavioral and these physiological changes within one night or so of poor sleep right?

**DAN PARDI:**

That's absolutely right and a lot of sleep deprivation research and by the way there's this sort of research is broken down and two terms are used:

So there is **total sleep deprivation** right and that's where in research we say okay we're not going to give you any sleep for one night and then we're going to see what happens,. One, two, or even three nights.

Or there's **partial sleep restriction,** which means 'okay usually we need eight hours but we're going to give you four hours of time in bed per night for five nights and then we're going to do some measurements'.

And the latter tends to be more relevant (and what I mean by that is that it's more similar to how people are actually existing) because we know now that total sleep time in the United States has decreased about 20% from 50 years ago. So that's equivalent to you losing one full night of sleep every week which is just crazy and again sort of the societal costs, cost to the individual is...we're just really appreciating that now and what's really scary is there is a lot of similarities to diet in that your making these little choices every day that lead to these big alterations in your pattern of living which has the serious consequences.

So my interest though is looking at okay what about really kind of subtle loses in sleep? Let's say you usually get eight hours but last night you got six or seven or five, so some degree less

than what your body would have gotten if it weren't interrupted or truncated by your own behaviour, right? So a lot of sleep loss today is not because of chronic sleep issue but due to something they call voluntary sleep curtailment or getting less sleep because we went to bed later because we wanted to watch another episode of game of thrones and we have a fixed wake up time right. That is extremely common and it's not like oh well we're stupid, again it relates back to nutrition is that our world, our modern world filled with really compelling and interesting options right. Now you can go on the internet and you can make into this world of decay. These are all things I'm really interested in and so at night you could be sitting in front of the computer clicking away and all of a sudden you could have lost forty minutes or you could have been sleeping. You have now gotten forty minutes less sleep than you would have because you have a fixed wake up time. So that's an incredibly common scenario and I'm sure everybody who's listening to this can relate to it, has faced it, and faces it daily. I do, even though I really appreciate sleep it's still a daily struggle regarding...you know what just trying to get in bed and what I've done myself is not even has to do with the education, like I talk about sleep a lot, very passionate about it and it's still how do I be mindful to get in bed at the right time and sometimes I do have a job and generally I do and sometimes I don't.

**DANNY LENNON:**

I mean it's probably a by-product of people's schedules being so packed, so then you come up with a day where something extra gets added in and your just extra busy for whatever reason. The first thing that usually gets bumped off is a certain amount of sleep because you can't afford to cut out anything else and its usually the first thing that people bump out. So it's more the way we just set up the day and unfortunately sleep is the thing that gets cut out.

**DAN PARDI:**

That is a scientifically valid statement. Yeah, and as simple as that is and as intuitive as that seems, it has been researched. David Dingus is a sleep professor at the University of Pennsylvania. He works was major sleep organizations, the department of transportation, NASA

and he's really trying to work with large governing bodies to say 'hey these are some of the regulations that we need'.

We can't ask a pilot to fly without at least a certain amount of break for them to rest. So those are the types of questions that he is really working hard to kind of bring to these organizations so that they are thinking about it. And one thing that he's done in his research or looked at is where are people kind of making these choices and usually it's the area you have the most flexibility to get better sleep is to try and get into bed earlier because a lot of the time people will have fixed wake up times because they got to get to work, they got to get kids to school, whatever it may be and so the option happens at that time usually. Of course this doesn't apply to everybody but that's come in to the more common scenario and just as you know why are we doing this and getting sleep less, work times elongate as commute times elongate. It encroaches into our personal time and we will always take time for our own personal pursuits. As silly as it may seem, I mean as silly as it is to say "gosh why are you reading this blog on Conor McGregor right now you should be going to bed" is because we need that personal time. So it's not silly, we do need that time and it takes, I think the big picture for me is that basically getting good sleep requires a little bit of planning and intentions to get sleep, some know how about what matters and why and then just staying mindful of it. It's not like a set it, forget it, learn it and then that's it, you have to interact with your own sleep practice or else you will probably end up in a situation where kind of the modern world will win.

**DANNY LENNON:**

Yeah, yeah and I thoroughly agree and I think using the word 'practice' is key there because it is a continuing practice that you constantly have to do. It's the same thing when I think about the idea of expressing gratitude, which is a big thing that I've recently gotten into the last couple of months. And keeping a gratitude journal has been massive for me because it's a constant practice. Because otherwise when you say on a one-off day 'I'm just going to be thankful from now on for things', you do it for a day or two and then you forget and it drifts away. Where it

has to become a constant practice and I think we need to adapt that with other things in life for example our sleep, so I think that's kind of a key point for people there as well.

I'm sure at this point Dan, before I get to jump into any of the stuff that I'm really intrigued to ask you about, there are many people listening now that are probably just screaming "I just want to know how much sleep do I actually have to get!". So what I'm going to ask is do we even have a way to answer that or do we even know that's the right question to be asking? Should we be looking at sleep quality as opposed to quantity or is it a function of both and do we have any data to support this is where people should be?

**DAN PARDI:**

So that's a really good question and sometimes I feel like quality and quantity are inappropriately juxtaposed, right? There is a certain degree of quality that relates to quantity. It's like you can't get twenty minutes of just great quality sleep and have that be sufficient right. So part of quality sleep is sufficient time in bed for sleep to do what it needs to but having said that you could also be in bed for eight hours or more and get really bad quality sleep and feel like you didn't sleep at all. So yes both do matter and the things that matter for sleep are **timing, intensity and duration**.

