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Abstract

**Abstract:** In reindeer *Rangifer tarandus*, a high latitude species, the rhythmic production of melatonin periodically dissipates under natural photoperiods when, in mid‐winter, there is near permanent darkness and again, in summer, when there is permanent light. In spring and autumn, as expected, melatonin production reflects the ambient light:dark (LD) cycle. We investigated the expression of circadian mechanisms on blood levels of melatonin in reindeer. Two experiments were conducted in which animals were transferred from natural photic conditions into continuous darkness for 3 days: (i) in February, when they had been exposed to an LD cycle (11L:13D) and (ii) in July, when they had been exposed to permanent light. In July, plasma levels of melatonin rose abruptly on exposure to darkness but then declined over 24 hr before displaying a second rise and decline over the following 36 hr. In contrast, in February, levels of melatonin rose abruptly but then remained elevated for more than 60 hr in darkness.

Melatonin secretion upon exposure to darkness did not conform to a circadian pattern and did not, therefore, support the hypothesis that pineal activity in reindeer is tightly regulated by circadian mechanisms. Instead the secretion of melatonin appeared to be acutely and directly sensitive to ambient lighting. The results are consistent with a model in which Arctic resident animals have adapted to extreme photic conditions by disconnecting the generation of the pineal melatonin signal from their circadian machinery and relying, instead, on its being driven by the LD cycle for just a few weeks annually in spring and autumn.

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