DANNY LENNON: Michael, thank you so much for taking the time to talk to me on the podcast today.

MICHAEL GRANDNER: No thanks, I really appreciate the opportunity.

DANNY LENNON: Maybe just to lay the groundwork for people, can you explain some of your own background, the work that you're involved in, and your main areas of focus with work and research?

MICHAEL GRANDNER: Sure. I'm a clinical psychologist by training, I am the director of the sleep and health research program at the University of Arizona, and also the director of the behavioral sleep medicine clinic here in Tucson. I am an associate professor in the Department of Psychiatry here with joint appointments in a few other departments like psychology and medicine and nutritional sciences and clinical translational science. My background is in sleep and circadian research. My main focus is looking at real world implications of sleep and health. So this means downstream impacts of insufficient sleep and poor sleep quality, things like how does lack of sleep lead to things like poor health, cardiovascular disease, obesity, diabetes, depression and cognitive problems, work productivity loss, things like that. And on the upstream side, trying to understand how and why people sleep the way they do in the

real world, what drives sleep, what impacts sleep in a real-world setting, and then bringing those two things together to figure out what we can do, how we can make it impact and improve health and well-being by improving sleep.

DANNY LENNON: Yeah, and I think that's actually a great segue into where I wanted to start the fact that you mentioned both looking at those downstream and upstream effects, and I think so often now we can focus on a lot of the physiological processes around sleep and how that can lead to health issues which is obviously great. But on that other factor, one of the big things I've taken from some of your publications that I've read is making people aware beyond this physiological processes how sleep is also socially driven and can be impacted on by our environment and things that are related not just to the person but to societal factors. And I think in one of your papers, in particular, you talked quite at depth about how we can look at factors related to the individual level but they are also embedded within a social level and that gets embedded within a societal level. Can you maybe explain some of that model for people who haven't came across some of these ideas before?

MICHAEL GRANDNER: Sure, yeah. I mean, the thing about sleep is it's a lot like diet, in that, it represents a biological need that is met by engaging in behaviors. Unlike breathing, it's not passive, you have to do something. So you have to eat. And because you have to eat, that means that you have to get food and you have to have time to eat, and so that's why we have food being something that's partially socioeconomically driven and environmental and cultural. And what you eat, and when you eat, and how you eat, and with whom you eat – all of these things are driven by some of these other social, environmental and historical factors. And the same thing with sleep, where, when you sleep, and where you sleep, and how you sleep, and what you believe and think about sleep, these are ideas and

practices and behaviors that come out of context. So in terms of the model, so when you think about how you slept last night, so what drove that – well, one thing that drove that were things about you, your own genetics, your own biology, your own beliefs, your own attitudes, your priorities, your behaviors, your health, your psychology, all of these things drove your choices and behaviors around sleep last night.

However, you don't exist in isolation. These individual level factors are embedded within a social level, so the social level includes things that exist outside of you, like if you ceased to exist, they would still be there, but you are a part of them, the things like your social network, things like your job or school, your family, your neighborhood, your religion and your culture, your socioeconomic status – all of these things about you that you are a part of, you are a person within, and what they do is they actually shape many of these individual level factors, things like your job often shapes when you have to get up in the morning and when you can go to bed at night, or your family responsibilities, what you're doing before you are able to go to bed or get out the door in the morning, things like who you live with, who you sleep with, what sort of noise and environments in the area depending on what kind of home you're in, who else is there, what neighborhood you're in, your beliefs and attitudes and priorities about sleep are taught to you by your friends, your parents, your job, all of these things that exist outside of you filter into you and dictate some of these individual things.

