



# PHYSIOLOGY OF TASTE

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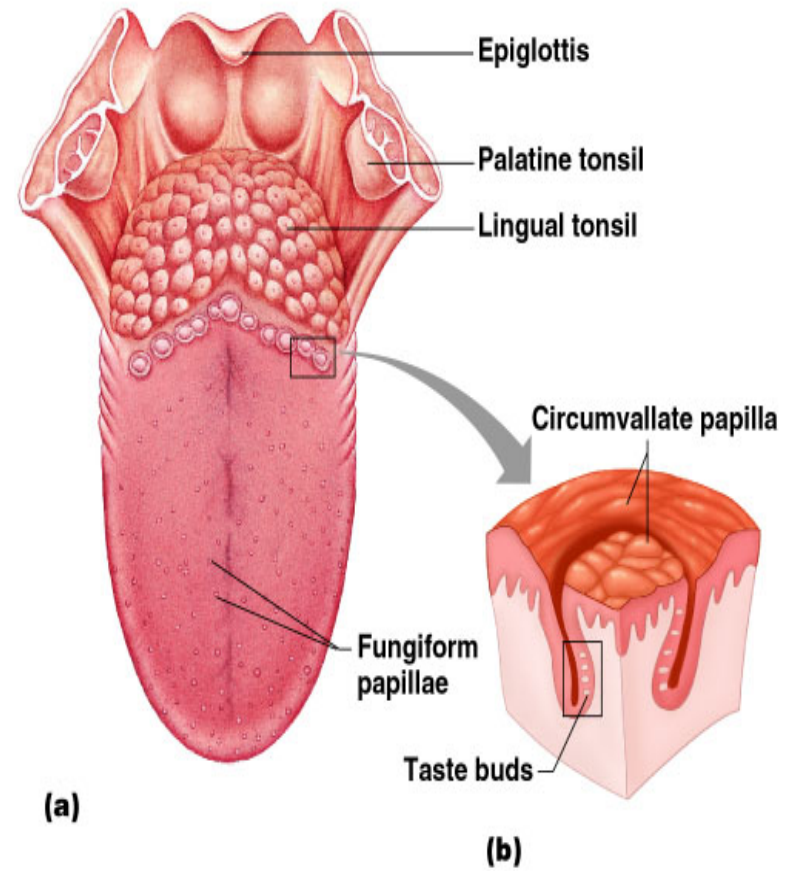


## **Prof. Sultan Ayoub Meo**

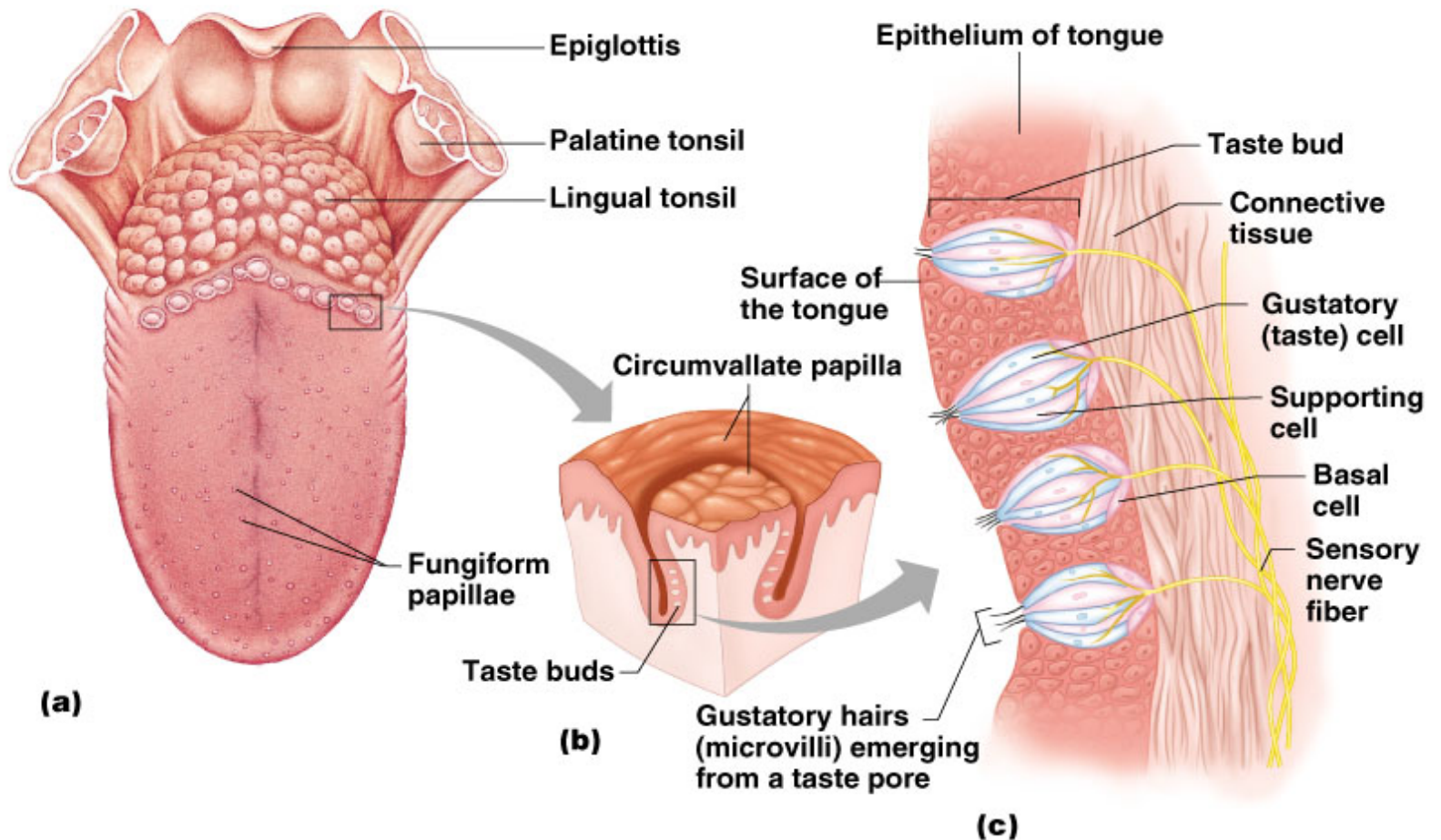
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# The Sense of Taste

- Taste is the sensation produced when a substance in the mouth reacts chemically with taste receptor
- Taste buds are specialized receptors widely scattered throughout the oral cavity
  - Tongue
  - Soft palate
  - Inner surface of cheeks



