

Clock gene expression in adult primate suprachiasmatic nuclei and adrenal: Is the adrenal a peripheral clock responsive to melatonin?

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Abstract

The circadian production of glucocorticoids involves the concerted action of several factors that eventually allow an adequate adaptation to the environment. Circadian rhythms are controlled by the circadian timing system that comprises peripheral oscillators and a central rhythm generator located in the suprachiasmatic nucleus (SCN) of the hypothalamus, driven by the self-regulatory interaction of a set of proteins encoded by genes named clock genes. Here we describe the phase relationship between the SCN and adrenal gland for the expression of selected core clock transcripts (Per-2, Bmal-1) in the adult capuchin monkey, a New World, diurnal nonhuman primate. In the SCN we found a higher expression of Bmal-1 during the h of darkness (2000 – 0200 h) and Per-2 during day-time h (1400 h). The adrenal gland expressed clock genes in oscillatory fashion, with higher values for Bmal-1 during the day (1400 –2000 h), whereas Per-2 was higher at nighttime (about 0200 h), resulting in a 9- to 12-h antiphase pattern. In the adrenal gland, the oscillation of clock genes was accompanied by rhythmic expression of a functional output, the steroidogenic enzyme 3-hydroxysteroid dehydrogenase. Furthermore, we show that adrenal explants maintained oscillatory expression of Per-2 and Bmal-1 for at least 36 h in culture. The acrophase of both transcripts, but not its overall expression along the incubation, was blunted by 100 nM melatonin. Altogether, these results demonstrate oscillation of clock genes in the SCN and adrenal gland of a diurnal primate and support an oscillation of clock genes in the adrenal gland that may be modulated by the neurohormone melatonin.