NAME : AGOHA CHINAZA

MATRIC NO: 17/MHS01/034

COURSE : NEUROPHYSIOLOGY

1. Discuss the physiology of sleep

Sleep is defined as a state of unconsciousness from which a person can be aroused by sensory or other stimuli, sleep can be divided into 2 types;

A) Rapid Eye Movement (REM) or paradoxical sleep : in a normal night of sleep bouts of REM sleep appear on the average of every 90 minutes in young adults, when the person is very sleepy REM may be short or even absent but as the person gets more rested REM duration increases. It has the following characteristics;

- Active form of sleep associated with bodily movements

- The person is more difficult to be aroused by stimuli

- Depressed muscle tone as a result of inhibition of spinal muscle control areas

- Irregular heart rate and respiratory rate

- Irregular muscle movement in addition to rapid eye movement

- Increased brain metabolism and brain activity which explains the paradoxical nature of sleep in which brain activity is the same as the awaken state

B) Slow wave sleep or Non Rapid Eye Movement Sleep (NREM): This sleep of extremely restful and is associated with decreased peripheral vascular tone and other functions of the body like blood pressure, respiratory rate & basal metabolic rate. Dreams of slow wave sleep are usually not remembered because consolidation of dreams in memory does not occur.

**Basic theories of sleep**

- Sleep is caused by an active inhibitory process because a center located at midpontine level of brain stem is required to cause sleep by inhibiting other parts of the brain

- Neuronal centers and neurohormonal substances cause sleep: example of certain areas in the brain which when stimulated cause sleep are;

i) Raphe nuclei : it is found in lower pons and medulla region , fibers from this region extend into the hypothalamus, thalamus, limbic system, neocortex and evening descend to the spinal cord where they terminate in the posterior horn and inhibit sensory signals.

Serotonin is also released by the nerve endings is this fibers and plays an important role in inducing sleep

ii) Nucleus of tractus solitarius : this nucleus terminates in the medulla and pons, stimulation of this nuclei results in sleep

iii) Regions in the diencephalon : parts like the suprachiasmal area of hypothalamus and occasional area in diffuse nuclei of thalamus are also responsible for sleep

iv) cerebrospinal fluid and blood of sleep deprived animals contains certain substances that may be used to induce sleep e.g muramyl peptide

When sleep centers are not activated, the mesencephalic and upper pontile reticular activating nuclei are released from inhibition, which allows the reticular activating nuclei to become spontaneously active . The activity then sends positive feedbacks signals to reticular activating nuclei from the cerebral cortex and peripheral nervous system, after the brain remains activated for a while the neurons in the activating system becomes fatigue which fades the positive feedback making the sleep promoting effects of sleep centers take over leading to transition from wakefulness to sleep.

Sleep is very important as it helps to restore natural balances among neuronal centers

2. Discuss the role of basal ganglia in coordinating movements

Basal ganglia are group of structures found deep in the cerebral hemisphere and brain stem, they are involved in movement . They include;

- Subthalamic nucleus: it lies between the thalamus (above) and substantia nigra (below) the fibers connecting the this nucleus to globus pallidus form the subthalamic fasciculus which passes the internal capsule . The subthalamic nucleus contains glutamate which sends excitatory input to globus pallidus

- Substantia nigra: it is the mesencephalic grey matter portion of basal ganglia and is divided into reticular and compact parts based on arrangement of the neurons . Dopamine- an inhibitory neurotransmitter is producer in the pars compacta, there is a connection between pars reticulata, subthalamic nucleus and globus pallidus through which dopaminergic fibers are sent to thalamus

- Corpus striatum : This is made up of 2 parts ;

I) pallidum: made to of globus pallidus , received afferent fibers from striatum but sends efferent to substantia nigra and thalamus

II) striatum : composed of caudate nucleus & putamen . It sends efferent fibers to the substantia nigra and pallidum but receives afferent fibers from the following

a) cerebral cortex : the fibers are excitatory releasing glutamate which excite the neurons in the striatum

b) substantia nigra: This connection releases dopamine to the striatum (inhibitory in nature)

c) thalamus: thalmostriatal connections carry glutamate and are thus excitatory

d) reticular formation : especially those in the mid brain supply noradrenaline neurotransmitter to the basal ganglia

d) locus ceruleus: the fibers from this are serotonergic.

Basal ganglia exert their role in motor control through constant interaction with cerebral cortex and corticospinal pathway. Cognitive control of motor activity in which nucleus caudatus plays an important role and one of the major roles of the basal ganglia is to participate in control of complex patterns of motor activity such as letter writing , cutting paper with scissors, etc

The role of basal ganglia in motor coordination is performed collectively by each individual component which results in coordinated motor movement