

**Project Sleep Podcast**  
**“What’s Light Got to Do with It?”**  
**(Sleep Insights Series Episode 4)**

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**Dr. Till Roenneberg** is a professor of chronobiology at the Institute of Medical Psychology at Ludwig-Maximilian University (LMU) in Munich, Germany. Dr. Roenneberg’s research explores the impact of light on human circadian rhythms, focusing on aspects such as chronotypes and social jet lag in relation to health benefits.

The Sleep Insight Series invites listeners to learn about this amazing adventure we take every night called sleep. Through these insightful discussions, we examine sleep, and our societies beliefs about sleep, from a variety of angles. We hope you'll learn some cool new facts and analogies that you can use to help us raise awareness about this under-appreciated one third of our lives. This is a written transcription of the podcast “What’s Light Got to Do With It?” (Sleep Insights Series Episode 4) from Project Sleep. Transcription provided by Mirela Starlight.

Project Sleep is a 501(c)3 Nonprofit Organization, dedicated to raising awareness and advocating for sleep health, sleep equity and sleep disorders.

*All guests and speakers express their own opinions. While medical diagnoses and treatment options are discussed for educational purposes, this information should not be taken as medical advice. Each person’s experience is so unique, which is why it’s so important to always consult your own medical team when making decisions about your own health.*

**Julie in intro:** How much light did you get today? Not a typical question we ask ourselves, but maybe we should be. In this fascinating podcast, Dr. Till Roenneberg explains how powerful light and darkness are in setting our internal clocks. And how industrialization has shifted how we use light. We discuss how variable our internal clocks can be, and the importance of figuring out if you’re a lark, an owl, or a dove— or my personal addition, the peacock.

**Julie:** Hello everybody! Dr. Till Roenneberg is joining us from Germany.

**Dr. Roenneberg:** Hi, it’s evening already here.

**Julie:** Thank you for staying up for us. I'm really excited here. I have the book that Dr. Roenneberg wrote and hopefully someday I can have him sign this in person. I actually saw Dr. Roenneberg on social media, someone else had taken a picture of the comment that you'd made in their book and how they cherish that. And I believe you said something to the effect of, sleep is not the enemy of wake, it's the thing that makes it possible, or something like that.

**Dr. Roenneberg:** "Sleep does not take away from wake, it makes it possible."

**Julie:** I just love that. I just— that's such a beautiful message. So, hopefully someday you're going to sign this for me. And, so Dr. Roenneberg is really an international leader on this topic of chronobiology and we're just so lucky to have him with us. He is a professor of chronobiology at the Institute of Medical Psychology at Ludwig Maximilian University, is that correct?

**Dr. Roenneberg:** Yeah, but we call it LMU, that's much easier.

**Julie:** LMU, in Germany. We're really excited to hear what you have to share with us about chronobiology and social jet lag, so take it away.

**Dr. Roenneberg:** Okay, I take it away and I already criticize you, there is no time change. Time has not changed tomorrow, only the clocks. That's something that one has to really take into account when we talk about DST. But let me explain why I think you wanted me to speak on the topic of sleep and space— because one has to understand that besides being tired and having been awake for quite some time, there's another very important factor that controls when you are able to sleep and that is the circadian clock, our body clock. And many people know that they have a body clock, but very few people know what drives this body clock and what sets this body clock and how variable it is, and— how much it differs between individuals. And, I want to talk about this a bit.

**Dr. Roenneberg:** So, I'm not going to go into the details of the circadian clock, but basically it is a 24 hour clock or a circa 24 hour clock. It's a biological function, a biological program— that produces an internal day. Now why would one do that? One does that because one would like to predict things. It's one of the few biological functions that has been invented to actually predict things. Predicting things is very, very simple when you can predict things about the environment. If I would ask you to bet with me what the next lottery numbers are, it would be very hard for me to convince you that I know that. But if I would bet with you that the sun will come up tomorrow morning at a certain time, it would be very easy for me and you shouldn't go into any bets with me because that's something that we really can predict. And since our world is shaped into daily spaces of different temperatures, different light, different resources, different animals, different enemies— and so forth, we— our biology wants to predict what's going to happen. And in order to predict something, we know that— if we have to catch a plane, or a train, our clocks predict when this train will leave, when we consult the clocks— so that we know when we have to leave. It's a prediction. Because if it's not a prediction anymore, but the past, we miss the train or we miss the plane. So, the internal clock does nothing else, but the external clock that we carry around on our mobiles, or around the wrist— it predicts what is going to happen and it structures the day into a certain structure. And, the most important thing that one has to learn about this clock, that basically the only thing that can set this clock, is light and darkness. And light and darkness have changed enormously over the past decades. Of course, not light and darkness have changed so much, but the way we use light and darkness.