So duration is easy, duration is how long, did you sleep within a twenty four hour period and that can be consolidated into one chunk, I got eight hours of sleep last night. There are cultures around the world that maintain siestas as a part of that culture, so you'll sleep six hours at night and then you'll sleep two hours during the day, that seems to be just as healthy. And then there's kind of the question well how much can you break? How many periods can you break sleep into? There's kind of this concept recently that's been popular is phasic sleep, where if you just get little bursts here and there of sleep then it's going to be just as good. I don't actually think that's true. A lot of research that has been done on polyphasic sleep has been done with the military and really the best way to think about that is; okay well in these circumstances if you're in battle, can you get... and you don't have a chance to get let's say eight hours, basically it's better to get some verses none, that's what it comes down to. That's

the appropriate way to look at polyphasic sleep. Not: “hey here's a trick and a hack to help you get less sleep without consequence”. That's not what that literature has shown. So a little tangent there but then there is timing, right so that's duration, like how much sleep do you need in a twenty our hour period and there's **timing** which is the circadian phase. I haven't introduced the word circadian yet but circadian is essentially these twenty four hour patterns that our body's maintains of which sleep is one of them.

So all sorts of behavioral patterns, physiological patterns that take place in our body is based off of this clock and this clock is in the brain. The site is called the suprachiasmatic nucleus**.** And what happens is that this clock is synchronizing with the light/dark cycle of the environment. And then we have clock genes throughout our body in all of our cells and all of our tissues and their synchronizing with the master clock.

So there's two levels of synchronization: The master clock with the environment and then clocks throughout our tissues with our master clock.

So this is how your body gets ready for a certain behavior at a certain time and if you were to then say okay well I usually get eight hours of sleep and I usually sleep from midnight to eight but now I'm going to get eight hours of sleep but the duration is the same but I'm going to shift that, I'm going to go to bed at four and I'm going to get up at midnight or get up at noon. So it's the same amount of time but the phase where that sleep occurred has shifted. Well in that scenario that type of sleep is not going to be as restorative because the body...it's not just that eight hours you would need, the timing of it matters too, for example you’re more inclined to get REM sleep at 4 am if you usually go to bed at midnight or around ten or whatever. Like your body is actually ready to get a certain types of sleep at a certain type of day and so that we know as well, so the timing of sleep matters and your body builds this regular rhythm, the eight hours during a normal phase is going to me more restorative than eight hours during when it's out of phase we'll say okay.

And then there is **intensity**, now this is something you can effect more indirectly, the intensity of sleep has to do with the concatenation of stages so as you sleep your body and your mind

will go through these different phases of sleep. So sleep looks different, it's not one monolithic quiescent period. It changes and it's actually a very dynamic process. There are some parts of the brain that are more active during sleep than they are at any other time during the day. The brain is replaying memories through dreams to try and consolidate memory. It's pruning other memories, things that it's as I don't really need to remember this and then get rid of it.

So it's a very, very active process. The body is being restored. So if you ever go to bed and you feel exhausted and you wake up the next day and you feel pretty good, what happened? Well hormones are released, the body has a chance to repair itself for the next day functioning. Really exciting research from...that was published in the journal Science in 2013 showed that during sleep the space between neurons and astrocytes (which are cells that support neurons in the brain). The distance between those will increase by about 60% which creates room for neurons to excrete potentially neurotoxic substances which are a by-product of energy formation and that's how the body will excrete those substances and get rid of them.

So this whole orchestration at night that is just like science fiction and there is some really cool work on that. I wrote a short blog referencing a TED video *[link in show notes at sigmanutrition.com/episode38],* I was really excited to see that one of the researchers that was a part of that work did a TED presentation on it and there's great graphics. It's only about ten minutes, I would suggest everybody who's finding this interesting to go to the blog and you'll find it there and you can watch the video. He does a great job of explaining it but yeah this question of what is even the purpose of sleep has been thoroughly elusive and that's certainly seems to be one major answer to that question is that its purging these neurotoxic substances and if you're not getting enough sleep could those substances build up and then be part of the cause of certain problems and I think that the answer is absolutely yes but more research needs to be done to kind of show real discrete clear connections.

**DANNY LENNON:**

So I just want to pull back to a few things that you mentioned there that were particularly interesting. One of them is around the timing piece for this and you mentioned around that certain phase that's going to be best for someone to sleep or certain period time based on their circadian rhythm and I was just wondering how someone's chronotype might play into this?

So we have some people who are naturally early risers, other people might be night owls, is there a way of actually determining this for people and if we can work out what someone's chronotype is or what period of time is best for them to sleep? Is this something that's genetically determined or can we change it or can we train it to change? If that makes sense?

**DAN PARDI:**

Yeah, that's a really interesting question and yeah this chronotype - that is the term used to describe your natural proclivity to either want to get up earlier or be a night owl, so it's a lark or an owl. This is something that can change over the lifespan. You could be a night owl when you're younger and you can become a lark. It does have to do with the compliment of circadian genes that you have but it can also be modified behaviorally.

So if you think about it the timing of your circadian rhythm is completely depending on your environment, not completely but in a large part its depending on your environment and so right now I'm in California, you're in the UK, so we have opposite schedules right. So when you're sleeping I'm awakened vice versa for kind of a large overlap of our day but if I were to travel to the UK then over a period of days as my eyes would be taking in light from the timing there I could adjust. So if you utilize that same knowledge and know how you know that you can modify, if you get bright light exposure first thing in the morning and you can do a little bit of exercise, a night owl can actually become more of a lark, so you'll have more of an alerting signal earlier in the morning. So by manipulating your light environment you can actually kind of become more of one or the other. Become more of a night owl or more of a lark and a lot of it has to do with light, so there are other things that will control your circadian rhythm, so

basically when it's wanting to do a certain activity or behavior the preeminent **zeitgeber** or the primary synchronizer of that timing is light coming into the eye.

Alright so we have visual photoreceptors of rods and cones and these are really interesting cells. The can transduce this photon signal into a nerve signal that goes to the primary visual cortex where we turn light into images. So as I'm saying this look around and kind of think about vision and how amazing that is.

