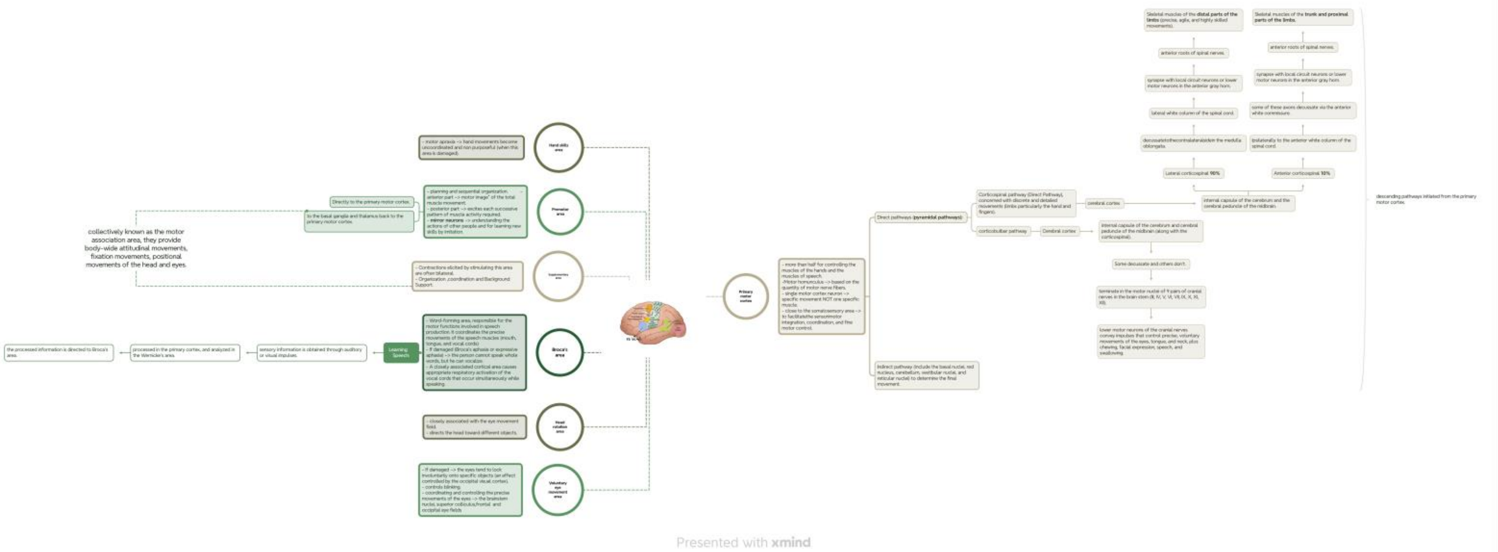
Lecture 1 (Motor cortex)

- Cortex ~> lower brain areas (cord, brain stem, basal ganglia, and cerebellum) ~> skeletal muscles ~> voluntary movement **OR** cortex ~> anterior motor neurons of the cord (directly) ~> skeletal muscles (fine movements of the fingers and hands).

  https://drive.google.com/file/d/1SdJzCck5aeR_YQ0McT5F2Mm0Ma8G51g_/view?usp=sharing



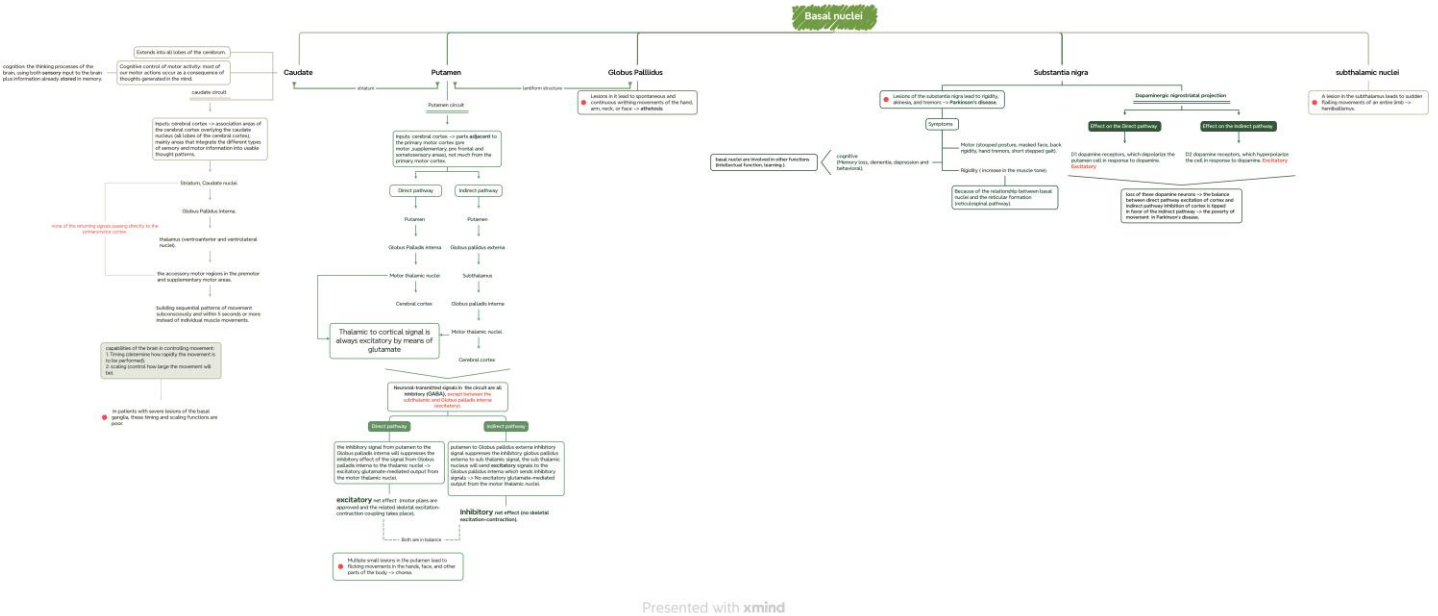
- There are other small pathways which rise from the motor cortex and go deeply in the cerebrum and brain stem.
- functions of the motor cortex are controlled mainly by nerve signals from the sensory system, and then it operates in association with the basal ganglia and cerebellum to excite appropriate motor actions.
  - incoming fiber pathways to the motor cortex:
    1. from adjacent regions of the cerebral cortex.
    2. arrive through the corpus callosum from the opposite cerebral hemisphere.
    3. from different thalamic nuclei.
- Columns in motor cortex: each column has six layers of cells. each column of cells functions as a unit (stimulating a group of synergistic muscles, or just a single muscle). each column can function as an amplifying system to stimulate large numbers of pyramidal fibers (to same muscle or synergistic muscles). The neurons of each column use information from multiple input sources to determine the output response from the column.
  - each column of cells excites two populations of pyramidal cell neurons:
    1. dynamic neurons: excited at a high rate for a short period at the beginning of a contraction, causing the initial rapid development of force.
    2. static neurons: fire a slower rate and continue firing ~> maintain the force of contraction.
  - Activating of one pyramidal cell is not enough.
  - pyramidal cells lie in the 5th layer, has a pyramid-shaped cell body.
  - Pyramidal cells are the main output cells of the cerebral cortex.
  - Giant pyramidal cells (Betz cells) ~> the most rapid rate of transmission of signals from the brain to the cord.

