1. Physiology of Sleep

Sleep is a condition of the body and mind which recurs for some hours with the eyes closed, postural mucles relaxed and cosciousness practically suspended.

It is important to know that the electrical activity of the body during sleep is different from the electrical activity of the body during wakefulness and this is known through the use of the EEG (electroencephalographic) recordings.

We fall asleep when there is inhibition of the Reticular Activating System and GABA (gamma-aminobutyric acid) neurotransmitter becomes dominant. Increase in GABA leads to a decrease in acetycholine, noradrenaline, gluatamate and histamine which are important neurotransmitters helping in wakefulness.

STAGES OF SLEEP

Rapid Eye Movement Stage (REM) also known as quiet sleep

Non-Rapid Eye Movement Stage (NON-REM) also known as active sleep is further divided into 4 stages:

Stage 1

Stage 2

Stage 3 and 4 (they are grouped together because they are similar)

DIFFERENCES BETWEEN THE TWO STAGES OF SLEEP

REM sleep is very peaceful because of the dominance of the parasymathetic activity while NON-REM sleep is not exactly restful as there is dominance of the sympathetic activity.

In REM sleep dreaming is not frequent because it cannot be recalled after awakening but in NON-REM sleep dreams occur and can be remembered after awakening.

NON-REM STAGES

Stage 1- this is the transition between wakefulness and sleep. Consciousness can easily be regained as a result of external factors like noise. It lasts between 5-10 minutes. Brain waves in this stage as identified by the EEG are alpha waves.

Stage 2- it is the deeper form of Stage 1. It constitutes about 45% of the total sleep episode. Body temperature and heart rate slows down during this stage and the rain becomes relatively relaxed. This is the longest stage of sleep. Here sleep spindles are K-compexes are formed.

Stage 3 and 4- it is the deepest form of all the stages of sleep. The muscles become relaxed and blood pressure and breathing rate remain low. In stage 3 the brain waves as identified by the EEG are delta waves.

REM STAGE

In this stage the brain becomes very active. Dreams occur in this stage. It is very important as it helps in revitalizing memory.

Individuals do not remain in REM sleep throughout the night but, rather, cycle between the stages of NON-REM and REM sleep throughout the night.

SLEEP DISORDERS

Sleep talking- it can occur during any sleep stage and it is commonly seen in children.

Bedwetting- this is the involuntary release of urine at night by people who do not have bladder control. It is commonly seen in children.

2) Role of the basal ganglia in co-ordinating movement

Basal Ganglia is a group of sub-cortical nuclei of varied origin situated at the base of the fore-brain and top of the mid-brain. The primary function of the basal ganglia is to control and regulate activities of the motor and premotor cortical areas so that voluntary movements can be performed smoothly. The basal ganglia is strongly interconnected with the cerebral cortex, thalamus and brain stem as well as other brain areas. The direct pathway throughthe basal ganglia facilitates the initiation and execution of voluntary movement.

The direct pathway passes through the caudate nucleus, putamen and globus pallidus which are all part of the basal ganglia. It also involves the substantia nigra which is another part of the basal ganglia.

When an individual is at rest, a specific region of the globus pallidus sends spontaneous inhibitory signals to the ventral nucleus of the thalamus through the release of GABA which is an inhibitory neurotransmiter. Inhibition of the neurons that project to the ventral anterior nucleus which projects to the motor regions of the cerebral cortices of the telencephalon leads to an increase in motor activity thereby promoting muscular action.