Well in the mid 90's we had discovered basically a different type of cell that does something very similar. It transduces a photosignal into a nerve signal but instead of going to the visual cortex where you turn light into images it would actually go to this master clock. And that was what is controlling the timing of our circadian rhythms. Now with artificial light we have the ability to essentially create day when it's usually night time and that can reap havoc on our circadian rhythms. It's one of the reasons why we're getting less sleep because when light is coming into the eye and when it's daytime, it's a signal that actually increases activity in the cortex. It's an alerting signal, so there is something that I like to talk about, there is a concept of 'iPad insomnia' right where somebody is like "well I'm just going to read my iPad until I feel sleepy and then I'll go to bed". Where the light itself is actually masking sleepiness. If you were sitting in a completely dark room then you would actually feel the urge to sleep sooner. So bright light can control your attention and alertness in two ways. Both in an acute way but then also in more of this longer term tonic way which is in control of your circadian rhythms. So light directly makes you feel more alert but it will also tell your circadian rhythm when to be on and when to be off but as you know if you've ever traveled across multiple time zones, like you don't arrive from the UK into San Francisco and your body doesn't react immediately, it takes days of that timing or rhythm to shift up to ten days.

So if you're having a lot of flexibility in or in kind of variation in when you're getting light, like if you do shift work your rhythms are always trying to catch up or they are always moving, no, no, no now it's daytime now, oh no, no, no now daytime now I'm getting darkness signal. So they are not maintaining a very strong daily rhythm because it doesn't know when it's day and when

it's night and so this is because of the strength of the circadian rhythmicity on neuro-endocrine function, which controls all of our endocrine functions. This is probably one of the primary reasons why...I'll put it in quotes "sleep including circadian physiology" is leading to when you have circadian misalignment and when you have improper sleep this is one of the reasons why we see metabolic disturbance. When we see cognitive impairment, why we see all of these things that lead to much heightened increase for obesity and cardiovascular disease and cancers is because the rhythm of our body is off. It's one of the primary reasons.

So you were asking can you control your circadian rhythm based off of or can you kind of control when you're feeling more alert and when you're feeling less alert like an owl and a lark and yes it has a lot to do with manipulating your light in your environment.

**DANNY LENNON:**

Yeah, those are some great points there Dan. I just wanted to go through some of that. First I think I should jump in before any of my Irish listeners start to freak out because I know they all say it to me that to point out that in Ireland we like to point out that we're kind of separate from the UK so I'll just say that for them.

**DAN PARDI:**

Oh yeah. (laughing) My apologies that was ignorance on my part.

**DANNY LENNON:**

No it's a surprisingly common mistake (laughing).

One thing that I did want to point out about the light and dark cycles that is really an important point here, because thankfully people are becoming more aware of the importance of sleep, and I know especially with a lot of coaches out there that will be getting people to pay attention to sleep and you need to sleep more and get good quality sleep and all that is great. BUT I think that most are probably missing the bigger picture and that's the one that you have just laid out

for us Dan; that it's probably not just a sleep story but the main story is probably the light and dark cycles and how our actions also affect or circadian clocks, right? So you can do all these things to make yourself sleep at the right time and the sleep hygiene things we hear people saying about, the pitch black room or wearing blue blockers just before you go to bed and all that great stuff, but that's also only one half of the equation because you mentioned light and how that can disrupt things but also light the next thing in the morning to set that cycle up is just as important as taking away at night. Can you just go into a bit around why light and specifically blue light is not all bad, should we say?

**DAN PARDI:**

Absolutely. It's become popular to, if you're talking about sleep and circadian rhythms to talk about oh yeah you really want to not have any blue light in the evening and I can explain that in a moment but unfortunately I think the interpretation that okay blue light is bad is actually all too common as well and that's not true. Blue light is very important and when you think about blue light, I don't want you to actually think about blue light, it has to do with that spectrum entering into your eye and what that would look like it would just basically be full spectrum blue light from light blue daylight, alright there's a lot of blue and a full spectrum of colors that's coming into your eye. So what I want you to think about is blue light is a signal for daytime right, during the day you want that and you want to get a lot of it. In the evening you want to get less of it to none of it and then of course at night you want to have a dark room that's useful.

So with my company and part of this behavior model that I'd set up, what I try to do is that I will take a step back and I want to relate because I want to, I think this will be useful. I try to help everybody, when I started to kind of architect this idea, it's like okay what is the big problem that we're facing? Is it obesity, is it diabetes, well what is the root cause of all of that, it is the daily pattern by which we live, right and that has to do with a lot of things like sun exposure. It's the type of food exposure that we get good or bad it's then the physical activity that we're getting both low intensity or higher intensity. So when is that daily pattern look like and some

of the big, I think that a big domains for healthy lifestyle are food, movement and sleep and so I set up this idea that we want to help everybody live as an intelligent eater an enduring mover and a restorative sleeper. So these are inspirational concepts so for example the restorative sleeper wakes refreshed and feels alert all day, okay cool I want that, how do I do it? So then you work backwards and you start to think okay what are the key determinates to getting good sleep so that you can live like that and as we're discussing it has a lot to do with light exposure and it has a lot to do with sleep behaviors. So as I was mentioning earlier, the things that matter for sleep are timing, intensity and duration, so you can measure timing and duration. So duration is alright am I planning to spend an appropriate amount of time in bed per night. You can plan for that, you can track that and then you can stay mindful if you're doing it or not.

The timing is also actionable and trackable, am I going to bed at the same time. I want everybody that's listening on to this podcast to set a sleep time. I want you to have a very clear idea in your mind, I want to be in bed by 11:30, I want to be in bed by 1 am, whatever it is have that time in your mind and very, very clear so that you know, well alright if I need to get up by 10 am or 9 am or 6 am, whatever it is, that the way it will happen is that you're going to have a very clear idea about that time that you go to bed right. So I try to be in bed by 10:30 or really be asleep by 10:30. So I try to get into bed a little bit earlier than that, so timing intensity and duration. We talked about timing and duration, the intensity part has actually to do more with light exposure and then also daytime physical activity. So for that a restorative sleeper is going to track timing and duration and is also going to maintain smart light rhythms day, evening and night. So you're going to get the appropriate amount and the appropriate type of light during the day and then you're also going to get the appropriate amount and type in the evening and then the same when you're sleeping. So what does that look like? Well we're all on this planet, we're living outdoors with this light dark cycle that was a daily pattern and that pattern would shift over the course of seasons but that would be very slow, that difference and so what we've found through research that I was not a part of but I've seen presented. So I work at a circadian biology lab at Stanford and these are the questions we look at a lot or explore a lot through other peoples research and some really interesting work that has been done is that okay lets looks at the degree of what I'd call circadian anchoring which means that your brain is getting a