- The frontal cortex ~> assessing the appropriateness of certain movements, inhibiting actions, making judgments, deciding whether to initiate or or suppress specific movement and evaluating the context and consequences of actions.

Lecture 2 (Basal nuclei)

- The basal nuclei are gathered as bundles and surrounded completely by white matter.
- Cerebral cortex (mostly) ~> basal nuclei ~> cerebral cortex.
- The internal capsule is located between the caudate nucleus and the putamen, which represents association between the basal nuclei with the corticospinal system and the sensory nerve fibers connecting the cerebral cortex and spinal cord.
- The basal nuclei function in close association with the cerebral cortex, basal nuclei interpret motor decisions provided by premotor and prefrontal areas, prioritize some, and reject others and even modify the pattern of some.

  https://drive.google.com/file/d/1FTEABLcqAaACXKwaeUSC2Bd2RQFuUj0K/view?usp=sharing



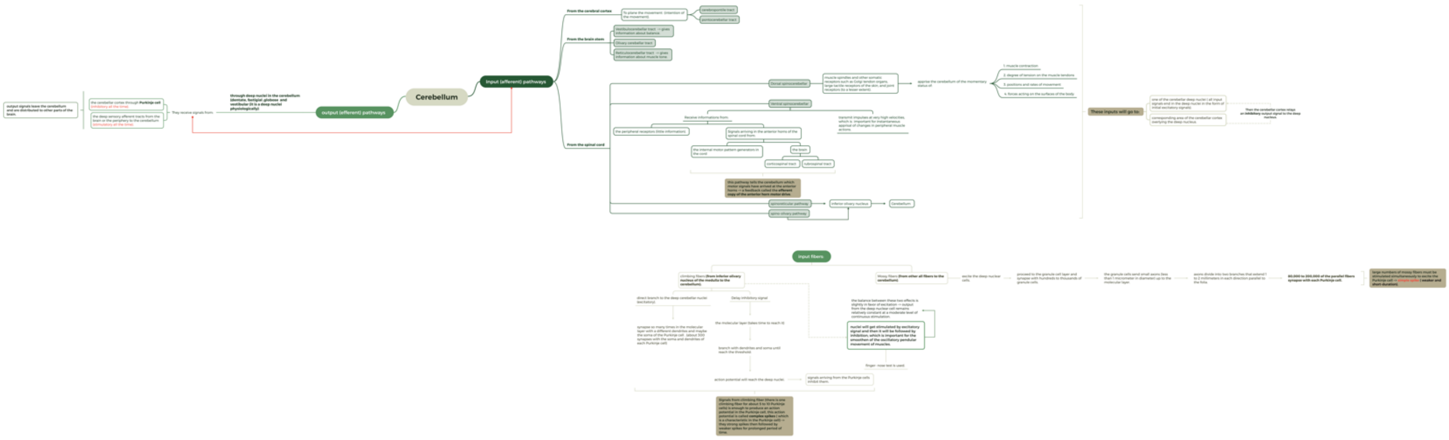
  - **Huntington's disease:** inherited (autosomal dominant). the caudate nucleus and putamen degenerate, with loss of neurons that normally release GABA or acetylcholine. Chorea is a key sign (rapid, jerky movements occur involuntarily). Progressive mental deterioration occurs. Symptoms appear in age of 30 or 40, death occurs 10 to 20 years after symptoms.
- Function of basal nuclei: plan and control complex patterns of muscle movement (control relative intensities of the separate movements, directions of movements and sequencing of multiple successive and parallel movements), initiation of movements, suppression of unwanted movements and regulation of muscle tone and nonmotor processes.
  - Initiation of movements: basal nuclei ~> thalamus ~> premotor area ~> upper motor neurons in the primary motor area ~> activate corticospinal and corticobulbar tracts.
  - Suppression of unwanted movements: by tonically inhibiting the neurons of the thalamus.
  - Regulation of muscle tone: basal nuclei ~> reticular formation ~> reduce muscle tone via the medial and lateral reticulospinal tracts.
  - Regulation of nonmotor processes: sensory, limbic (with the limbic system to regulate emotional behaviors), cognitive (attention, memory, and planning) and linguistic functions.

- **Tourette syndrome:** involuntary body movements (motor tics) and the use of inappropriate or unnecessary sounds or words (vocal tics). Unknown cause (dysfunction of the cognitive neural circuits between the basal nuclei and the prefrontal cortex is suggested).
- **Psychiatric disorders:** such as schizophrenia and obsessive-compulsive disorder, are thought to involve dysfunction of the behavioral neural circuits between the basal nuclei and the limbic system.
- Posterior parietal cortex:
  - The locus of the spatial coordinates, for motor control of all parts of the body, as well as for the relationship of the body and its parts to all its surroundings.
  - 🔴 lesions of the posterior parietal cortex produce an inability to spatially perceive objects or body parts accurately through normally functioning sensory mechanisms ~> agnosia. These patients can't perceive the spatial dimensions of one side, they deal completely with only one side of the world ~>personal neglect syndrome.

