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Physiology of Taste & Smell

CNS



Sources

- Male slides
- Female slides

Taste sensation

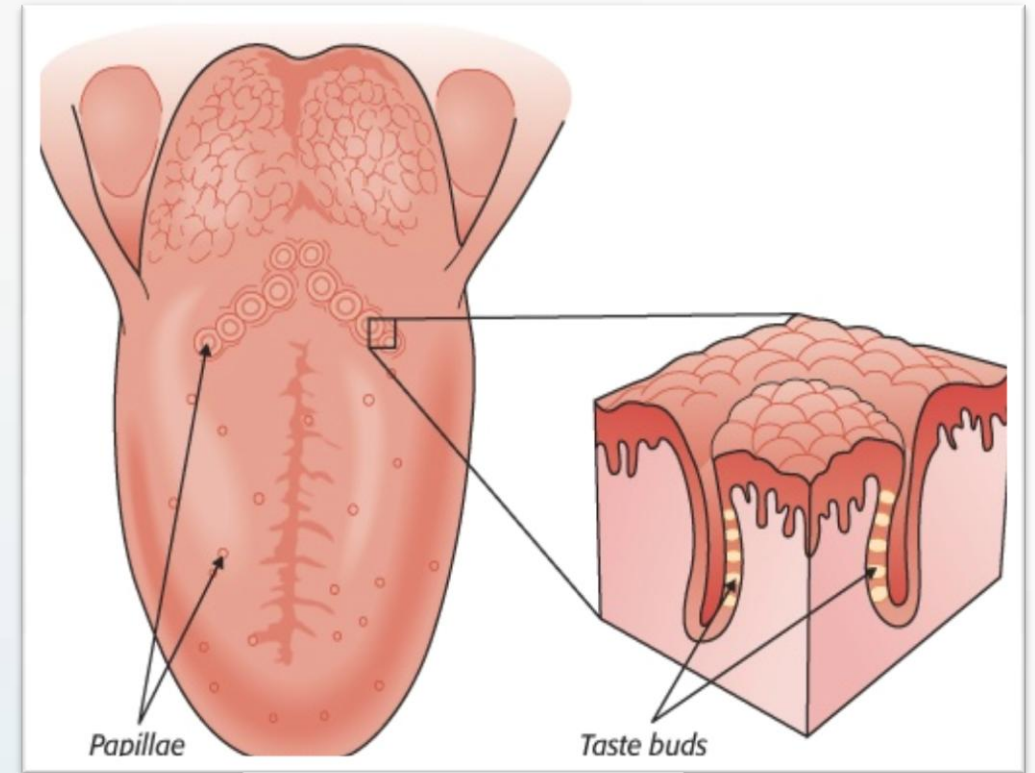
- Taste is received by “**Taste Buds**” which contain huge amount of taste receptors.
- These Buds are distributed throughout the whole oral cavity including:
 - 1/Tongue (mostly)
 - 2/Palate
 - 3/Inner surface of cheeks

Papillae : are structures projecting on the surface of the tongue , it gives the tongue its rough nature.

Each papilla contain numerous taste buds.

3 types:

- Filiform papilla
- Fungiform papilla
- Circumvallate papilla

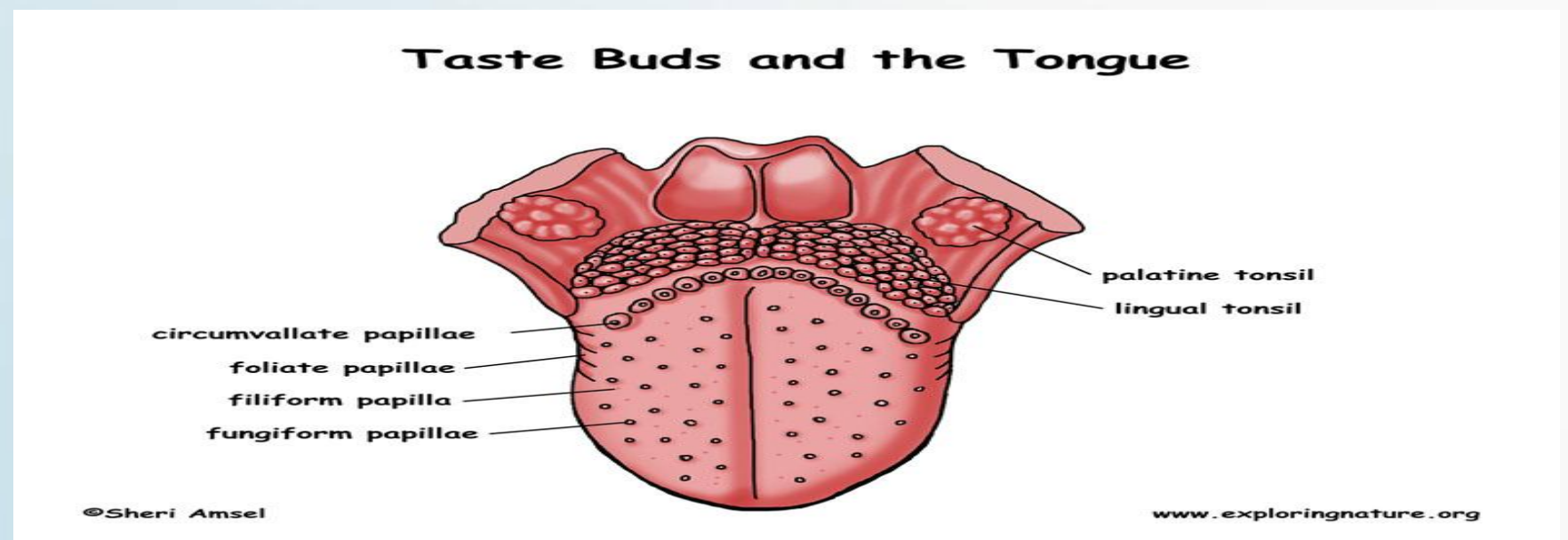


Lingual Papillae

Type of papilla	Shape	Distribution	Presence of taste buds	Number
Filiform	Sharp	most of the front two thirds of the tongue's surface	Not present	Most numerous
Fungiform	Mushroom-like	on the upper surface of the tongue	Present	Less than Filiform
Circumvallate	Dome-shaped	immediately in front of the foramen cecum	Present	From 8-12 only

Note:

There are no Taste Buds on the dorsum of the tongue.