**Dr. Roenneberg:** Now, in the old days, before we had an industrialization and before we had electrical light, or artificial light— we had practically no light during the night, after sunset— and we had an enormous amount of light when we went outside, which most of us did, in that era, because we were agriculturally or otherwise occupied, and therefore we had to go outside. So if we go outside on a rainy day, we get about 10,000 lux or more. Lux is just a dimension that we use to measure light intensity. On a clear sky day, we get over a hundred thousand lux. Now, if we stay inside, which we have done for the past hundred years, because we are working, either in factories or in offices— if we stay inside, we can be lucky if we get 400 lux. So it's a fraction of

the light that we used to get during the day. But we are not so lucky to still get something like 100 to 200 lux after sunset— because we're switching on lights when our clocks used to have darkness. So the clocks are set by light and darkness and if you have very strong light during the day and no light during the night, this is what we call a very strong time giver to signal for the clock to set itself. We have weakened that time giver, enormously by not going outside during the day, and by switching on light during the night. For most of us that meant that our clocks had to become later, in order to still synchronize to the 24 hour day. And that is always forgotten. Although we all know it without thinking about it. Our clocks are so late that over 80% of the population need an alarm clock to wake up in the morning. Now if you need an alarm clock to wake up in the morning, your biology hasn't slept to the end. Because your clock is late and you have to wake yourself up in order to go to work, for example, or to school.

**Dr. Roenneberg:** Now the important thing about this is that this is really light dependent. Our internal clocks cannot be set by the alarm that goes off on the mobile phone, or any other alarm. It's light and darkness that set our clocks. And the variability in the population is very, very high. So we have— each of us embeds itself— her or himself— into this light dark cycle differently. The famous larks and owls. So larks embed their clocks early, so that they wake up early, so that they fall asleep early at night and wake up early in the morning. And owls can't fall asleep early, and they can't, by themselves, get up early. They want to get up late. Of course the extreme larks and the extreme owls, which can be now 12 hours apart. Huge differences in how our individual clocks synchronize with the light dark cycle. Of course, there are only the extremes. And there are many, many people in between, which I have started to call doves because I don't know why we only call the extremes with bird names and the people, the majority in between us. So we have very few extreme larks, we have very few extreme owls. And we have many, many doves in between. Who all in one way or the other need alarm clocks to wake up. So most of the doves are quite late habit. Now this changes— this is not genetic. And this is not learnt, because if you take a normal urban population on a camping trip, all the late people become much earlier, and actually the very early people become later, but we don't have to go there— into that. But the distribution of larks and owls becomes very narrow, and much earlier under the natural condition. So, what is important for you to learn, concerning your sleep and your environment, is that you have to be very careful with light, and with darkness.

**Dr. Roenneberg:** Now, most people, for example, like to sleep in a dark room. I always say don't do that, unless you are an extreme lark and it is summer. Because extreme larks actually do wake up at 4 o'clock in the morning and they need shading. But everybody else should actually try to sleep in with light coming into the bedroom because if your brain doesn't know that the light has come up, it thinks it's still dark and still night and it will become even later. So if you're a late type, who sleeps in a dark room, and sleeps in, you're making your clock even later, it's something which you don't want. So if you sleep— if you're able to sleep into the light, you are a true owl and you are allowed to. If you're not, you are just a procrastinating lark and you should go to bed earlier and get up earlier. That is one message I would like to get across, the other message is that we really have to change both the physics of our illumination and the architecture of our houses. Basically we have to be able to go camping every day, even in the office. Meaning we have to get the lights that we encounter when we go camping, into the offices and building. That means, for example, we have to simulate what's going on outside. By, for example, getting more light. However, I'm not a specialist, but it's the architects and the light specialists who have to do that. We have to get the light that arrives at the roof of building. We have to get that into the ceilings of offices, so it's really bright— and diffuse, like the light in the sky. But we also have to tune, all illuminations, spectrally, so that after sunset— and that's local sunset, that's sunset in Chicago or in Georgia or in Munich. To a local sunset, should tune down

the blue content of any artificial light and practically take it away. So that we just have enough spectral variability in the light so that we can see properly. But otherwise take away every blue. We have to go camping on many levels so that we basically, my goal is that none of us needs an alarm clock in the future and we can do that by either having very flexible work times, or— going camping all the time, light wise.

