

Setting the clock: Physiological integration of seasonal cues by the grizzly bear

Jasmine V. Ware

O. L. Nelson, C. T. Robbins, G. Wright

Dr. Heiko T. Jansen

Dr. Heiko T. Jansen Laboratory, Neuroscience Program

Washington State University, Pullman, WA

ABSTRACT

In many temperate zone animals, seasonal cycles such as reproduction, migration and hibernation are synchronized to changes in daylength (photoperiod). The brain mediates this synchronization via a diverse set of neural pathways and endocrine signals. The objective of this study was to characterize the seasonal endocrine and behavioral rhythms in the grizzly bear (*Ursus arctos horribilis*) and to determine their relationship to photoperiod. Daily locomotor activity was recorded during four separate hibernation periods and during the non-hibernation period of 2008 for 6-9 bears in each time period. Activity duration and relationships between activity onset/offset and dawn/dusk were determined for hibernating and non-hibernating periods. Blood samples collected in the summer were analyzed for melatonin while blood collected in summer, fall, and winter samples was assayed for cortisol. Duration of activity increased in a linear fashion ($P < 0.001$) as daylength increased. However, the relationships between onset of activity and dawn along with the offset of activity and dusk did not remain stable ($P < 0.001$) between hibernating and non-hibernating periods, suggesting that entrainment to photoperiod is not the only mediator of seasonal changes in activity. Melatonin was present at very low concentrations while cortisol exhibited both a diurnal and seasonal rhythm. These results indicate that the grizzly bear exhibits clear daily locomotor activity rhythms that vary with season. However, melatonin, a widely accepted endocrine signal of photoperiod, may not be playing a critical role in the generation or entrainment of these seasonal rhythms, thus distinguishing the bear from other seasonal mammals.