Lingual Papillae

- Each **taste bud** contains too many “**Gustatory cells**”. Gustatory cells are cells with **microvilli** arise from its surface, in between there are **supporting cells**.
- These microvilli act as **receptors** for **chemicals(food)**, to transmit an impulse to the **brain**.
- **The Impulses are carried from Gustatory cells along the pathway of taste sensation through 3 Cranial Nerves.**

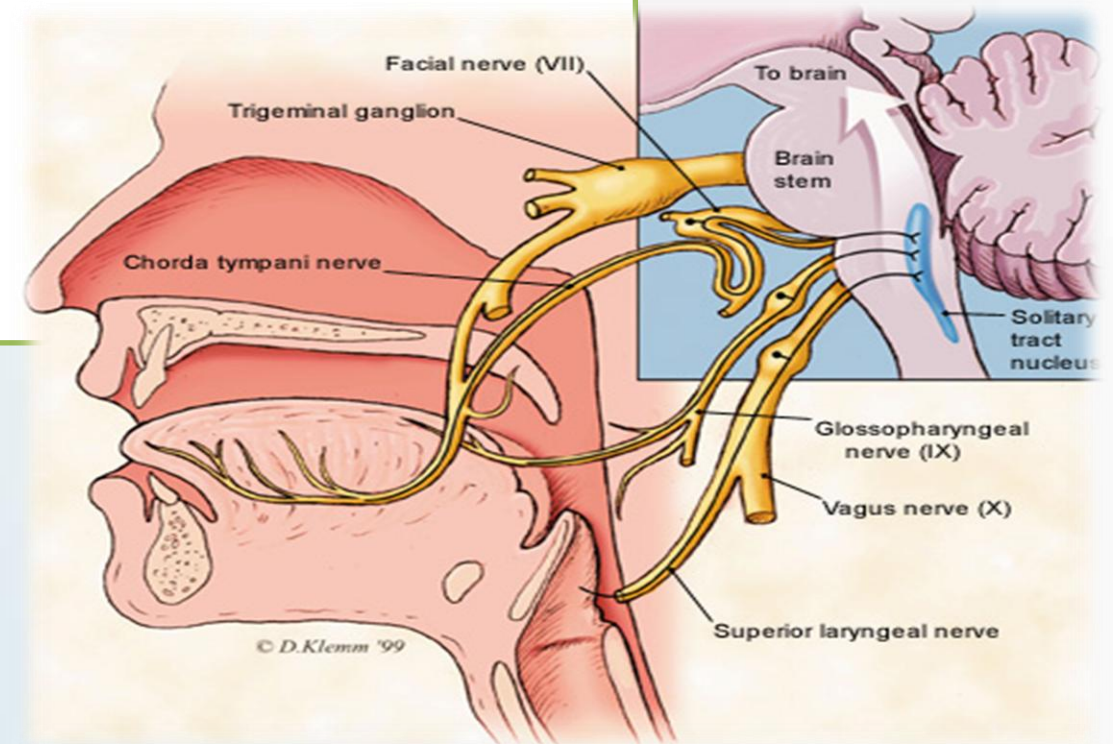
Each supply different part.