And even still, these social level factors exist in the context of societal level factors. So what I mean by that, these are things that, if your social level factors cease to exist, if your workplace disappeared tomorrow, and your school ceased to exist, and all your friends disappeared, and your family ceased to exist, what would still be there? Things like

technology, like public policy, like geography, 24/7 society, globalization, racism, all of these sort of larger issues that all of these individual social level things exist within where the individual people exist within those, they also drive sleep. So, for example, looking at mobile phones and smart phones, so many people have a mobile phone in their room – well, they didn't 20 years ago, and it's not a coincidence, technology changed, which changed jobs, which changed families, which changed how social networks communicate with each other, which changed the individual's behavior and beliefs and practices around that technology, which changed their own behaviors related to sleep last night, right; or the fact that globalization exists and you can get on the phone at 2:00 a.m. and call customer service for something and somebody somewhere in the world will pick up and log in and answer your question; or if you want to buy something at 3:00 in the morning, you can; or if you need to go to the hospital and it's the middle of the night, the hospital has a staff emergency room. So there's all these things in society or maybe you live in a place that's remote and it requires you to drive two hours to get to work every morning – well, that's going to change your sleep. Your geography changes things.

There's all kinds of things that filter into how these social level factors influence the individual. So taken together, you have the individual level stuff embedded within the social level stuff which is embedded within the societal level stuff and that is what filters down into the bedroom. And what that means is if you want to understand how somebody sleeps and how sleep exists in someone's life, you can't just look at their own individual behaviors, beliefs, and practices. You have to look at them in context. It doesn't mean you have to change society to improve sleep. But what it means is that if you ignore the role of these things, you're going to be – it's going to be ineffective. So for example, if I have a patient who comes in, says, I'm sleeping five

hours and I'm exhausted because I'm a shift worker, what am I going to say? It's like, well, it's your fault that you have a job that requires you to sleep less, just change jobs. Well, if that were that simple, more people would do it. So you have to understand the context.

DANNY LENNON: And I think that really opens up or just exposes people to how complex the web of those factors are, because I think the parallel with nutrition is a really useful one because again you can have this narrative of we're going to place everything on personal responsibility on one hand, whereas really when you start looking at all the other factors that will dictate someone's even ability to make decisions around food and what they likely are going to be, it doesn't make sense that everything boils down to this over simplistic personal or personal responsibility or an overly reductionist focus on just the nutrients and thinking of a nutrition in that way. So I think the parallel, as you've explained here, can be very similar within sleep and going a long way to explain some of those. So maybe to give people an idea of where we are in terms of maybe some of the literature in this area, there are so many interesting aspects to this. First, I think, if we're talking about both the societal and social level, what do we know about say the impact of socioeconomic status on sleep in general – and then maybe we can go into some specifics after that.

MICHAEL GRANDNER: Yeah, so socioeconomics is a major driver of sleep. I mean, everybody listening should think to themselves about how socioeconomics impacts their own sleep, and I think everyone can come up with something, whether it's a matter of how their environment is shaped or what choices they have or don't have. So for example, there are many studies now that show that, on average, if you're poor, you're sleeping less, and you have more sleep problems. It's not because money buy asleep. It's more likely because money buys a quieter neighborhood, a job with more flexibility maybe, or access to healthcare, or a better school for your kids, or a

better education for yourself which might land you into a better job that might have more flexibility, or you can – so there's a key issue with socioeconomics in health is this idea of autonomy. So people, what money can buy is autonomy. It buys choices. It buys control.

So let's say, there are some people who work in jobs so they get a paycheck and it's direct deposited into their account, and that way they don't have to worry about finding a check cashing place that's taking a fee out of their paycheck that only gets released after a few days – like, there are all these sorts of limitations that get put on people when they are socioeconomically disadvantaged that just make life harder. It's harder, it costs money to be poor, where at least here in the US, it's very difficult. And it usually means, look you have fewer choices, you are more at the whim of the system where this must be deposited in person and this person by this date. You lose flexibility, and when losing that flexibility often means losing control to some degree over how you're allowed to spend your time because time gets eaten up by some of these other things. So I don't think that money buys sleep, but what I do believe is that money buys choice, money buys flexibility. And that's also why when you see people at the highest end of the socioeconomic spectrum, a lot of them aren't sleeping well either. You look at CEOs and other powerful people, a lot of them aren't sleeping very much. And I think that it's for the same reason where for those people might seem to at least, I don't know that many of them, but they seem to when they talk about sleep, talk about it from a perspective of a lack of control. I wish I could sleep more, but I'm just too busy, I have too many things, I have to, if it's a doctor, I have to work these 36-hour shifts; or if it's a CEO, it's saying I have to be on in all these different time zones at once holding meetings and there's no time for sleep in there, or whatever. So even on the upper end of the socioeconomic spectrum, it seems like the link

between money and sleep has more to do with control than it has really to do with money.