Lecture 3 (Cerebellum)

- Function of cerebellum: coordination, it the collects information about the movements and positions of all parts of the body even at a subconscious level. It helps provide turn-on signals (on the agonist muscles and off for the antagonist).
- Parts of cerebellum:
  1. lateral zone: no representation of body parts.
  2. intermediate zone represents the distal muscles.
  3. vermis part represents the axial and proximal muscles.
  4. Flocculonodular lobe.
- Layers of the cerebellum:
  1. Molecular layer (outermost).
     - basket cells and stellate cells are located in in the molecular layer. They are inhibitory cells with short axons. These cells send their axons at right angles across the parallel fibers and cause **lateral inhibition** of adjacent Purkinje cells.
  2. Purkenje cell layer.
  3. Granule cell layer (the deepest)
- signals that will reach to the cerebellum: actual movement from motor and sensory signals and the plan of movement, depending on these informations it will send corrective feedback mostly to the cerebral cortex and rubrospinal tract.

https://drive.google.com/file/d/1JWcpMBSOZCNZv-YI1ri6LQhc13obxPUX/view?usp=sharing



Presented with xmind

- functional unit centers on large Purkinje cell and a corresponding deep nuclear cell.
- Both Purkinje cells and deep nuclear cells are that normally fire continuously, Purkinje cell fires at about 50 to 100 action potentials per second, and the deep nuclear cells fire at much higher rates.
- the output activity of both Purkinje and deep nuclear cells can be modulated.
- deep nuclear cell is under both excitatory and inhibitory influences.

- The degree to which the cerebellum supports onset an offset of muscle contractions, as well as timing of contractions, **must be learned** by the cerebellum.

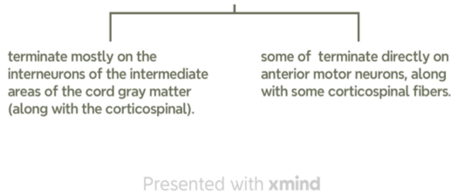
Lecture 4 (Motor control)

Functional subdivisions of the cerebellum			
	1. Vestibulocerebellum	2. Spinocerebellum	3. Cerebrocerebellum
Consists of:	the flocculonodular cerebellar lobes and adjacent portions of the vermis.	most of the vermis and the intermediate zones.	the lateral zones of the cerebellar hemispheres.
Function:	Controlling and coordinating the equilibrium and postural movements. → It is important in controlling balance between agonist and antagonist muscle contractions of the spine, hips, and shoulders during rapid changes in body positions. → Informations from the periphery and the vestibular apparatus are in a feedback control circuit providing a correction postural motor signals for maintaining equilibrium.	coordinate the reciprocal contractions of agonist and antagonist muscles in the peripheral portions of the limbs, especially in the hands, fingers, and thumbs. → Ballistic movements are controlled by having the entire movement preplanned and set into motion to go a specific distance and then to stop. (By learning)	1. plan sequential voluntary body and limb movements. → not with what movement is happening at a given moment but with what will be happening during the next sequential movement (seconds later). → Important of smooth progression of the successive movement. 2. timing of the sequential movements. → provide appropriate timing for each succeeding movement 3. Prediction of the rates of progression of both auditory and visual phenomena. → interpreting rapidly changing spatiotemporal relations in these sensory information.
Dysfunction:	disturbance of equilibrium and postural movements, especially during **rapid movements** which involve changes in direction.	the ballistic movements are slow to develop and to stop.	1. lateral zones of the cerebellar hemispheres, along with their deep nuclei (dentate nuclei) -> incoordination of complex purposeful movements of the hands, fingers, and feet and of the speech apparatus. 2. capability of planning is disturbed for rapid movements. 3. loses the subconscious ability to predict how far the different parts of the body will move in a given time -> inability to determine when the next sequential movement needs to begin. → failure of smooth progression of movements.
Pathway:		information from the motor cortex And the periphery about the intention of the plan of movement -> intermediate zone -> comparing these information then decide if there is any corrective feedback -> the corrective feedback will come through interposed deep nuclei (intermediate zone) or fastigial nuclei (vermis) -> 1. red nucleus (magnocellular part) through **rubrospinal tract** then to periphery through and another signal will go to 2. the thalamus through ventromedial and ventrolateral nuclei to the **cerebral cortex** to do the appropriate correction.	It receives all its input from the cerebral cortex, no inputs from the periphery. And transmits its output information back to the brain (feedback). cerebral cortex to the cerebellum mainly the dentate nucleus then via the thalamus go back to the cortex.

Presented with xmind

Midbrain:

1. Red nucleus:
    - Receives fibers from the primary motor cortex through the **corticorubral tract** and from the **corticospinal tract** that passes through the mesencephalon. These fibers will synapse in the lower portion of the red nucleus (the magnocellular portion) .
    - the magnocellular portion contains large neurons similar in size to the Betz cells, these neurons give rise to the **rubrospinal tract** which crosses to the **opposite side** in the lower brain stem and follows a course immediately adjacent to the corticospinal tract into the **lateral columns of the spinal cord**, then



    - corticospinal and rubrospinal tracts ~> lateral motor system of the cord.
    - vestibuloreticulospinal system ~> medial motor system of the cord.
        - When the corticospinal fibers are destroyed but the corticorubrospinal pathway is intact ~> discrete movements c occur, except the movements for fine control of the fingers and hands.
    - The magnocellular portion of the red nucleus has a somatographic representation of all the muscles of the body (less developed than in the motor cortex), so stimulation of a single point in this portion causes contraction of either a single muscle or a small group of muscles.
    - greater percentage of dynamic neurons is in the red nucleus and a greater percentage of static neurons is in the primary motor cortex; because the red nucleus is closely allied with the cerebellum, which plays an important role in rapid initiation of muscle contraction. (similar to the connections between the motor cortex and the cerebellum)
2. Reticular nuclei:
    - divided into pontine reticular nuclei and medullary reticular nuclei.

