SLEEP: Circadian Rhythm to the Rescue: A Top 10 Episode with Satchin Panda

Announcer:

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Dave Asprey:

You're listening to Bulletproof Radio with Dave Asprey. You may have noticed in my continuous evolution of becoming great at foreshadowing, that we might talk about sleep and circadian biology in today's episode. I'm really happy to have a friend and former guest of Bulletproof Radio back on the show. I'm talking about none other than Satchin Panda, PhD, who's a leading expert in circadian rhythm and a professor at the Salk Institute in San Diego. And his lab has been transformative because he's shown the profound impact of ambient light in daily eating fasting on preventing huge numbers of diseases like diabetes, depression, metabolic syndrome, heart disease, cancer, and stuff like that. He's also come up with this concept of time-restricted eating and it's very related to intermittent fasting, but he says that people who eat everything within an 8 to 12-hour period can boost their circadian rhythm and maybe even reduce chronic diseases. Dr. Panda, welcome to the show.

Satchin Panda:

Thank you, Dave. That is a really nice introduction and I'm really flattered that you are such a big fan of circadian rhythm.

Dave:

Why are we finding all of these changes just in the period of time of your work? What happens to make us become more aware and to crack the code, given this is the title of your book?

Satchin:

In the last 20 years, the key discoveries can be summarized into three major things. One is people discovered that just like our brain has a clock, almost every organ has its own clock. And that completely transformed how we think about circadian clocks. The second one was we also figured out that blue light is a strong agent in sunlight that resets our clock or having exposure to blue light at night can disrupt the clock. And the third measure discovery was how food timing affects our clock. So these three really transformed how we think about health. Because if you think about now, what circadian rhythm field is doing, this is the only field that's actually studying what is health? Because all of the fields of biomedical research study what is disease?

Dave:

You mentioned the liver quite a lot in there. And it's funny, people oftentimes don't associate circadian things and sleep with what the liver is doing. Tell me more about why you brought that up.

Satchin:

Well, if you think about, liver is the one of the largest solid organ that is very important for metabolism. So, it produces fuel for almost every part of our body including brain. It also breaks down a lot of xenobiotics or unwanted molecules that we ingest. So for example, if we think about fasting, then liver is the major place where we should... Our liver produces some ketone bodies towards the end of our 14,

16, or 18 hours of fasting. And that ketone body is transported to our heart and brain for better function. So in that way, liver plays a huge role in fueling our brain and keeping us smart.

Dave:

It really matters so much. One of the studies that I was really pleased to see that came out of UC San Diego was Dr. [Canean's 00:03:49] research that showed the amount of caffeine in two small cups of coffee doubled ketone production. I just slept all night which is a fasting window unless you sleep-eat. And then all of a sudden, you wake up and you want to get some more of those ketones that will happen if you skip breakfast. But if you have black coffee, you're going to have more ketones than if you didn't according to that study. If you look at traditional Chinese medicine, Ayurveda, all these Eastern systems of healing, a lot of them are heavily focused on liver and kidneys. And of course they care about the brain, but it seems like we're now using circadian biology to rediscover things that maybe we knew 1,000 years ago. Do you agree with that?

Satchin:

Well, the thing is when it comes to health and wellness, anything that we can think of has already been tried in human history because humans have been trying by trial and error and many other methods to figure out what is the best way to live a healthy long life.

Dave:

When I interviewed all the people in Game Changers, I ended up having some weird thoughts on that and saying, all right, number one data point that came out was food. But certainly not everyone agrees on what to eat, but everyone agrees if I eat the wrong stuff, I can't show up. I'm not going to be a game changer if I eat garbage. So, I think there is an algorithm for eating and the bulk of diets worked very well and it's an algorithmic approach that says, look, eat less of the stuff that makes you weak so you're less inflamed, eat more of the stuff that gives you energy and more nutrients, et cetera, et cetera.

Dave:

So, if you were to flip a coin and say, "Will I handle legumes? Will I handle nightshades? Will I handle dairy? Will I handle these things?" It is more likely that since your mitochondria are the things that turn air and food into electrons at the end of the day, it's more likely that if you look at what your ancestors ate on that side, you'll get some hints as to where you might want to start when you're figuring out what's going to work for you. Do you buy that line of reasoning?