DANNY LENNON: Super interesting. There was also another example of how some of these factors go probably undetected by most of us because, or at least, I wouldn't have originally thought of some of them. So with socioeconomics to some degree, as you've lined out, there are some clear explanations as to why that makes sense. You also talked about, I believe, it was a study out of Michigan perhaps, that was looking at the impact of discrimination, and I think specifically racial discrimination in this case that had an impact on sleep. But the interesting thing is it seemed to be independent of sociodemographics, and it also seemed to be independent of mood state if I remember correctly as well, which kind of throws up that there's this distinct thing about people experiencing discrimination which is not something I think a lot of people would even consider. Can you maybe touch on that a small bit?

MICHAEL GRANDNER: Yeah, so we've done a number of studies in this area looking at racial discrimination, and racism itself as something that drives lack of sleep. It seems to be independent of age, sex – it actually seems to be independent of race ethnicity. Even though there's some groups that experience racism far more than others, the impact of that experience on sleep seems to be somewhat universal. And it seems to be that it does something about impairing sleep more than what it does to just – it makes you depressed and defeated and stressed, where when we control statistically for levels of stress or levels of mood in some of these studies, we show that people who are experiencing discrimination sleep worse. All right, well, what if we factor it – so imagine a Venn diagram where one circle is exposure to racism and the other circle is the experience of poor sleep and there's an overlap. Now imagine we statistically remove every part of that overlap that had to do with demographics and let's see how much

is left. Then if we remove every part of that overlap that was explained by whether someone was depressed or not, or whether they're feeling down, or whether they were highly anxious and just stressed in general and the degree to which it led to or was overlapped in some way with those things, when you remove that, statistically we ask the question, is there anything left. And the truth is, it looks like there is, it looks like there's actually quite a bit left, it looks like there's something that the exposure to racism does that impacts sleep more than just socioeconomics and mood and this general mental health.

My guess is that it's complicated, in that, exposure to racism often means connections with health in lots of sort of diverse nonspecific ways. So for example, just because you're measuring someone's stress level might not capture the degree to which a person grew up in a stressful place which changes how your body handles stress, which changes how your body reacts to things. Or it might lead you to just having more difficulty to take care of yourself, where, let's say, you're exposed, so that one paper in particular was looking at specifically racial discrimination in healthcare settings. Well, if you're experiencing racial discrimination in healthcare settings, maybe one of the reasons you're not sleeping well is because you're not getting as good care for your health which might lead to sleep for example. Or maybe it's because there are other things in your life that follow that might overlap with this pathway, but still explain things that are different. And I think you hit on something important that it's not a simple story when you're talking about sleep. That just because somebody is exposed to something like this or another example of something that seems to impact sleep quality very strongly for reasons we don't seem to be able to explain is actually demographics. So for example, if you're an American who is African American, you are more likely about, depending on the study, may be about twice as likely to be getting six hours

or less of sleep – even after you control for socioeconomics and age and employment status and health and obesity levels and healthcare access, there still seems to be something persistent driving a difference.

And we can't seem to figure out what exactly it is, it's probably a combination of a lot of things that might manifest differently in different people, it's clearly not genetic because the evidence shows that there's much more genetic variability within the group than between groups. There's no systematic genetic reason why this would exist. So there's something environmental, something behavioral, something that's driving this or some combination of things that isn't just simply explained by, oh well, you're just more stressed, or your life is just more stressful, or you're just overreacting to things.

