The Emens Lab: Sleep as the key

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As a kid, Jonathan Emens and his friends stayed up late at a slumber party waiting for other kids to fall asleep to see what sleep looks like. As they got more and more tired, their idea lost its appeal, but later in life as a sleep researcher, Dr. Emens is still intrigued by sleep.

When I talked to Dr. Emens about his field, he said the word “sleep” at least a few times a minute. A few issues of the journal “Sleep” sat on his desk and his shelves were lined with books and journals with titles related to sleep. I had awakened that morning at 4 A.M. and not been able to get back to sleep, so I found myself trying to keep from yawning. I didn't want to be caught in the state of sleep-deprivation. Here is someone who has focused his research career on sleep, and myself along with most Americans aren't getting enough of it.

Why is sleep so important? Lack of sleep can affect mood, concentration, alertness, and your immune system.[1] Drowsy drivers falling asleep at the wheel can cause deadly accidents. (Long term effects of sleep debt?) An average adult needs 8 hours of sleep a night and an average teen-ager needs 9 hours, but most Americans often sleep fewer hours. Whether from busy schedules or sleep disorders, sleep often loses out.

Why is it that I wake up before my alarm clock most mornings, even when I want to sleep more, but many of my students are bleary-eyed through first period? What makes me a “morning-person” while others are night owls?

To get to those answers, we'll back up to the hormone melatonin. Melatonin is sold as a supplement, but it's also produced by your body, specifically by your *pineal gland* in your brain. You normally start producing more of it 2-3 hours before your

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1 http://www.nhlbi.nih.gov/health/public/sleep/starslp/teachers/whysleep.htm

bedtime and you produce it for about 12 hours. Melatonin levels are decreased by light. The light registered by your eyes transfer a message to your brain that resets your body's internal clock.

Your fluctuating melatonin level is one of several physiological factors that cycle in about 24 hours. From the Latin *circa* meaning "about" and *dies* meaning day, we get the term Circadian Rhythm for these patterns that include other hormone levels, sleepiness, temperature, and moods. These rhythms have been found in animals and even single-celled organisms. Melatonin is a particularly appropriate one to study with respect to sleep because it's affected only by your internal clock and light. Temperature, for example, isn't as amenable for sleep studies because everything from eating to activity could mask its internal cycles. Your circadian cycle can be determined by measuring your melatonin levels and tracing the changes over time.

How, then, do sleep researchers study melatonin levels and sleep without the masking influence of light. You could monitor the sleep of research subjects kept in a caves or dim rooms without clocks for a month or more. These methods have been used, but are quite disruptive to the lives of the research subjects. How, then, do you get the data without that disruption? Dr. Emens colleagues, Dr. Lewy and Dr. Sack, have circumvented this in their studies by using blind research participants, particularly those without light receptive *retinal ganglion cells*.

If your circadian rhythm is synchronized to the Earth's 24 hour day, you are said to be *entrained*. What happens if your circadian rhythms aren't synchronized to the 24 hour day and you are not entrained? How does it affect you, though, if your circadian rhythm is closer to 23 or 25 hours? You can imagine it as changing a time zone as much as once a day. Blind people, lacking the influence of light on their biological clock, could "free-run." That is, their circadian rhythms change daily, sometimes making them sleepy at night , but in the middle of the day other times. Dr. Emens and his OHSU colleagues hypothesize that sighted individuals with a shorter than 24-hr circadian cycle

tend to be “morning larks” while those with a longer cycle tend to be “night-owls.” One of their current investigations compares the circadian cycle and “clock genes” of blind free-runners, sighted morning-types, and sighted evening-types to gain a greater understanding of the genetics of circadian rhythms.

A greater understanding of sleep could lead to better public policies and medical treatments related to sleep. Perhaps middle school students shouldn’t start school at 7 or 8 A.M. if evidence develops that many of them have circadian rhythms that push them towards being night owls. Could melatonin (currently being studied at OHSU as a way to entrain blind free-runners) or light be used to adjust the body clock in morning and evening types? Could sleep research lead to less sleep-deprivation in the U.S?

I was surprised to find that sleep, important as it is to overall health, isn’t named once in the K-CIM level Oregon Health Content Standards or in the National Health Education Standards. If adequate sleep can boost immune response, increase alertness, and improve concentration, then it makes sense for schools to teach its importance. More sleep could reduce tardiness and absenteeism and better prepare students for learning while at school. Teachers, often encouraged to focus on teaching the standards, could be leaving sleep out of their instruction, even though it’s a factor in making students better learners of everything schools teach.