Testimony on 2024 Oregon SB 1548 - Opposition
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Gresham, Oregon
February 22, 2024

In addition to short online testimony and my oral presentation before the Senate Rules Committee, I have included below several links to relevant scientific articles which examine the relationship of latitudes to sleep cycles and circadian rhythms.

Oral Testimony

I am not in a position to dispute anyone's research, but I find that in many of the narratives submitted for testimony that favor year-round standard time, there is a failure to address Oregon's position on the planet... i.e., our latitude.

We cannot change the fact that we swing from barely over 8 ½ hours light in the Winter to almost 2 months of 15 hour Summer days where we sit here in Salem. In fact, research has found that circadian rhythms are actually less powerful in latitudes further away from the equator, and that genetics plays a role in a living organism's biological time clock. To truly come to the best answer for Oregon, I would suggest that an even broader interdisciplinary approach is needed, incorporating the work of geneticists, neuroscientists, psychiatrists, psychologists, environment scientists and more with focus on geographic areas that straddle the 45th parallel. Right now, you are only hearing from one vector of the scientific community, who are asking you to make the quantum leap that yearlong PST will be a panacea for better health.

I am not ready to buy that civil twilight - the daylight before sun-up at 3:44 a.m. is in the best interest of my circadian rhythm.

I am not a scientist, but where I am an expert is in my own economic viability as a small business owner/operator.

Oregon has a vast "Summer Economy" that is dependent on long days and evenings of sunlight. Many small outdoor businesses, often owned, operated and staffed by people of color, rely on a healthy summer of work to get through the winter months. Year-round standard time would cost those businesses thousands of dollars because you just can't just shift that later work hour to the impractically early a.m.

I operate one of those kinds of businesses that has an asymmetrical calendar; I am a mobile business owner doing minor paint repair on cars and trucks, mostly outdoors. In 2019, I estimated that I would lose about 10% of my gross income if I lost that hour of

late light - an hour that I assuredly cannot make up at 4:30 in the morning. This year, I estimate my loss would range between $6000 and $9000, a significant chunk for a lone wolf business.

Senators, think of your own hometowns and Summer evenings.

Oregon's massive Summer calendar and tourism economy is reliant on the late sundown in the Summer months. Losing that extra hour, every day, on the beach or in the festivals in our cities will cost local businesses dearly. Those extra hours of pickleball, softball and every other outdoor activity won't shift to 4:30a.m.; they will just be gone.

So the question really is, does it make more sense to have that 14th hour of sunlight between 4:30 and 5:30a.m., or between 8 and 9 p.m.?

And even if you are not sure, that still leads you to the only vote that is reasonable to cast when there is doubt…

Please vote NO on SB 1548

Resources links:

Life Across Latitudes

https://cet.org/life-across-latitudes/

"...the data clearly show shorter sleep duration and later sleep onset in city dwellers compared with their rural counterparts. The study of communities at different latitudes and levels of urbanization — our focus of research — may help to delineate the risk factors that underly a distinct set of sleep disturbances, mental disorders, and physical illnesses."

Latitude affects Morningness-Eveningness: evidence for the environment hypothesis based on a systematic review

https://www.nature.com/articles/srep39976

Abstract

Morningness-eveningness (M/E) is an individual trait related to a person's sleep-wake cycle and preference for morning or evening hours. The "environment hypothesis" suggests that M/E is dependent on environmental factors, such as latitude, mean average temperature and photoperiod. We here analyzed a large number of datasets to assess this effect based on a systematic review. Data were from a total of 87 datasets and 35,589 individuals based on 28 countries. Partial correlations correcting for age revealed significant relationships between M/E and latitude, mean yearly temperature, photoperiod and sunset. Evening orientation was related to higher latitude, longer days and later sunset.

Latitudinal cline of chronotype

https://www.nature.com/articles/s41598-017-05797-w

"...The timing of circadian rhythms varies among individuals of a given population and biological and environmental factors underlie this variability. In the present study, we tested the hypothesis that latitude is associated to the regulation of circadian rhythm in humans. We have studied chronotype profiles across latitudinal cline from around 0° to 32° South in Brazil in a sample of 12,884 volunteers living in the same time zone. The analysis of the results revealed that humans are sensitive to the different sunlight signals tied to differences in latitude, resulting in a morning to evening latitudinal cline of chronotypes towards higher latitudes.