1/Facial (**Anterior 2/3 of tongue**).

2/Glossopharyngeal (**Posterior 1/3 of tongue**).

3/Vagus (**Palate, pharynx, epiglottis**).

Note: Microvilli can't respond to chemicals without the help of saliva (They dissolve the chemical molecules to stimulate the receptors well).



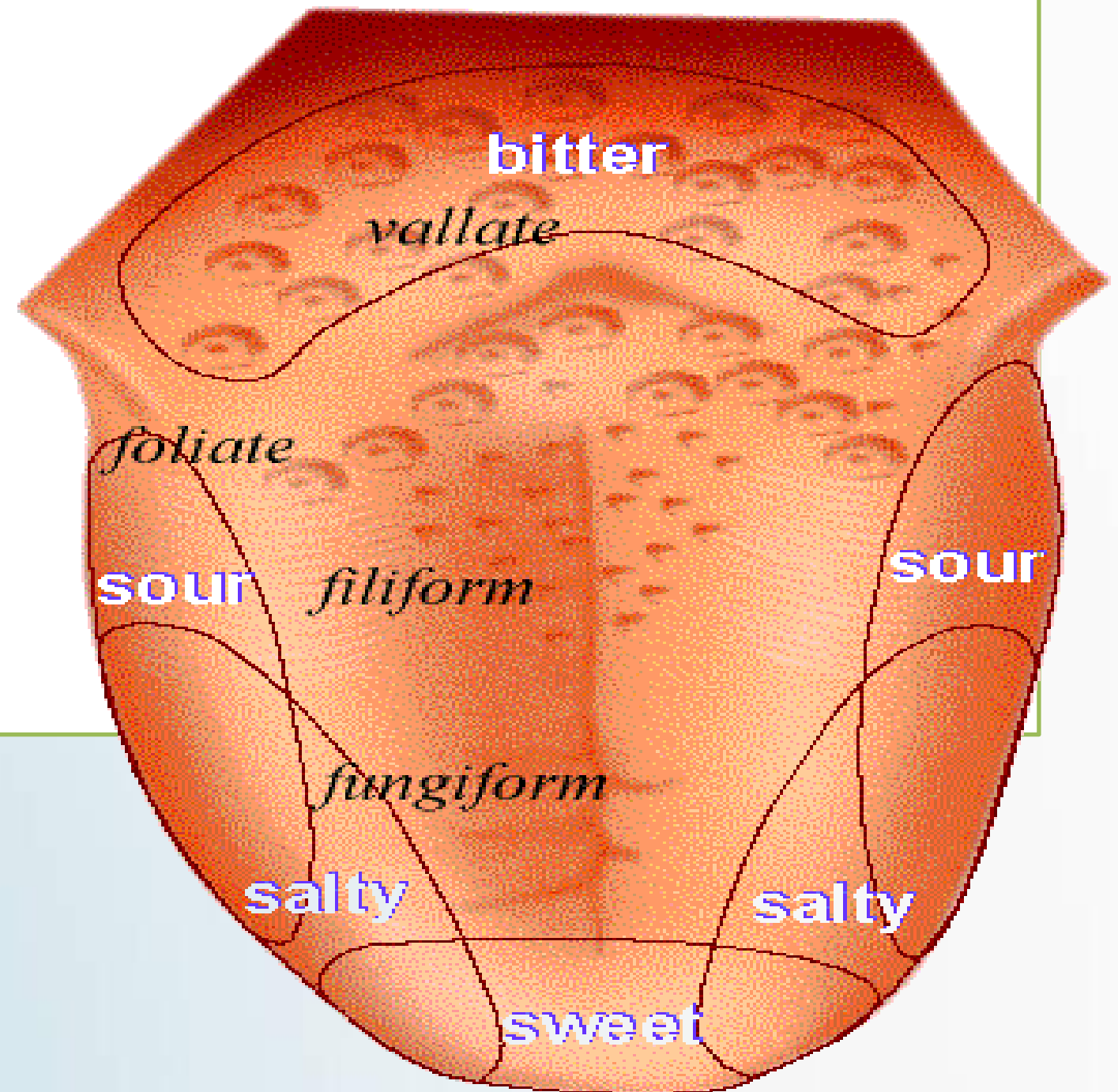
Cranial nerves supplying the tongue

Taste buds are grouped in different locations according to the taste that stimulated by.

There are **4 main tastes**, and each is received in different place in the tongue.

- 1/**Sweet** (tongue tip)
- 2/**Sour** (tongue margins)
- 3/**Bitter** (back of tongue)
- 4/**Salty** (widely distributed)

Note: An additional taste flavor called (*Umami*), it's a mixture of more than one flavor (e.g. Meat)



Each taste flavor is mediated by special chemicals.

1/Sweet:

Sugar – Saccharide – Amino acids

2/Sour:

H ions - Acids

3/Bitter:

Alkaloids

4/Salty:

Salt – Ions – Metals

5/Umami:

Glutamate (Meats: Steak)

Note:

1-Combination between molecules and receptors are weak (since taste can be easily abolished by washing mouth with water)

2-Taste fibres from the three cranial nerves form tractus solitarius

Pathway:

- These chemicals are dissolved in saliva. After that they stimulate the **microvilli** (cilia) of **Gustatory cells** to initiate an **Action potential**.
- Action potential begins in gustatory cells and ends reaching the Cortex passing some structures:

1/Gustatory cells.

By cranial nerves to:

2/Tractus solitarius in medulla.

By Medial lemniscus to:

3/Ventral posterior medial nucleus of the Thalamus.

By Thalamic radiation to:

4/Taste cerebral cortex(Insula)

New Pathological terms

- ***Ageusia*** (complete loss of taste)
- ***Dysgeusia*** (disturbed taste)
- ***Hypergeusia*** (Adrenal insufficiency) : Due to parasympathetic dominance which leads to increase in saliva production.
- ***Hypogeusia*** : Due to some disease or Drugs such as (Captopril) & (Pinecillamine) that contain sulfhydryl group.

