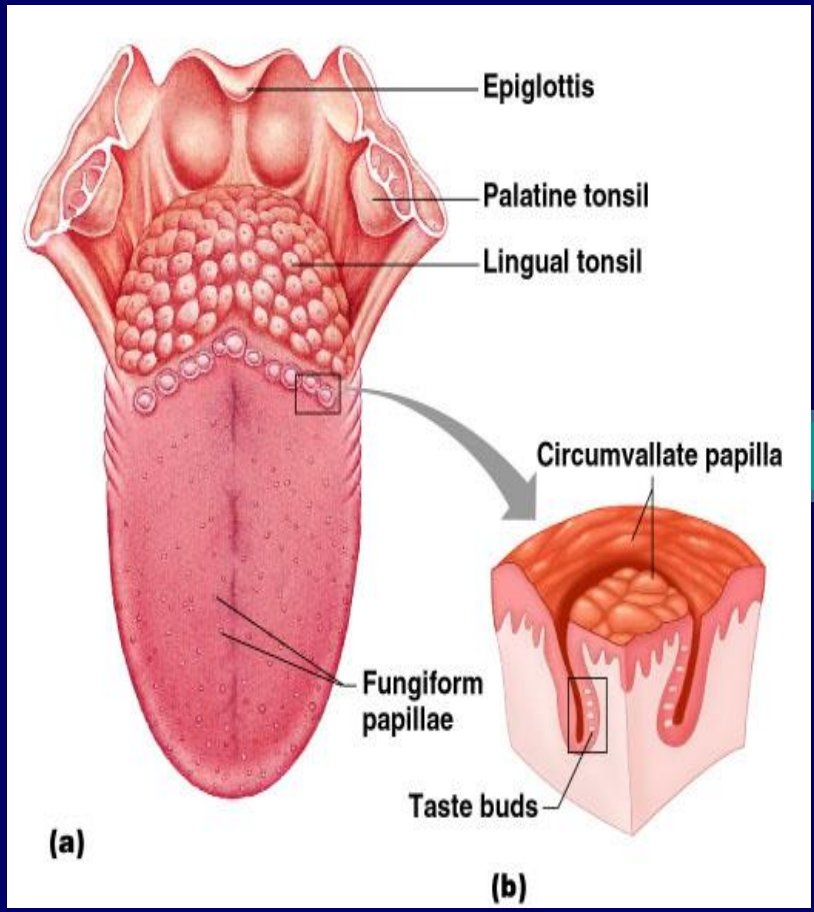
PHYSIOLOGY OF TASTE

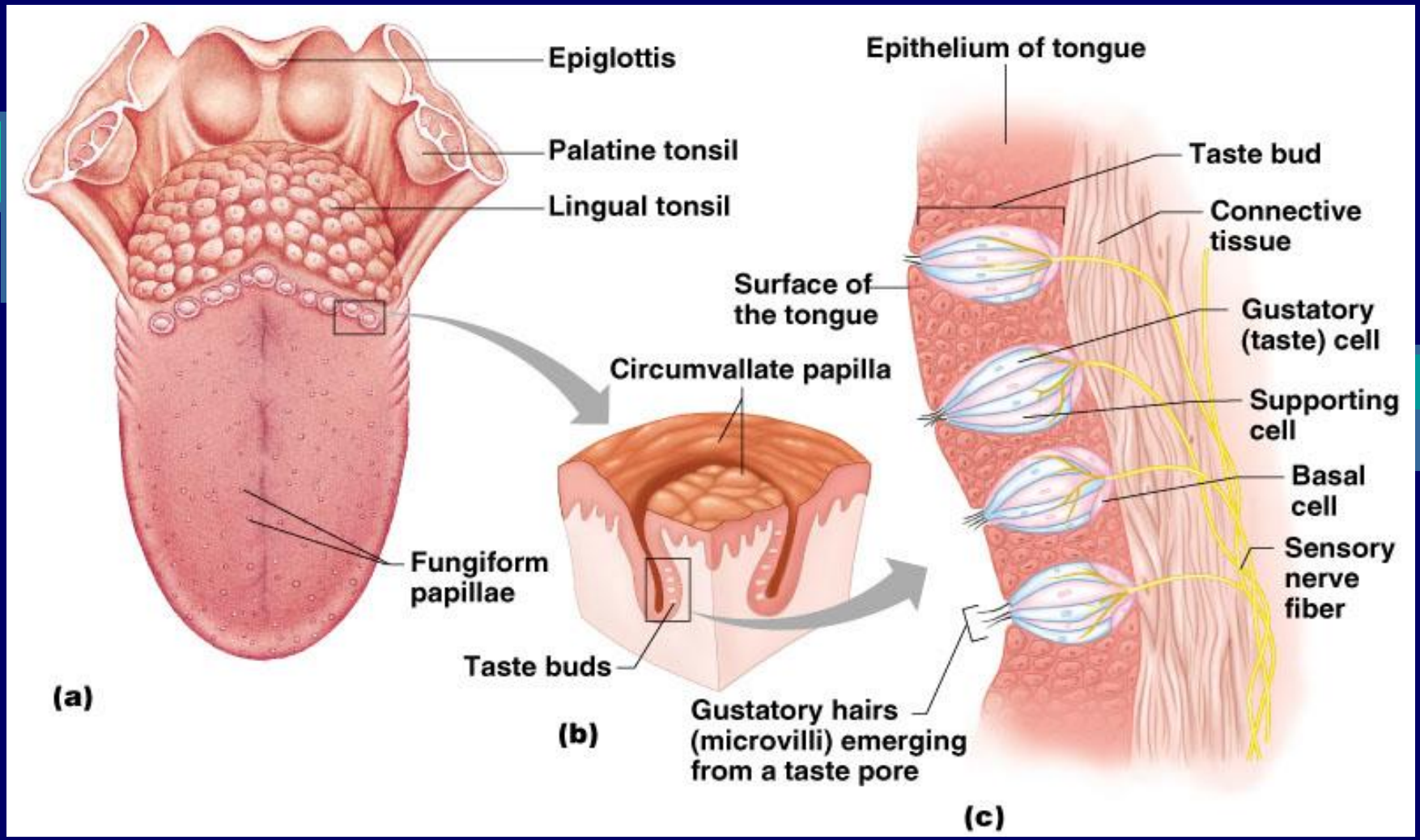
The Sense of Taste

- 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

- 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