DANNY LENNON: Right. And so over the past few years, I think one of the more useful things that has come out within, let's say, pop science or popular health information has been more of a focus on sleep and at least people being aware, hey, this is an issue and you will see things like we have this sleep epidemic now and people are sleeping less than ever and there's all these negative health consequences. But in terms of, to address something like that and address all the negative health impacts that are occurring because of this high prevalence of sleep issues, based on some of what we've discussed it would make sense that probably the bottleneck in a lot of cases isn't just knowledge, it isn't information of, hey, we just need to tell people about these things related to sleep hygiene. So do you think that in order to do something really at a population level, it has to not only just be that kind of bottom-up approach of giving people the right information but really the bigger issue is probably top-down how do we address some of those, I suppose, disparities at a social and societal level before we can even think about improving someone's sleep?

MICHAEL GRANDNER: Exactly. I mean, education is extremely powerful and extremely useful, and without it, it's hard to start anything. It's like breathing is the basis of like every relaxation technique in yoga, in meditation and everything. You need to have that to be able to do all the other things. So you need education, but that's just a place to start. If education was the solution, nobody would smoke, everybody would eat three to five servings of vegetables every day and everyone would get thirty minutes of physical activity every day. I mean, if telling people what to do and showing them that it's good for them changed behavior, then it would be easy. The truth is it does for some people, the people who have the opportunity and the ability and the scaffolding to make the change do. But it turns out, for most health behaviors, that's not enough most of the time, and that's where you get into health behavior change theory where there's decades of work done in diet and exercise and smoking and alcohol and all these other things that people do that aren't healthy. So how do you change behavior? Turns out, it's very hard. And one of the reasons it's hard is because life is complicated. And lots of people smoke, even though they know it's bad for them, why? Not because they're stupid, not because they're not motivated to quit, it's because there's other reasons. And sometimes we have to understand not just what the scaffolding is and what the infrastructure is to help people make a positive change – as you mentioned, we also have to understand what is in the environment that's setting them up to fail, what is in the environment that's making change hard, and is that modifiable, is there anything we can do to make things reasonable and easy.

So for example, if you've got a shift worker, telling him to sleep more is not going to change anything. If anything, it's going to make you look like you don't know what you're talking about because you're trying to tell a shift worker that not to work at night and to sleep

during the night. Well, all of a sudden, everything you say is useless at this point. What you need to do is understand, okay, well, maybe not everybody needs to be told, maybe just telling people that you know what you shouldn't work shifts; well, okay, well, I like to eat, so now what? Well, if we stop there and we don't address these things in the environment going on, whether it's discrimination, whether it's access, whether it's increasing self-efficacy and sense of control, I think that's really where we need to go is understand what are the actual bottlenecks. Is the bottleneck that people don't understand? If so, okay, let's start with education. But what if they do understand and feel like they can't? So here's a great example, athletes, pro-athletes, college athletes – so that's another group that I've done some work with, and they are a great group to work with around sleep because they often don't sleep very well. They usually wake up very early, whether it's to for training, swimmers start at 5:00 in the morning and the pool, it's crazy how early a lot of them have to get up to train, especially the college athletes, they're still taking classes and turning in a homework at midnight, so their ability to sleep is highly constrained. And so when you talk to an athlete, whether it's a pro athlete or a college athlete, a lot of times they'll say like, look, I just don't have time for sleep, I can't, because of the things in the environment out of my control that impinge on my ability to get sleep, whether it's my schedule, whether it's training, whether it's the fact that I'm 19 and my biological night didn't start until 1:00 in the morning as opposed to a 40-year-old where it starts at 10:00 or 11:00.

So there's all kinds of things at play here and when you say, hey, maybe go to bed an hour earlier, you're saying, hey, maybe give up the one hour of the day that you actually have some mental control over for yourself. It's quite hard to do. And so how do you get an athlete who's otherwise in good health? How do you get them to sleep more because lack of sleep, it slows you

down, it impairs mental health, impairs mental performance, and physical performance, these are things they all care about, they want to be able to improve these things, but they feel like they can't. So what do you do? And actually what we've been focusing on is you start with education, because sometimes people hear all kinds of stuff that may or may not be true. And so you start with education, and then you actually identify, in every group it's going to be different. But you start identifying where are the barriers, and what do they not have control over, and where actually can you insert some control even if people didn't realize it.