Satchin:

That is inherited from our ancestors. But at the same time, if our ancestors went through famine, or fasting, or maybe too much food of certain type of food and that's imprinted in their genome or mitochondria as you know, then that is also a good sign that if we change our behavior, we'll also imprint our mitochondria or our genome in a very different way. We can pass on that mitochondria, that episodic cord to our children. So in that way, it's an interesting hypothesis. People always say that whatever your parents did that is imprinted on you. And the flip side of that coin is if you pick up some good habit, you'll also pass on those good habits to your children. And if you pick up some bad habits, that's also going to pass on to your children.

Dave:

Well, let's talk a little bit more about circadian rhythms. Sleep came up very high on the things that high performers do in Game Changers. And it led me to create a Law 19 in the book. And the title of Law 19 is Waking Up Earlier Does Not Make You a Good Person. And the subtext of that is there is no morality in waking up early or staying up late. There's a huge amount of power in finding out when you sleep past and building your life so you can sleep then. And the point for that is that one of the other laws is what you do in the morning really does matter, so The Miracle Morning perspective from Hal Elrod. But the definition of morning for an early riser is different than the definition of morning for a late riser, and that knowing when to sleep seems like an important thing to discover so you can show up all the way. Talk to me about what you've seen either in the lab or in other readings, other research around proper wake-up time, and is it the same for everyone?

Satchin:

Day actually begins when you go to bed the previous night, because that determines how long you'll sleep, how long you'll reset your brain, and then how fresh you wake up in the morning. So, one rule of thumb is most sleep researchers agree that an adult should be in bed for eight hours. I'm saying should be in bed for eight hours. So out of that, somebody may get six and a half to seven hours of sleep. So, that means if someone wants to wake up at 6:00 AM, then this person aim to go to bed at 10:00 PM.

Dave:

Where does eight hours really come from? And do you believe that having seen rat melanopsin sensors in labs, in petri dishes and all that? How much BS are we dealing with?

Satchin:

The epidemiology is right. The self-reported six and a half hour of sleep correlates very well with longevity or disease free life. When it comes to eight hours, it's not eight hours of sleep, it's eight hours in bed. That's what I always tell people that-

Dave:

So, it's what else you're doing in bed that makes you live longer. Okay. That changed the whole equation.

Satchin:

Yeah. So, I always tell people aim for eight hours in bed. And we know these days when people go to bed, they're checking emails and doing other things. And then when they wake up, sometimes they wake up and then they're still tired, they check their email and other stuff before they get out of the bed. So that's what we say that target eight hours in bed.

Dave:

Okay. Eight hours in bed no matter what you're doing. I might be able to get away with that. Do you have any thing you've learned from all the work you've done specifically with lighting, or food, or anything else about reducing sleep latency so people go to sleep faster when they want to in bed?

Satchin:

What we're finding, people who do time-restricted eating and particularly if they stop eating two to three hours before bedtime, that helps. Second, reducing exposure to blue light for two to three hours

before going to bed, that also helps. Some people, their core body temperature or body temperature doesn't fall well at nighttime. And to have a good night sleep, we need to have a good drop in core body temperature. So, people can take a shower and that actually helps to drop the body temperature. They can go to sleep cool.

Dave:

A cool shower?

Satchin:

Yeah. Some people like a warm shower, some like cold shower. But the bottom line is whatever shower you take, your blood circulation will draw towards your skin away from the core and that helps to cool down your body. And then, the last one is your right to darkness because we have lost our right to darkness. There is so much light everywhere. Sometimes it's mind-boggling how we have lost our right to darkness. Even in a modern house with the best architecture, without a good-

Dave:

Blackout shades?

Satchin:

Yeah. Good insulation, that good darker curtains, it's almost impossible to get darkness. Plus, there are all these indicators and all this lights on your phones, on your appliances, TV, et cetera, so that keeps us very jazzed up. And in fact, there is a study that just came out showing that even one lux of light, which is equivalent to even a bright moonlight on full moon night, having that one lux of light in some bedroom, for some people, can disrupt their sleep. And so, that's why it's very important to have right to darkness. If you cannot have darkness, then maybe a pair of eye sets or a sleeping mask will help.

