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Ascending pathways

-> Carry sensations from the peripheral structures to d/f areas in the brain mainly via thalamus to sensory cortex

Classification :

1) DORSAL COLUMN

-> fibers ascending in dorsal column of spinal cord

-> lemniscal system as fibers occupy medial lemniscus.

-> 6 sensations :-

1) Fine touch
2) Vibration
3) Proprioception
4) Tactile localization
5) Stereognosis
6) Tactile discrimination

-> large myelinated fibers that enter dorsal column of spinal cord to reach medulla

-> In spinal cord, ascend up in 2 fasciculi : fasciculus gracile & cuneate fasciculus.

1st order of neuron

- Gracile fasciculus is located medially in the spinal cord

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& carries sensations from hindlimb & trunk

- Cuneate fasciculus is located laterally that transmits impulses from upper limb & upper part of trunk.

- 1st order terminates in nucleus gracilis & nucleus cuneatus in medulla.

2nd order of neuron

Cell bodies of these neurons present in nucleus gracilis & nucleus cuneatus in medulla

- These 2 nuclei → Dorsal column nuclei

→ fibers cross midline & pass on to opp side in medulla & ascend up in medial lemniscus to reach thalamus.

- transmit impulses to ventrolateral thalamus

- Ascends up & synapse in thalamus (VPL nucleus)

3rd order of neuron

- Originate from specific nucleus in thalamus.

- Neurons project to the somatosensory areas of cerebral cortex (Area 3, 1, 2)

• Clinical significance

1) Anesthesia

- Complete loss of all forms of sensations.

- Hypesthesia ; partial loss of sensations

2) Paraesthesia

- When sensations are abnormal & distressing
- Causes :
  - i) Nerve compression
  - ii) Spinal tumors
  - iii) Thalamic lesions.

- ROMBERG SIGN

Inability to maintain balanced standing position with feet together & eyes closed.

- Displays lack of ~~sensation~~ sense of position in both the legs.
- Patient should be tested in barefoot
- This is called sensory ataxia
- Ataxia also occurs in cerebellar disease & vestibulopathy & should be differentiated from posterior column lesion.

- ANTEROLATERAL SYSTEM

-> Divided into anterior spinothalamic tract that carries crude touch, lateral spinothalamic tract that carries pain and temperature.

1st order of neuron

-> Primarily the afferent fibers originating from nociceptors, thermoreceptors, mechanoreceptors

-> Fibers enter the spinal cord through dorsal root & cell bodies

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Present in DRG

- In spinal cord, fibers terminate at 2nd order of neuron, present at same side of dorsal horn of spinal cord.
- Cell bodies of 2nd ~~neuron~~ order @ lamina I, II, V

2nd order of neuron

Cell bodies of these neurons present in ~~the~~ dorsal horn of spinal cord.

- Axons cross midline in same spinal segment & ascend up to the opp. side of anterolateral funiculus to reach thalamus
- fibers carrying crude touch are placed anteriorly & so called anterior / ventral spinothalamic tract
- fibers carrying pain & temperature are placed laterally, so called lateral spinothalamic tract

3rd order of neuron

- Neurons originate from VPL, midline & intralaminar nuclei of thalamus, project to specific areas in sensory cortex

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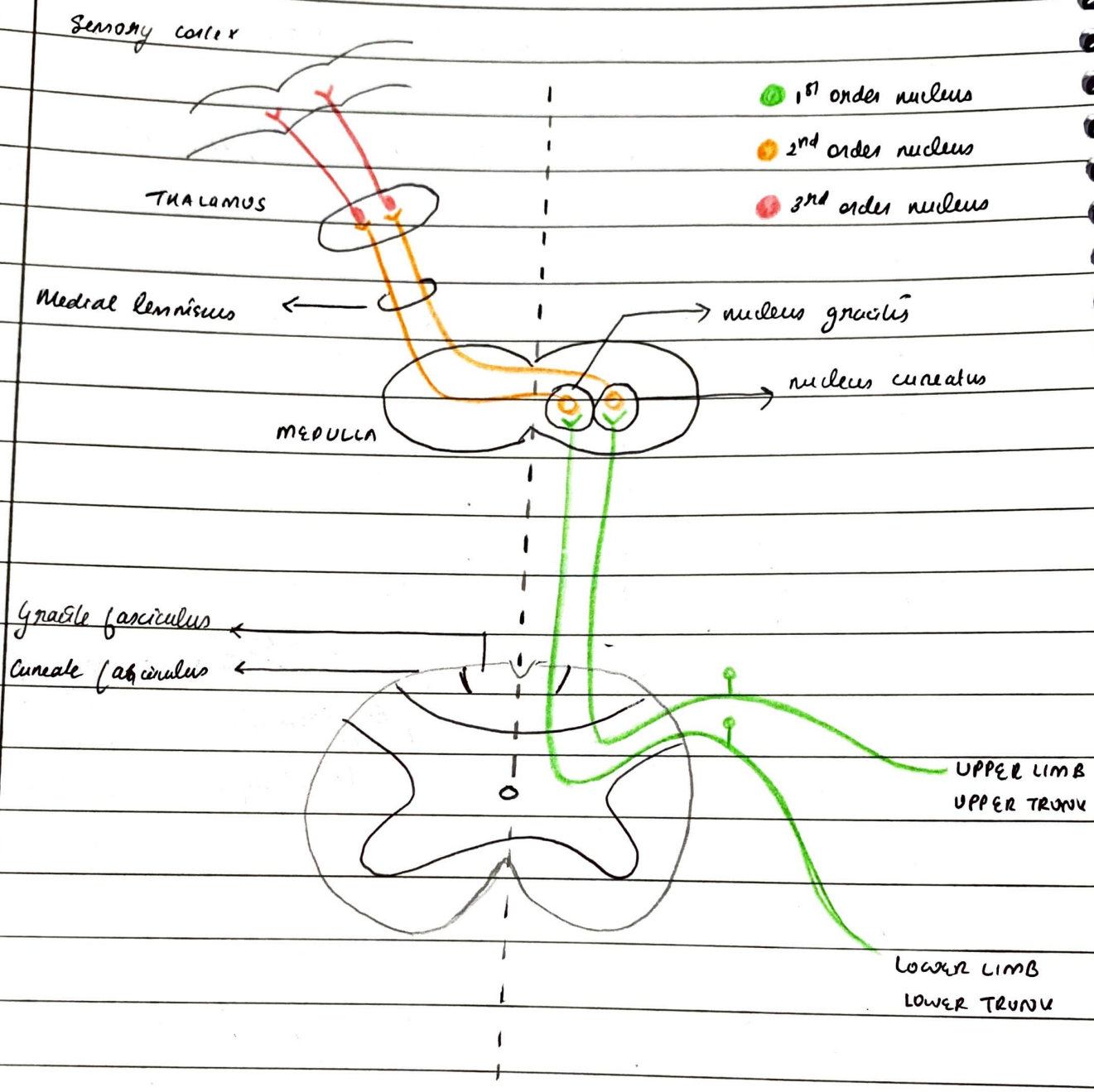