"...we have confirmed that the differential variation in the natural light/dark cycle, driven by latitude, may be crucial for the entrainment process of the human circadian system."

Amplitude of circadian rhythms becomes weaken in the north, but there is no cline in the period of rhythm in a beetle

https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0245115

In the present study, the power and period of circadian rhythms and total locomotor activity varied among geographical populations of *T. castaneum*. Circadian periods seemed to vary evenly between 20 h and 28 h (Fig 3). The present results showed that the power of circadian rhythms was significantly lower for beetles collected in northern areas than in southern areas (Fig 2). This result suggests that beetles collected from

different parts of Japan have different characteristics. In this study, we reared individuals collected from the fields for a few generations in a chamber under the same environmental conditions in the laboratory before measuring their traits. Therefore, it is unlikely that the present results were affected by any maternal effects.

Although clines in the power of the rhythm have been observed in only a few species, the trend of weaker circadian rhythms in northern populations has been observed in other insect species. Specifically, a clear rhythm was shown at lower latitudes whereas no rhythmic activity was shown at higher latitudes in *Hymenoptera* and *Drosophila* species [30, 31]. The present results are consistent with the results of these previous studies. Why is the rhythm weaker at higher latitudes? One answer may be that in more extreme environments, it may be easier to survive with less restriction of activity by the clock and more control by direct environmental responses, namely, masking of circadian activity.

Life at High Latitudes Does Not Require Circadian Behavioral Rhythmicity under Constant Darkness

https://www.sciencedirect.com/science/article/pii/S0960982219311947

Summary

Nearly all organisms evolved endogenous self-sustained timekeeping mechanisms to track and anticipate cyclic changes in the environment. Circadian clocks, with a periodicity of about 24 h, allow animals to adapt to day-night cycles. Biological clocks are highly adaptive, but strong behavioral rhythms might be a disadvantage for adaptation to weakly rhythmic environments such as polar areas [1, 2]. Several high-latitude species, including *Drosophila* species, were found to be highly arrhythmic under constant conditions [3, 4, 5, 6]. Furthermore, *Drosophila* species from subarctic regions can extend evening activity until dusk under long days. These traits depend on the clock network neurochemistry, and we previously proposed that high-latitude *Drosophila* species evolved specific clock adaptations to colonize polar regions

Related article: **What drives circadian rhythms at the poles?**

https://www.sciencedaily.com/releases/2019/11/191104141656.htm

"Circadian clocks with a periodicity of about 24 hours enable animals to adapt to the day-and-night cycles. However, if these clocks are too rigid, this could be a disadvantage when adapting to weakly rhythmic environments like the polar regions," (Study co-author Dr. Pamela) Menegazzi describes the background of the new study. She explains that several high-latitude species that live in the far north or south are known to no longer adapt their activities to a 24-hour rhythm but have adopted an arrhythmic behaviour instead.

Seasonal and geographical impact on human resting periods

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5587566/

Abstract

We study the influence of seasonally and geographically related daily dynamics of daylight and ambient temperature on human resting or sleeping patterns using mobile phone data of a large number of individuals. We observe two daily inactivity periods in the people's aggregated mobile phone calling patterns and infer these to represent the resting times of the population. We find that the nocturnal resting period is strongly influenced by the length of daylight, and that its seasonal variation depends on the latitude, such that for people living in two different cities separated by eight latitudinal degrees, the difference in the resting periods of people between the summer and winter in southern cities is almost twice that in the northern cities…

Persistence, Entrainment, and Function of Circadian Rhythms in Polar Vertebrates

https://journals.physiology.org/doi/full/10.1152/physiol.00045.2014

Conclusions

Polar vertebrates exhibit diverse behavioral and physiological responses to the continuous lighting conditions during summers and winters at high latitudes, which may reflect variance in the ecological niches they occupy, as well as differences in their evolutionary histories. Our understanding of how light signals are captured and integrated by circadian systems has advanced markedly in the past decade, although it is currently unclear whether polar vertebrates have specific adaptations within their circadian photoreceptive pathways that increase sensitivity to subtle daily variation in the intensity or spectral quality of light. Functionality of persistent circadian rhythms in polar vertebrates is generally thought to be linked to synchronization of physiology and behavior with the geophysical environment, although persistent rhythmicity may also be adaptive due to interdependence between circadian clock function and homeostatic processes.