- 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

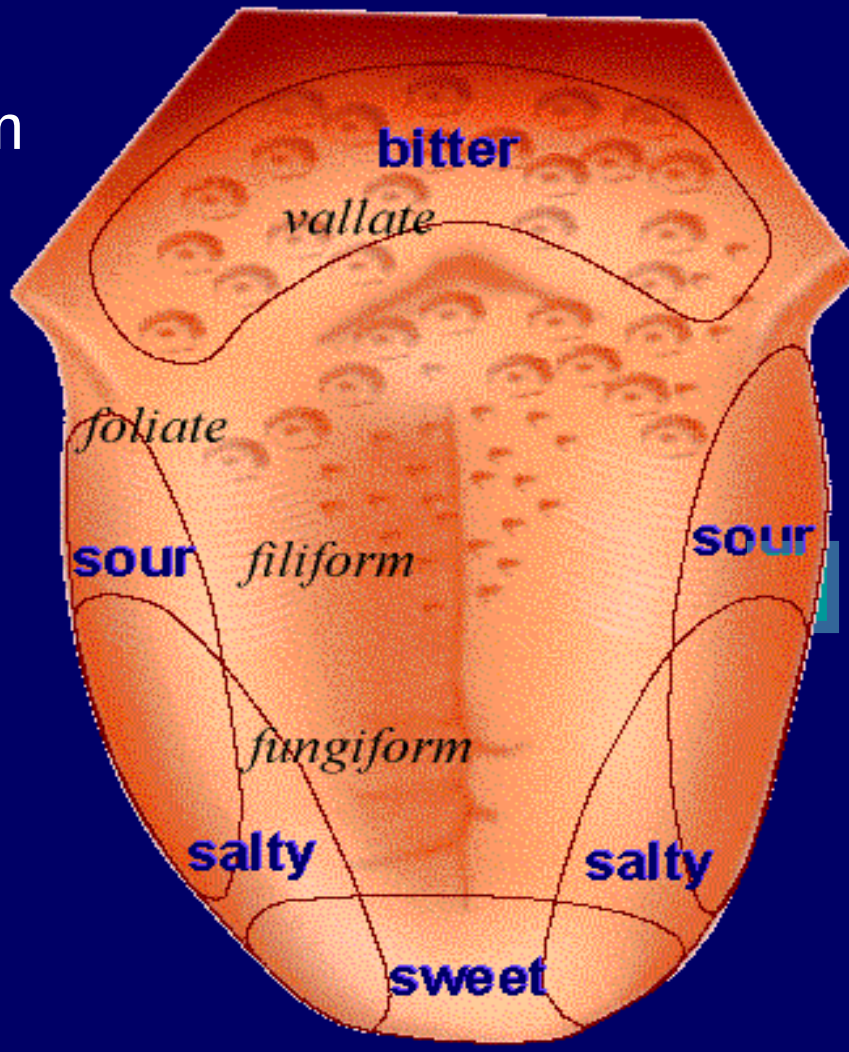
- Impulses are carried to the gustatory complex by cranial nerves as taste buds are found in different areas
  - Facial nerve
  - Glossopharyngeal nerve
  - Vagus nerve