really strong signal but yes it's daytime and there's a real **Pareto** principle happening here which is you get basically 80% of the effect with 20% of the exposure. So getting a half an hour of outside full light exposure is going to create about 80% of that anchoring effect that you can get from outdoor light during the day which is great. Which means that exercise outside, eat lunch outside, go for walks whenever you can and a very common question in response to this is what about cans and the timing, you know the weather is not hospitable and do the best that you can, you know have lunch by a window if you can. So do the things where you can get as much kind of daylight type exposure as possible during the day. In the evening then you want to dim the lights and you want to also make sure that the amber incandescent warm light. Now that warm light actually has less blue light in it and those cells that I mentioned that were just in the eye that aren't responsible for visual photo reception but are responsible for kind of telling the master clock well hey this is the time of day it is. They are most sensitive to blue light and alright blue light is, don't think of blue light as like some rave (laughing), think of blue light as just full spectrum daylight. There is a lot of blue light when you go outside in the middle of the day but if you think about what is the type of fire in the evening around for like example the light like around the fire, that's the type of light you want to get in the evening and those cells that are basically...you can create something called virtual darkness or circadian darkness which means that you can see but your brain doesn't think that its day and that's why you wear blue blocking glasses in the evening. That's why you put F dot rux on your computer to change, if you've not heard of that it's a computer program that's free, you can install it and it starts to pull out the blue light from your computer screen after sundown. So these are the types of things you can do to kind of manipulate your own light environment where you can still see but you're not giving your brain the wrong signal at the wrong time.

**DANNY LENNON:**

Yeah, perfect. I think that's a great breakdown and one thing that jump to me is to emphasize that it is that cycling between the light and the dark as opposed to just doing one and I can't remember where it was, it could have been the Calories Proper blog that we were chatting about off-air, where someone had reported an anecdotal case of someone getting the blue

blocking glasses and essentially just wearing them all the time and it pretty soon become really, really sick because they were getting none of that light through their eye and when I think of that then just how common that probably is in the general population now with people getting up, going or starting work from indoors while it's still dark in the morning and by the time they leave the office it could be still dark as well and they never get any time outside and I know you've highlighted before Dan about how the difference between indoor lighting verses what we'd get when we do get outside is very different, no matter how people might interpret that they are getting light into their eye right?

**DAN PARDI:**

Yeah, the thing with your eye it's almost like a photon counter and light intensity is measured in a unit called lux. So when you go outside on a bright blue day the light intensity is about 100,000 lux. Indoor in a normally lit room that seems to have totally ample light for seeing, I mean it doesn't feel dim will be somewhere around 5,000 lux. So this is a huge difference 100,000 to 5,000. We spend 90% of our time indoors on average now. So your brain is just not getting extraordinarily strong daylight signal even in good scenarios. Well good scenarios, it's very possible but as you say it's also very possible especially during the winter when the weather is inhospitable, the daylight hours are shorter, you drive to work when it's dark, your indoors all day and you drive home when it's dark and a colleague of mine was a part of some research on the concordia which is a research station in the Antarctica which is a great place to do research on light because there's time where you can go 24 hours a day of darkness, so you can really look at the impact of artificial light from an internal environments without having to worry about like a couple minute exposure to daylight from outside. So that's actually the work, that's the actually the research that they did. They did two weeks where they had just normal room light and this is throughout the research station and they measured peoples reaction times, their mood, their tendency to want to go to bed later and get up later every day, all things like that, their depresses, you know there is depression scale, there's outlook scales and what they found is peoples reaction time slows so they get, they're not as fast at being able to attend to a signal, they want to go to bed later every night, they have impaired moods, so it's

sign that normal indoor lighting is just not strong enough to anchor that circadian rhythm. And in the next two weeks they put in blue enriched bright light so they added greater blue light to the normal room light and it's kind of like a harsher more fluorescent light but what they found is that it totally anchored their rhythms. The reaction time stayed constant, their moods were good, they went to bed, they wanted to go to bed at the right time, they wanted to get up at the time that they should have, the time to be ready for work and so they did this. They went from two weeks with blue enriched white light to two weeks with normal light not kind of enhanced from more blue light during the day and they went back and forth two weeks, two weeks, two weeks and two weeks and it was every time they did that you would see for example if their using normal blue light you would see impaired mood, impaired reaction time shit went back to blue enriched bright light everything was anchored. You know everything was stable, fixed, good performance, good outlook and it just went back and forth and back and forth. It was an extremely clear example of just how much light can influence these things even from indoor room light which actually speaks to the potential for environmental design. I'm really excited that as homes becomes smarter we'll have light bulbs that now with LED you can adjust the tone where it's just on a program, so you just wake up and it's mimicking what's happening outdoors during full...at noon you have really high blue light coming out, it's very, very bright and it dims over the course of the afternoon and evening and the color goes from a harsher blue to like a warm incandescent.

Just think about the tone of light over the course of the day from the outside during sunrise to noon to sunset to evening and all that and just try to mimic. You know everything I try to teach with what I'm doing, is really just trying to help you live a more natural existence but in the context of the real world verses oh just give up your job and work outside. And anybody who wants to do that I'm in support of it but that's just not going to be a practical solution for a lot of people so how do we make the normal world actually healthy for us and some of this environmental design is going to be a huge factor.

**DANNY LENNON:**

Yeah for sure. That's fascinating some of that stuff and it also got me thinking there as you were saying that Dan around the idea of people feeling sleeping at the appropriate times or feeling sleepy at inappropriate times as well and I think probably you were one of the first people whose explanation of those regulatory processes of sleep pressure and weight drive and actually how they tie into the overall picture. So could you perhaps go into that a bit more and lay out for us what these processes are and how they kind of interact with to create these bigger sleep process?