1. **Pontine reticular nuclei**:
        - excitatory signals into the cord through the pontine reticulospinal tract in the anterior column of the cord.
        - terminate on the **medial** anterior motor neurons that excite the axial muscles (**against gravity**), muscles of the vertebral column and the extensor muscles of the limbs.
        - receive excitatory signals from the vestibular nuclei and the deep nuclei of the cerebellum. These pathways medullary reticular inhibitory system.

2. **Medullary reticular nuclei:**
        - inhibitory signals to the antigravity anterior motor neurons via the medullary reticulospinal tract in the **lateral** column of the cord.
        - receive inputs from the corticospinal tract, the rubrospinal tract and other motor pathways.
    - The excitatory and inhibitory reticular nuclei constitute a controllable system that is manipulated by motor signals from the cerebral cortex.

3. Vestibular nuclei:
    - function in with the pontine reticular nuclei to control the antigravity muscles, without this support the pontine reticular system would lose much of its excitation of the axial antigravity muscles.
    - The specific role: **selectively** control the excitatory signals to the antigravity muscles to maintain **equilibrium** in response to signals from the vestibular apparatus.
    - transmit strong **excitatory** signals to the antigravity muscles via the lateral and medial vestibulospinal tracts in the **anterior** columns of the spinal cord.
    - the vestibular nerve fibers terminate in:
      1. The vestibular nuclei (mostly) ~> synapse with neurons send fibers into the cerebellum, the vestibulospinal tracts and other areas of the brain stem, particularly the reticular nuclei.
      2. the brain stem reticular nuclei.
      3. the cerebellar fastigial.
      4. flocculonodular lobe nuclei ~> concerned with dynamic equilibrium signals from the semicircular ducts (🔴 Injury of the duct or the lobes causes loss of dynamic equilibrium during rapid changes in direction, but not static conditions).
    - Signals transmitted both the vestibular nuclei and the cerebellum via the medial longitudinal fasciculus cause corrective movements of the eyes when the head rotates. Signals also pass to the cerebral cortex, terminating in a primary cortical center for equilibrium.

Lecture 5 (Limbic system)

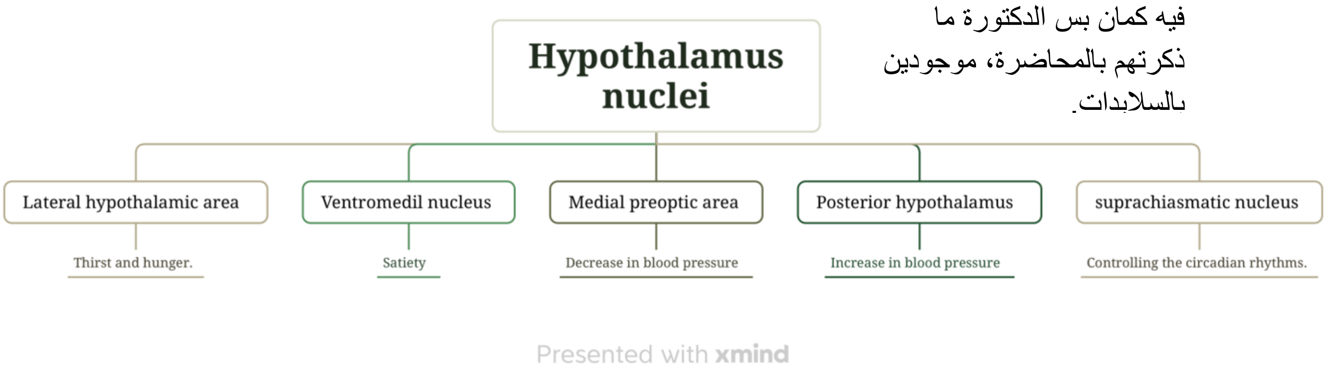
- The cerebrum is useless without signals from the brain stem.
- cerebrum is activated by the brain stem through two ways:

1. Direct neuronal signal: from the **excitatory area of the reticular formation** in the pons and mesencephalon (the bulboreticular facilitory area).
    - Excitatory neurons, neurotransmitters are acetylcholine.
    - Gigantocellular cells ~> through the thalamus ~> the widespread areas in the cerebral cortex and multiple subcortical areas.
    - the excitatory area of the reticular formation is stimulated by: 1. Excitatory sensory signals from the periphery. 2. positive feedback from the stimulated area of the cortex (by brain thought processes or by motor processes), so maintain the level of excitation of the cerebral cortex or enhance it.
    - Each area of the thalamus will transmit signals to specific area of the cerebral cortex.
    - Pain is the most stimulatory signal for this area ~> strongly excite the brain to attention.
    - Olfaction has no pathway to this area. (Inhalation of alcohol or onion smell stimulate pain pathway not olfactory)
    - This area is inhibited by the inhibitory area which stimulate a serotonergic neuron (serotonin, that is inhibitory).
2. neurohormonal systems (neurotransmitters):
    - long periods of control.
    - neurotransmitters ether inhibitory or excitatory or inhibitory and excretory at the same time.

- Substantia nigra ~> dopamine (inhibitory).
  Gigantocellular cells ~> acetylcholine (excitatory).
  Locus ceruleus ~> norepinephrine (excitatory, dreaming).
  Raphe nuclei ~> serotonin (inhibitory, suppress pain and sleep).

- **Limbic system:**
  - Controls emotional, behavior and motivations, to control the circadian rhythms.
  - Parts: amygdala, hippocampus, parts of the basal nuclei, anterior nuclei of the thalamus, paraolfactory area, septum area, the limbic cortex and the **Hypothalamus.**
  - Limbic cortex: communicating between neocortex and the subcortical areas.
  - The hypothalamus controls the vegetative and endocrine functions and many aspects of emotional behavior.
  - Signals form the hypothalamus go to three directions:
    1. the pituitary gland.
    2. Anterior thalamus (then to the cortex) and other limbic portions.
    3. Reticular areas in the brain stem.

فيه كمان بس الدكتورة ما ذكرتهم بالمحاضرة، موجودين بالسلايدات.



