

# **Study of Circadian functions in humans (sleep pattern)**

## **Introduction**

Periodic circadian (24-h) cycles play an important role in daily hormonal and behavioral rhythms. Usually our sleep/wake cycle, temperature and melatonin rhythms are internally synchronized with a stable phase relationship. Our sleep/wake cycle is determined by the two independent but additive processes of homeostatic sleep drive and circadian influences. Homeostatic process involves an increasing sleep drive that builds up during wake and is dissipated in sleep. The circadian process involves self-sustaining 24- h rhythms of physiological activity.

In a normally entrained individual (synchronized with the light/dark cycle), the major sleep period occurs during the hours of darkness, with sleep onset taking place about 23:00 h and wake-up time occurring about 07:00 h. Melatonin onset precedes sleep onset by about 2 h and about 7 h before core body temperature minimum.

In humans, the circadian pacemaker is located in the suprachiasmatic nucleus (SCN), a small structure in the anterior hypothalamus, above the optic chiasma, on either side of the third ventricle. The SCN generates the endogenous rhythm with a period length (or time taken to complete a full cycle) of approximately 24.2 h. Entrainment of the circadian pacemaker (setting the clock time) is by photoperiodic information of light/dark cycle that is relayed to the SCN via the optic nerve (retinohypothalamic tract, RHT). Light/dark information is converted into action potentials by the photoreceptors in the retina and transmitted to the SCN via the RHT. From the SCN, rhythmic information reaches the pineal gland, a small pea-sized structure located close to the 3rd ventricle and ventrally to the splenium, and results in the synthesis and secretion of melatonin.

The present experiment was carried out to examine the sleep pattern of the subject, i.e. whether he/she is a morning person or an evening person, depending on the score obtained in the questionnaire (the copy of the questionnaire is already with the students.)

There have been a number of studies done about being a morning person vs. being a night owl. Night owls have a tendency to be more creative, but also can be prone to bad habits such as midnight snacking, smoking and they often suffer with insomnia. Morning people or early birds or larks are found to be persistent, agreeable, cooperative and proactive.

## **Methods and materials:**

Questionnaire was prepared according to Horne, J.A. and O. Ostberg (1976), International Journal of Chronobiology.

## **Observation and Result:**

Each subject then calculated the observed score from the questionnaire.

**Score results:**

70-86: Definitely a morning type

59-69: Moderately a morning type

42-58: Neither type

31-41: Moderately an evening type

16-30: Definitely an evening type (International Journal of Chronobiology)

**Interpretation:**

Sleep occurs within a circadian chronobiological context. Sleep is enhanced at some circadian phases and impaired at others. There are sleep and chronobiological disorders such as jet lag and shift work that appear to be based on desynchrony between the sleep-wake cycle and circadian rhythm. Zeitgebers can retine the body circadian system and thus resynchronize the circadian rhythm with the sleep-wake cycle and ameliorate these disorders. The most potent retiming effect appears to be that of intense bright light, particularly in the blue and green wavelengths. Therefore the appropriate timing of exposure to bright light and darkness would be indicated as effective treatments of these disorders.

The propensity to fall asleep appears to be determined by the circadian system with the most rapid increase of sleep propensity occurring approximately 2 h after the onset of the secretion of nocturnal melatonin and when core temperature is falling. Sleep propensity is then high for a period of about 8 h with the maximum propensity at the time of the temperature nadir. There also appears to be two 3-h periods when individuals are rarely able to fall asleep spontaneously. The first period, termed “the wake maintenance zone”, is centered approximately 6 – 9 h before the temperature minimum (about 19:00 – 22:00 h) with the second zone 4 – 7 h after the temperature minimum (about 09:00 – 12:00 h). This second zone, “the wake-up zone”, usually occurs during the rising part of the temperature cycle and appears to be associated with an increased probability of awakening from sleep.

Hence, according to the present experiment, the subject is .....