

The chemistry of Biological clock

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ABSTRACT ; As compared to total body, Brain is having small size but it consumes about 25% of body's energy. During sleep body and brain repair itself. Without sleep we are irritable, dizzy and even can have hallucinations. The sleep/wake homeostat regulates our sleep and awake. These two systems usually counterbalance each other but they operate independently so they can become misaligned. Jet lag or shift work can alter signals for these internal systems

An internal mechanism in organisms that controls the periodicity of various functions such as metabolic changes, sleep cycles, or photosynthesis is called the biological clock.

Also our Body function such as temperature and blood pressure are not constant throughout the day, they change in cyclic pattern. These daily fluctuations or circadian rhythms are fundamental to all organisms, from bacteria to human beings. Circadian rhythms help coordinate and synchronize our internal body functions, as well as our interactions with the external world. Our biological clocks drive our circadian rhythms.

Key words; Circadian rhythms, biological clock, melatonin, jet lag,

Introduction:

Depending on light and darkness in an environment there are physical, mental and behavioral changes that follow a roughly 24-hour cycle in living beings (circadian rhythms)

A group of nerve cells ("master clock") in the brain called the suprachiasmatic nucleus (SCN), controls circadian rhythms, it is powered, in a sense, by light. When light from outside strikes

the retina, bioelectric signals are generated and sent to the SCN via a neural pathway called the retinohypothalamic tract. Signals are also sent (via the optic nerve), to the visual cortex, where the sensation of vision is produced.

The signals that reach the SCN are processed and forwarded to the pineal gland. This is a pea size endocrine gland which secretes melatonin (This compound is the end product of a biosynthetic pathway that begins with the nutrient amino acid tryptophan). Melatonin is a hormone that makes us drowsy. When there is night more melatonin is produced which leads us to sleep.

Daylight signals from the retina, instructs the pineal gland to suppress melatonin production (though not entirely). Then, when daylight fades in the evening, the SCN's lack of stimulation is signaled to the pineal gland, and melatonin secretion is increased many times over, creating a physiological condition of "biological night" in the person.

By directly controlling the pineal gland's melatonin secretion, the SCN indirectly controls many of the body's circadian rhythms. Melatonin can significantly decrease sleep latency (the time it takes to fall asleep) and increase sleep efficiency and sleep duration[1]. When travelers pass through different time zones (jet lag) the circadian rhythms are disturbed hence the body's clock will reset itself but this takes a few days.

Along with melatonin another hormone serotonin is important. Serotonin is related to waking functions as melatonin is to sleepiness. Serotonin serves several functions, including the regulation of attention. Serotonin is important for healthily functioning of brain it filters out background noise and sensory data. Serotonin keeps our attention focused

Serotonin (hormone) is converted to melatonin at night. melatonin plays a fundamental role in regulating the body's biological clock. Melatonin governs the entire sleep/wake cycle, whereas serotonin is involved more specifically in wakefulness, in triggering sleep and in REM sleep.

Circadian rhythms show temperature compensation within limits (15-35⁰c), Under constant conditions, period of these rhythms is close to but never equal to 24 h.[2]

Circadian rhythms are also linked to various sleep disorders, obesity, diabetes, depression, bipolar disorder and seasonal affective disorder.

Studies demonstrated the loss of circadian rhythms in locomotor activity, drinking and circulating levels of adrenal corticosteroid upon the removal of the SCN [3,4]

In a landmark study [5] recording of neuronal activity from the SCN tissues, completely cutoff from the rest of the brain, continued to exhibit rhythm, while the rest of the brain showed arrhythmic neuronal activity and the animal too showed arrhythmic locomotor activity.

Studies have shown that during night shift work if there is timed light exposure at work environment the workers have decreased sleepiness and alertness is improved [6-11]

Conclusion

Circadian rhythms controls sleep-wake cycles, hormone release, body temperature and other important bodily functions. Circadian rhythms are produced by natural factors within the body, but they are also affected by Light present in the environment (turning on or turning off genes that control an organism's internal clocks).

There is close association between the circadian rhythms, melatonin and sleep in human beings. So melatonin can be useful for the treatment of insomnia related to jet lag or shift work. Serotonin also plays an even more vital governing role in regulating body clock than does melatonin. On regular daily cycles the body converts serotonin to melatonin, thus influencing the organism to undergo a period of sleep. Then, as the sleeping period approaches its end, the body converts melatonin back into serotonin.

In dark melatonin secretion is increased many times, the people which work in closed places having environment of poor light, feels drowsy and have altered circadian rhythms. If possible day light must be preferred at work environment to keep circadian rhyme in perfect order.

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