SENSORY SYSTEM

: DEFINE Synapes ? Give its types ? & Properties of Synapes ?

Synapes: A Synapes is a junctional Point b/w two neurons, that transmit impulse From first to Second neuron.

Types:

(i) **on Basis of Communication:**

(i) Axo-Somatic (iii) Axo-dendritic

(ii) Axo-Axonic (iv) Dendro-Somatic

(v) Somato-Somatic

(ii) **on Basis of nature:**

(i) Electrical (ii) Chemical

PROPERTIES:

(i) Fatigue

(ii) Synaptic Cleft

(iii) one way conduction

(iv) Summation

(v) Electrical Property

(vi) Convergence

(vii) Divergence

(viii) inhibition

Summation:

It is a progressive increase in Excitatory post-synaptic potential in post-synapt neuron when many Excitatory pre-synaptic Terminal are stimulated simultaneously.

Types:

(i) Spatial Summation

(ii) Temporal Summation

(i) **SPATIAL Summation** Summation of Stimuli from two or more pre-synaptic element reacning a neuron simultaneously, which by Adding up results in Excitation or Fascilitation of a post-synaptic neuron.

(ii) **TEMPORAL Summation** Summation of Stimuli From a Single pre-synaptic neuron that is stimulated repeatedly, which by adding up results in Excitation or Fascilitation of a post-synaptic neuron.

Compare between Dorsal Column and Anterolateral System?

Dorsal Column	Anterolateral
1. Nerve Fiber:	
large myelinated Fibers	small myelinated Fibers
2. velocity :	
velocity is 30/110 m/sec	velocity is upto 40m/sec
3. Spatial orientation :	
High Degree Spatial orientation	less degree S.. orientation
4. Transmission :	
NO ability to transmit Broad spectrum of Sensory modalities.	Ability to response transmit broad spectrum OF Sensory modalities.
5. Stimulus :	
Fine touch, pressure vibration, Proprioception 2 point Discrimination	**lateral :** Pain, Temperature **Anterior :** Crude touch, Tickle

Dorsal Column	Anterolateral
6. lateral inhibition:	
lateral inhibition occur (increase Degree of spatial orientation)	NO this is not occur in it.
7. Intensity:	
Rapid change in intensity	NO
8. Position:	
Has position sense	NO
9. Fiber crossed:	
At medullary level	At spinal cord level
10. Diameter of Axon:	
NO	low Diameter of Axon
11. Impulse Action:	
Impulse are amplify	NO
Order Neuron area:	
1st Dorsal root Ganglion	1st Dorsal root Ganglion
2nd Dorsal Horn	2nd Ant. Grey matter Spinal cord
3rd Thalamus	3rd Thalamus

DEFINE Receptor ? Classify it and also properties of Receptor ?

RECEPTOR: Specialize structure at ending of afferent neuron which are even sensitive to a minor changes.

Classifications:

(i) Mechanoreceptor
- Expanded tip ending → Meckies disc
- Free Nerve ending
- Encapsuled ending
  - Pacinian corpuscles
  - Mesener corpuscles
- Ruffens ending
- Spray ending

(ii) Electromagnetic Receptor
- Rods
- Cons

(iii) Thermal Receptor
- (i) warm receptor
- (ii) cold "
- (iii) Pain "

(iv) Chemical Receptor
- (i) in Hypothalamus
- (ii) in olfactory epithelium
- (iii) Aretic Body
- (iv) Carotid Body

(v) Nocireceptor

Properties:

(i) Specificity of Response (Muller - Law)

(ii) Adaptation

(iii) Response to ↑ Strength of Stimulus (Weber Fechnar Law)

(iv) Sensory Transduction

(v) Receptor Potential

(vi) labeled - Line Principle ↑ "specificity of Nerve fiber for transmiting only one one modality of sensation."

(i) **MULLER LAW :**

In this Law each type of receptor Give response to specific type of Stimulation.

(i) **TOUCH :** Touch receptor give response to touch.

(ii) **Pain :** Pain give response to only pain receptor.

(ii) **ADAPTATION :** When a stimulus continuously applied receptor become less sensitive to stimulus or ignore it

When receptor is stimulated with same strength of stimulus, the ability to give response through afferent nerve decrease or receptor stop sending impulse through afferent nerve.

MECHANORECEPTOR → Adapt Completly

CHEMORECEPTOR → never Adapt Completly.

