

Mechanism of Coordination between Homeostatic and Circadian Regulatory Systems of Sleep

Aman Gupta^{1,2,3*}

¹PhD, Amity Institute of Neuropsychology & Neurosciences, Amity University Uttar Pradesh, Noida, India

²Visiting Fellowship fMRI- A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Harvard Medical School Boston, USA

³Sleep Medicine Graduate Reading, Nuffield Department of Clinical Neurosciences, University of Oxford, England

***Corresponding Author:** Aman Gupta, PhD, Amity Institute of Neuropsychology & Neurosciences, Amity University Uttar Pradesh, Noida, India.

Received: April 02, 2018; **Published:** May 11, 2018

Abstract

Statement of the Problem: Sleep is regulated through Homeostatic (S) and Circadian (C) processes. Significant literature is available on individual processes. In the current paper, coordination mechanism between the Homeostatic (S) and Circadian (C) Regulatory processes are with reference to Sleep/Wake Cycle is being reviewed.

Methodology: In the current write multiple original contributions were reviewed and a coordination process between the processes S and C is being explained. For the regulatory process S key components were found to be Orexin neuronal system, VLPO (Ventrolateral preoptic nucleus) and GABA neurons, monoaminergic neurons and Adenosine are involved. The process C involves the SCN (Suprachiasmatic -Nucleus), melatonin secretion, pRGCs (Retinal ganglionic cells) and peripheral organ clocks activation. Increased levels of adenosine in the forebrain are linked to induce sleep by virtue of activation of VLPO through GABA neurons. The GABA neurons also give feedback to the Orexin neurons at lateral hypothalamus which in turn leads to sleep induction. In the reciprocal process VLPO system gets deactivated leading to activation of Orexin system and through the Monoaminergic neurons wake state is brought. The process C involves the activation of the SCN by specific wavelength light. SCN which has direct connection with retina of the eye and the former initiates the secretion of Melatonin in the pineal gland and subsequent to which the peripheral organs clocks are activated leading to sleep state (Figure 1).

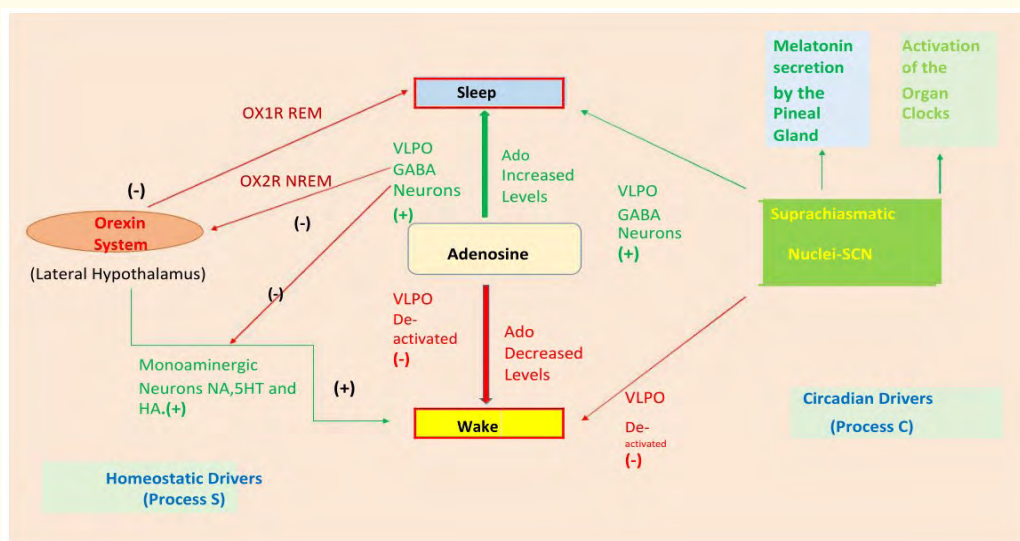


Figure 1: Schematic Diagram Illustrating the Circadian and Homeostatic Regulatory Processes of Sleep.

Findings: During the literature review it was observed that the process S and C are proposed to coordinate by interaction of Retina of the eye involving pRGCs (Retinal ganglionic cells) with VLPO (Homeostatic part) and controls Sleep/ Wakefulness.

Conclusion: Significance: Current review focused to investigate the linkage between the process C and S. It was found that another cells of retinal origin Retinal ganglionic cells (other than rods and cones) were responsible for the link between the two processes. This may lead to innovations in the field of diagnosis and management of Sleep disorders.

Keywords: Mechanism; Homeostatic; Circadian; Regulatory.

Bibliography

1. Bjorness TE and Greene RW. "Adenosine and Sleep". *Current Neuropharmacology* 7.3 (2009): 238-245.
2. Czeisler CA and Gooley J. "Sleep and circadian rhythms in humans". *Cold Spring Harbor Symposia on Quantitative Biology* 72 (2007): 579-597.
3. Dijk DJ and Archer and SN. "Light, Sleep, and Circadian Rhythms: Together Again". *PLOS Biology* 7.6 (2009): e1000145.
4. Ohno K and Sakurai T. "Orexin neuronal circuitry: Role in the regulation of sleep and wakefulness". *Frontiers in Neuroendocrinology* 29.1 (2008): 70-87.
5. Sakurai T. "Roles of orexin/hypocretin in regulation of sleep/wakefulness and energy homeostasis". *Sleep Medicine Reviews* 9.4 (2005): 231-241.

Volume 10 Issue 6 June 2018

©All rights reserved by Aman Gupta.