- The suprachiasmatic nucleus receives inputs from the ganglion cells (contain melanopsin pigment) in the retina. Sense the light and transmit the signals to the suprachiasmatic nucleus through the retinohypothalamic tract.
- the circadian rhythms are needed to regulate body functions. cels can have their own circadian rhythms and can work hours to days (not more than that).
- the circadian rhythms of are endogenous and self-sustained but can be affected by environmental changes such as temperature and timing of the light-dark cycle.
- limbic structures are concerned with the affective nature of sensory sensations which may be pleasant (reward, satisfaction), or unpleasant (punishment or aversion).
- reward and punishment centers are one of the most important of all the controllers of our bodily activities.
- **Punishment centers**:
  - areas in the hippocampus, amygdala and some nuclei of the hypothalamus (Periventricular area).
  - Areas the amygdala and hippocampus are less potent.
  - stimulation in the punishment centers can p inhibit the reward centers completely.

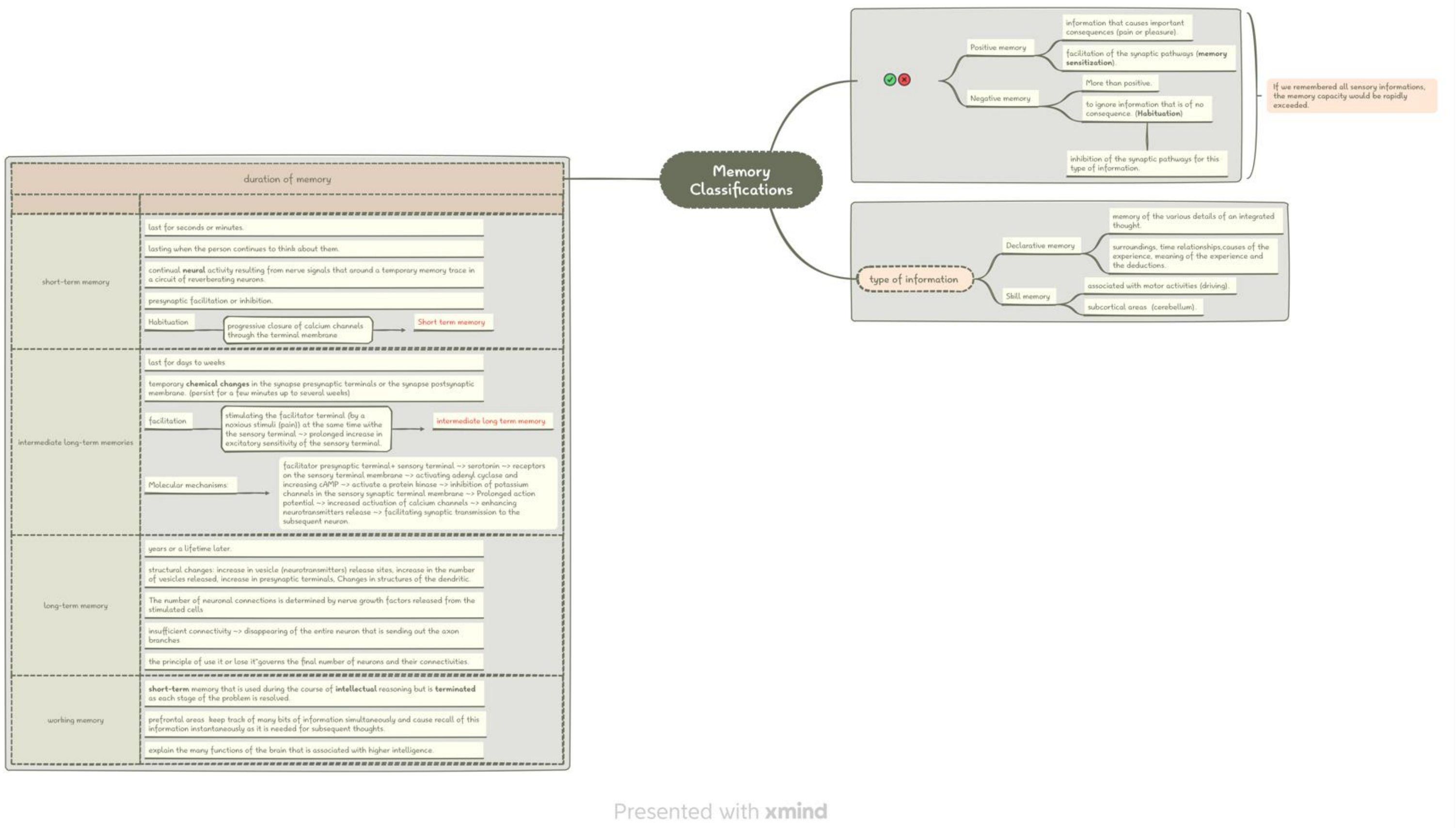
  - Rage pattern: emotional pattern involves the punishment centers, this pattern is held and check (inhibitory signals from the ventromedial nuclei of the hypothalamus, portions of the hippocampi and anterior limbic cortex
- **Reward centers:**
  - Weak stimulus ~> the reward kind of think, but intense stimulation ~> punishment.
  - Placidity and tameness.
- Sensory experience that causes neither reward nor punishment is hardly remembered, and with repetition it will be ignored (Habituation).
- If the stimulus does cause reward or punishment, during repeated stimulation response becomes more intense (Reinforcement).
- Newly experienced sensory stimulus always excites multiple areas in the cerebral cortex.

- **The Hippocampus**:
  - Stimulation of different areas of the hippocampus can cause different behavioral patterns.
  - Any type of sensory experience causes activation of at least some part of the hippocampus.
  - It distributes outgoing signals to the anterior thalamus, hypothalamus, and other parts of the limbic systemthrough the **fornix (**communicating pathway).
  - Do memory consolidation (short memory ~> long term memory), a lesion in the hippocampus is capable of short-term memory (anterograde amnesia).
  - Hyperexcitable area ~> weak electrical stimulation may cause focal epileptic seizures for minutes; it is associated with hallucinations, which will go on when the seizures are going.
- **Amygdala:**
  - Olfactory sensations.
  - Called the window of the limbic system; because the multiple connections (limbic cortex and neocortex of the temporal, parietal, and occipital lobes, especially from the auditory and visual association areas).
  - Amygdala ~> back to same cortical areas ~> hippocampus ~> septum ~> thalamus ~> hypothalamus.
  - If stimulated ~> same effect of the hypothalamus, several types of involuntary movement, sexual activities, person' s behavioral response appropriate for each occasion. and pattern of punishment or reward.
- **Limbic cortex:** effect functions as a cerebral association area for control of many behavioral patterns.