So for example, one of the things that that we work with, not just with athletes – actually, if you ask me what is the number one best bang for your buck sleep tip to improve control over your sleep and to maximize your sleep, I would say, it's stimulus control. And basically what it means in a nutshell, and I can explain in more detail if you want, but in a nutshell, it's if you can't sleep, get out of bed, because you're not sleeping anyway, and by spending extra time in bed awake, essentially what you're doing is you're programming your brain to just be awake more in bed and you're training yourself that the bed is a place to wake up, so whenever you get into bed you feel like you can't slow your mind down because you trained it by being in bed awake. So actually the key is, tonight, actually get up, maybe even sleep less, go back to bed if you think you can, but the point is to not spend time in bed awake, so that tomorrow and in the future and over time the bed is so thoroughly paired to sleep that you might actually even be able to go to bed early when you're not even tired to catch some extra sleep and you can do it, for example. So a lot of times people who say they don't have enough time to sleep, actually they find time and they were already spending it in bed anyway, we just helped make their sleep more efficient, as in one example.

DANNY LENNON: The reason I was jumping in was just it was such a good example how you illustrated how we can essentially program someone that the bed when you're there is for sleeping as opposed to that you're there to be awake and you're doing things. And I was going to say, presumably that makes it a doubly bad idea for what a lot of people will end up doing is they will get into bed but then spend a couple of hours watching Netflix on a tablet or something where they're – so it's like the technology on top of also cueing themselves that, oh I'm doing other stuff apart from sleeping here.

MICHAEL GRANDNER: Well, there's three things that screens do to sleep, and they work in three different ways. The first one is light, you've probably heard a lot about light and blue light and whatever coming from screens. And that's because when that light hits the eye, it sends a signal to the brain that it's daylight, and when your brain is thinking, no it should be nighttime, it gets confused, and sometimes it can make it harder to fall asleep and wind down. The second thing that screens do, in addition to light, is the mental activation. I mean, they're built to be stimulating, these apps and programs and whatever, they're built to hold your attention, and so they become mentally stimulating, which means sometimes it could be rather than watching screens to relax, you're actually getting more amped up, rather than more relaxed, and so, then it takes more time to wind down. The third thing that screens tend to do for sleep is time displacement. What that means is you lose sense of the passage of time where you're not aware of a half an hour going by, it goes by in a flash. And you could be, like you were saying, you could be watching two hours of shows on something, and next thing you know, two hours has gone by and you hardly even noticed, when you could have turned it off an hour ago, gotten an hour more of sleep and your life would have been no worse for missing whatever that episode was. But we lose sense of the passage of time, which also

means we lose sense of our ability to tell when we are getting sleepy.

So that's what screens do, so it's the idea of programming though, think about it this way – here's an example, think about going to the gym. So anyone who goes to the gym, even if you go in the morning and you're tired and you're kind of not in the mood and whatever, once you cross the threshold and get there, you can usually – most people can just make it through whatever their routine or their workout is. They usually don't have to stop halfway through. They can make it to the end. And then maybe they're tired or whatever or hungry or whatever, but once you cross into that place, it can carry you through, the place itself has the ability to help get you into the zone to stay there and to maintain and to do what you want to do there. And one of the reasons is, is that you don't do other things there, you don't eat lunch there, you don't socialize there, you don't watch movies there, you don't do work there, you don't do other stuff there. All you do is work out or go to your class or whatever, it's a very limited set of possibilities happen once you cross that door. And that is the key – the fact that your brain has a very limited number, or your brain and body recognize a very limited number of choices, sets you up for success. So for example, it's the same thing of why people hate going to the dentist, where, when you go to the dentist and you have a terrible time in that chair, your brain learns very quickly that sitting in that dentist chair bad things happen. So you very quickly learn that as soon as you walk in the door and sit in the waiting room, you're already in a bad mood. Nothing happened yet to trigger that bad mood, you just learned that that place is what provides – is inevitably going to lead to a bad mood, so you set yourself up for it. And it even gets the point where you're in a bad mood and you got in the car and didn't even get there yet, because you know what's coming, you learn – you learn that once you're there, there's a very limited number of things

that are going to happen. And the dentist's office, for some people, it's all stressful.