**Julie:** Thank you so much Dr. Roenneberg. I think this is just so fascinating. I'd never heard the term lux before— is that the word, is it L U X?

**Dr. Roenneberg:** L U X, it's Latin for light.

**Julie:** Okay, I'd never heard that term before starting to watch some of your videos and ever since I've kind of become obsessed with making sure I'm getting outside more, and getting some more natural sunlight during the day. So, thank you, just so much for sharing with our community. I think, often you know, I think a lot of our community members have sleep disorders and sometimes— when your sleep's messed up— I, sometimes I haven't thought as much about some of these basic things, though, that could be possibly helpful to know about. And, so, you have the larks, you have the owls, you have the doves. Now what about people with sleep disorders? I mean I'm thinking I'm maybe a peacock— I don't really know, but I think I'm pretty special. You have any sort of—

**Dr. Roenneberg:** In what way?

**Julie:** Well 'cause I'm special— 'cause I have a sleep disorder.

**Dr. Roenneberg:** But— but, besides that obvious point, in what way.

**Julie:** That maybe I'm not a dove because I'm probably— a little bit different. 'Cause of my having narcolepsy with cataplexy.

**Dr. Roenneberg:** That's a big difference, yes.

**Julie:** Yeah.

**Dr. Roenneberg:** Many people I encounter, and I help— with sleep problems— take for example a person who comes to me and says, "I'm always tired during the day because I wake up in the middle of the night. And I'm very tired early in the evening." So it turns out that this woman was an extreme lark. But didn't know it. And so she thought she's waking up in the middle of the night, although it was her actual natural wake-up time. Because she related it to what most of the population does. And for that, it was— compared to that it was the middle of the night. But once you are aware that it's your choice to go to bed at 8 o'clock in the evening, or even at 7:30— or not, because it's so exciting— but that you will wake up at 3 or 4 o'clock in the morning, you are not a patient anymore, but you are somebody who knows, I have a biology that wants me to go to bed at 7:30 or 8 o'clock— and I will wake up, it's not pathological, it's just normal and I have it under control because if I— if it's boring— if my husband tells boring stories I go to bed.

**(Julie laughs)**

**Dr. Roenneberg:** But if there are lovely friends over, I don't. But that's a choice.

**Julie:** I love that. I was thinking about not just thinking of sleep as being awake or, you know, being asleep— if there's any sort of commentary on that.

**Dr. Roenneberg:** Well, I think it's very important to understand that sleep is not just one state. What is sleep is a wonderful question. I always claim that I— what's the function of sleep, is a wonderful question. I always claim that I have an answer to that question without going into any details, yet— it's a conceptual answer. And that answer is— the function of sleep is to prevent malfunction during wake. And if you want to understand sleep, we cannot just look at sleep, we have to look at sleep in context— we cannot judge— when we wake up, whether we've— or readily judge, when we wake up, whether we've slept well or not well. Because it's just what we feel when we wake up in this transition. And it could very well be that if I haven't slept properly for several nights and I finally get to sleep, whatever— 10 to 12 hours— but I wake up and feel really dreadful— but it still was an extremely important sleep. So, the question of— and later on in the day, I will find that I actually feel much better, now that I've slept or that I've caught up with my sleep. So I think we should— more and more, see— we should look for a judgment of sleep during wake. I always compare sleep with a pit stop. So, every race driver wants to win the race, but they still go and stop at the pit. As part of how to win the race. And, if you look at pictures of what pit stops looked like, many decades ago, there were two people and they filled up the tank because you can't have enough petrol to go through a whole race so they have to fill up the tank. And they may have done something to the wheels or something, so forth. Nowadays a pit stop involves, probably 30 to 40 people— just swarming around the car, and doing stuff. And if we look at sleep in evolution, probably the pit stop of more— of lower evolved animals has three to four people around the car. Whereas we have, in our sleep, probably 500 workers around our car when we go into that pit stop. And they all make sure that the race— will be we win the race. And we have to understand that sleep is a multitude of function— that are all necessary in order to win the wakeful race. And not just a waste of time.