Dave:

What do you do at home for sleep with your lighting?

Satchin:

Well, we don't have any light that produces more than 40 watt of light, so these are all dim. And if we need lighting, then we have spotlighting or work lighting. For example, double lamps that illuminates the work area, but not your eyes, not your face. And then, all of my computers and our smartphones, they already have night shift or night light feature. So, they switch to orange color or dim down around 8:30 or 9:00.

Dave:

I want to ask about more of your work. I think that informs The Circadian Code, your book. You talk about a single gene that controls central timing system in the body and that pair of genes that keep eating and sleep in sync. Can you walk me through those genes and what they are?

Satchin:

Yeah. Well, there are, at least now, a dozen genes that form this circadian rhythms. Actually, the name of one of the genes itself is CLOCK. And this gene pairs up with another gene called BMAL. So this CLOCK and BMAL, they turn on other sets of genes, which are also called period, cryptochrome, REV-ERB, and

few other genes. And these genes turn on and it's like a ice maker in your freezer when the ice maker starts making ice. Yes, for next few hours, it will make ice until it reaches a level where it touches the sensor in the ice maker, so the ice making stops. So similarly, CLOCK and BMAL will drive these genes to some extent and then they will stop. Because this protein levels will build up and it will say, tell CLOCK and BMAL that is enough. Let's stop now and then the ice will melt. Or in this case, this protein level will go down.

Satchin:

So, this thing happens in every 24 hours. There will be buildup of this ice or these proteins. And then for the next 12 hours, they will go down. So, that seems to work almost in every cell. Every brain cell, every skin cell, every stomach cell. Every cell has the same circadian clock. But what is interesting is to... So then, the question is, what is the function of circadian clock? What is it really doing? What we think is... Clocks do a few things. One is it anticipates events. So for example, before we wake up, clocks in our brain and body work together to build up our day hormone. In this case, cortisol. And warmup your body, make your heartbeat slightly faster, breathing becomes faster, so that when you wake up, you're actually full of energy. So, that's why having a good circadian clock and good night's sleep makes you more alert and energetic when you wake up. Because your body can anticipate when you're going to wake up.

Satchin:

So similarly, it anticipates when you are going to have breakfast. So, as soon as you have your breakfast, your gut microbiome, your gut enzymes and everything is working in sync to digest that food very well. So, one is anticipation. And then, the second one is to separate incompatible process so that you don't feel hungry in the middle of the night. Because feeling hungry and sleeping are not compatible. You cannot eat while you're sleeping. That's a very bad combination. So similarly, a body cannot make fat and break fat at the same time. Our body cannot make cholesterol and break cholesterol at the same time. So, having these things to be done at different time actually improves productivity of our body.

Dave:

When women are pregnant, they're much more likely to wake up between 3:00 and 5:00 in the morning. And a lot of people who aren't pregnant, men and women, have this problem. They wake up and they can't go back to sleep, and their mind is racing and things like that. And what is happening in many of these cases is their blood sugar crash. They didn't have enough blood sugar to basically run the glymphatic system and to sleep. So the body said, I know how to make sugar. Well, let's secrete some cortisol. Maybe a little adrenaline because those raise blood sugar. Therefore, now I have enough fuel for the brain. Unfortunately, cortisol and adrenaline wake you up at 3:00 to 5:00 and you can't go back to sleep.

Dave:

So, the hack for that was... I found two different groups. Maybe it's a gene. I don't have the genetic testing to tell you what it is. But one group of people, they do some collagen protein, high in glycine and low in the stimulating amino acids that raise or wrecks in the same way modafinil does. Some of that with some ketogenic things, dare I say, brain octane, which raises ketones. They have enough energy that they sleep through the night. And then, the other half of people, they take a teaspoon or two of raw honey. And I found a study that showed it raised liver glycogen 22% more than cooked honey or other forms of sugar. And liver glycogen can feel the brain effectively versus muscle glycogen.

Dave:

So, I want you to try it out. If you're having this problem, a little bit of this before sleep can stop you from waking up because of the blood sugar stabilizing effect of honey. Not in hot tea because then it's cooked honey, but raw honey. Those are both eating before bed. They're small amounts. We're talking, 5, 10 grams. Is there some lower limit of food like that that's not going to break my circadian rhythm? Because I don't want to break my circadian rhythm, but I want to sleep all night. What do you do for that case?

