

Light and Circadian Rhythms

Wehr TA, Duncan WC Jr, Sher L, Aeschbach D, Schwartz PJ, Turner EH, Postolache TT, Rosenthal NE.

A circadian signal of change of season in patients with seasonal affective disorder. . Arch Gen Psychiatry. 2001 Dec;58(12):1108-14.

Section of Biological Rhythms, Mood and Anxiety Disorders Program, Intramural Research Program, National Institute of Mental Health, National Institutes of Health, Bethesda, MD 20892-1390, USA

BACKGROUND: In animals, the circadian pacemaker regulates seasonal changes in behavior by transmitting a signal of day length to other sites in the organism. The signal is expressed reciprocally in the duration of nocturnal melatonin secretion, which is longer in winter than in summer. We investigated whether such a signal could mediate the effects of change of season on patients with seasonal affective disorder. **METHODS:** The duration of melatonin secretion in constant dim light was measured in winter and in summer in 55 patients and 55 matched healthy volunteers. Levels of melatonin were measured in plasma samples that were obtained every 30 minutes for 24 hours in each season. **RESULTS:** Patients and volunteers responded differently to change of season. In patients, the duration of the nocturnal period of active melatonin secretion was longer in winter than in summer (9.0 +/- 1.3 vs 8.4 +/- 1.3 hours; P=.001) but in healthy volunteers there was no change (9.0 +/- 1.6 vs 8.9 +/- 1.2 hours; P=.5). **CONCLUSIONS:** The results show that patients with seasonal affective disorder generate a biological signal of change of season that is absent in healthy volunteers and that is similar to the signal that mammals use to regulate seasonal changes in their behavior. While not proving causality, this finding is consistent with the hypothesis that neural circuits that mediate the effects of seasonal changes in day length on mammalian behavior mediate effects of season and light treatment on seasonal affective disorder.

Kuller R.

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Environmental Psychology Unit, School of Architecture, Lund Institute of Technology, Sweden.

The present review discusses two types of biological rhythms, namely, circadian rhythms and circannual rhythms. Humans possess a circadian rhythm of approximately 24 hours, which is regulated by neural and hormonal processes. The synchronisation of this rhythm with the solar day and night is maintained through entrainment mainly by light. Dark environments completely lacking windows may have a negative effect on well-being and work capacity. During shift work the biological clock tends to maintain its normal 'diurnal' rhythm, which may lead to extreme tiredness and increased risk of accidents. Negative effects such as these may be partially alleviated by means of bright light during the night. During air travel across several time zones there is little time for the biological clock to adjust, but the resulting 'jet lag' may possibly be overcome by means of appropriately timed exposure to bright light. In countries situated far from the equator, the biological clock may become seriously disrupted during the short days of the dark season. Characterised by fatigue, sadness and sleep problems, these seasonal affective disorders may be cured or alleviated by means of regular periods outdoors, better lighting indoors, or, in the most serious cases, light therapy.