

Slow Wave and REM Sleep

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Introduction

Sleep involves a series of five rhythms that are followed by the body throughout the sleep process. The stages are divided into slow-wave sleep and REM sleep. It is worth noting that sleep is a common phenomenon in all organisms, and without it, their quality of life is adversely affected. A full cycle takes at least ninety minutes, and several cycles of sleep are observed during the night. The organism transits these sleep states throughout the night, a process that determines the quality of sleep and the general mental state of the organisms after sleep (Vyazovski, 2014).

Slow-Wave Sleep

Slow-wave sleep is a sleep stage that involves the third and fourth stages of the sleep cycle. Recent studies have led to the consolidation of both stages by several scholars due to their similarities in sleep architecture. The slow-wave phase shows a decrease in neuronal activity. The secretion of hormones at this stage of sleep shows more secretion of growth hormone into the circulation. Slowed brain activity is also associated with lower glucose intake, which balances the high intakes experienced during the wakeful states. The slow-wave state is signified by the absence of muscle tone, the absence of genital stimulation, and average muscle tone.

REM Sleep

REM sleep is a phase of sleep that is marked by the presence of increased body movement and dreaming. The phase is also marked by increased muscle tone. The phase also shows the presence of brain activity that is not well coordinated. The presence of waves is thought to be due to increased acetylcholine levels in the brainstem with decreased monoamine neurotransmitters, leading to increased brain electrical activity. REM sleep is associated with phases of central nervous system disruption of homeostasis, leading to dysregulation of thermoregulation, respiration, and circulation in the rest of the body.

Brain Activity

The slow-wave sleep is associated with the resting of the neocortical neurons. The resting of these neurons is enabled by neuronal hyperpolarization, which leads to reduced neuronal activity. The second phase of this cycle is signified by mild depolarization of the neocortical neurons. The slow-

wave sleep is important for memory formation and learning. In this stage, the brain is able to synthesize events and form a basis for sleep-dependent memory consolidation. The REM stage of sleep is associated with neuronal stimulation identical to the wakeful state, with the principal stimulation originating from the brainstem.

EEG Recording

The EEG recording of slow-wave sleep is characterized by slow waves of frequencies between 0.5-2Hz. The peak amplitude is normally greater than 75 microvolts. The slow-wave sleep cycle is associated with slowed neuronal firing, leading to the low frequencies recorded in the electroencephalogram.

The EEG findings in REM sleep are identical to the wakefulness state, with a hippocampal recording of electrical activity between 40-60 Hz, which includes predominantly gamma waves. The neurons of the cortex and the thalamus show more stimulation in REM sleep, just as in the wakeful state, with the only difference being a reduced cohesion between the different sections of the brain activity. The lack of coordination between the electrical activities of the different sections of the brain causes the disorganized state associated with dreaming (Vyazovski, 2014).

Stimulus-Response Learning

Stimulus-response learning is a learning process in which the learner is enabled to associate certain stimuli in the environment with responses that were not present for the given stimulus in the past. In this form of learning, the individual is made to respond to a given environment phenomenon in a given way that was not present in the past.

The stimulus-response form of learning was pioneered by early behaviorists like Ivan Pavlov through his work in the development of the theory of operant conditioning. Through his experiments with dogs, he was able to demonstrate the effects of pairing an environmental stimulus to a stimulus that elicits a natural response in the subject. After a series of experiments, he was able to evoke salivation in dogs after ringing a bell due to the continuous pairing of the giving of food and the ringing of the bell. After some time, the dogs learned to salivate even without the presence of food if the bell was rung. Pavlov demonstrated that it is possible for an organism to learn new behavior by pairing an unconditioned stimulus with a neutral stimulus, which, with time, leads to the development of the response of interest. It is worth noting that in stimulus-response learning, all the responses targeted are always involuntary, and the organism evokes them without knowing (Vartak, 2017).

Motor Learning

Motor learning is a complex process in which the individual going through the learning process retains skills through observation and assimilation. The process is continuous, and the more time the subject takes to interact with different scenarios of the same set-up, the increased the chances of retaining the motor skills of interest. The process of motor learning is an individualized process with differential learning ability from one subject to the other.

Motor learning involves three stages, the cognitive stage, the associative stage, and the autonomous stage. The cognitive stage is the first stage of the learning process in which the learner identifies with the skill of interest. The modification of environmental factors to best suit the learning of the motor skill is crucial in ensuring that the student understands the basics of the skill of interest. The cognitive stage is a stage where the learner is mostly concerned with learning what to do.

In the associative stage, the learner has learned the basics required to learn the motor skill, and he/she is able to concentrate on perfecting the skill learned. The success of this stage is dependent on practice. The learner now relies more on their joint position and proprioceptive function to perfect the skill being learned.

The last stage of autonomous control is signified by the automation of motor skills. The learner is now able to perform the skill learned in different settings with minimal cognitive involvement.

Example Situation

Motor learning is well demonstrated in children learning how to walk. The initial stages need aid from the guidance to avoid injuries to the subject. The learning child then uses associative events to improve their walking and, later on, after learning the skill, can subconsciously carry out different procedures, including dancing.

Stimulus-response learning has been demonstrated in clinical trials. For instance, by pairing loud noise, which naturally evokes fear in children, it is possible to cause fear responses when the noise is paired with other components like furry objects. The child responds to the new stimulus as they would to the initial noise alone, as demonstrated by Skinner on Little Albert.

References

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