Distribution of taste buds

- 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

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

Taste sensation

- 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

- **First order neurone:**
  - Taste fibres from the three cranials 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 the cerebral cortex through thalamic radiation

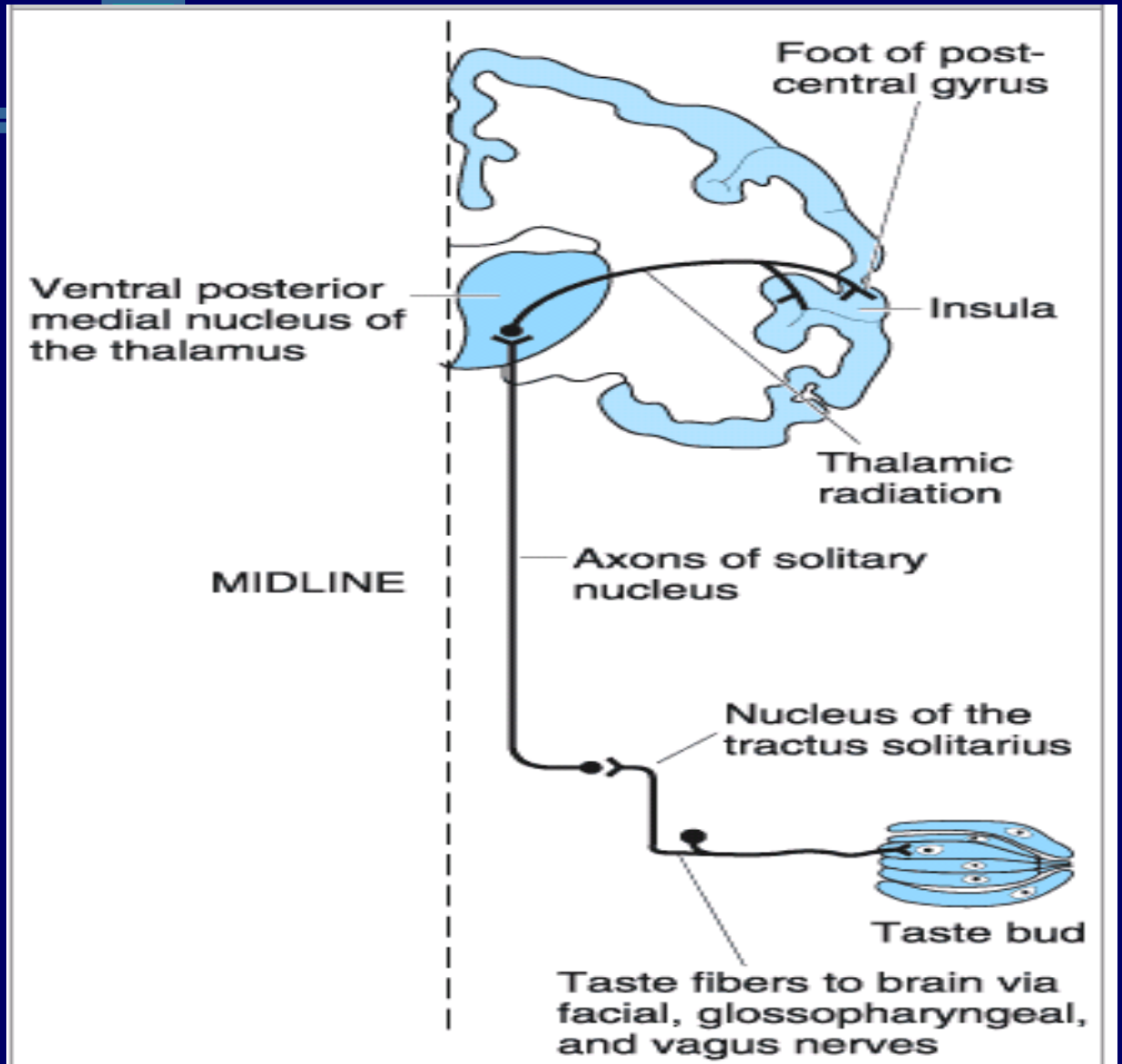
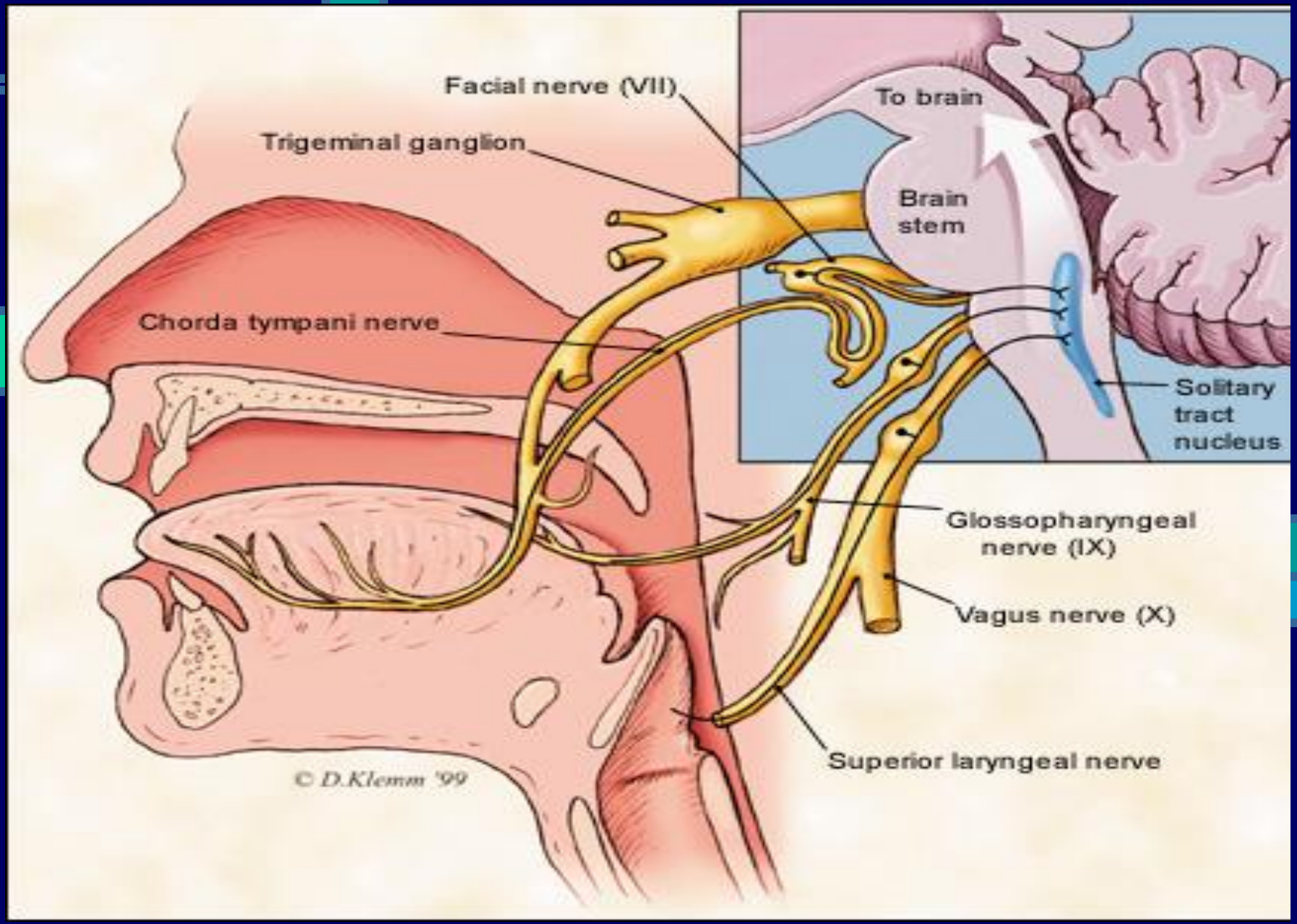


