

[MUSIC PLAYING]

DR. CHARLES CZEISLER: Many people understand that they need good nutrition in order to be healthy, and that they need to exercise in order to keep their body fit. Few people understand the importance of sleep as the third pillar of good health. It is during sleep that many critical things happen for the brain.

We actually remove toxins that have built up because of burning of energy during the daytime. And when we go to sleep, those toxins are flushed from our brain because the rate of flow of cerebrospinal fluid within the brain increases 20-fold during sleep. It is also during sleep that we integrate the new information that we have learned with information that we've previously learned. And that mainly happens during rapid eye movement sleep which is the sleep stage associated with vivid dreaming.

It's not just the brain that needs sleep, but even the body needs sleep. So if we don't get the sleep that we need, we increase the risk of cardiovascular disease. In fact, people who don't get an adequate amount of sleep at night have a 300% increased risk of calcification of the coronary arteries over five-year period as compared to those who are getting enough sleep.

Many different functions are affected by sleep, even the immune system, for example. If you're coming in for your flu shot in the fall and you haven't gotten an adequate amount of sleep in the previous week, you'll only have half the antibody response as if you've been getting enough sleep. The metabolic system is also very sensitive to sleep deficiency. When we haven't been getting enough sleep, we become more hungry because somewhere in evolution, sleep got linked with appetite.

When we're not getting enough sleep, let's say, sleeping four or five hours a night instead of the seven to eight hours a night we need, then we release more of the hormone, ghrelin, which makes us hungrier, less of the hormone, leptin, that makes us satisfied with what we have eaten. And if we go on a diet, let's say, reducing the amount of food that we're getting, if we're not getting enough sleep when we're on that diet, then 75% of the weight that we lose will be in lean body mass rather than in fat. Because the body is squirreling away all the calories that it has into fat because it's in starvation mode.

When we don't get enough sleep, it also adversely impacts the effectiveness of the insulin that we release. So the insulin becomes less effective. And in our laboratory here at the Brigham and Women's Hospital, we have demonstrated that if we restrict sleep and shift the timing of when sleep is occurring, many of our healthy, normal volunteers go into almost a pre-diabetic state within about two or three weeks of being on that kind of a schedule. So we're doing this fundamental research to try to understand the risk factors associated with illnesses, metabolic diseases, such as diabetes.

As the price of electricity has dropped, our exposure to artificial light has increased per person by about 10-fold, even over that 50-year period. And that increased exposure to artificial light essentially tricks the brain so that we've trick the brain into thinking that dusk, instead of happening at six o'clock in the evening or seven o'clock in the evening, is happening at midnight or later. So the brain is sending out a strong, strong drive to keep us awake at 11 o'clock at night, 12 o'clock at night, one o'clock in the morning, and that leads to chronic insomnia in many individuals. And in many others, they don't have insomnia, but they just can't sleep more than four, or five, six hours a night because the surge for wakefulness that always precedes dusk is now occurring so late in the day.

The techniques that we developed here at the Brigham and Women's Hospital for resetting circadian rhythms with light have been used for more than two decades for all the astronauts before they launch into space to synchronize their circadian rhythms with the scheduled timing of the launch. And that is a direct application from our research program here at that Brigham to the space program.

We're very excited about our new program to try to understand the pathophysiology of obstructive sleep apnea. So everybody calls the condition with the same name. It would be a bit like saying someone has cancer, but there are many different types of cancers. And it turns out there are many different ways that an individual can have the condition of obstructive sleep apnea.

And so we have a research program here that is on the cutting edge, trying to understand the different ways that a person can have obstructive sleep apnea that will result in their having that condition. Because these different physiologic changes and pathophysiologic changes may need different treatment approaches. And so we're hoping to develop a whole series of treatments for the condition through this groundbreaking research that's happening here at the Brigham.

We're also trying to develop bedmakers in which we can look at epigenetic and other metabolomic markers that may herald the presence of sleep deficiency. Because it would be great if we had a blood test and we could identify, just from a drop of blood, whether or not someone is deficient in sleep. Because then, in the same ways that we can say, gee, your blood test shows that you're at increased risk for heart disease, we could say, your blood test shows that you are deficient of sleep and we've got to get to the bottom of it, and maybe we need to do a sleep study or some other thing to try to understand why.