(i) **PHASIC RECEPTOR :** Adapt rapidly e.g Touch & Pressure receptor

(ii) **TONIC RECEPTOR :** Adapt slowly e.g Spindle Fiber, pain & warm receptor

IMPORTANCE :

Adaptation lower the Neural Excitability which Conserve Energy.

OUTFLOW OF impulse ↓ Adaptation

(iii) **Respond to increase in Strength of Stimulus:**

During Stimulation of Receptor, If response given by receptor is to be doubled then the Strength of Stimulus must be increased too time.

Weber Fechner Law:

Response given by receptor is Directly proportional to logrithum increase in intensity of Stimulus.

(iv) **Sensory Transduction:**

Energy in Environment is conveited into electrical impulse of Nerve Fiber.

Chemoreceptor: convert Chemical energy into Action Potential of nerve Fiber

Mechanoreceptor: convert Mechanical energy into Action Potential of nerve Fiber.

(v) **Receptor potential:**

When receptor is stimulated non propagated transmembrane potential differences is Develop → Receptor Potential

- Not True Action Potential
- Monophasic

Mechanism of Adaptation of Receptor in Pacinian Corpuscles ?

1st Mechanism: Pressure Stimulus applied

Compresion of pacinian corpuscles

↓

elongation of pacinian corpuscles

↓

Deformation of central core fibers
ie: Nerve fiber

↓

Na^+ channel open

↓

Mild depolarization & receptor potential Develop

↓

Receptor potential move along unmylinated nerve fiber

↓

When receptor potential reaches node of Ranvier & it become True Action potential.

2nd Mechanism:

accomodations to Stimuli

↓

Closures of Na^+ channels in nerve fiber membrane

Define Pain ? Difference b/w Fast & Slow Pain ? Dual Pain Pathway :-

Pain: unpleasent and emotional experience associated with or without actual tissue Damage.

Fast Pain	Slow Pain
(i) Felt within 0.1 sec	(i) Felt after 1 sec.
(ii) Sharp pain, Pricking pain, Electric pain & acute pain	(ii) Dull Pain, Thrombic pain Chronic pain, Neasous pain.
(iii) Cannot felt Deeper Part body Tissue	(iii) Felt Both in Superficia and deeper part of Tis

Pain Pathway Diagram :

Dual Pain Pathway:

For Transmission of pain signal into CNS

Fast / Acute Pain

(6-30) m/s

Fibers: A Delta

Neospinothalamic Tract

A - Delta Fiber

↓

Spinal cord Dorsal Horn

↓

Lamina 1

↓

cross to opposite side of Spinal cord

↓

Join Anterolateral column

↓

Brain Stem

↓

Thalamus (VLP nucleus)

↓

Somatosensory cortex

Neurotransmitter: Glutamate

Slow Chronic Pain

(0.5-2) m/s

Fibers: C Fiber

Pleospinothalamic Tract

C - Fiber

↓

Dorsal column spinal cord

↓

Lamina 2, 3

↓

cross Spinal cord From Ant. to Lateral

↓

Ascends up

↓ → Some fibers go to Gray matter

Brain Stem

↓

Thalamus (VLP nucleus)

↓

Somatosensory cortex

Neurotransmitter: Substance P

Classification of Nerve Fiber according to Conduction velocity ?

Nerve Fiber		Diameter	Conduction velocity
A	Alpha	12-24	70-120 m/s
A	Beta	6-12	30-70 m/s
A	Gamma	5-6	15-30 m/s
A	Delta	3-5	12-15 m/s
	B	1-2	3-10 m/s

Different Type of Touch receptor / Tactile Receptor ?

(i) Free nerve ending

(ii) Spray ending / Ruffin ending

(iii) Encapsulated ending
- Meseneir corpuscle
- Pacinian corpuscle

(iv) Expanded tip tactile receptor / Merckle Disc
Ruffen's Ending

Types of intracranial Headache and Causes of Migrane Headach?

Types :-

(i) Headach Caused by low CSF
(ii) Alcoholic Headach
(iii) Margrine Headach
(iv) Meningitis

Causes of Margme Headach :

(i) Nausea
(ii) Sensory Hallucination
(iii) loss of vision
(iv) visual aura

visceral Pain & It's Causes ?

visceral Pain : Pain From viscera is called visceral Pain.