**DAN PARDI:**

Absolutely. Yeah, well I'm glad to hear that. It's a bit of a difficult system to explain but I'll start with the person that first identified and wrote about this model. A guy Alexander Borbay is a Vietnamese professor who published a paper in 1982 that's the most cited publication in sleep and still being cited thirty years later and its the two process model for sleep and wake regulation. So what does that mean? It means in your sleep or how awake or how sleepy you feel at any point during a twenty four hour period has to do with two different systems that are interacting and one of those we've been discussing is the circadian rhythms. The other one...right so usually I explain circadian rhythms secondary but these as I was mentioning earlier, circadian rhythm is determining all sorts of things right so how the behavioral patterns, like there's times of day when you're the most coordinated when you have your best reaction time, when you feel like going to the bathroom, when you feel hungry, these are all part of the twenty four hour biological clock. Part of that is also when you feel alert and when that system is working and how it's working. So that is something called a wake drive is orchestrated in part by a circadian time element which means as light is coming into the eye and you are living in your biological day, that means that there is a strong alerting signal that is coming from that orchestration of multiple centers in the brain that have to do with various neurotransmitters. So the dorsal raphe nucleus has serotonergic cells that are kind of getting a signal to help to alert the cortex. You've got histermatergic cells that are cells that will produce histamine that are coming from the tuberomamillary nucleus, all these different areas are getting told to hey be on, be working and that orchestration is coming from...almost think of it as there is a

symphony that is playing and there is a symphony conductor and that conductor is saying it's daytime be on, play, light up that cortex. So that's how you can think of circadian timing right so it is telling this wake network, this collection of all these different works of cells. Now you should be playing and you should be playing at this volume, okay so hopefully that was a good explanation of that.

Now it is counteracting this other process, so what I just mentioned is one process, the other process is something called sleep pressure. So when you wake up in the morning your pressure for sleep is very low and as the day goes on the pressure for sleep build, builds, builds, builds, builds all the way across the day but you don't get sleepier from the moment you wake up. It's not like this inextricable decline from...when I wake up I'm the most alert and then I just get worse until I fall asleep, that's not how that works. You wake up, you might be a little groggy or an hour, it might take you a little of time to really become at your most alertness. There might be some circadian variation which means that a little variation within the days, you might be sleepier at 10, you might be a bit sleepier at 2 but generally you have good days or bad days. Right like I feel pretty good today or I'm sleepy today and so even though your building up pressure for sleep that circadian rhythm, remember when I said that weight network is being told when to play and at what volume. Well as sleep pressure builds wake drive is also building to counteract it and that's why then you got these two systems that are working kind of in opposition to create one degree of wakefulness really throughout that day and in the evening what happens is you've got this very high sleep pressure that's been building and all of a sudden wake drive starts to drop and now you've got unopposed sleep pressure. So that wake drive is dropping because the brain is now saying I can't start it's time to go to bed and now all this unopposed sleep pressure it initiates sleep and it also keeps you asleep for a long period of time and helps to consolidate sleep, so you don't just sleep for an hour and then wake up again. It actually helps you sleep throughout the whole night and so it's this beautiful dance between these two different systems and if you don't get enough sleep, let's say your body wants eight but you only get six you can build up something called sleep depth which means you're not starting the next day with a blank slate of sleep pressure but your actually starting the next day

building upon the unresolved burden of yesterdays sleep pressure because it didn't have a full chance to wear all the way down.

**DANNY LENNON:**

Yeah, fascinating. Yes it's amazing and we can dive so deep into that because I find that area so fascinating but for the sake of time here there is so much I actually wanted to get to and I'm mindful of your time as well. So I think I'll be able to just jump to one of the other questions that I know people wanted me to ask so it's around caffeine consumption because that's one thing that people start paying attention to when their looking at sleep or one common enough recommendation that I've often given to people in the past is around having like a cut off point for their caffeine. So generally the early afternoon maybe eight or nine hours before their expected bed time and again that was based on what I'd seen previously. Now I have not looked at stuff in a while so is that still a descent recommendation based on what that actually is out there and if that is what's the actual mechanism that's going on their Dan?

**DAN PARDI:**

The timing of that question is very good because as we were just talking about there's this sleep pressure that builds and another question you can ask is well what is that pressure because what I just described is a concept model that this is how these systems work but then if you take a deeper dive and you say well okay what is sleep pressure? What is the physiological core-let or the thing that you can point to and say this is what's building and what's building, and by the way this is an answer to your question about caffeine trust me (laughing) is as the brain is using energy you know that kind of the major currency for energy in the body is ATP or adenosine tri-phosphate**.** And as the body is using energy, the way that it is used is that ATP breaks down, the chemical bond is broken and energy is released as a result of that. So if you think about what adenosine triphosphate is, it's adenosine and then three phosphates and then as it breaks down to adenosine diphosphate or monophosphate. Eventually you can end up with just kind of the adenosine molecule and that is thought to be adenosine is at the core of what sleep pressure is. And this is a lot of work that had been done by Radica Bashier and Tera

Porcahicidine at Harvard. And it was very difficult to actually identify or to figure this out because it's a complex system but basically you can see adenosine accumulating in the base of the fore-brain which is a part of the brain that is kind of sensitive to...well it's part of the brain that seems to be a source for adenosine accumulation and triggering sleep initiation.

So what they found is that animals that they did this work in rats and they saw that the longer that the animal is awake the more adenosine build up in the basal forbore and when they slept those levels would subside. So it seemed to be this marker of sleep pressure and now it makes total sense. As your using energy over the course of the day there is an accumulation of energy bi-products that accumulate and then at some point cause kind of like the scales to tip and say okay I need to rest now. There is enough pressure that is built up from the accumulation of these energy bi-products, I need to kind of then purge those and this is a perfect homeostatic process. So homeostasis is basically balance, balance within the body and something kind of gets out of balance and the system tries to react to try to reestablish balance. So much of our physiology is based on homeostasis, homeostatic processes and sleep is absolutely one of them.