Diagram of taste pathways.


Facial nerve (VII)
Trigeminal ganglion
Chorda tympani nerve
To brain
Brain stem
Solitary tract nucleus
Glossopharyngeal nerve (IX)
Vagus nerve (X)
Superior laryngeal nerve
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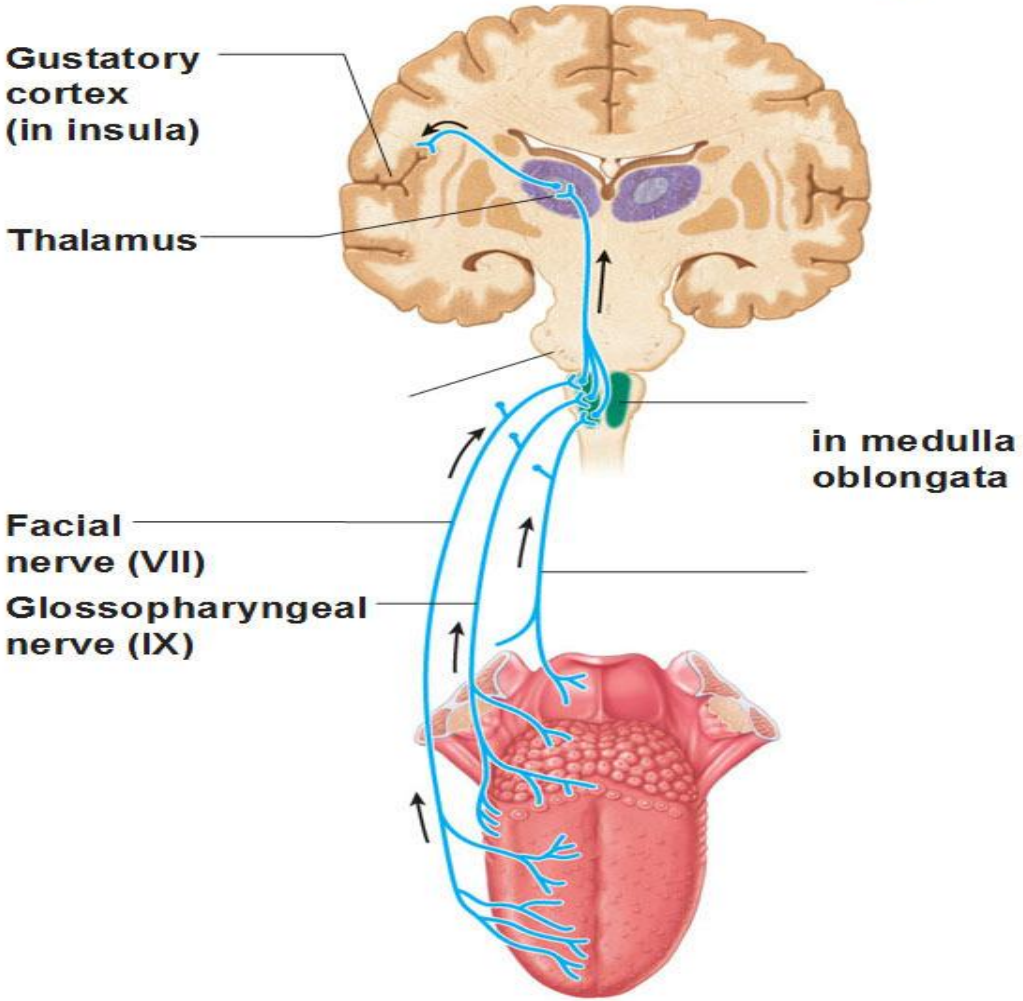
Gustatory Pathway



Pathophysiology

- 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.