Causses :

(i) IscHemia (Brady Kinin & Proteolytic enzyme relased in ischemic reaction
(ii) Spasm of Hollow organ
(iii) Distention of Hollow organ also produce Pain
(iv) CHemical Substances also produce Pain
e.g = Gastric juice From reptured ulcer

What is Reffered pain & its Mechanism?

Reffered Pain: Pain produced in one part of body is felt is other structure rather than site of production of ion.

Examples:

(i) Pain in cardiac felt in inner part of left Arm

(ii) Diaphragmatic pain reffered to R. Shoulder.

(iii) Testies pain reffered to Abdomen.

MECHANISM OF Reffered Pain

Pain is reffered to a structure which is develop from same Dermatome from which pain Producing structure is develop.

A Dermatome include all structure and parts of body which are innervated by Afferent nerve of one Dorsal root.

Heart & inner aspect of arm are orginate From one Dermatome.

Excitatory Neurotransmitter :

Cause Na^+ channel to open

(i) Acetylcholine

(ii) (NO_2) Nitric oxide

(iii) Histamine

Inhibitory Neurotransmitter :

Cause K^+ channel open

(i) GABA

(ii) Glycine

(iii) Serotonine

Both Neurotransmitter

(i) Adrenaline

(ii) Nor-Adrenaline

Herper zoster / Shingles :

Herpes virus infect Dorsal root Ganglion

This virus cause severe pain in Dermatom segment by Ganglion.

- Skin eruption.

Pain Suppersion (Analgesia) System in Brain & Spinal Cord :

↳ Capability of Brain itself to suppress input of pain signal to nervous system by acting pain control system.

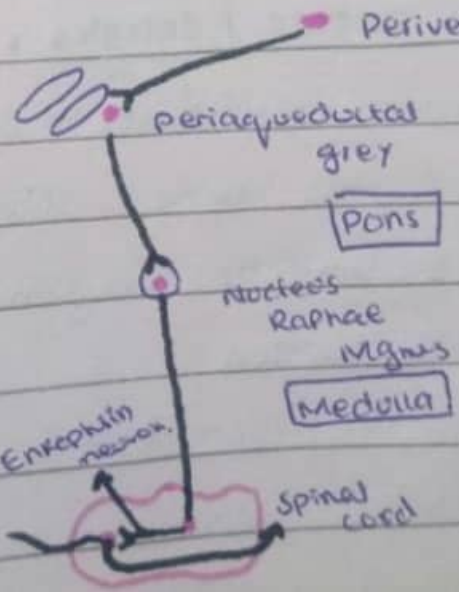
Consist of 3 Components.

(i) Pre-aqueductal greys and periventricular nuclei of mesencephalon and upper pons.

(ii) Raphae magnus nucleus located in lower pons and nucleus reticularis paragigatocellularis lateral to medulla.

(iii) Pain inhibitory Complex located in Dorsal Horn of Spinal Cord.

Encephlin & Serotonin Causes Pre-Synaptic and Post-Synaptic inhibition.



Define Hyperalgesia system & mention Causes?

Hyperalgesia: Exaggerated pain sensation is called Hyperalgesia.

Causes:

(i) Ischemia
(ii) Tissue or nerve injury
(iii) Opioids

Draw the Sensory Homunculus ?

Scenario

A Forty year old male is brought to OPD Following road side accident. The attending doctor find loss of Fine touch, pressure & vibration in left leg while sensation of pain crude touch, Hot & cold are intact?

WHICH Tract is Damaged?

Dorsal Column medial Leminiscal

WHat is Spatial orientation of Nerve FiBer in this tract?

Spatial orientation of nerve fiber from individual parts of body that is maintained throughout.

- **In Dorsal column of Spinal cord:** Fibers from lower part of body lie toward the Centre of cord
- **In thalamus:** Spatial orientation still maintained with Tail end of body Represent by most lateral portion of ventrobasal Complex & Head & Face → represent medial areas of complex.

A middle aged male presented to medical doctor with lancinating pain on one side of face. It is set off when he swallow bows of food. on Examination there is sensory loss of over fore head?

Diagnose:

Trigeminal Neuralgia

Causes:

(i) Tumor Compressing Nerve

(ii) Multiple Sclerosis or Similar Disorder that Damage the mylein Sheath Protecting nerves