



Regulation of serotonin N-acetyltransferase activity in the chick pineal gland by UV-A and white light: role of MK 801- and SCH 23390-sensitive retinal signals

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Abstract:

The rhythmic melatonin synthesis in the pineal gland is one of the most extensively studied circadian rhythms in vertebrates. Light is the dominant environmental factor controlling this process. Light at night acutely suppresses pineal melatonin content and activity of serotonin N-acetyltransferase (AANAT; the key and penultimate enzyme in the hormone biosynthetic pathway). In addition, pulses of light appropriately timed reset the circadian oscillator generating the melatonin rhythm. Although the avian pineal gland is a directly photosensitive organ, it has recently been demonstrated that light perceived by the eyes only regulates its activity. The present study shows that ocular exposure of chicks to UV-A radiation or white light during the second half of the subjective night markedly decreased AANAT activity in the pineal gland, and produced a significant phase advance of the circadian rhythm of the enzyme activity. Both the suppressive and phase-shifting effects of UV-A light were antagonized by intraocular pretreatment of birds with MK 801 (a selective blocker of NMDA glutamate receptors), but were not modified by SCH 23390 (a selective antagonist of D1-dopamine receptors). On the other hand, the suppressive and phase-shifting effects of retinally perceived white light were antagonized by intraocular injection of SCH 23390, and not affected by MK 801. Our results demonstrate that retinal illumination with UV-A radiation and white light provide powerful signals that shift phase of the circadian oscillator generating melatonin rhythm in the chick pineal gland. It is suggested that control of pineal melatonin synthesis by retinally perceived UV-A and white light might involve input from different photoreceptors.

Key words:

melatonin, AANAT, pineal gland, circadian rhythm, light, dopamine, glutamate, chick