Satchin:

Well, we haven't done anything like that because it's a moving target. People will say how much is small enough. The reason why that raw honey or whatever you're eating is going to your liver and is getting stored is because the whole system wakes up. So, we haven't done any research in that area. But what we have seen as people who do time-restricted eating, they do sleep very well. Maybe they normalize the way their body learns how much glycogen to store.

Satchin:

One has a very strong circadian rhythm where we go through a very regular habit of when we stop eating that our body will learn how much stored glycogen the body needs. Maybe that's what is happening because we see that people who do time-restricted eating, they always report that they sleep better. Particularly this waking up at 3:00. I used to wake up at 3:00 for an hour or two. And then, I thought that that was normal because there are so common. But then, quickly I realized that what is common is not normal because you need that continuous restorative sleep. Now it feels much better waking up after continuous sleep than waking up in the middle of the night and staying awake for one or two hours.

Dave:

All right, let's talk about astronauts. Okay. They seem like they're going to have the worst garbage circadian rhythm of any humans on earth, because it's always noisy in the spaceships and space stations. The lighting is junk light. It's pretty much the definition. There is no sunlight. And if there is, it's through heavily shielded lead-filtered windows and things like that. And they're on weird sleep schedules and probably gravity affects circadian rhythm too that we haven't figured out yet. What are we going to do to fix the circadian rhythm of astronauts? Put on your science fiction hat and give yourself a $10 billion. What would you do?

Satchin:

Well, the first thing is the circadian lighting. And in fact the International Space Station got new circadian lighting a couple of years ago. So these lighting will simulate, as close as possible, to daylight for 10, 12 hours. And then, switch to orange or red light at night. So, we'll see whether that helps astronauts. Long-term space flight is always a big problem. How are we going to sustain that long-term space flight? And this is where maybe time-restricted eating will also help because we know that astronauts may get better sleep if they are on time-restricted eating combined with circadian lighting. And maybe we'll also see whether the astronauts can go through slight caloric restriction. Because calorie restriction or reducing calories even with time-restricted eating will naturally push their ketone bodies. And that will help to keep their brain sharp because we don't want them to be dumb or we don't want them to be too tired.

Satchin:

So finding that sweet spot where they can, their body can generate enough ketone bodies to keep their brain working. And during fasting, they can also lower their core body temperature. And this will be a long-term study to figure out how to reduce metabolism with the modest trends that will reduce demand on oxygen, reduce demand on water, reduce demand on how much recycling they have to do. At the same time, stay at peak performance. And I don't see that the lifestyle that we have or not, eat whenever we want, and eat too much food, or get exposed to junk lighting, all of these things will help them. So, I think that may be the case. That may be the ideal situation where we can figure out the optimum circadian code to keep astronauts fully active and fully productive for very long time without compromising their health span, lifespan.

Dave:

You mentioned something important about caloric restriction. We know that eating too much of anything is bad, eating too much protein is bad, eating too many carbs is bad, and probably eating too much and certainly the wrong kinds of fat is bad. And eating too much fat that's high calorie so you're going too many calories is also bad. What is your take on longer fasts? Maybe even going to up to three or four days where you're just having water. I'll do water and black coffee because I mean, come on. But during that what is that going to do to my circadian rhythm? Is it advisable? How does that line up with The Circadian Code?

Satchin:

Well, the circadian rhythm still continues with a longer fast. And it actually goes through a longer rejuveness in a way. We haven't looked at longer fast in animals because animals don't like this very long fast water only fast for two to three days. And in humans, we know there are a lot of studies from other groups saying that longer fast are very good in reversing or managing many chronic disease. And we know that longer fast will activate autophagy pathway to much higher levels, so that will help longer fast. Also increase your ketone body production and that also helps. So all the indications are yes, longer fast, if you can do, are beneficial for the body. And it's not going to disturb the circadian clock because the circadian clock is an internal time keeping mechanism that continues even without calorie.

Dave:

You finished a 48-hour fast. Do you finish it with breakfast or finish it with dinner?