And in the gym, you're going to get through your workout. So just getting there has the ability to put you in a mental and physical state. You could be in a great mood before you were going to the dentist, you had a wonderful day and then all of a sudden you're like, aw, crap, I got to go, and your mood changes; or in the gym, you could be totally exhausted, you walk in the door, you can make it through, and that's because the place has the ability to put you into that mental and physical state. That's what you want to do with the bed and the bedroom: you want the bed to be the place like the gym, you only work out there; like the dentist's office, you have that reaction there because you learned it, it's consistent. And so you want the bed to be a consistent place where you're sleeping. If you're not sleeping, you get out, you don't allow that connection to form, because what happens is people who can't sleep, spend a lot of time awake in bed thinking or doing whatever, sometimes worrying, sometimes they're just thinking about stuff, and they can't seem to slow their mind down. Well, that's because you spent so much time there that even if you're falling asleep on the couch, then you get into bed and you feel wide awake. Well, you trained yourself to do that. The bed became, instead of the bed becoming the place for sleep, it became the place for all kinds of stuff, so the ability for it to trigger a sleep response got diluted and then it got replaced by the thing that became most reliable which was actually thinking, not sleep. So when you got into bed, you quickly learned that I get into bed, I'm going to start thinking; I get into bed, I'm going to start thinking. Well, eventually you learn that pattern, so you get into bed and you start thinking, because you learned that pattern.

DANNY LENNON: So would an example of maybe something someone could do, let's say, they're in bed but their mind is racing and they're awake, if

they're going to get out, presumably rather than just go and do any sort of stimulating activity or getting a big blast of light if it's during the night, maybe they get up, they go and sit in a chair somewhere, maybe do some breathing or meditation or whatever, maybe just sit there until they start to feel tired again, and then that's the time to return to bed, would that be an example?

MICHAEL GRANDNER: Yeah, I mean, that's a great example. The key thing to remember, and this is actually good news and makes things easier, the most important and most helpful thing you can do during that time is let time pass, because as you're awake, you build up pressure for sleep; like from the time you stop eating, you start building up hunger; and the longer you go, the more hungry you are; and when you eat, that hunger dissipates. Same thing with sleep: as you're awake, you get this internal pressure for sleep that builds and builds; and as you sleep, that dissipates. So if you want to build up more sleep pressure, all you have to do is just be awake. Actually, it mostly doesn't matter what you do. If what you do is in dimmer light, it'll make the process easier. If what you do is mentally relaxing, it makes the process easier. If what you do is even meditative and helps bring you back to sleep, it makes that process even easier. So not only do you have the increased sleep pressure which is probably the most important thing, but you also now have something else in your favor which is increased relaxation or decreased melatonin suppression from the light or whatever.

So when I tell patients what to do in the middle of the night, I say, I kind of don't care, except you let enough time pass that you're ready to try again, and you could fail – if you go in and you know sleep isn't coming, just get up again; if you think sleep is possible, give it a shot. Try to avoid anything other than dim light. Try to avoid anything that's too mentally stimulating. Try to avoid anything where you're going to get too much time displacement and you're going

to lose an hour and not even realize it, because you might even be getting sleepy and you won't even notice because you're too distracted. And try and actually the one other thing is try not to do something that's too enjoyable, because if it's really enjoyable, we get these reward centers that fire in our brain when we do something that's fun, that we enjoy, or if we feel really productive, or wow I cleaned out that whole closet, or I got all this work done and no one bothered me because it was the middle of the night. If you're super productive or you do something that's really rewarding, you get that reward signifier, which is fine. But then if you keep doing that, if you get up, if you have this awakening at 3:00 in the morning and then you do something awesome and you really enjoy it, and then you have another awakening at 3:00 in the morning and you do something that you really enjoy it, after a few days your brain's going to be like, ah, I get it, if I wake up at 3:00 in the morning, I get rewarded. So even if you could sleep, you end up waking yourself up. So you don't want to do that. You don't want to train yourself to wake up. You want what you're doing to be boring enough that it's not going to be too enjoyable or too rewarding or else it might backfire.