SMELL Sensation

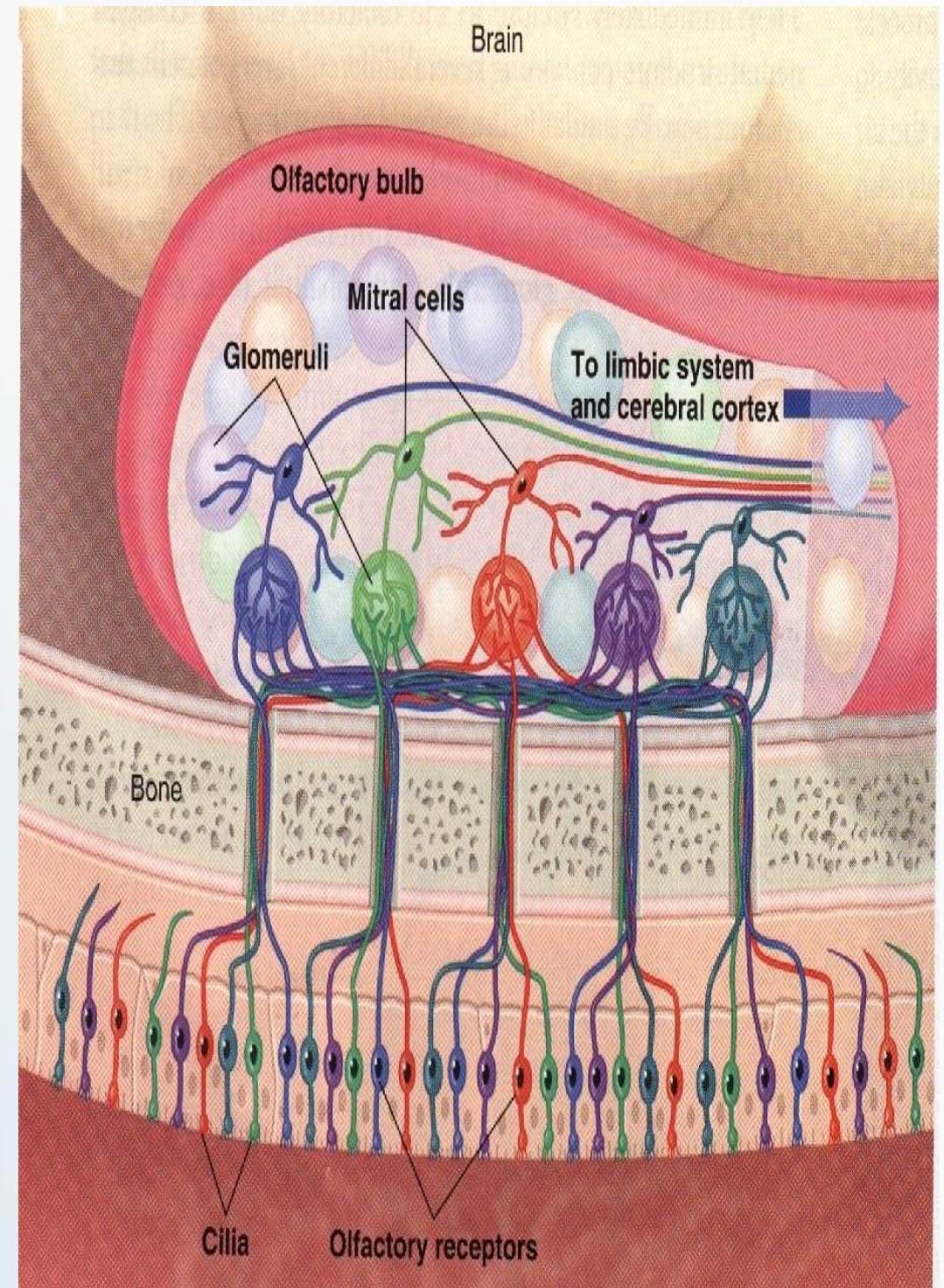
- **Olfaction** (the sense of smell):

- There are olfactory receptors (*bipolar neurons*) in the "Roof" of each nasal cavity, which contain the (*olfactory hairs*).

- The chemicals must be dissolved in the mucus to be detected.

- Impulses are transmitted via olfactory nerve to be interpreted in the *olfactory cortex* of the brain.

- Axons collected in bundles called *fila olfactoria*



Olfactory Bulb

• *Physiology of olfaction*

-Human can differentiate between **2000-4000** odours.

-Molecules dissolve in mucus layer → to combine with the receptors
→ that stimulate adenylyl cyclase → lead to increase intracellular cAMP
→ result in opening in Na channels → AP.

- ***Olfactory pathway:***

- Fila Olfactoria* enters olfactory bulb to make synapses with mitral & tufted cells

- Impulses travel along the olfactory tracts to the limbic system*, also involved in emotions and memory

- and interpreted in the olfactory cortex (Deep in temporal lobe & base of frontal lobe)

	<i>Strial type</i>	<i>Ending</i>
<i>Mitral cells</i>	<i>Lateral & intermediate stria*</i>	<i>Ipsilateral cortex</i>
<i>Tufted cells</i>	<i>Medial stria</i>	<i>In granular cells (contralateral) opposite side</i>

*Axons collected in bundles.

*Responsible for emotions & memory.

*Bundle of fibres ascend along the white matter of the brain reaching the cortex.

New Pathological terms

Anosmia: *loss of smell sensation.* Due to damage to olfactory epithelium

Parosmia: *Alteration in smell sensation.*

Hyperosmia: *increase in smell sensation (due to adrenal insufficiency).*

Hyposomia: *decreased smell sensation (due to Vitamin A deficiency).*



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CNS Block