Lecture 6 (Learning and memory)

- Thinking ~> in the cerebral cortex, thalamus, limbic system, and reticular formation.
- **Memory:**
    - Memories are stored by by changing the basic sensitivity of synaptic transmission between neurons as a result of previous neural activity. New or facilitated pathways are called memory traces, which are selectively activated by the thinking mind to reproduce the memories.

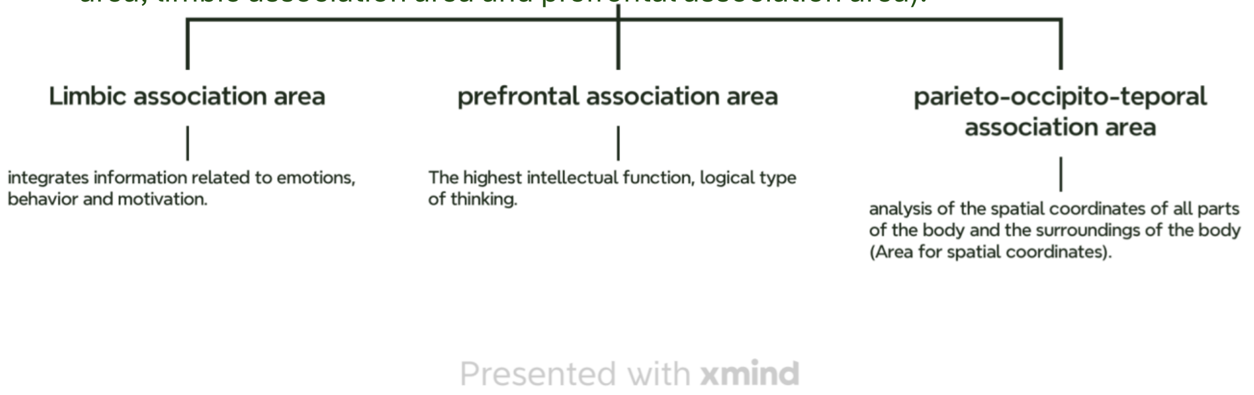
      https://drive.google.com/file/d/1LbeQJfQ5RhnhmFLwtK0g6XkOu4tnhtaY/view?usp=sharing



- Memory consolidation: Conversion of short-term memory into long-term memory. Occurs in hippocampus and dorsal medial nuclei of the thalamus on a basis of reward and punishment.
    - More repetition ~> more connections and structural changes (chemical, physical, and anatomical changes) ~> consolidation is accelerated and enhanced.
    - new memories are codified into different classes of information (aren't stored randomly) by the thalamus.
- Retrograde amnesia: loss of memory access to events and information learned **prior**.
- Lesion in hippocampus ~> mainly anterograde amnesia, retrograde amnesia may occur.

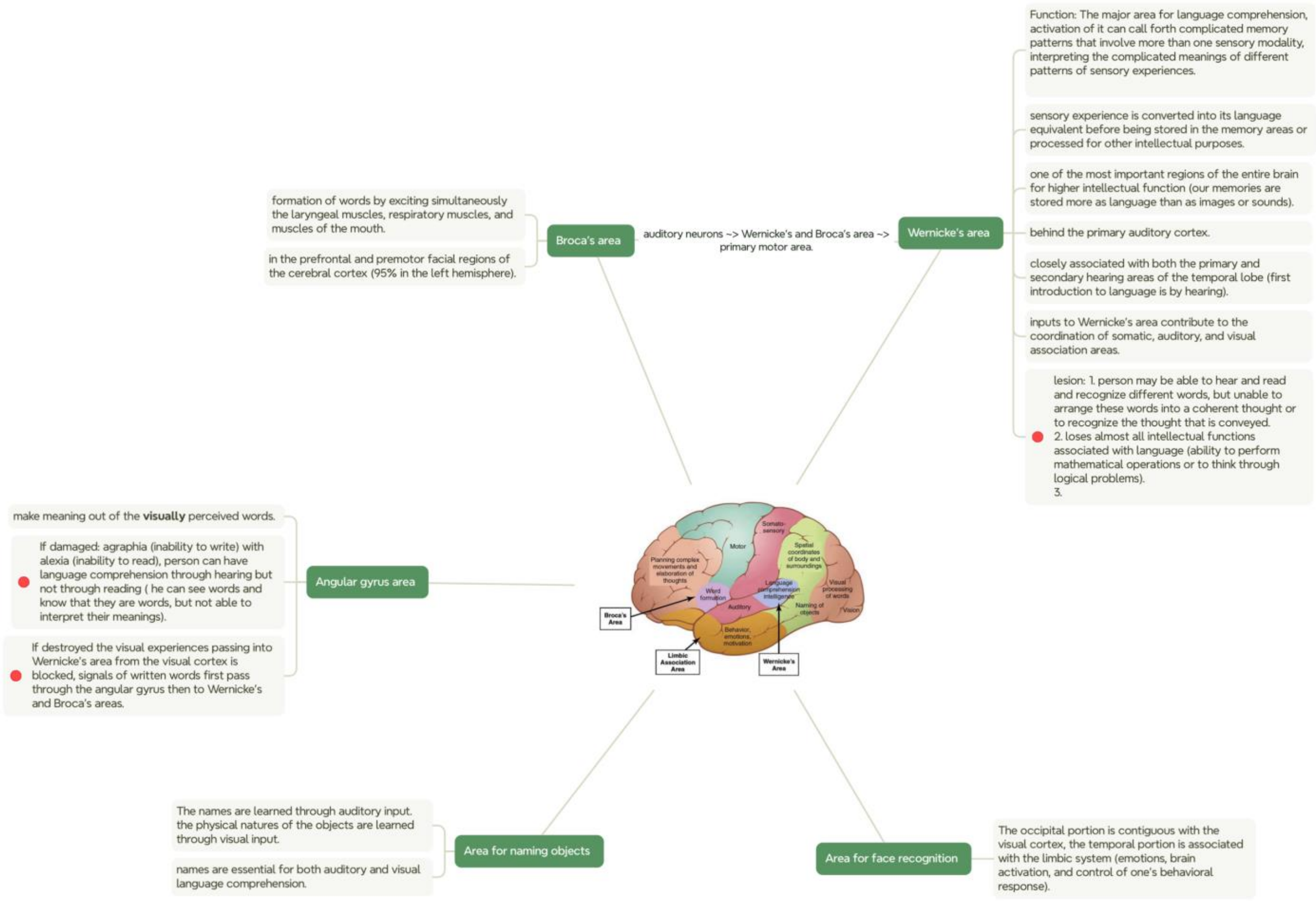
  Lesion in the thalamus ~> mainly retrograde amnesia without significant anterograde amnesia; due to its role in codifying.
- memory process not only requires the storing of memories but also an ability to search and find the memory.
- If the hippocampus is injured, the skill learning or reflexive learning is NOT affected.