PHYSIOLOGY OF SMELL

PHYSIOLOGY OF SMELL

- 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

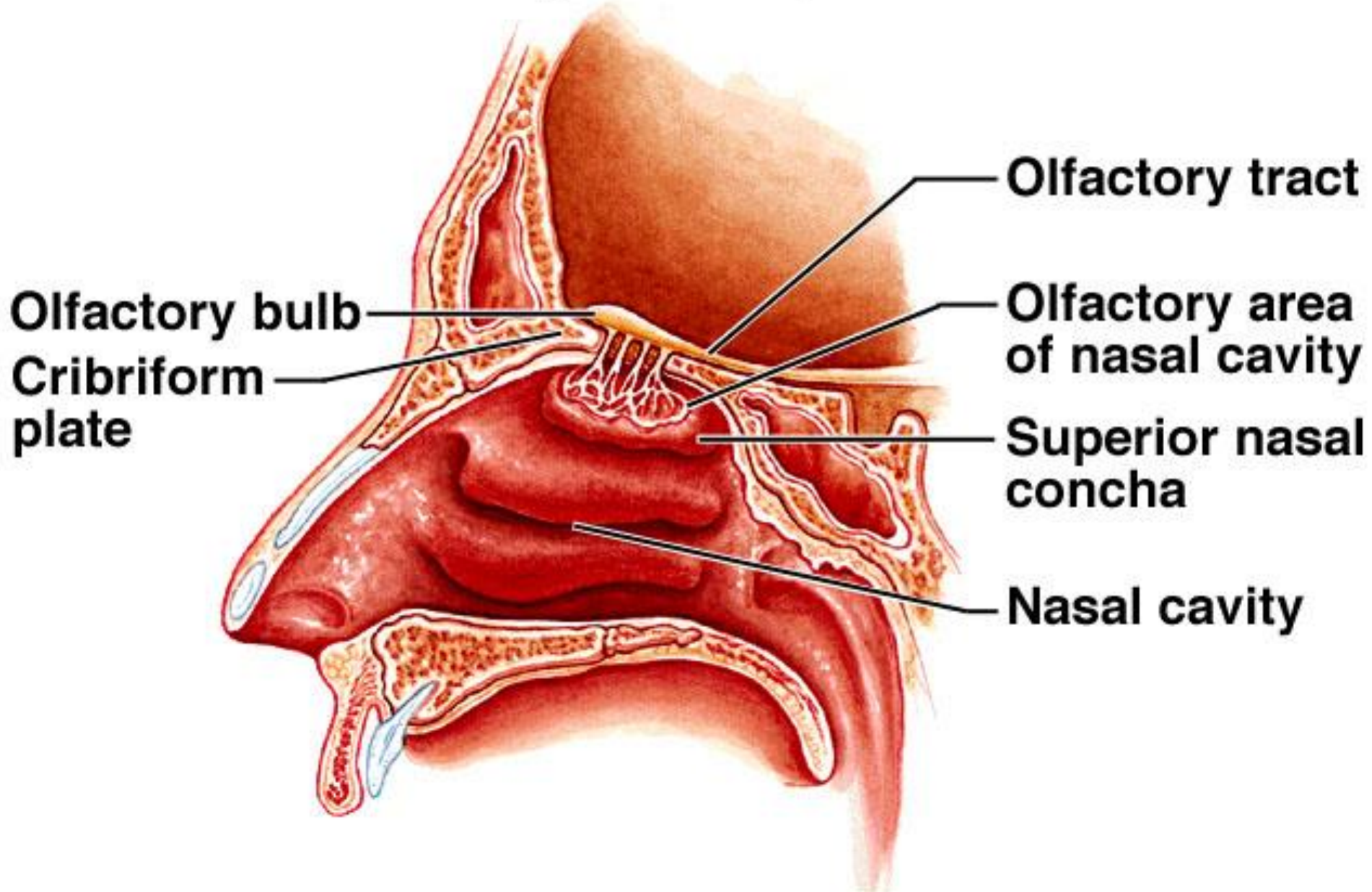
PHYSIOLOGY OF SMELL

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

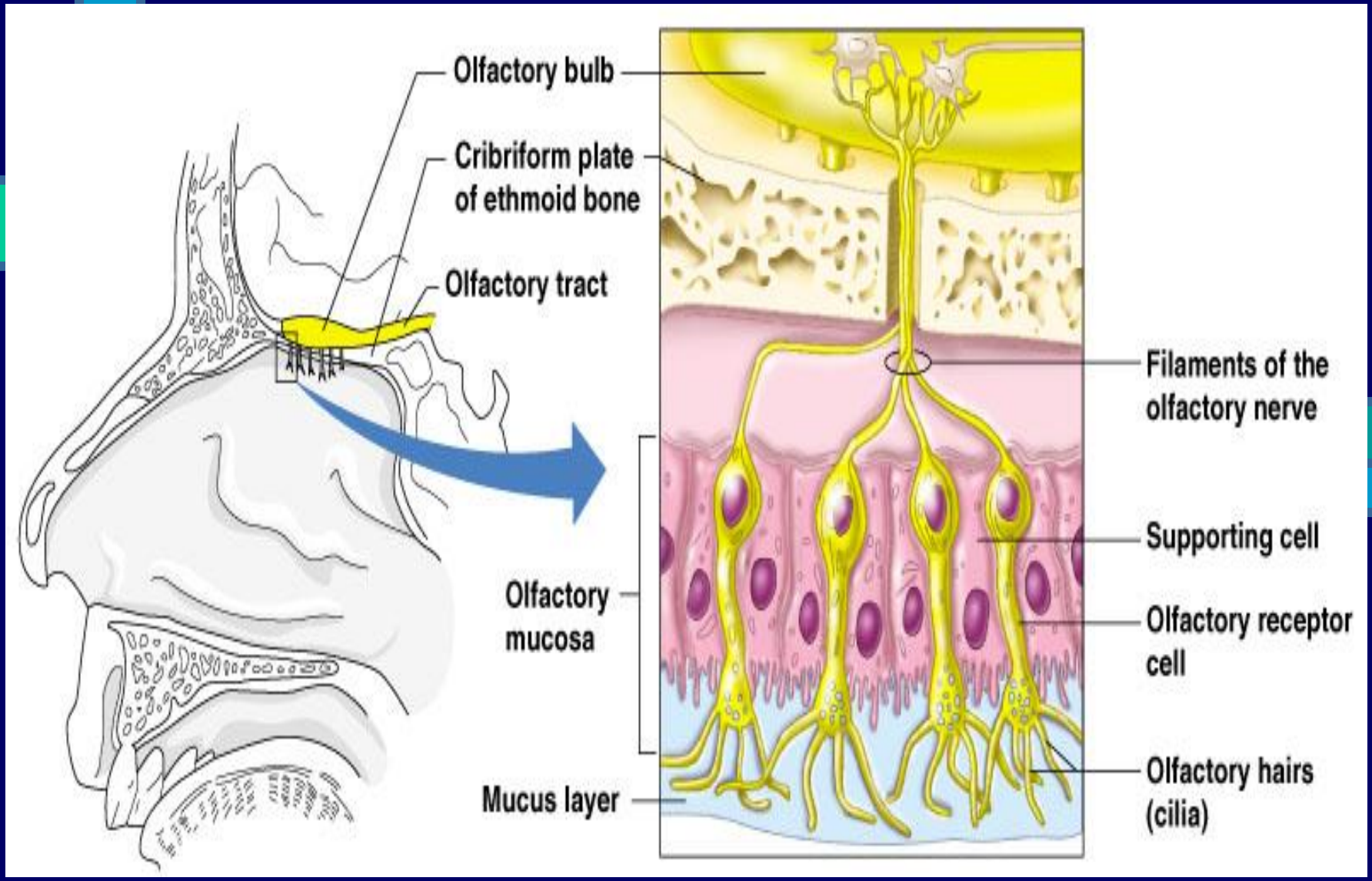