**Julie:** That is so cool. I've never thought about a pit stop analogy. I have another analogy I've been thinking about that I'm a little bit scared to bring up to you because I think you're going to be honest with me. (laughs) I've been thinking about whether— we like to think of ourselves as just kind of individuals and like, I, Julie Flygare, can do whatever I want, during the day— but actually maybe we're a little bit more like plants. Like, you know, we need light, we need food, we need water, and— we are connected to our environment. The way we think of— we care for plants. And you know, you get a new plant you think, how much light does it need, you know. And also that some plants are more resilient than others— and so I don't know, I just think that the connection to our environment is something that I hadn't thought of, really— until I got more exposed your work— and I just think we don't live our lives like that, thinking that we are— as our bodies are truly connected to our environments. So what do you think about my plant analogy?

**Dr. Roenneberg:** I think it's a very good analogy, and of course it's a very short analogy, because what you're doing is you're moving away from— from everything that is an animal, because you have the feeling that animals don't appreciate the environment, but of course you're only speaking about the animal— the human animal. Plants are as far away from the human animal as it can be. And there you can suddenly realize how much the plant is part of its

environment. But of course it's a very good analogy on the other hand, because as plants we are incredibly— incredibly dependent on our environment. Just look at what I said about the clock and the light. If you go camping, you suddenly become sort of a larkish person. If you live in towns and urban environments and don't go outside during the day, you become an owl. You're completely a slave of your life environment. Don't ever underestimate your environment.

**Julie:** So when we think about systemic change, I guess I'd love to hear— oh gosh, there's so many— there's so much change that should be made. But if you had to choose one, as far as like a systemic change, on a policy level, perhaps— what one would you choose?

**Dr. Roenneberg:** I would say, suddenly, employers realize that they can rely on what comes back from their employees, even if they're not in the office. Because of course all that counts is what do you deliver? And not how much have you been in the office. And that's a huge experiment which we have queried in a huge study— queried 10,000 people from many, many different countries and in the end we analyzed 7,000. And, it taught us that we probably can do with more sleep than we thought, or we need more sleep— I'm always hesitant to use the word need, but we could do with more sleep than we thought. Because if you look at what happened before and in the lockdown or social restrictions situation, what you find is that everybody sort of migrates towards eight and a half hours. So somebody who had eight and a half hours before the— before lockdown, doesn't move. But everybody else sort of migrates towards eight and a half hours. It also showed that we can tolerate 20 minutes of social jetlag— the discrepancy between what our body clock wants and what our social clock wants. And that's not much, but there is a tolerance. So what I would say is policy makers should look at what has happened in the pandemic, and how beneficial it was to— I'm not saying we should all work from home from now on, because— as Galesh said, it's not only the sun as a physical entity, but also the warmth and the wind that we need. Is we don't only need to communicate via Zoom and work at home— we also need a hug, from time to time. And that's sort of the the warmth and the breeze. But still, we have the opportunity to look at what has improved under the pandemic. And go and run for it, make something of it, and sleep has— many people sleep with home office as they do normally, on weekend. Very few people have to use alarm clocks, especially those who don't have children who have to wake up to attend virtual school stuff. So, things are moving, and they're moving in the right direction, and I think that is something we should make policy makers believe in.

**Julie:** Especially with school start times too. I don't know about— if that's a thing in Europe, that's a problem— but in America the school start times are so early. So there's a huge movement about setting school start times a little bit later.

**Dr. Roenneberg:** Well, I mean, the school start times in the States are ridiculously early, especially for the teenagers— who go to school before the small ones go. And the internal clocks are the other way around. The internal clocks of teenagers are late and the internal clocks of small children are earlier. So that by itself is already a ridiculous decision. But I would say that if we had evidence-based pedagogic, nobody would go to school after the age of 13 at 8 o'clock in the morning, because what you get is somebody who falls asleep in class. And because of the internal clock not being awake, and so it's not effective and we should judge school and pedagogic activities by how effective they are in producing people who can critically think and know something. And critically thinking is even more important than knowing.

**Julie:** Alright guys, we'll see you later, thank you!

*This discussion was originally recorded during Project Sleep's [Sleep Advocacy Forum](#) in October 2021.*