And so why is caffeine relevant? Well caffeine is an adenosine antagonist which means that the molecule caffeine is blocking adenosine from binding to its receptors, so that's another thing I didn't mention is that adenosine does bind to A1 and A2 receptors both of which are in the brain, both of which will either suppress he wake, the ability for the wake signal to be strong or it will heighten the sleepiness signal but if you look at both of that its either suppressing wake or heightening sleep is causing you to feel sleepy and caffeine will block adenosine from binding to its receptors and that helps you feel more alert. So that is how in part adenosine is influencing how alert we feel and it's also one of the primary reasons why it's such a popular drug particularly now. I mean caffeine itself has its own reinforcing properties. The drug is desirable to consume because of other effects that it has on systems that make us like it right but I tell you that the popularity of the drug would not be nearly to the degree that it is now if we were existing in a sleep deprived society and we are.

**DANNY LENNON:**

Yeah and I suppose where the issue comes in that it's not used as something to makes someone feel as small but better when they are already fresh. It's people using it as a crutch for energy and that's why there is an over consumption needing to go through X amount of mugs a day is coming in. So essentially with that just so I have it right Dan where we have this build up of adenosine that's accumulating over the course of the day which should leave this feeling of sleepiness and then during sleep that adenosine somehow gets cleared and it's the caffeine that is blocking or the caffeine itself, does that bind the adenosine receptors than preventing those from the adenosine from attaching right?

**DAN PARDI:**

That's absolutely right.

**DANNY LENNON:**

Cool. I just wanted to make sure of that.

**DAN PARDI:**

No, that's good. There might be some other things that are going on too, well they certainly are but that's why the timing of caffeine and the half life of it is important and there are slow metabolizers of thousands of metabolizers of caffeine. There is tolerance that can build up from how frequently you take in caffeine and the does that you can take in. Often times people will have to drink more coffee to even have a similar effect and then some people might even say oh it's not affecting me at all. I know some people that will get this kick right before bed and they would absolutely be fine but these are also people that drink a lot of it. My mentor in graduate school he would drink like two pots a day (laughing) and it was just amazing but I think the best way to kind of arrive at an idea about what you need, it's going to be a moving target because again it's depending on how much your drinking but I think it's a good rule of thumb to not want to take in any caffeine after 3 o'clock. Now some people it might even be

afternoon but again the more you drink, maybe there's less sensitivity to it. I know that there are certain types for example there is a coffee manufacturer or cafe called Phil's in the United States and it makes great coffee. For some reason if I drink their coffee any time after noon I will stay up at night. It's really, really strong and it's probably stronger, it probably has more caffeine that's part of the reason why but I've noticed that. Like I just need to be very careful, there are times where I can have coffee up to three and I'm okay but it might not automatically just cause insomnia and what I mean by that is kind of elongating the time that it would take for you to close your eyes to actually fall asleep but it also could lighten sleep. So it could make that initial stage because when you fall asleep you go right into slow age sleep, not immediately but really soon after you fall asleep in the evening you go into slow age sleep which if you were to look at what that sleep looks like on something called an electroencephalograph, which is a way to monitor what the brain wave activity would have these long, very high amplitude, consistent wave pattern and that is representative of a type of sleep that is going on which is called slow age sleep.

Now what's happening during slow wave sleep? Well you are rapidly clearing adenosine for the basal fore brain at a very fast pace and so when you have an adenosine blocker like caffeine that is unpleasant you can actually lighten that sleep making that phase of sleep less restorative basically. It means that you can kind of wake up and feel like you've been in bed for eight hours but it feels like I was in bed for six. So not only can it delay how quickly you fall asleep but again it can also lighten your sleep as well. So you need to be careful and when your thinking about the right amount of caffeine for you and the timing of it accessed by both is well is this causing me to stay up longer, so you have to be very mindful of what your usual pattern is and then also is it affecting the quality of my sleep. So how do I generally feel in the morning and it's going to require more than one night exposure, it's going to require you being mindful of okay, what's a general pattern that I noticed with my coffee drinking because one night does not make...that's often a problem when people do kind of self tracking out of one experimentation. You kind of do false associations, you're like oh I had once night I didn't sleep well so I can't do this or I have to do this, whatever that might be, you got to kind of look at a pattern over time. So I would say it kind of has a fixed time if you do know what time you want to go to bed, is it harder to fall

asleep around that time and then say okay I'm not going to have any caffeine after three and then try to monitor how you're doing and then if you feel like there is an influence then move it back an hour, say no caffeine after two.

And I'll tell you this I think right now in general in our society there is an idea that it's like I want to get kind of more in my day, I'm going to sleep less so I can have more time for being product productive. You'll never be more productive than if you were getting what I call complete sleep. So your sleeping within a very consistent circadian phase and your waking upon your own volition and by an alarm so you're getting as much sleep as you can pretty much every night and the idea of even having coffee, try that for three weeks, try to get complete sleep, now your sleep practiced for three weeks in a row and then see how you feel and most people that do that might go from yeah it felt fine to oh my gosh I feel like I am super person, you know like my memory recall is so sharp, thinking speed is so sharp, it's actually addictive because of how well you perform.

**DANNY LENNON:**

It's crazy because once you experience that then you have an actual genuine marker of what good quality sleep actually is and then your very mindful of days you don't get good quality sleep or enough sleep you notice that effect immediately whereas with many people walking around now that if you asked them well are you tired or how has your sleep been and say oh I'm fine but it's just because their fine as they actually don't know what actually feeling fully restored actually is.

