Orexins/hypocretins and biological clock – anatomical and physiological approach.

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The thalamic intergeniculate leaflet (IGL) is involved in circadian rhythms entrainment by processing photic and non-photic/arousal-related cues. This modified signal is conveyed to the main circadian oscillator located in suprachiasmatic nuclei (SCN) of hypothalamus. It has been shown that nonphoptic-related cues associated with promotion and maintenance of wakefulness and locomotor activity are under influence of hypothalamic peptides - orexins (hypocretins). Furthermore, orexinergic fibers have been found in the areas of the IGL and SCN. Therefore, using in vitro extracellular recording we evaluated the influence of orexins on neuronal activity of rat IGL and SCN.

Local application of orexin A and orexin B (1 microM) increased firing rate in about 30% of IGL neurons. Approximately 73% of orexin B-responsive cells were also sensitive to specific orexin-2 receptor agonist (Ala11, D-Leu15-orexin B - 1 μM). None of investigated SCN neurons was sensitive to locally applied orexins. Using immunofluorescence labelings we showed that orexin-immunoreactive fibers may make synaptic contacts with neurons in the IGL. Only few orexinergic fibers were found in the SCN.

Presented data are the first showing the excitatory and modulatory influence of orexinergic system on IGL activity, which occurs mostly through stimulation of orexin-2 receptor.