# Anatomy of Taste Buds





# Types of papillae

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- The tongue is covered with 3 types of projections called papillae
- **Filiform:** Sharp – no taste buds
- **Fungiform:** Rounded with taste buds
- **Circumvallate:** Large papillae with taste buds
- No taste buds on the mid dorsum of the tongue



# Structure of Taste Buds

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- Gustatory cells
- Gustatory cells with long microvilli (gustatory hair cells)
- They are receptor cells with cilia projected through taste pore b/w the supporting cells
- Hairs are stimulated by chemicals dissolved with saliva and transmit impulses to the brain



# Structure of Taste Buds

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- Impulses are carried to the gustatory complex by cranial nerves as taste buds are found in different areas
  - Facial nerve
  - Glossopharyngeal nerve
  - Vagus nerve



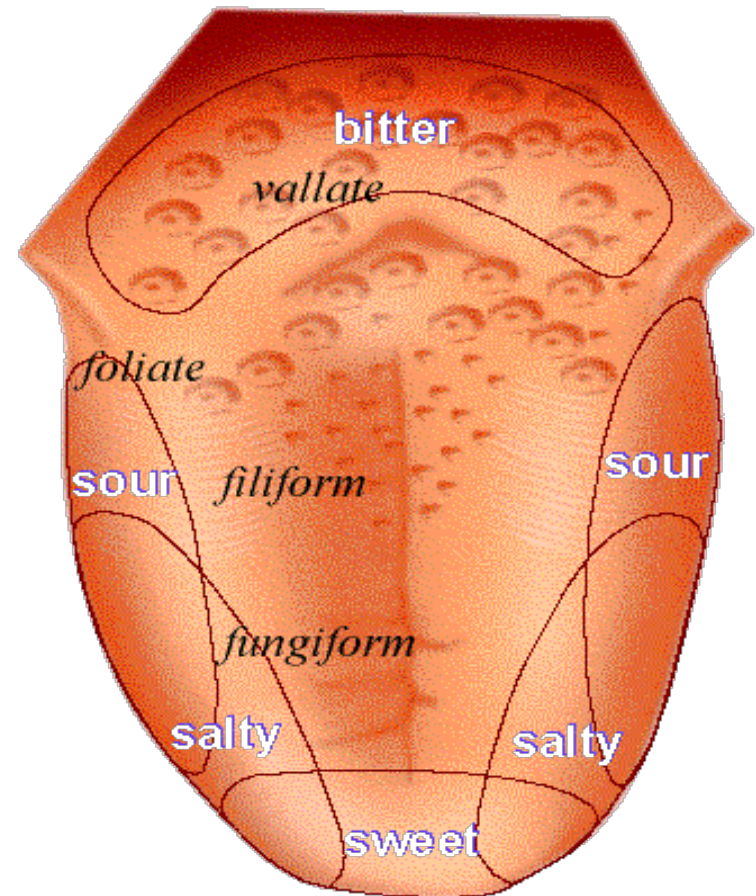
# Distribution of taste buds

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- Distribution of taste buds on tongue not uniform
  - sweet - tongue tip
  - sour - tongue margins
  - bitter - back of tongue
  - salt - widely distributed

# Taste Sensations

- 5 established taste
- Taste buds on tongue not uniform
- **Sweet receptors responds to**
  - Sugars
  - Saccharine
  - Some amino acids
- **Sour receptors.....**
  - H
  - Acids
- **Bitter receptors.....**
  - Alkaloids
- **Salty receptors.....**
  - Salt, ions, metal
- **Umami**
  - Glutamate-“Beef taste” of steak







# Taste sensation

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- Molecules dissolve in the saliva  
»»»»»» attached to receptors on  
cilia of gustatory cells receptors  
potential action potential
- Combination between molecules  
and receptors are weak (since taste  
can be easily abolished by washing  
mouth with water)



# Taste sensation

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- When stimulated produce nerve impulse to specific brain area through:
- Anterior 2/3 of the tongue..... VII
- Posterior 1/3 of the tongue..... IX
- Palate, pharynx, epiglottis..... X