**DAN PARDI:**

That's right and that's very common. It's easy to condition to getting less sleep, that's one of the big problems. People feel like oh yeah I get six and a half hours at night, it's all I really need I do fine. They really don't accommodate to that feeling as feeling normal and I'll just have a little coffee and I'm fine but we know the effects, the reaction time slows in a day. If you think about what reaction time is, it is a signal, it's a way to access the brain's ability to kind of attend to

information in your environment. So in order for you to learn a packet of information needs to come into the brain and needs to be sent between different brain centers that are involved in processing, thinking, responding, contextualizing, if that is slowed down like you drop thoughts really easily, it's hard to hold on to that thought before you can kind of take it to its conclusion where you have real clarity about what that thought means. There is so much. I've been getting great sleep over the last couple of days and I'm still even surprised by...like yesterday I just had an incredibly productive day and that is not always my condition but I was able to work through it, kind of a to do list, so efficiently with no interruption, I was kind of able to execute my plan with extreme fidelity and I recognized that as being completely a factor based upon the fact that I was getting really good sleep over the last week and like you said it is addictive when you kind of can experience that. And I'm still sometimes surprised by like oh yeah go to bed dummy. (laughing) Like you know don't read this later into the day because you'll do better tomorrow, go to bed. (laughing)

**DANNY LENNON:**

Yes, it's amazing but that's the place we have to get people with because I think it's great showing look these are all these physiological things that are going on when you don't pay attention to your sleep properly but for a lot of people if they don't see that immediate effect of it then they can almost dismiss it in their own mind so that they can continue to sleep a certain way but then if you then have them nailed asleep or those few weeks that you mentioned and suddenly they are so productive that their work increases and their business benefits from it and their relationship and their day to day life increases and their general feeling everyday improves then that's straight away has got them more into it and then people will then start to really take things seriously as opposed to just thinking oh tonight it would be if I could sleep more.

**DAN PARDI:**

I'll go back to the behavior model, as I mentioned it's called the *'loop model to sustain health behaviors'*. Of behavior change what are the different tools and techniques that you can use to

facilitate behavior change in the other person? Well part of it I think kind of an intellectual understanding about the importance and that kind of persuasion and once you start to hear the details of something you may not be able to read a picture like those in precise form. Like somebody who's listening to this might stumble a little bit when their trying to explain what they've learned today to somebody else but they grasp the concepts and that is really important and the grasping of the big picture and the details is really the key to facilitate a sense of desire. Right like okay you know yeah okay I want that. I want this, I want to wake refreshed and feel alert all day, here are the most important things that I grasp and then it's the first part of the behavior model and why is this important. Then next is how do you do it? And this is the tracking and the small light rhythms that we mentioned, next is am I doing it. So can you measure aspects of the lifestyle, aspects of those actionable steps and get feedback to just stay in sync with your goals and then the reason I'm being this up now or what triggered it in my mind is the last step. So it's why should I do something, how do I do it, am I doing it and then is it working and when you get that experimental evidence that okay wow I've perfected my sleep practice for three weeks in a row and now I have the experienced the result of really good sleep. That is different than an intellectual persuasive argument that might get you to try something in the first place. It is a validation that okay yes this really does work, I get this and that can drive a sense of identity formation. Okay now this is who I am, this is what I want and also kind of an additional source of motivation that is very, very powerful. It's not an abstract concept that might be appealing but it is an internal experience that can be part of the stronger source o motivation, yeah I want to live in that state as much as possible.

So thanks for allowing me that slight tangent but it's kind of how this all relates in my mind. It's not just information for information sake but there is a real purpose to it and this is that sequence.

**DANNY LENNON:**

Yeah, no I think that really helps to clarify a lot of things and thinking through it in that way just brings everything together and at this stage there is so much that I could have asked you and I

still have in my mind I'd love to get into. I mean we really didn't get a chance to get into your whole area of research about sleep restriction on food choices which is something I really want to get into and how alcohol affects sleep and some of the stuff you got going on with Dan's Plan and the stuff your doing with Stephan Guyenet. Like there is so much we could have gotten into but I know tight for time and you've already been way too kind with your time up to now. So we'll start to wrap up here and I think I'll have to get you back on hopefully at some stage in the future to get to those other topics.

**DAN PARDI:**

I would love to.

**DANNY LENNON:**

Yeah, awesome! Before we get to the final question, maybe now is a great time to let people know what you've got going on, where they can find your stuff online and where they should go to check out your stuff.

**DAN PARDI:**

Yeah, thanks. Let me, before I say that I'd like to say that I do a lot of radio, a lot of podcasts and interviews. I love talking about sleep and I feel really driven to try and get good information out there because of the need but I really enjoyed this interview a lot. So thank you your clearly...I always kind of judge these interviews by how well I feel somebody is kind of grasping the information and the question they're asking and so I'd be happy to do any other interview with you at any time and yeah there is a lot more to talk about.

**DANNY LENNON:**

Thanks so much for that Dan, that's awesome to hear and very thankful for that.

**DAN PARDI:**

Yeah, I'm impressed.

So Dan's Plan is a site that anybody can go to, it's free to sign up and the idea is there is this whole new movement of quantified self trackers and it's this ability to track aspects of your lifestyle and in my opinion it's an exploding movement. There is a lot of good about it, you know the Apple watch is coming out, it's going to have aspects of that. There is a lot of it that is in my opinion done in a manner that is not optimal in terms of the practicality that it could promote. So for example a lot of these devices that are tracking sleep are going to give you all sorts of information about your sleep stages, etc and that's kind of sexy in a way but none of what we do and you can hear how passionate I am about sleep. We don't track your sleep with all your stages. What we do is track your behavior around getting good sleep because that is the stuff that you can control. So unless we're using sleep data as a diagnostic tool to figure out if you have some sort of sleep issue or whatever, it's really not that important. What's important is that your getting enough time in bed and your sleeping in a certain circadian phase and your getting the right light exposure. I like to focus people on behaviors that help you get the results and that is kind of where we focus the attention but as you heard there is a variety of things, so we're doing education, we're creating courses so over the last year I developed a learning methodology that I love starting projects with asking a question. How do you facilitate the greatest degree of learner retention of information and I spent about half a year kind of researching learning techniques and I'm really excited in the next year to be releasing these courses on all sort of health topics that I call micro courses because they are not long, weeks long. They are more targeted so it's like this is the important information that you need to know in order to operational that into a practice that you will benefit from in your life right?