Satchin:

Well, when you finish a 48, or 72, or multi-day fast, breaking the fast is not easy because your body has forgotten food. You don't have that appetite for a big meal. So usually, you break it with a small meal.

Dave:

Well, is there anything else that you would like hundreds of thousands of listeners to know about their circadian biology about your work? I mean, you've done so much. But you've got a big microphone right now, help people with some stuff you know

Satchin:

Well, the thing is, last couple of years, few things that have come out that are very reassuring and essentially telling that timing makes healthy food junk. And the bottom line is this. Last year, there was a

study that came out from [Jorta Khahasi's lab 00:24:30] who is considered a leader in the circadian rhythm field because he discovered the [Zinn 00:24:38] clock. What he found was we know that caloric restriction is beneficial. But most caloric restriction studies in mice and larger animals are done in a way that the mice are given a chunk of food which is less than what they should be eating. And this chunk of food is given usually in the afternoon or evening. And mice eat that food within three to four hours every single day. So essentially, all caloric restriction studies done in rodents are mixture of caloric restriction and time restriction. If you eat at the wrong time, then you might not see sufficient benefit of caloric restriction.

Satchin:

There is another one from ketogenic diet in mouse. People think that a ketogenic diet will increase lifespan, so there are two studies done that came out last year. And in both studies, mice were given ketogenic diet ad libitum, whenever they can eat. Or in another study in one study, actually the ketogenic diet was given once a day. So, that means they were self-imposing time-restricted eating. And only when ketogenic diet was given once a day and they were eating all this food within 10 to 12 hours, those mice only saw some benefit of ketogenic diet. These mice sleep slightly longer and they had better health outcomes. But when the ketogenic diet was given ad libitum, so mice can eat whenever they want. Those mice actually had worse health outcomes compared to even mice that are eating normal diet, standard time. So, this is, again, another case where ketogenic diet, which seems to have a lot of benefit, has to be combined with time restriction.

Dave:

Yeah. You've got to do it right.

Satchin:

If we think about, say, mouse and rat study versus human studies, human study are worse because we don't have control over genetics or genotypes. And then, we cannot keep people inside and then feed them at the right time.

Dave:

I thought that's what's cool so far.

Satchin:

Yeah. So, this study has its own strengths and limitations. The nice thing about the mouse and rat study, whatever we do is we can be completely transparent about which particular diet source we used. We can even put the catalog number, so we know that this mice at that particular diet from this supplier. And then, the supplier has all the ingredients. Whether it was artificial, natural, and whatever source. So in that way, we know, in very detail, what kind of food this mice ate every single day. So, those are the kind of stuff we cannot do in human because it cannot keep track about the life history.

Dave:

Got it. So I think there's great data and knowledge in them. But if you take one study, I'm pretty sure that it didn't account for the cycle of the noon and all these other things that no one thought might matter but it might.

Satchin:

Yeah, yeah.

Dave:

Beautiful. Satchin Panda, your work is truly groundbreaking on circadian biology. I will never forget standing there in your lab and looking at retinal cells from a mouse on a high powered microscope, and grateful that you've come on the show and that you wrote The Circadian Code. And I've got a final question for you. How long are you going to live?

Satchin:

How long I'm going to live? Actually, I don't want to live too long because I'll lose many of my friends and-

Dave:

So, even if you felt like you do now where you have your energy, your body, your mind, you're not in a walker, you know your name, you don't put your keys in the refrigerator. All those things. Still, [crosstalk 00:28:23] alive?

Satchin:

Yeah. I really don't want to put a number there. Because one thing is we still know that our genetics play a big role in longevity and that's something that we don't know. In my lifetime, I don't think we can change, by CRISPR or any other technology, hundreds of thousands of genes to change my lifespan.

Dave:

Thanks for being on the show. Thank you for your work. If you like Satchin Panda's knowledge, you got to read The Circadian Code. And also, you should get myCircadianClock. And Satchin, what's the name of the other app you mentioned? The lux app?

Satchin:

myLuxRecorder.

Dave:

I have a $10,000 light sensor that's part of the TrueDark company's research and all. But it's too of a pain to walk around with it. And also, I never do. And it's at their headquarters and all. So having you on my phone, you just made my day. Satchin, thanks again, man.

Satchin:

Thank you.