PHYSIOLOGY OF SMELL

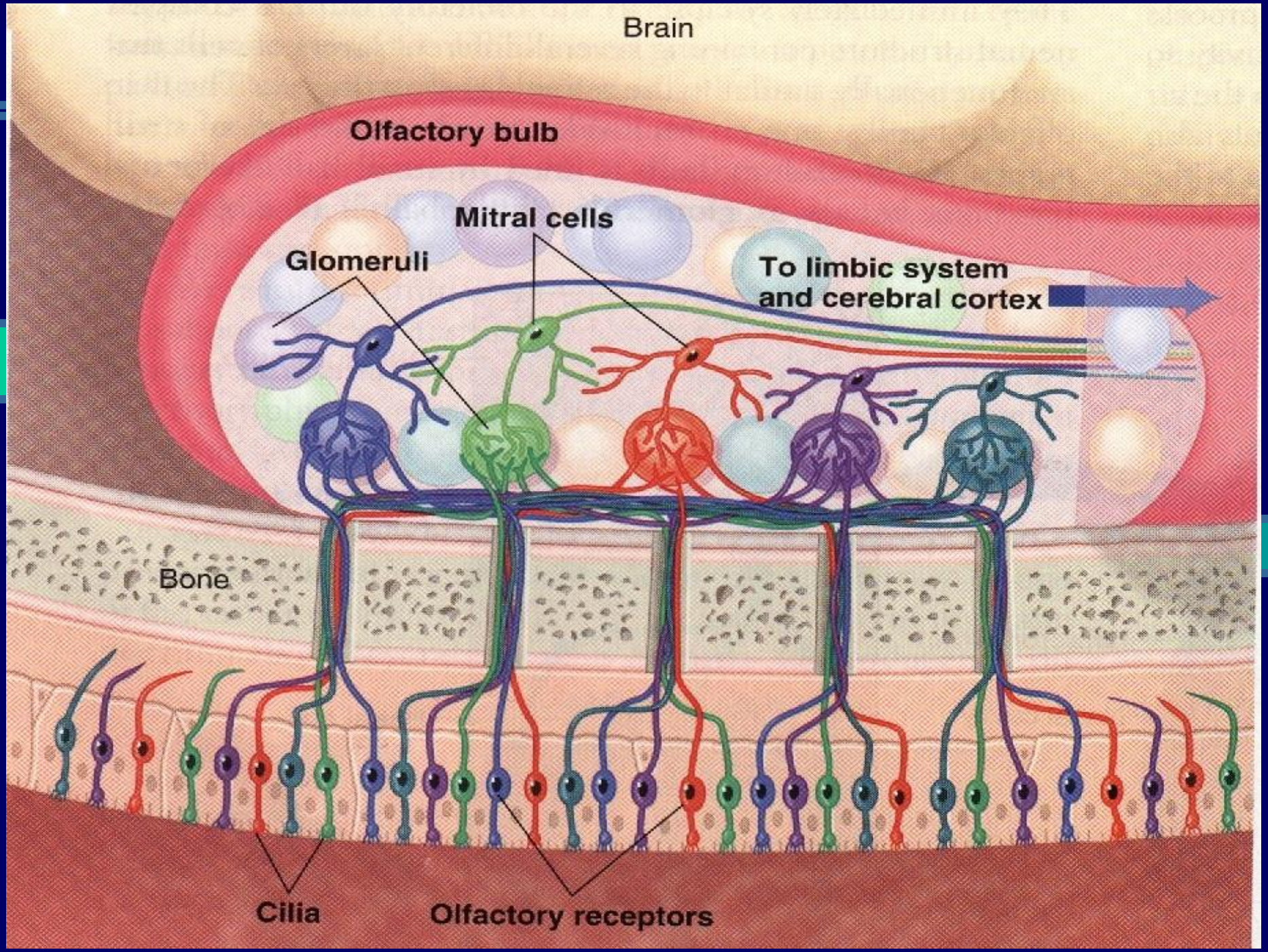
- Molecules dissolve in mucus layer
- Combine with receptors on cilia
- Stimulate adenylat cyclase
- Increase intracellular cAMP
- Opening of Na channels receptors
- Potential AP in olfactory pathway