DANNY LENNON: That's really useful and instructive. Michael, before we finish, I did want to briefly touch on the area of mental health and sleep, because you've published some really good stuff in this area as well, although this could be a whole discussion itself, so I realize I'll probably only be scratching the tip of the iceberg over a couple of minutes. But one thing that I really wanted to ask you about, because I think this sometimes can be a bit confusing to piece through depending on where people are looking for information, is they'll be made aware of there are links between various different mental health issues and sleep, and of course each one of those is distinct so whether we're talking about depression or a suicide risk which is a lot of the papers you publish or any other aspect, anxiety, or so on, there's different

associations with sleep – one thing that I want to get your take on is, do we know exactly what way that arrow of causation is, is it going from one to the other, is it bi-directional, how should we view what that association actually is? And I understand that's a very broad question that may be difficult to give an exact answer, but what would be the initial thought?

MICHAEL GRANDNER: Well, the evidence seems to suggest that it's highly bi-directional, and what that means is if you're in a bad place mentally, there are two things that that will do that will disrupt sleep. One is that it could cause increased levels of arousal. So this is where things like anxiety disorders and even sometimes depression and PTSD and lots of other aspects of mental health, you get elevated arousal. Sometimes that has to do with, you're just more worried or you're more tense or you're more on edge, that can elevate arousal which then can get in the way of sleep for obvious reasons. Another thing that it can do is it can elevate uncomfortable mental activity like worrying and ruminating and obsessing and things like that, which make it hard to detach and let go and get to sleep. Another thing, on the other end what mental health does to sleep is that sometimes what it does is it alters, it plays a role in how the brain even regulates sleep and wake. So the sleep/wake system, there's actually a sleep system and a wake system, and there are a lot of neurotransmitters involved in the sleep and wake system whether it's serotonin, melatonin, norepinephrine, dopamine, GABA, all of these things are involved in sleep wake regulation, and many of them can be disrupted by mental health issues themselves. So those are ways that poor mental health leads to worse sleep. I mean, it's not rocket science to think that when you're really stressed out, you don't sleep well. Well, there's actually a biology to that. But it doesn't just go that way, that lack of sleep actually makes mental health problems worse, partially because sleep plays important roles in mental organization, emotion regulation, emotion recognition, and things like cognitive

function and ability to get through the day and energy level and fatigue. So fatigue is something that goes with mental health and with sleep loss. They go together and they could start feeding each other.

And similarly, when you disrupt sleep, you can disrupt your ability to regulate mental health optimally. So which is why I can lead to that. So some further evidence to that is that lack of sleep or insomnia specifically are key risk factors for the development of depression and anxiety disorders especially, such that if you take someone who is not depressed or have anxiety – and another key domain is suicide ideation – if you get somebody who's not suicidal, not depressed, not anxious, give them insomnia, they are more likely to become depressed, more likely to become anxious, or more likely to become suicidal. The suicide one is of particular interest to me, because it's a public health problem to a degree that most people don't even realize that, for example, here in the US at least which is the data I'm most familiar with, suicide is the second leading cause of death at least according to most recent statistics I saw for every age group between 10 and 34; and it stays high, it's just not second after age 34. The fact that it's so common and we actually have a risk factor, so people who aren't sleeping are about three times as likely to think about suicide but they're also about three times as likely to attempt, even though there's a big difference between thinking and attempting, the risk is parallel which means that there's something going on and we're trying to understand what it is right now. But the fact that it leads to it and actually there's data that shows that when you track changes in depressed mood and insomnia over time in people who have a history of suicide ideation, it's actually the worsening sleep predicts worsening suicide ideation over time better than worsening mood in overall, some people both individual and a group, but on average, changing and worsening sleep predicts worsening suicide ideation, worsening

depression, and worsening other mental health outcomes more than the things that you think would be obvious, which to me says there is something causal because it's predating it and it's predicting it.