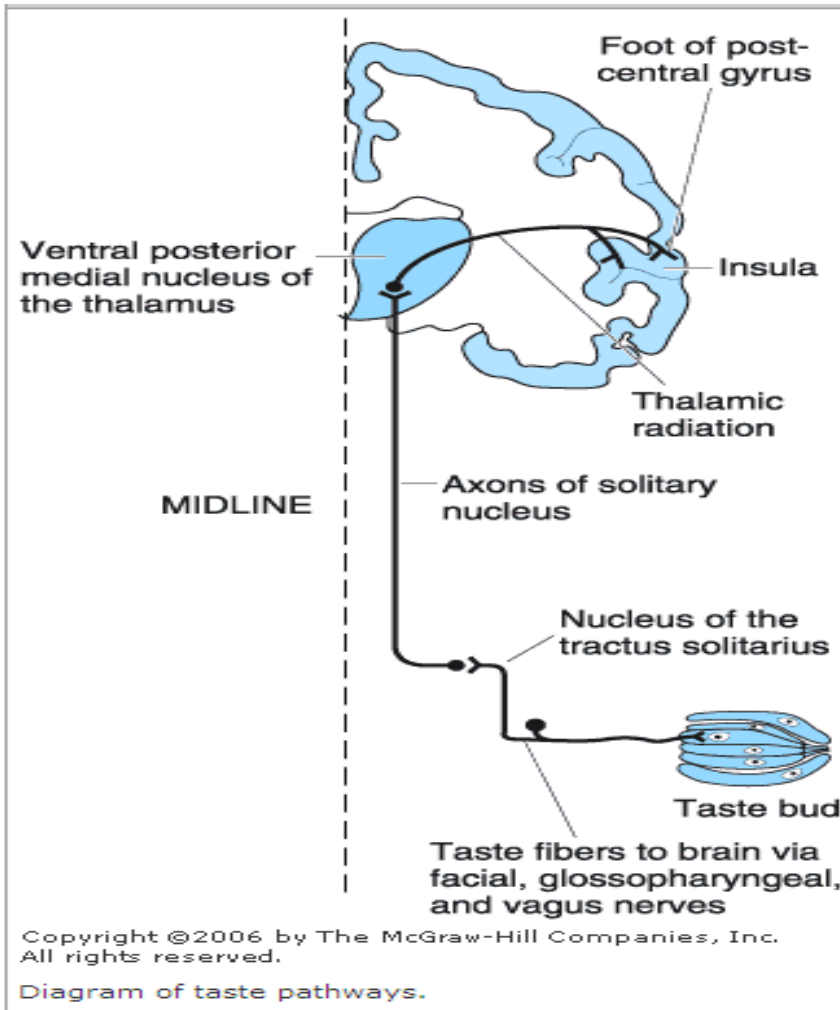


# Taste pathway

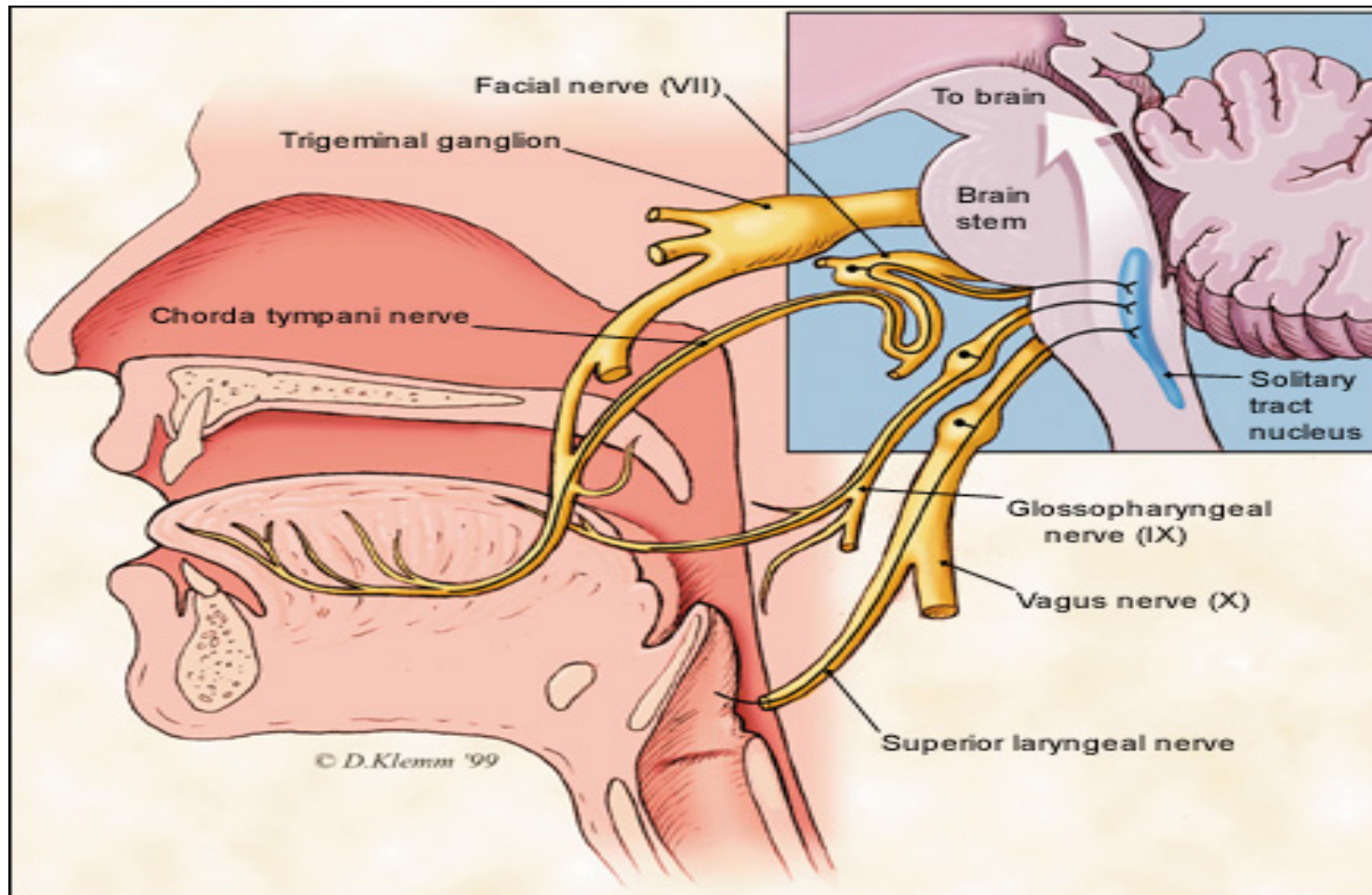
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- **First order neurone:**
  - Taste fibres from the three cranial nerves form tractus solitarius »»»»»» end in the nucleus of tractus solitarius (medulla)
- **Second order neurone:**
  - From TS cross the midline to ascend in the medial lemniscus to the thalamus
- **Third order neuron:**
  - From thalamus project to the cerebral cortex through thalamic radiation

