THE Science BREAKER
SCIENCE MEETS SOCIETY

June 21, 2017

Health & Physiology

A Weekend Camping is Just What the Doctor Ordered

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This Break was edited by Massimo Caine, *Editor-in-chief* - TheScienceBreaker

The invention of electrical lighting has permitted work and social activities to continue beyond sunlight, however it has also caused an unnatural desynchrony between human's biology and the environment. The body's internal timekeeping system (also called circadian clock) is designed to predict environmental time in order to appropriately coordinate behaviors, such as sleeping and eating, with the solar night and day. The fine-tuning of such delicate timing is made possible thanks to our ability to perceive the quality (*i.e.* colors) and intensity of the surrounding light. However, with the invention of electrical light, the sun is not the only light source providing time-of-day information to the internal clock. Specifically, exposure to electrical light at night - whether from a lamp, smartphone, or television - serves as a time cue informing the body's internal clock that it is still daytime. As a result, our internal clock and sleep timing is shifted later relative to the natural light/dark cycle. While this may be beneficial when attempting to meet a deadline, cramming for an exam, or socializing, it can make it difficult to awaken early for work or school the following morning. Furthermore, this desynchrony between the internal clock and environmental light/dark cycle has been shown to be associated with negative consequences such as reduced school performance and increased risk of accidents, mood disorders, diabetes, and obesity. Therefore, a remedy to realign the internal clock with environmental time is relevant for public health and well-being.

We have previously shown that going camping for one week during the summer can help re-synchronize the internal circadian clock to solar time (Wright et al., *Current Biology*, 2013). Specifically, one week of exposure to only natural sunlight shifts the timing of the internal clock earlier such that the biological night begins near sunset and ends near sunrise. However, the natural light/dark cycle changes with seasons such that the environmental nighttime is much longer during the winter. Therefore, in the current study, we sought to determine how the circadian clock responds to seasonal changes in the natural light/dark cycle.

We took one group of participants camping for six days near the winter solstice in the Rocky Mountains of Colorado with exposure to only natural light (i.e., sunlight, moonlight, and campfires; no flashlights, no personal electronic devices, etc.). We found that after exposure to the winter natural light/dark cycle, the start of the biological night and start of sleep were timed earlier than in the modern environment with exposure to electrical light. Additionally, the biological night was expanded after camping in the winter compared to the summer suggesting a substantial seasonal circadian response to the natural light/dark cycle. Furthermore, participants were exposed to ~13x higher light levels during waking hours while camping compared to the modern environment.

We were then curious as to how rapidly this re-synchronization could occur. Therefore, we took participants camping for one weekend in the summer to examine whether this shorter duration of exposure to natural light would be sufficient to re-synchronize the clock to solar time. We found that a weekend camping did indeed shift the internal clock earlier. Specifically, a weekend camping trip was sufficient to achieve ~69% of the shift in internal clock observed after a week camping.

These findings indicate that our internal clocks are timed later in the modern environment with electrical lighting, both in the summer and winter. This late timing often makes it difficult for people to fall asleep at night, yet they are still required to wake up early for work and school obligations. As a result, many people obtain less sleep during the workweek and attempt to catch-up on lost sleep during the weekend. This weekend catch-up sleep often causes individuals to miss morning exposure to light, thus even further delaying their internal clocks. As a result, the desynchrony between the internal clock and the environment is often exacerbated on Monday mornings. We suggest that a weekend spent camping can help to attenuate this delay and resynchronize the clock to the natural environment, making it easier to wake up for work and school. Furthermore, we found that, likely due to spending more time indoors, people are exposed to less light during the daytime in the modern environment. Therefore, we recommend that increasing exposure to sunlight by taking a morning walk or eating lunch outside can help to facilitate communication between the sun and the internal clock and promote synchrony with the environment.