

Circadian Rhythm and Your Health

Narrator: Have you ever traveled across multiple time zones and had trouble sleeping once you reached your destination? This experience, called jet lag, is caused by disruption of your body's circadian rhythm, or biological clock. The circadian rhythm regulates many important biological processes, such as hormone production and sleep patterns. It is largely controlled by external cues in the environment, primarily light. So when you travel across several time zones, your biological clock – and the processes it controls – are out of sync with the external cues in your new locale. But disruption of the circadian rhythm can have more serious health effects than just making you feel out of sorts after traveling — research shows that people who experience long term circadian rhythm disruption are at higher risk for certain types of cancers.

Our guest today is Dr. Helmut Zarbl. He's a professor of toxicology and environmental health and directs the NIEHS-funded Center for Environmental Exposures and Disease at Rutgers University. His research has led to important discoveries about how long-term disruption of circadian rhythm may increase the risk of breast cancer, and how a dietary supplement may reduce this risk.

Zarbl: Circadian rhythm is basically your biological clock. It determines a lot of biological functions like when you sleep, when you're hungry, your body temperature, and many functions throughout the day including your hormone levels, blood pressure, etc. So it's a very fundamental part of the body that allows the body to coordinate its responses to the environment.

Narrator: One of the major drivers of circadian rhythm is sunlight. The circadian rhythm cycles with the normal pattern of light and dark we experience in a 24-hour period. If you're exposed to light at night, some of the critical biological processes controlled by your circadian rhythm are disrupted — including those the body uses to defend itself against disease and cancer. According to Dr. Zarbl, this can cause health problems for people who work night shifts and are frequently exposed to nighttime light.

Zarbl: If you are a police man, or a fireman, or a health care worker that often has to work the night shift, and particularly if you rotate back and forth between day shift and night shift, you have chronic effects on your biological clock. So not only is your clock disrupted, but all of the biological functions that it controls are now disrupted.

And in fact, the International Agency for Cancer Research have concluded that shift work is a probable human carcinogen. That means that if you do chronic shift work, you are actually at higher risk of developing certain types of cancers. And there have been several large epidemiological studies that have shown that people who work shift work for many years have increased rates of certain types of cancer, including breast cancer, prostate cancer, and endometriosis.

Narrator: According to Dr. Zarbl, the types of cancer associated with shift work are related to the levels of hormones in the body, particularly the hormones melatonin and estrogen. These hormones naturally cycle with the circadian rhythm, with levels increasing at night and decreasing during the day. But Dr. Zarbl's research confirms that levels of these hormones, which are important in preventing breast cancer, remained low at night in rats whose circadian rhythm was disrupted. His research suggests this happens because the expression of specific genes controlling the circadian clock and hormone production are altered when the circadian rhythm is disrupted.

He says circadian rhythm disruption has effects on other genes as well, including most of the genes that are involved in DNA repair.

Zarbl: During the day, as a result of exposure to environmental chemicals, various stressors, oxidative stress, your DNA is continuously damaged. And so there are a series of genes whose proteins scan up and down the DNA, find this damage and remove it to prevent mutations that could then lead to disease and cancer.

So when you disrupt your circadian rhythm these DNA repair enzymes that normally go up to very high levels at night while you're sleeping, your DNA is being repaired, that no longer happens. So you're having a double effect in the breast cells – they're not able to repair their damage as well and they're also not responding to normal signals coming from hormones both of which we think are promoting breast cancer.

Narrator: Dr. Zarbl thinks this may explain the high incidence of breast cancer in shift workers. He's found that some of the same circadian rhythm genes that were altered in his rat studies were also disrupted in hospital interns and residents who worked the night shift.

To address this issue, his research group has also been studying how a dietary supplement may prevent breast cancer by restoring circadian rhythm genes. The supplement, called methylselenocysteine, or MSC, is a naturally occurring amino acid found in some foods, such as brazil nuts.

Dr. Zarbl found that rats who were exposed to chemicals known to cause cancer and also fed a diet enriched with MSC reduced their risk of breast cancer by more than 60 percent. His research suggested that MSC was preventing breast cancer by restoring the biological clock.

Now Dr. Zarbl is working with shift workers from a range of occupations to see whether MSC restores their circadian rhythm as well. If successful, it could mean that MSC taken as a dietary supplement could potentially reduce breast cancer in people who work night shifts. This could have large implications for public health, given that about 15 percent of full-time wage and salary workers in the U.S. work shifts outside the traditional daytime schedule.

If you clock in during the day, you may be wondering what all this means for you. Well, Dr. Zarbl says we are all at risk for circadian disruption because of the increasing amount of artificial light we're exposed to at night.

Zarbl: Our society in general is sleeping less and less; something called light pollution - the amount of light that is on late at night - continues to increase, and it is blue light that is the main culprit for disrupting your circadian rhythm. And so by looking at our phones, and other computer screens or television late at night, that actually interferes with our quality of sleep.

Narrator: Dr. Zarbl has some tips to help us all maintain a normal, healthy circadian rhythm. First, he doesn't suggest that you start eating lots of brazil nuts to get your dietary dose of MSC, as very high levels can be toxic. But, eating a brazil nut a day certainly can't hurt, and who knows — it may help restore your biological clock.

He does suggest reducing your exposure to blue light as the evening hours approach. The best way to do this is to turn off your electronic devices a few hours before bed. But, if you find it hard to disconnect completely, there are other ways to reduce your nighttime light exposure. You can dim the brightness on your phone, tablet, or computer. And many smart phones and computers now have a setting to dim the amount of blue light they emit. Additionally, some companies now sell glasses that block out blue light, so you can continue to use electronics at night without disrupting your circadian rhythm as dramatically.

We hope these tips help you get a good night's sleep. Thanks to again to our guest, Dr. Helmut Zarbl!

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