# Taste pathway

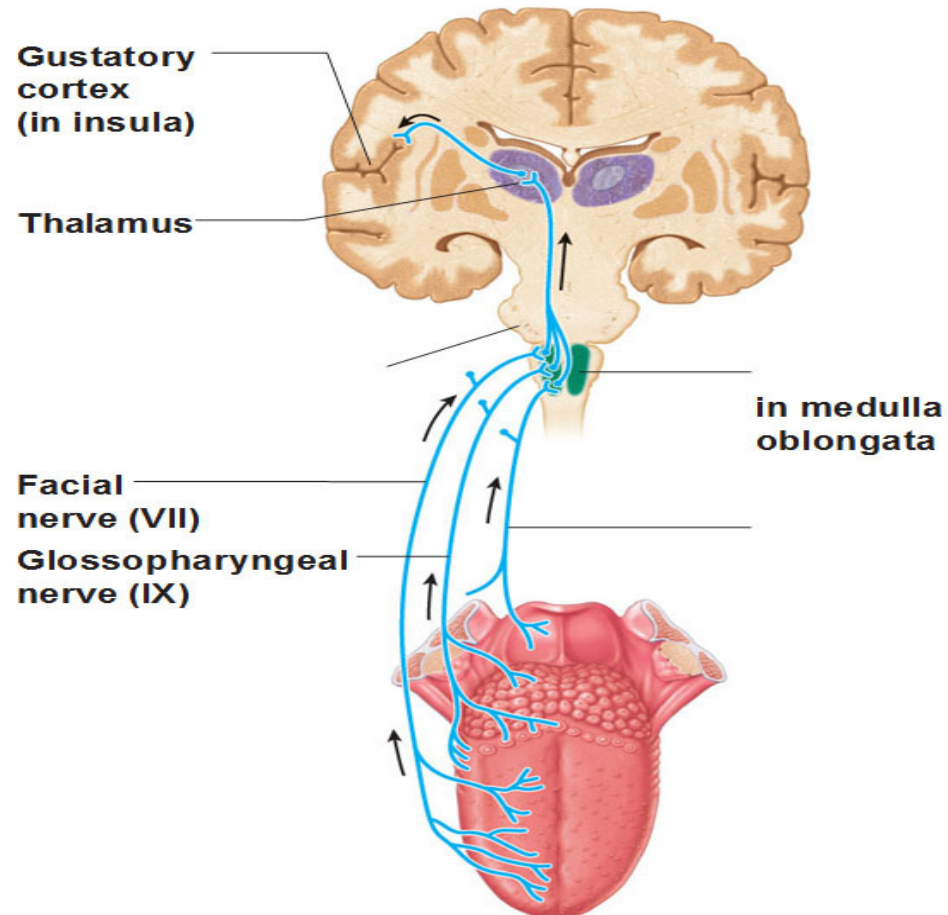


# Taste pathway



# Taste pathway

## Gustatory Pathway

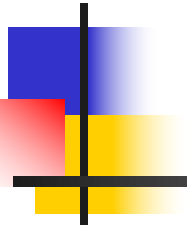




# Pathophysiology

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- Ageusia (complete loss of taste)
- Dysgeusia (disturbed taste)
- Hypergeusia (Adrenal insufficiency)
- Hypogeusia
- Many diseases can produce hypogeusia. In addition, drugs such as captopril and penicillamine, which contain sulfhydryl groups, cause temporary loss of taste sensation.



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# PHYSIOLOGY OF SMELL





# PHYSIOLOGY OF SMELL

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- Power of perceiving odors is called smell
- Olfactory receptors present in the roof of nasal cavity
- Neurons with long cilia (olfactory hairs)
- Chemicals must dissolved in mucus for detection
- Impulses transmitted via the olfactory nerve
- Interpretation of smells is made in the olfactory cortex of the brain



# PHYSIOLOGY OF SMELL

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- Human can differentiate between 2000-4000 odours
- Adaptation can occur to pleasant and nasty smells due to changes both in receptors and central connections



# PHYSIOLOGY OF SMELL

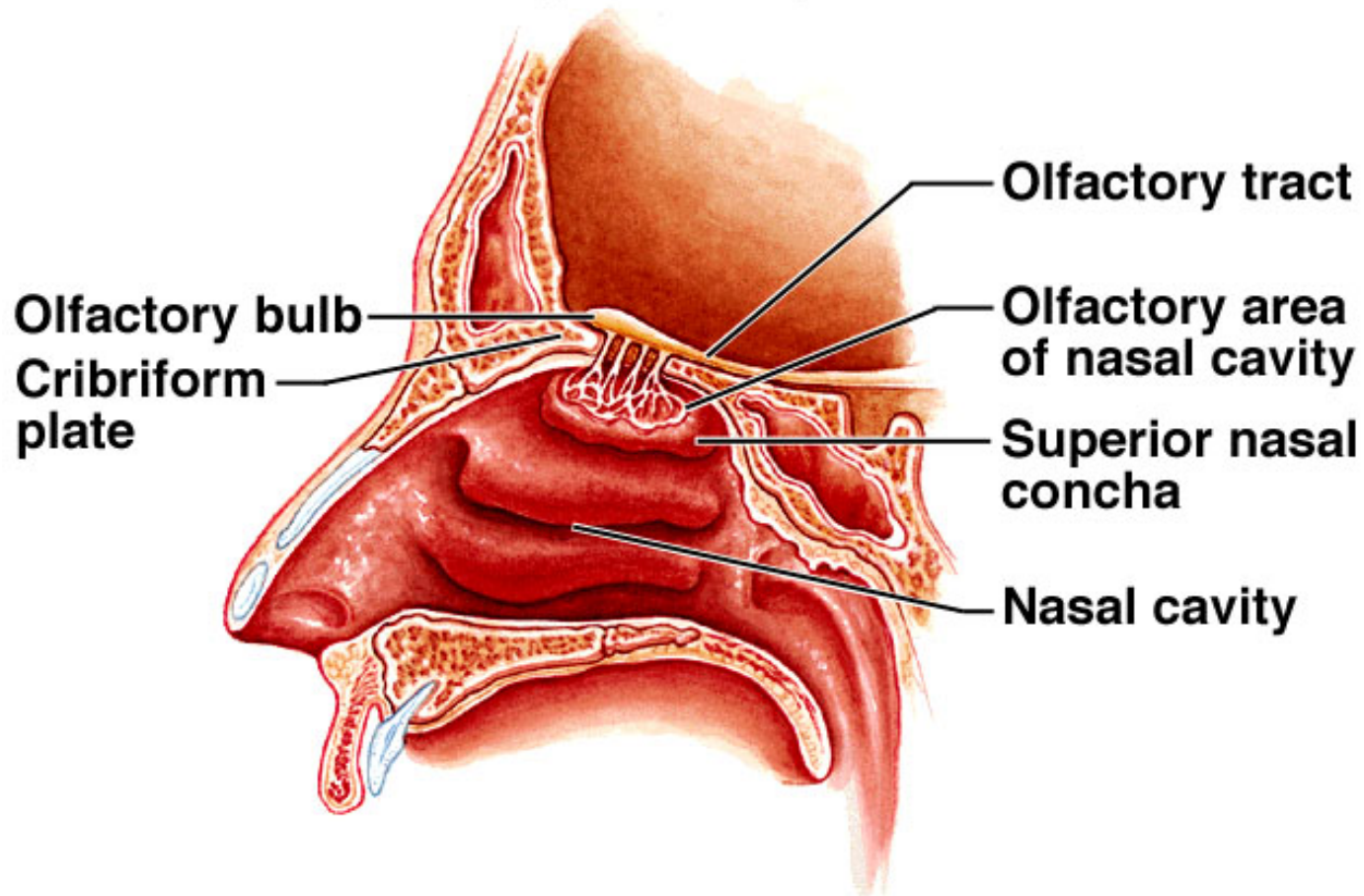
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- Molecules dissolve in mucus layer
- Combine with receptors on cilia
- Stimulate adenylat cyclase
- Increase intracellular cAMP
- Opening of Na channels receptors
- Potential AP in olfactory pathway