And the key here is it's actually modifiable, we can actually help people sleep better. We have treatments like that CBT-I, Cognitive Behavioral Therapy for Insomnia which is safe, has long lasting benefits, it still works months and even maybe years after you're done with therapy without medications, and it's a recommended first-line treatment for insomnia. We have these tools where we can actually help most people sleep better, and I think that's a message that I think is hopeful and important to know that poor sleep isn't in a sentence of inevitable poor health and poor mental health, what it means is you have a fixable problem, and if you ignore it, things may get worse. But if you don't ignore it, we actually have strategies that will really work.

DANNY LENNON: Yeah, I think that's so powerful, that whole area is fascinating and I'm going to link up in the show notes for people listening to some of the work that Dr. Grandner has published in this area if you want to dive in more into it. But also that it's such an important idea for people to realize that this is something that can be done, there are interventions rather than running these narratives that some people do of just saying, oh I'm a bad sleeper, that's the way it's always been, it will always be that way; and almost telling themselves there's nothing that can be done, so I think that idea alone is massive. I could talk about this stuff with you forever Michael, this is so fascinating. But to respect your time, we're going to start wrapping up. Before I get to the very final quick question, for people who are interested to know more about your work, what you're doing, where can they go online to find more information about you and the work that you do?

MICHAEL GRANDNER: So first I'd say, go to my website michaelgrandner.com. I've got all kinds of stuff there, information, and people can sign up and I send updates and stuff sometimes. Also, you can follow me on Twitter, just Michael Grandner. I regularly put out new findings and stuff that's interesting and important, at least in the sleep field if you're interested in following sleep. Check those out and see if they're useful for you.

DANNY LENNON: Perfect. And for every one listening, I'll of course link to that in the show notes, and Michael that brings us to the very final question, a quick, although large overview one, so apologies for the broad nature, and this can be completely divorced from anything we've discussed today, although it can be related if you wish and it's simply: if you could advise people to do one thing each day that would have a positive impact on any area of their life, what would that one thing be?

MICHAEL GRANDNER: Given that I already mentioned stimulus control, that's my first go-to answer. My second one would be give yourself enough time at the end of the day to wind down. When you're driving and you need to make a right turn and go in another direction, you have to slow down first. You can't just change directions without changing your speed. And if you try and do that, if you try and take an exit on the highway without slowing down at all, you're going to miss your exit, right? And we know this, and nobody's going to say, you know what, cars should be able to take an exit without slowing down at all, and the faster you're going, the more you have to slow down, and the more space and time you need to give yourself to brake – we know this, we instinctively know this, we experience this and we don't question it, because it makes sense, but we don't do it for ourselves. So we spend our day very busy and distracted with all these things we need to do and we expect to take that right turn into sleep without tapping the brakes first. So what happens is we get in too bad, we're still going

full speed, and so by then we start hitting the brakes, and so we eventually slow down and maybe get to the point where we can fall asleep, but it's better to do that before you get into bed because you're going to take that time anyway – your car needs to slow down, no matter whether you started tapping the brakes at the point of your exit or whether you did it enough time before to slow down. So if you take the time to slow down, wind down before getting into bed, you recognize that it's an inevitability anyway, and you can get to the point where you get into bed and you can fall asleep quickly. When people say they can't turn their mind off, it's probably because what started the process was they got into bed before their mind was slowed down enough. And so, if I had to give people one piece of advice, besides stimulus control and getting out of bed if they can't sleep, it's remember that your brain isn't a light switch, it doesn't just turn on and turn off, you've got to give yourself some lead time to wind down or else that's going to take it anyway and it's going to take it in bed where it doesn't belong.

DANNY LENNON: That's incredibly useful and I appreciate you for sharing that. So with that, Dr. Grandner, let me say, thank you for this conversation, it's been both a pleasure and also an honor to be able to talk to you especially after reading through your work now to be able to talk to you about it. So thank you for giving up your time to do it, but also for the great information you've given today, it's been a pleasure.

MICHAEL GRANDNER: Thank you very much