DORSAL COLUMN PATHWAY

- Functions of hypothalamus

1) Endocrine functions

control of ant. pituitary : Releasing & inhibiting hormones

- synthesized in HT

eg. ~~GH, TSH, gonado~~, GHIH / GHRH , TRH / PIH .

control of post. ~~horm~~ pituitary.

- eg- ADH & oxytocin
- transported to post. pituitary through hypothalamo-hypophyseal tract

2) Autonomic functions

Sympathetic control :- Post. & lateral HT

Parasympathetic : Anterior.

→ CVS regulation
- ↑ HR & BP
- Cutaneous vasoconstriction

} Stimulation of post & lateral HT

→ Regulation of pupil size
- Stimulation of post & lateral HT → dilation of pupil

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3) CIRCADIAN RHYTHM

Rhythmic fluctuations in certain physiological parameters of body

- 24 hrs cycle
- Day-night variation
- Biological clock

Common rhythmic variations.
- Rhythmic secretion of ACTH
- " " of GH
- " " of melatonin
- Sleep-wake cycle
- Body temp
- Rhythmic gonadotropin

Basis of circadian rhythm
- Suprachiasmatic nucleus of HT
- receive inputs from
  - eyes via retino-HT fibres
  - lateral geniculate nuclei

disturbance of CR

During high speed jet travel → traveller's external clock does not coincide with internal biological clock. Causes irritability, depression or even physical illness.

- Subside in few days : JET LAG

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4) Temp REGULATION

- depends on balance b/w control of heat gain & heat loss.

HT → thermostat of body.

→ Role of anterior HT (heat loss / gain)

- detects body temp by sensing temp of blood & by receiving inputs from thermoreceptors.
- causes VD & sweating → heat loss

→ Role of post HT (heat gain)

5) FOOD INTAKE

Aimed at maintaining balance b/w intake & energy expenditure so that body wt is maintained with normal range.

- Neural, hormonal, metabolic factors.

↓

feeding & satiety centre.

6) REGULATION OF WATER INTAKE

→ factors that regulates water intake : Plasma osmolality & blood volume

→ major thirst centre is brain

7) REPRODUCTIVE FUNCTIONS

- Secrete GnRH
- Controls sexual behaviour

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8) INFLUENCE OF EMOTION

- Limbic system principle seat of emotion.
- forms output pathway of limbic system
- Reward center & punishment center

9) ROLE IN SLEEP

Post. HT part of diencephalon sleep zone that induce slow wave sleep.

- Stimulation of preoptic area of HT → Induces sleep.
- Regulating circadian rhythm.

10) IMMUNOLOGICAL FN

By controlling secretion of ACTH & cortisol via HT-Pit-Adr axis (HPA axis)

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- Waves of EEG

  α, β, θ & δ according to their frequency.

1) α - wave 

   → 8 - 13 Hz

   → 50 μV to 100 μV

   → Seen in a normal adult at rest with eyes closed

   → Found in parieto - occipital regions.

   → Disappears upon opening of the eyes. Here α-wave replaced by irregular, low voltage activity ∴ α-block or desynchronization.

2) β - wave

   → 13 - 30 Hz

   → 5 μV to 10 μV

   → Seen in adults, when eyes open.

   → Appear in posterior regions.

3) θ - rhythm 

   → 4 Hz - 8 Hz

   → Seen in normal children

   → Also occurs during moderate sleep.

   → Also appear in adults when they are depressed.

4) δ - wave