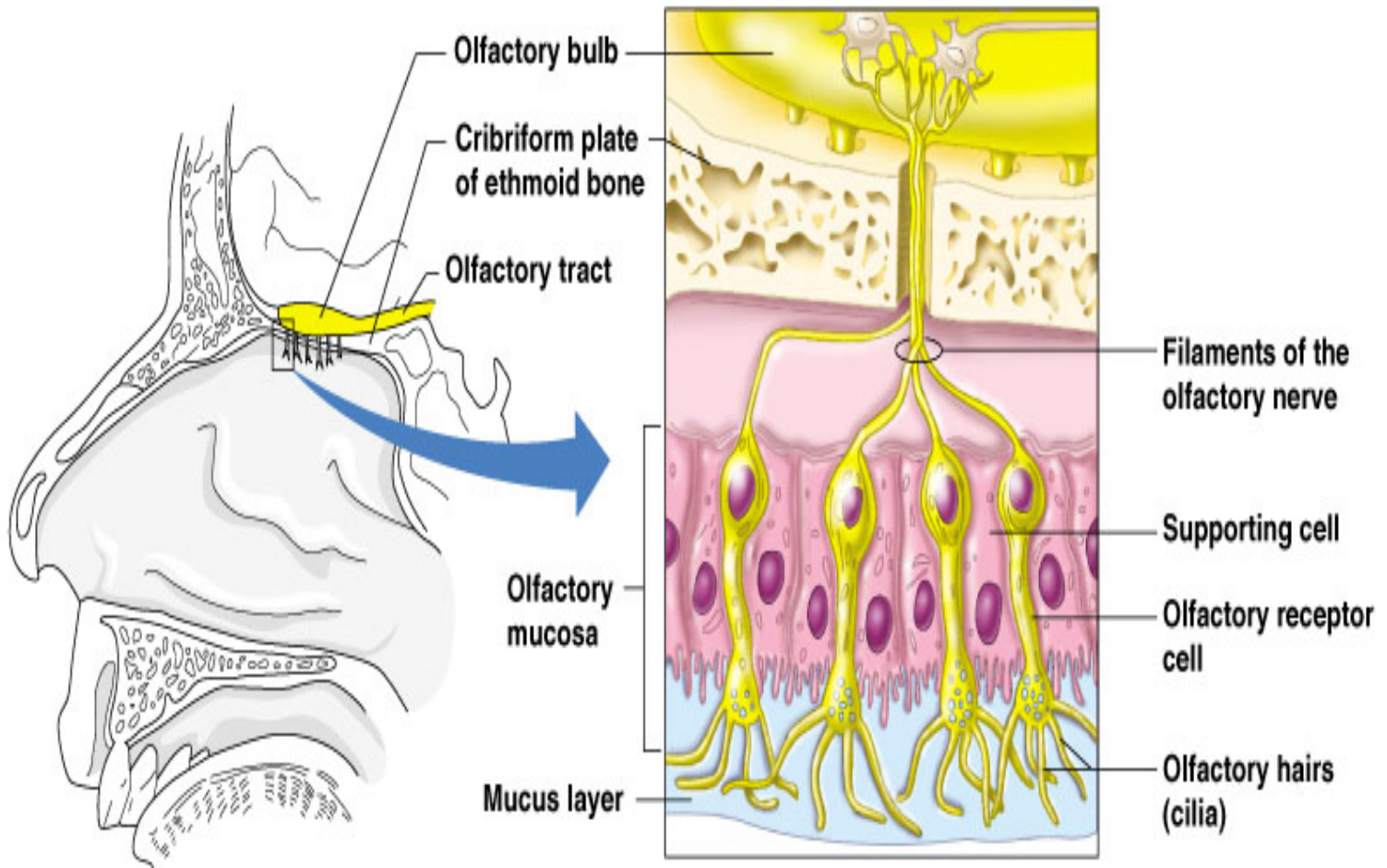
# Olfactory Epithelium

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## Olfactory Receptor Cells

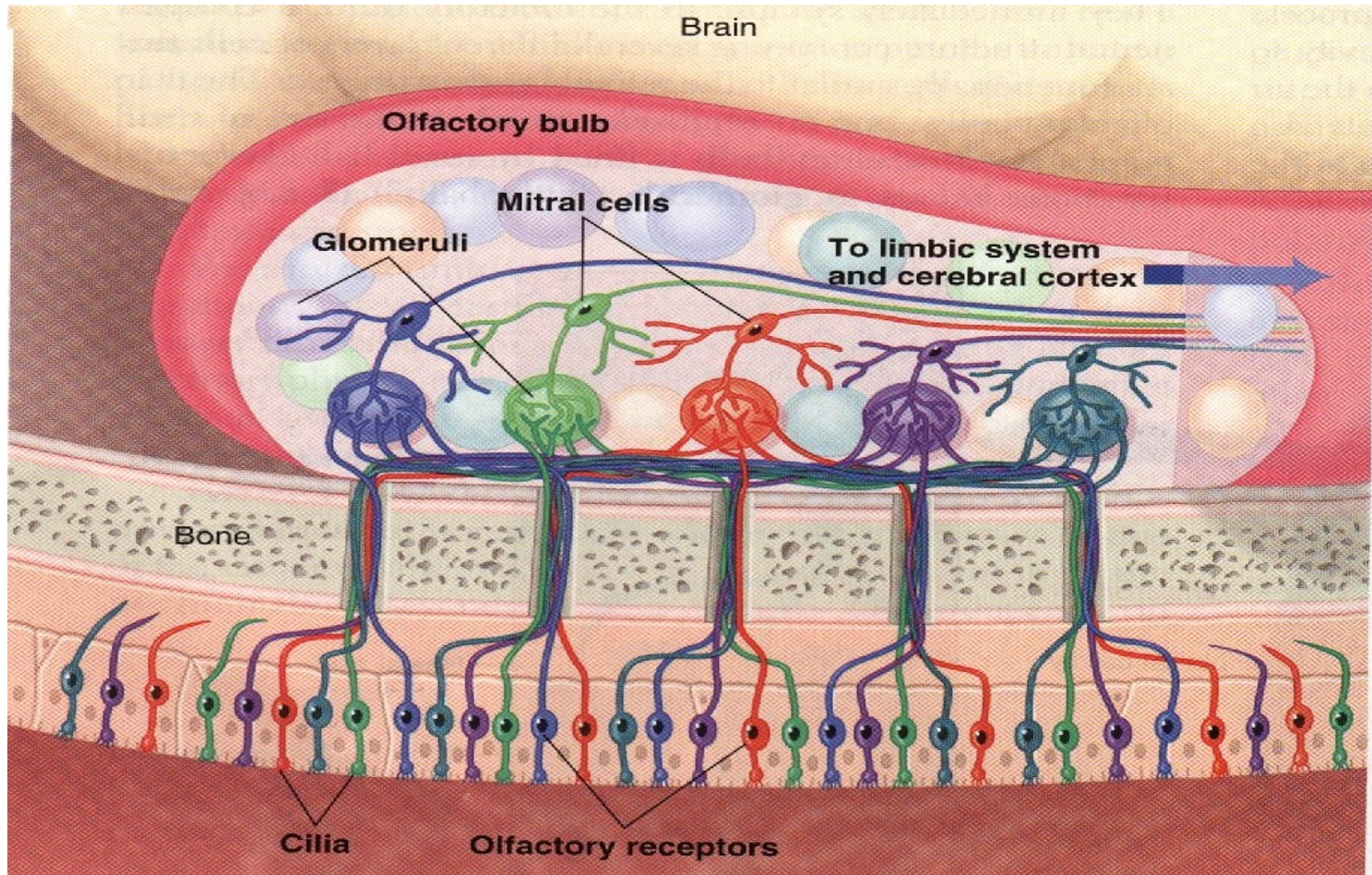


# Olfactory Epithelium

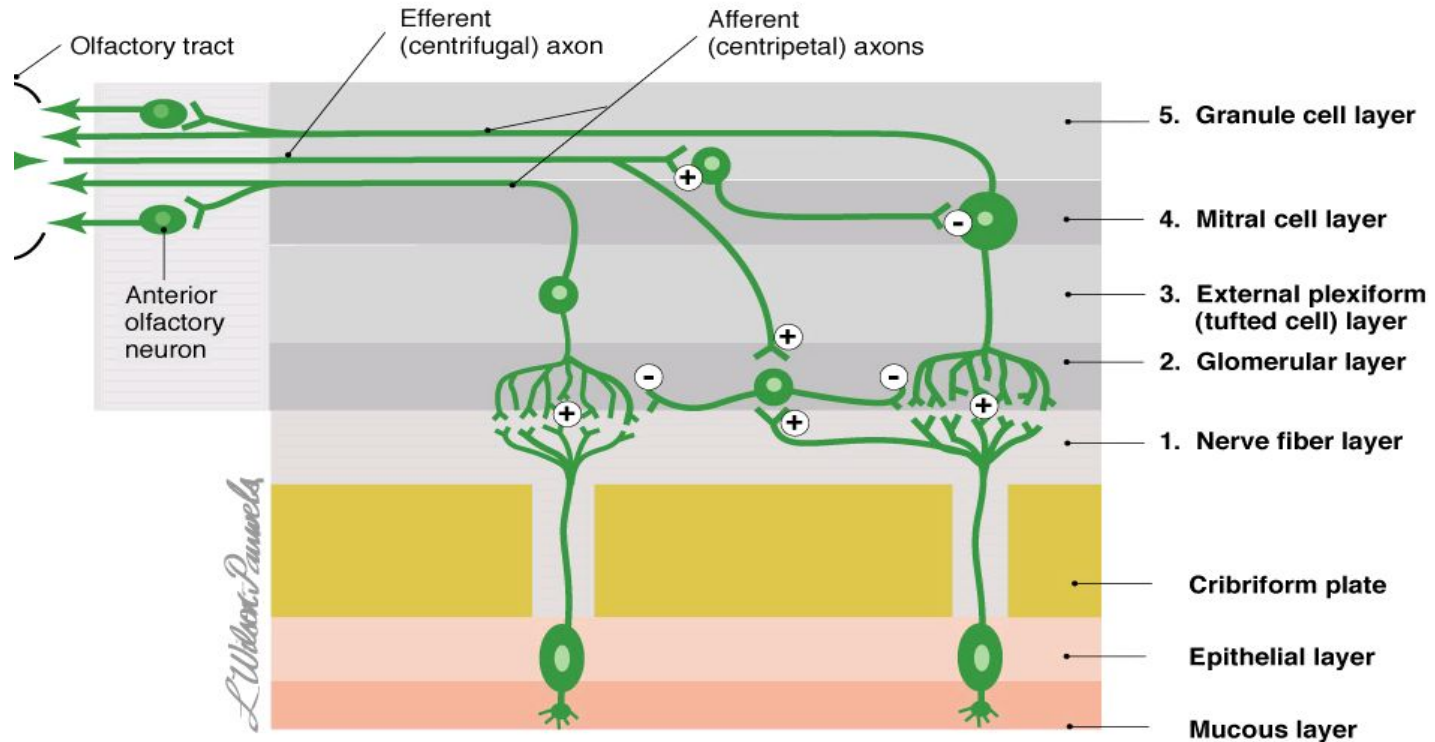




# Olfactory Epithelium



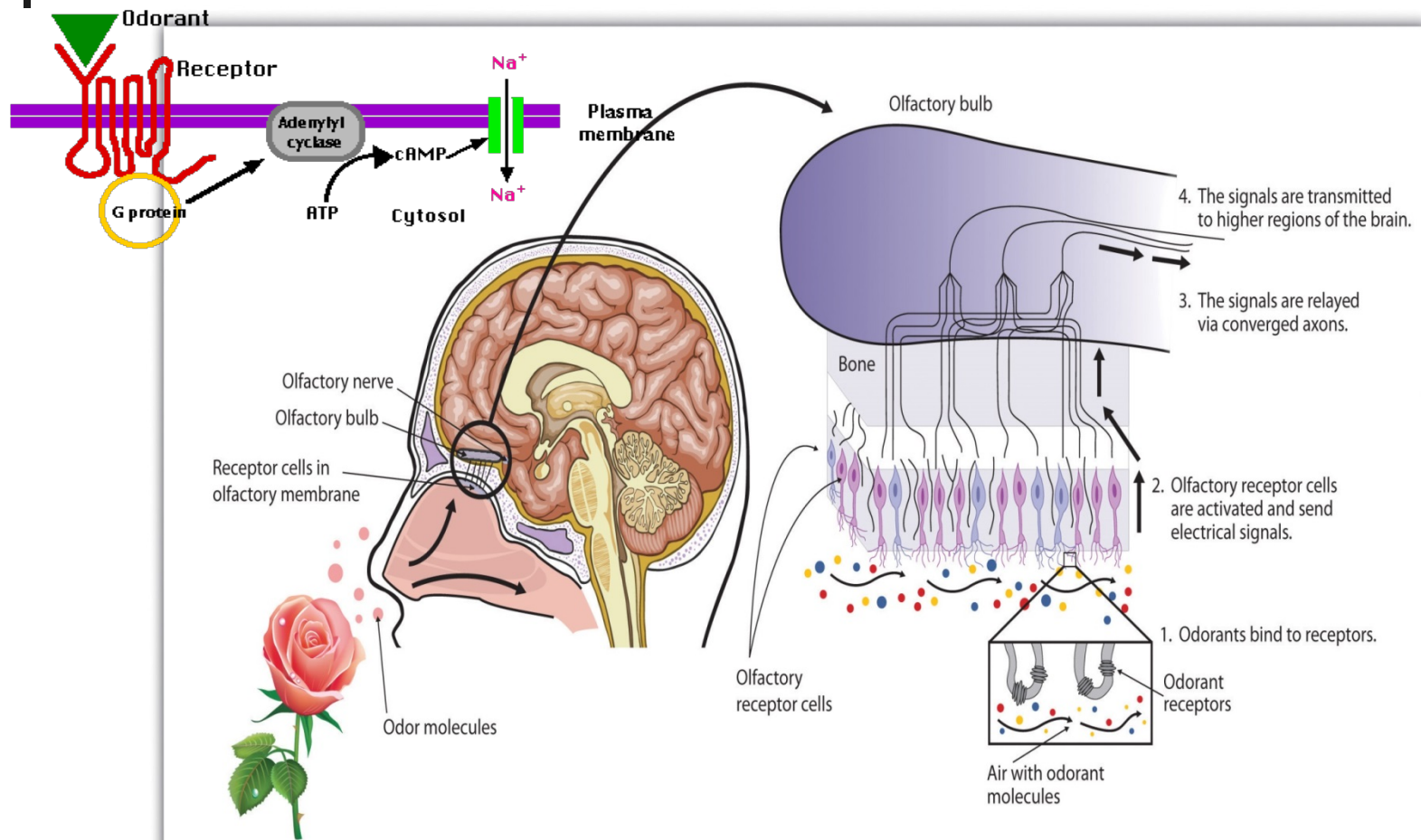
# Olfactory Mechanism



**Figure I-3** Olfactory pathway from olfactory epithelium to the olfactory tract. Numbers 1 to 5 represent the layers of the olfactory bulb. The olfactory tract includes afferent (second order) axons of tufted and mitral cells; neurons of the anterior olfactory nucleus; and efferent axons from the olfactory cortex and from the contralateral olfactory nucleus. (From "Cranial Nerves in Health and Disease" 2002, © Wilson-Pauwels, Akesson, Stewart, Spacey, B C Decker Inc.)