- **Cerebral cortex:**
  - When the thalamus with the is damaged, the loss of cerebral function is greater than when the cortex alone is damaged.
  - The cerebral cortex + thalamus ~> an anatomically and functionally unit called the **Thalamocortical system** (from the thalamus to the cortex and vise versa).
  - Cortical areas:
    1. Primary cortical areas: primary motor, primary somatic sensory, primary visual and primary auditory areas ~> areas in communication with periphery.
    2. Secondary areas: make sense out of the signals in the primary areas (movement, color, texture…).
    3. association areas: receive and analyze signals simultaneously from both the motor and sensory cortices and from subcortical structures (parieto-occipito-teporal association area, limbic association area and prefrontal association area).



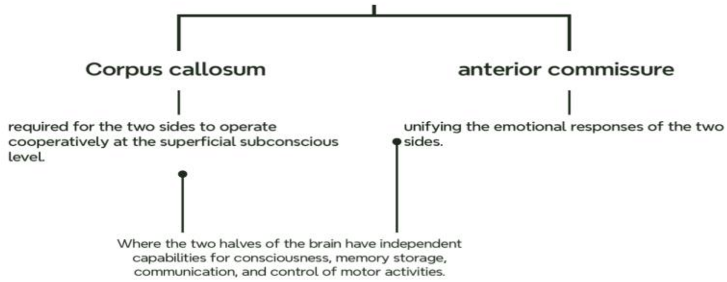
  - Parieto-occipito-temporal association area receives visual sensory information from the posterior occipital cortex and somatosensory information from the anterior parietal cortex.

  - auditory receptive aphasia (word deafness) and visual receptive aphasia (word blindness or alexia): inability to understand the spoken or written word due to destruction of portions of the auditory or visual association areas.
  - Global aphasia: totally demented for language understanding or communication due to a widespread lesion in Wernicke's area that extends backward into the angular gyrus region, inferiorly into the lower areas of the temporal lobe and superiorly into the superior border of the sylvian fissure.
  - Motor aphasia: person is capable of deciding what he or she wants to say but cannot make the vocal system emit words instead of noises due to damage to Broca's speech area.
  - Destruction of any of the facial and laryngeal regions of the motor cortex, the cerebellum, basal ganglia, and sensory cortex which activate and control the muscular movements of the mouth, tongue, larynx, vocal cords will cause either total or partial inability to speak distinctly.



Presented with **xmind**

- Dominant hemisphere: where the interpretative functions of Wernicke's area, the angular gyrus, and functions of the speech and motor control areas are highly developed in the cerebral hemisphere, 95% the left and 5% either both sides or right alone (rare).
    - interpretative areas of the temporal lobe, angular gyrus, and many of the motor areas are highly developed in the the left hemisphere, but they receive sensory information from both hemispheres and are control motor activities in both hemispheres through pathways pathways in the corpus callosum.
- Corpus callosum: its fibers provide bidirectional neural connections between the cortical areas of the two cerebral hemispheres, **except** for the anterior portions of the temporal lobes (especially the amygdala) ~> interconnected by fibers that pass through the **anterior commissure**.
    - corpus callosum + the anterior commissure ~> make information stored in the cortex of one hemisphere available to corresponding cortical areas of the opposite hemisphere.

