**PHYSIOLOGY OF SLEEP**

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**ABSTRACT**

The invention of Electroencephalography encouraged researchers to explore question related to sleep around the world. As a result, Dr.Nathaniel kleitman concluded that the brain act as the “Sleep Drive” in 1929. This marked the beginning of various discoveries in the science of sleep. Despite being a relatively young branch of science, it has become significant, particularly in the field of neuroscience. However, there is still much to be discovered in the world of sleep.

1. **INTRODUCTION**

Sleep is the state of rest for the body and mind where the body did not react to external stimuli. Sleep also lead to a loss of consciousness. Sleep is an important component of human physiology. Human spend 25 year of their lifetime asleep.

1. **SLEEP REQUIREMENT**

 The average period of sleep required for normal body function; sleep requirement vary for different age group. However sleep requirement are not constant.

 New born : 18 to 20 hours

 Growing children : 12 to 14 hours

 Adult : 7 to 9 hours

 Old person : 5 to 7 hours

We are not Paul Kern, who did not sleep for 40 year until his death due to brain injury during world war 1,and we are also not the fictional character Rip Van Winkle, who did not wake up for 25 year after drinking excessive amount of wine. We are normal human being, unlike Paul kern and Rip Van Winkle, so we want to prioritize proper sleep requirement to maintain a healthy life.

1. **TYPE OF SLEEP**

Classification of sleep:

1. Non-rapid eye movement sleep or slow wave sleep.
2. Rapid eye movement or paradoxical sleep.
3. **NON-RAPID EYE MOVEMENT SLEEP**

 NREM is a type of sleep without eyeball movement; during which fluctuation in heart rate, blood pressure, respiration, and body temperature occur. Dreams do not occur during NREM. It is also known as slow-wave sleep. It occupies around 70 to 80% of sleep.

1. **RAPID EYE MOVEMENT SLEEP**

REM is a type of sleep with rapid eyeball movement, during which dreams occur. It occupies around 20 to 30% of sleep. It is also known as paradoxical sleep.

1. **STAGE OF SLEEP WITH EEG PATTERN**

There are five stage of sleep: four stages of NREM followed by REM. These cycles occur periodically, and the time required for the completion of one cycle is 90 to 110 minutes. Adults have 5 to 6 cycle per night.

**4.1 STAGE 1: STAGE OF DROWSINESS**

It is a period of wakefulness in which a person move to a drowsy state, and activity of muscle decrease. This period last for 1 to 10 minutes.

**EEG PATTERN**

 During the stage of drowsiness, alpha waves are seen, which starts to slowly disappear, followed by the appearance of theta waves.

**4.2 STAGE 2: STAGE OF LIGHT SLEEP**

 In this stage, a person enters light sleep from drowsiness, during which heart rate and body temperature start to decrease. During this stage, the body prepares itself to start its transition to deep sleep. This period lasts for 20 minutes.

**EEG PATTERN**

 Continuation of theta waves is seen, and sleep spindles or spindle bursts appear in-between the theta waves at a frequency of 14 per second. Sleep spindles are produced due to the electrical activity of the thalamus and corticothalamic fibers. K complexes are also seen during this stage due to external stimuli.

**4.3 STAGE 3: STAGE OF DEEP STAGE**

 It is the transitional period between light sleep and deep sleep.

**EEG PATTERN**

 During this stage, sleep spindles and theta waves start to disappear, followed by the appearance of delta waves with high amplitude. The frequency decreases to 1 or 2 per second.

**4.4 STAGE 4: STAGE OF DEEP SLEEP**

 During this stage, a person enters deep sleep, making it difficult to wake them. If someone wakes up during this stage, he or she may feel disoriented for a few minutes. The body's restorative processes, secretion of vital hormones that induce growth and development, boosting the immune system, and muscle repair, all occur during this stage. Bedwetting, nightmare, and sleepwalking occur during this stage. In majority of people, stage 3 and stage 4 all together last for 40 to 60 minutes.

**EEG PATTERN**

 In this stage, delta waves become more pronounced, characterized by their low frequency and high amplitude.

**4.5 STAGE 5: REM SLEEP**

 During this stage, eyes dart around rapidly in all directions as dreams unfold. Muscles are relaxed or momentarily immobilized. Heart rate and blood pressure experience an uptick, while respiration becomes quicker, more shallow, and irregular. This stage only lasts for 10 minutes during the first cycle, but it progressively increases in subsequent cycles until it reaches about 1 hour.

**EEG PATTERN**

 Irregular waves with high frequency and low amplitude are observed during this stage. These are also referred to as desynchronized waves.

1. **SLEEP CENTER**

 Complex pathways between the reticular formation of the brainstem, diencephalon, and cerebral cortex are responsible for the onset and maintenance of sleep.

**5.1 BRAINSTEM HAS TWO CENTER RESPOSIBLE OF SLEEP**

1. Raphe nucleus
2. Locus coeruleus

**5.2 ROLE OF RAPHE NUCLEUS**

 The raphe nucleus releases serotonin, which is responsible for inducing non-rapid eye movement sleep. It is located in reticular formation of lower pons and medulla

**5.3 ROLE OF LOCUS COERLEUS**

The locus coerleus release Noradrenaline which is responsible for inducing REM sleep. It is located in reticular formation of pons.

1. **SLEEP DISORDER**

 **6.1 INSOMNIA**

 It is a common sleep disorder in which a person finds it hard to stay asleep. It is mainly caused by psychiatric problems, alcohol addiction, and drug addiction.

 **6.2 SOMNAMBULISM**

 It is characterized by walking while in the state of sleep. It is also called sleepwalking.

 **6.3 NIGHTMARE**

 It is characterized by extremely intense and uncomfortable fighting dreams that disrupt sleep.

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