

## **Wakefulness and Sleep** <sup>[1]</sup>

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The study of sleep and wakefulness is essential in understanding several symptoms or conditions of disorders associated to behavioural neuroscience.

### **Circadian Cycle**

Any biological and behavioural change in functioning that happens over a period of 24 hours is called a circadian cycle, more commonly known as the sleep-wake cycle. The body structure that controls the circadian rhythm is the suprachiasmatic nucleus (SCN), situated right above the optic chiasm in the middle part of the hypothalamus. The length of the circadian cycle is established by the SCN by means of releasing hormones. When the SCN is stimulated, it prevents the release of melatonin by the pineal gland. Melatonin is a hormone induces rapid and mild sleepiness. When activity in the SCN is decreased, melatonin levels are elevated as in the case of people with seasonal affective disorder (SAD). Thus, individuals with SAD have disrupted circadian cycles.

### **Wakefulness**

In humans, there are two levels of arousal. Being awake and active indicates a Beta activity of 18 to 24 Hz. On the other hand, being relaxed (with eyes closed) points to an Alpha activity of only 8 to 12 Hz. Beta activity happens upon the electrical stimulation of the reticular activating system (RAS) in the reticular formation. Another part of the reticular formation is the group of neurons called locus coeruleus. When this neural group is destroyed, the individual will experience decreased wakefulness and increased sleep. The locus coeruleus uses the neurotransmitter norepinephrine which causes wakefulness and increased environmental stimuli attention.

### **Sleep**

A natural reoccurring body state, sleep <sup>[3]</sup> is condition wherein a person experiences decreased or absent consciousness, inactivity of almost all voluntary muscles, and fairly hanging sensory activity. Sleep is essential for body restoration, particularly in growth hormone activity and brain protein synthesis.

Basically, there are two types of sleep – the NREM (non-rapid eye movement) sleep and the REM (rapid eye movement) sleep. There are three progressive stages of NREM sleep. NREM

Stage 1 is characterized with active muscles with opening, closing and rolling of the eyes. Stage 2 includes theta waves activity which makes it more difficult to awaken the person. The sleeper progresses with the emergence of K complexes and sleep spindles caused by several sleep-wake transitions still in Stage 2. Delta waves commonly occur in Stage 3 sleep, and become predominant in Stage 4 sleep. In these two stages, the sleeper becomes less responsive to environmental stimuli. After NREM Stage 4 comes the REM stage, also known as paradoxical sleep. It is characterized by the paralysis of most muscles and having similar EEG waves as compared to a waking state, but the sleeper is very hard to awaken at this stage.

## Insomnia

There are three processes that regulate sleep – Process S (the homeostatic drive), Process C (the circadian clock) and Process A (the environmental threat response system). Among these, Process A is associated to insomnia, the state of having difficulty falling or staying asleep. Process A is activated when there is a feeling of threat from stress, which causes interference in sleep rhythms. Cognitive behavioural therapy is one of the psychotherapeutic approaches that help deal with insomnia.

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