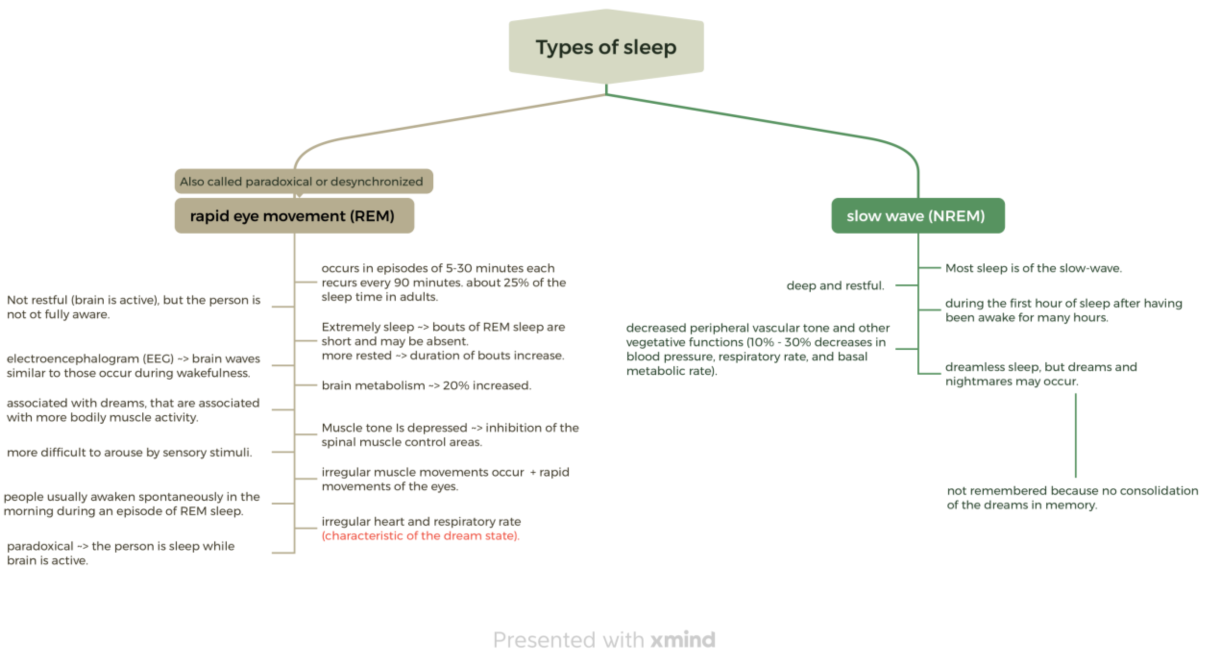


Presented with **xmind**

    - The nondominant hemisphere: understanding and interpreting music, nonverbal visual experiences (especially visual patterns), spatial relations between the person and their surroundings, body language, intonations of people's voices, and many somatic experiences related to use of the limbs and hands.
- Prefrontal association area ~> planning and deciding complex movement, delay action in response to incoming sensory signals until the best response is decided, consider the consequences of motor actions before they are performed.
  the elaboration of thoughts and its relationship with working memory that combine new thoughts while they are entering the brain, plan for future, prognosticate, control activities in accord with moral law, logical thinking, and correlate all avenues of information in diagnosing rare diseases.
    - Inputs: through a subcortical bundle of nerve fibers connecting the parieto-occipitotemporal association area with the prefrontal association area ~> pre analyzed sensory information on the spatial coordinates ~> planning effective movements.
    - Outputs: prefrontal ~> caudate portion of the basal ganglia–thalamic feedback circuit (provides many of the sequential and parallel components of movement stimulation) ~> motor planning.
    - 🔴 If damaged: can't solve complex problems, unable to string sequential tasks, unable to learn to do several parallel tasks at the same time, decreased aggressiveness, lost ambition, inappropriate social responses, loss of morals, little reticence in relation to sexual activity and excretion, unable to carry through any long trains of thought, rapid changes of mood, usual patterns of motor function but without purpose.

Lecture 7 (sleep)

- Sleep: unconsciousness where the person can be aroused by sensory or other stimuli.
- Coma: unconsciousness where the person cannot be aroused.
- Nuclei associated with sleep: raphe nuclei, reticular formation, nucleus tractus solitaire, and nuclei in the hypothalamus.



- Brain waves:
  - there is continuous electrical activity in the brain, its intensity and the patterns are determined by the level of excitation of different parts of the brain.
  - thousands to millions of neurons must fire synchronously for the waves to be recorded through the skull ~> reflex the degree of synchronization NOT the total degree of activity of the neurons.
  - In healthy people: alpha, beta, theta, and delta waves.
    1. Alpha  : in resting state of cerebration, disappear during deep sleep. result from spontaneous feedback oscillation in the thalamocortical system, including the reticular activating system in the brain stem.
       - occur most intensely in the occipital region, can also be recorded from the parietal and frontal regions.
       - 50 microvolts. 8 and 13 cycles/sec.

    If there is a mental actevity (especially in occipital region) it will be converted to beta.

    2.Beta  : mental activity, REM sleep. recorded mainly from the parietal and frontal. higher frequency (14-80 cycles/sec), lower voltage than alpha.

    3. Theta  : normally in the parietal and temporal regions in children, and during emotional stress in some adults (disappointment and frustration) stage 2 and 3 of sleep and in many brain disorders (in degenerative brain states'. 4- 7 cycles/sec.

    4. Delta  : in very deep sleep (stage 4) ~> the cortex is mainly released from the activating influences of the thalamus and other lower centers, in infancy, and with serious organic brain disease.

       - can occur strictly in the cortex independent of activities in lower regions of the brain.
       - frequencies less than 3.5 cycles/sec. voltages two to four times greater than other types of waves.
- Epilepsy: chronic condition of recurrent seizures that vary from undetectable symptoms to periods of vigorous convulsions.
  - not a single disease.
  - If the cause is known, it is treatable.
  - Seizures: temporary disruptions of brain function caused by uncontrolled excessive neuronal activity.
  - clinical symptoms are heterogeneous and reflect multiple underlying pathophysiological mechanisms.
  - Epileptic seizure types:
    1. focal seizures (partial seizures): limited to a focal area of one cerebral hemisphere, classified into:
       a. simple partial seizure ~> no major change in consciousness, it be preceded by an aura.
       b. complex partial seizures ~> may begin with an aura followed by impaired consciousness and strange repetitive movements.
       - postictal period: the time after the seizure, prior to the return of normal neurological function.

2. generalized seizures: diffuse, excessive, and uncontrolled neuronal discharges that spread to both cerebral hemispheres through interconnections between the thalamus and cortex.

A. Generalized tonic-clonic seizures (grand mal seizures) ~> abrupt loss consciousness and extreme neuronal discharges in all areas of the brain, the deeper parts of the cerebrum, the brain stem and the spinal cord ~> generalized tonic seizures of the entire body, followed toward the end of the attack by tonic and spasmodic muscle contractions. (from a few seconds to 3 to 4 minutes).
   - characterized by post-seizure depression of the entire nervous system.
   - person often bites or swallows his tongue and may have difficulty breathing which may cause cyanosis.
   - signals transmitted from the brain to the viscera cause urination and defecation.
   - Mostly idiopathic.
   - factors that increase the excitability of the abnormal epileptogenic circuitry: strong emotional stimuli, alkalosis caused by over-breathing, drugs, fever, and loud noises or flashing lights.

B. Absence seizures (petit mal seizures): 3 to 30 seconds of unconsciousness or diminished consciousness, during this time the person stares and has twitch-like contractions of muscles in the head (especially blinking), followed by a rapid return of consciousness and resumption of previous activities.
   - begin in childhood or early adolescence.
   - involve the thalamocortical brain activating system.