So that's one thing and then part of it is in creating, it's like here's your, we have something called zone of health, so we're going to track aspects of behavior that are important for your daily pattern to help keep you mindful and then we also give you daily triggers which is like okay this is your general pattern, are you living in accordance with your goals but then here are

things you can do today. Here is our daily workout, here is daily yoga for mobility training, here is a daily recipe. So it's like we're going to try and simplify your daily practice by making it easier by giving you programs that say hey do this, do this, this is another thing you can do to continue to live in accordance and so yeah we're going to be building in some social components as well so that you can formulate your own kind of health culture. It's not just your immediate surroundings but you can have a group of friends across the world and these are people that are kind of inspiring and encouraging your own kind of consistency and engagement with your health practice and vice versa your doing that for them.

So it's all these components that we known are efficacious and I'm pulling this together into this tool that I want people to make Dan's Plan a part of their daily health practice so that it's like every day I check in with this tool and it's keeping me mindful of my practice that is going to set a very healthy projectory and it helped me perform well today and helps me stay healthy tomorrow. So that's kind of the intention and that's also some of the methods and I would love everybody who's here go sign up for free, check it out, use it, give me feedback, I listen to that more than you know. It's really important to hear what people want, like, want next, all of it.

**DANNY LENNON:**

Yeah awesome and I just want to jump in and say to everyone go and take advantage of that. Jump into that stuff for free and some amazing stuff there and I think the big thing for me Dan is when you mentioned around that all this that you've put into this behavioral model is with the idea of it being actionable because you made a great point about we have all this great software and apps and different pieces of technology now where people are looking at sleep but they just don't know what to use with data. I mean you get back a reading of how much rem's sleep you got last night. That's interesting to look at but how actionable is it for most people? Like what do you do with it? Like it doesn't give you any actions to go and take, so I think the approach you've got going on, building on the behaviors is huge for people. It's the biggest thing to do with any change someone wants to make whether that's lifestyle, nutrition, general health. I mean it's all down to behavior so I definitely encourage people to check it out

and for everyone listening if you go to the show notes of this episode. I'll have all the links that Dan has just mentioned as well as a link to any of the other stuff that we chatted about in today's show which we go and find that stuff there. So I definitely encourage that and with that I'll just get to the last question as quickly as I can because I know you have to jump off Dan and it's simple I want to get everyone to answer if you could advise people to do just one thing each day that would improve their life in some way what would it be?

**DAN PARDI:**

Wow! Okay that is a big one. Let's see, oh gosh, the first thing that came to my mind is use Dan's Plan. (laughing) That's so promotional but...

... I actually believe it because it's obviously the source of what drives me. Everything that I do, it is about maintaining an effective daily health pattern or daily health practice which will then when you do the things, when you provide your body with the simulation that it needs across these disciplines that matter so much to our health you perform better in life. With social relationships, with your work, with the goals you care to attain with the longevity of your existence and it's so simple. I'm really anti silver bullet, like there is so much about health which is like oh yeah here's the secret and I feel the secret is just under our nose and it's actually sometimes boring. Going to bed on time is not the most exciting thing in the world, what's exciting is the results of it. And so my pause after you asked that question is that was the first thing that came to my mind and I honestly believe it but I didn't want it to sound like a sales pitch but I actually feel really good about that. It's maintaining an effective daily health practice whether you use Dan's Plan or not. I love the tools that we have, there simple and I think there useful but whatever that is that prioritize that in your life because the rest of your life will benefit from it.

**DANNY LENNON:**

Yeah, I totally agree with that whole message and certainly with using Dan's Plan as a tool. If people ever listen to one thing I say it's at this time go over to Dan's Plan and make sure you

sign up to that because it's really something that you're going to benefit from. So with that Dan I just want to say thank you so much. You've been an absolute legend. How much time you've given to us today and amazing information you've brought people and I just want to say I truly am so thankful for what you've done today, so thanks.

**DAN PARDI:**

The only request I have is that I want to be on a show with Conor McGregor at some point so if you can swing that…. (laughing)

**DANNY LENNON:**

We'll try to hook it up! We'll try it. That would be your returning show in 2015, we're going to have Dan Pardi and Conor McGregor on Sigma Nutrition Radio. So if anyone is listening and you want to get that… Let's get that going, let's everyone just tweet Conor McGregor and say "you've got to get on the show". (laughing)

**DAN PARDI:**

(laughing) I love that guy. I actually just really want to listen but yea, no thank you again Danny. Like I said I'm eager and happy to come back on. There is a lot more to talk about. I can't wait for the next time. So happy holidays to you and everyone that's listening and thanks for the time to talk about this stuff, I appreciate it.

**DANNY LENNON:**

And so there we have it episode 38 with Dan Pardi is in the books. Remember you can catch the show notes to this episode over at sigmanutrition.com/episode38 where you'll find a link to all Dan's stuff, any resources we mentioned throughout the show. You'll be able to download a transcript of the full show there for free as well so head on over there and you can get all those free stuff. In the meantime I just want to say thank you for listening yet again. It really is humbling to have people listening and leaving reviews in the numbers that they are. So please

continue to do that, it helps the show big time and please share the show around for anyone that you think may find it useful and with that we'll leave it until next week. We've got some pretty cool guests over the next couple of weeks to round out 2014 and already some pretty cool shows are being lined up for early 2015 as well. So there will be a few more announcements over the next couple of weeks in regards to not only the show but the general goings on at Sigma Nutrition and a few changes will be coming which are hopefully going to benefit you guys big time. So make sure you are on top of that stuff. Remember make sure to subscribe to the show whether that's on iTunes or Stitcher or whatever app you use to listen to the podcast on. So with that I want to say Thank you and I will talk to you again next week guys. Take care.