# Olfactory Mechanism





# Olfactory Mechanism

## Mechanism of olfactory cell stimulation

Odourant + receptor protein



Activation of G protein



Activation of adenylate  
cyclase



ATP → cAMP



Opening of Na<sup>+</sup> channels

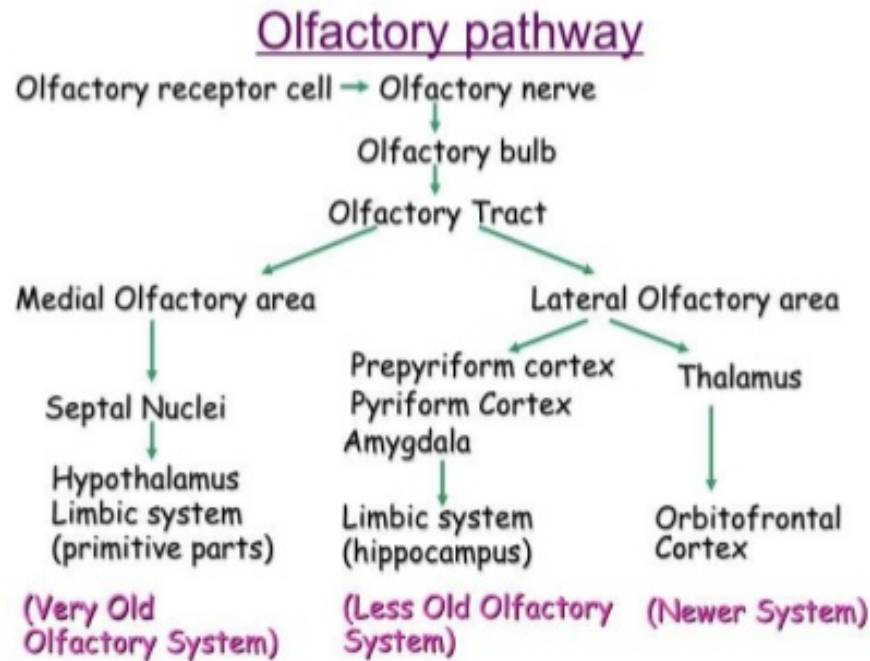


Na<sup>+</sup> influx



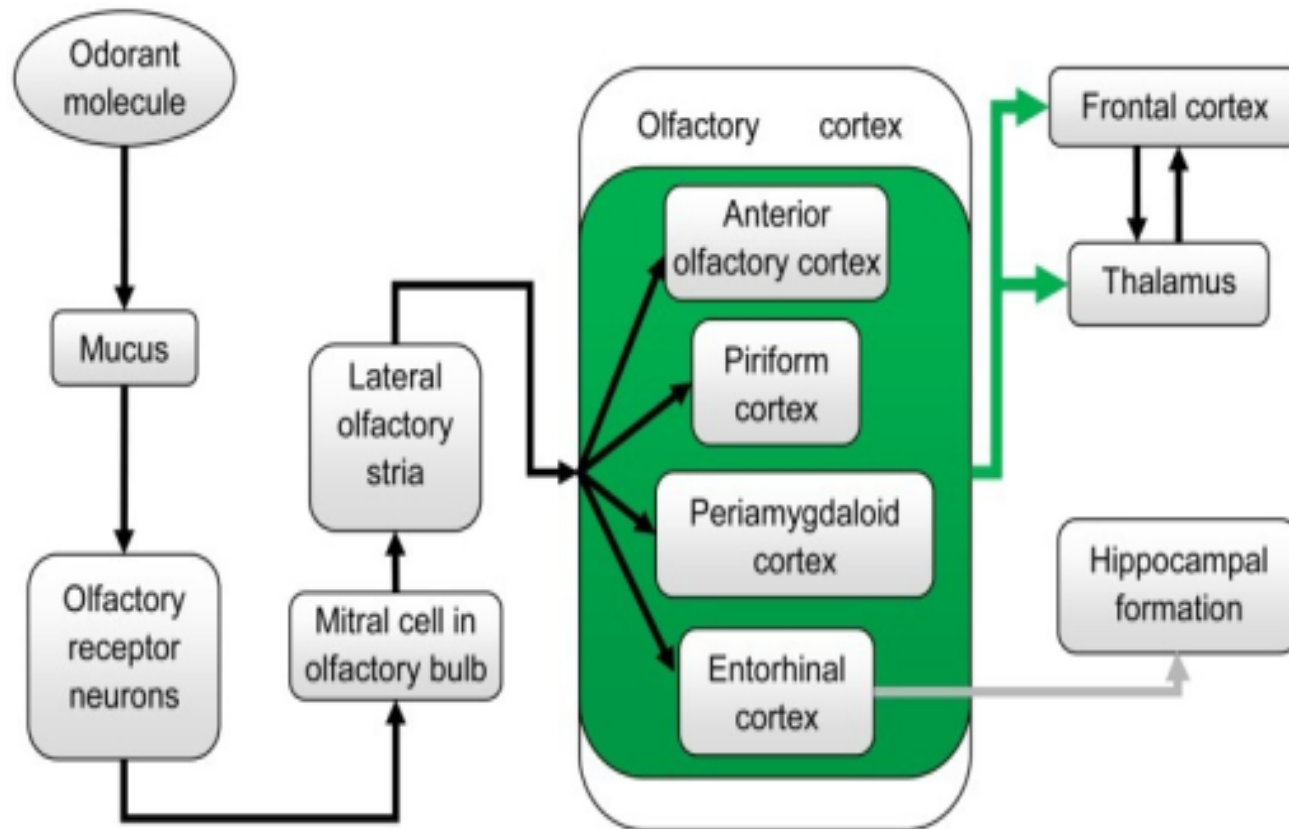
depolarization

# Olfactory Mechanism

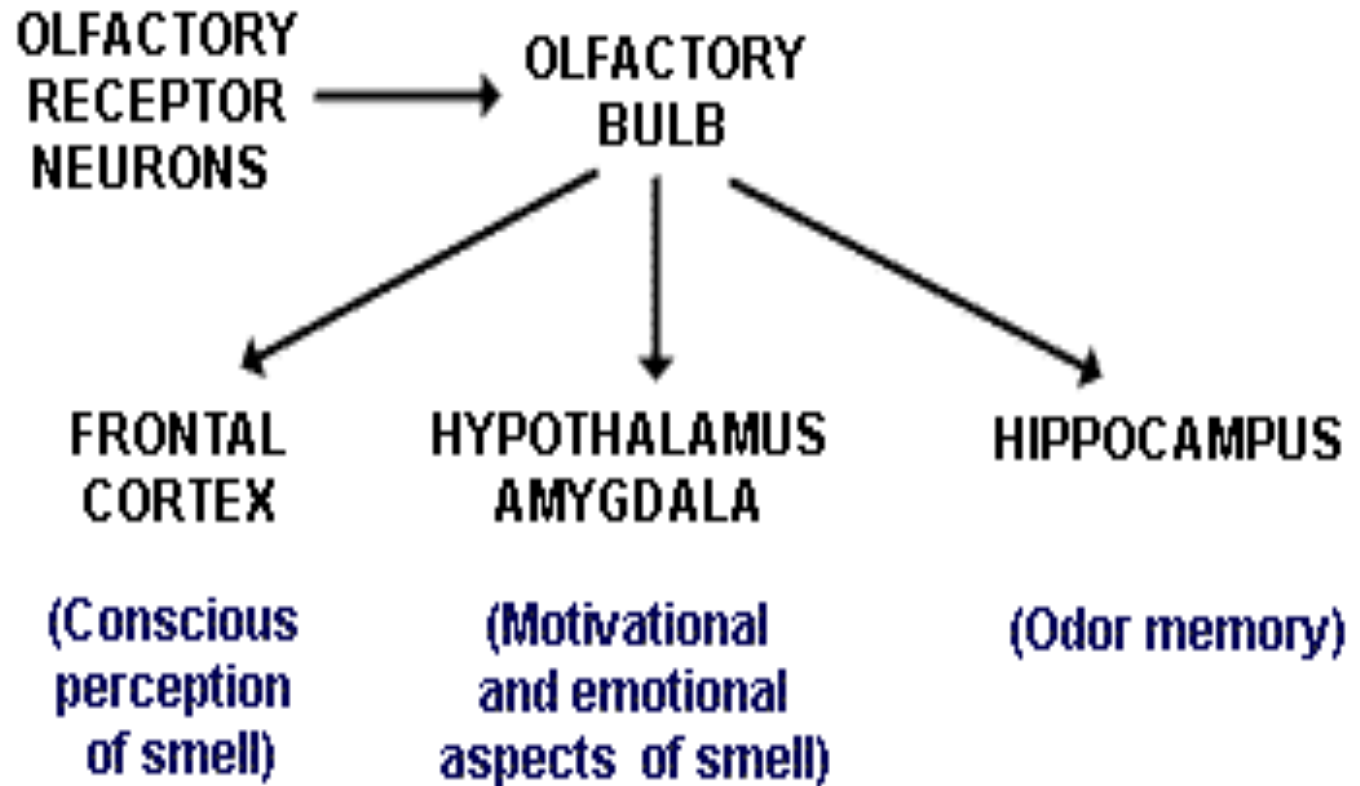


Impulses travel from olfactory tracts to the limbic system (also involved in emotions and memory)  
Impulses are interpreted in olfactory cortex  
Deep in temporal lobe and base of frontal lobe

# Olfactory Mechanism



# Olfactory Mechanism



## OLFACTORY PATHWAY

### ▶ **FIRST ORDER NEURON:**

- ▶ From olfactory epithelium to glomerulus

### ▶ **SECOND ORDER NEURON:**

- ▶ The olfactory bulb. where the second neurons of the olfactory pathway (mitral and tufted cells) are located.
- ▶ The axons of these Second order neurons pass centrally as the olfactory tract.

### ▶ **THIRD ORDER NEURON:**

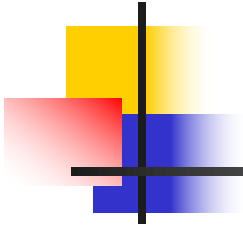
- ▶ The prepiriform area (area 28) is considered the primary olfactory cortex which contains the third order neurons.



# Pathophysiology

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- **Anosmia:** loss of smell sensation
- Due to damage to olfactory epithelium
- **Parosmia (dysosmia)**
- Alteration in smell sensation
- **Hyperosmia** (increase in smell sensation)
- Adrenal insufficiency
- **Hyposomia** (decreased smell sensation)
- Vitamin A deficiency



**THANK YOU**