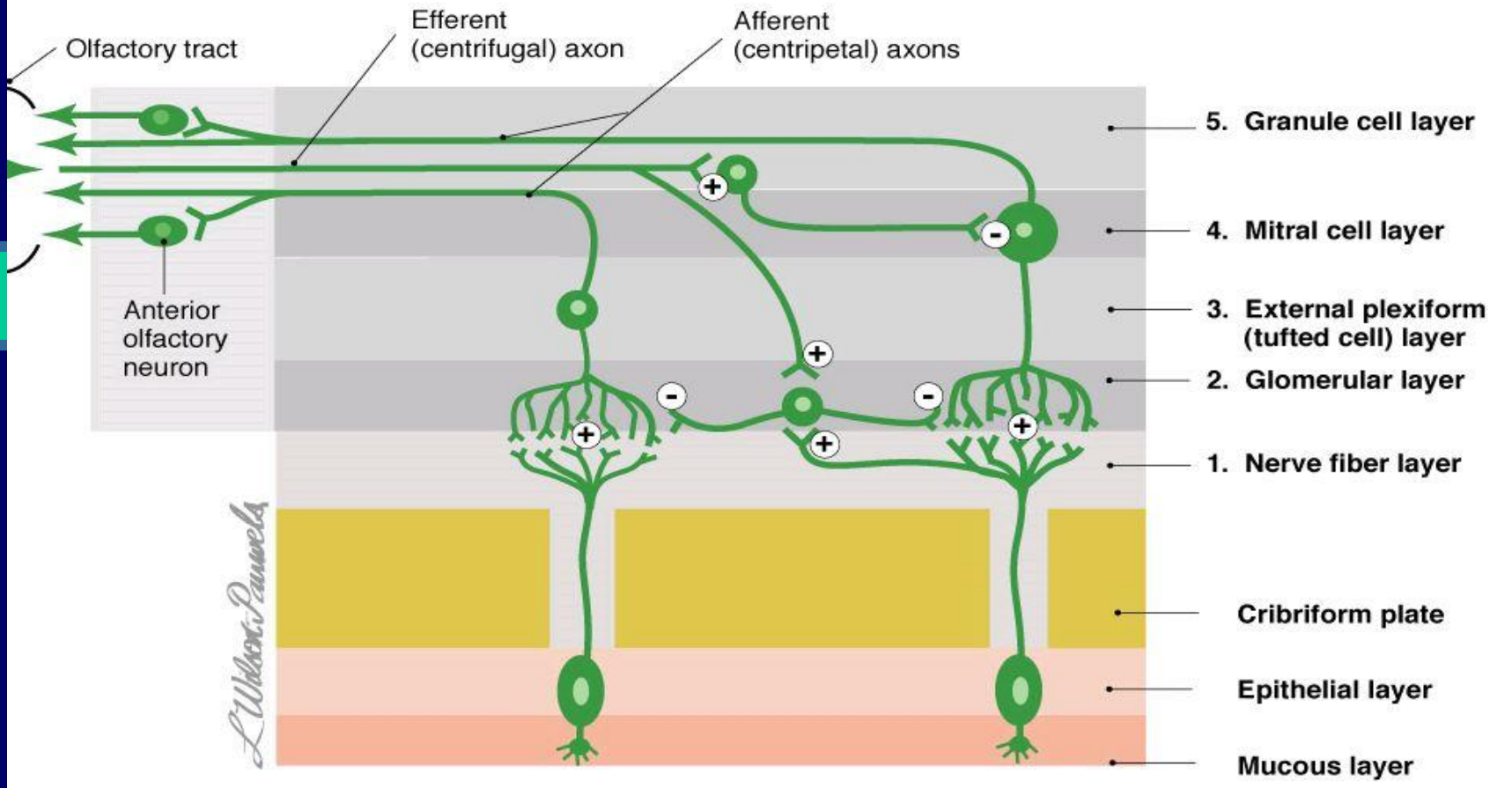
Olfactory Receptor Cells



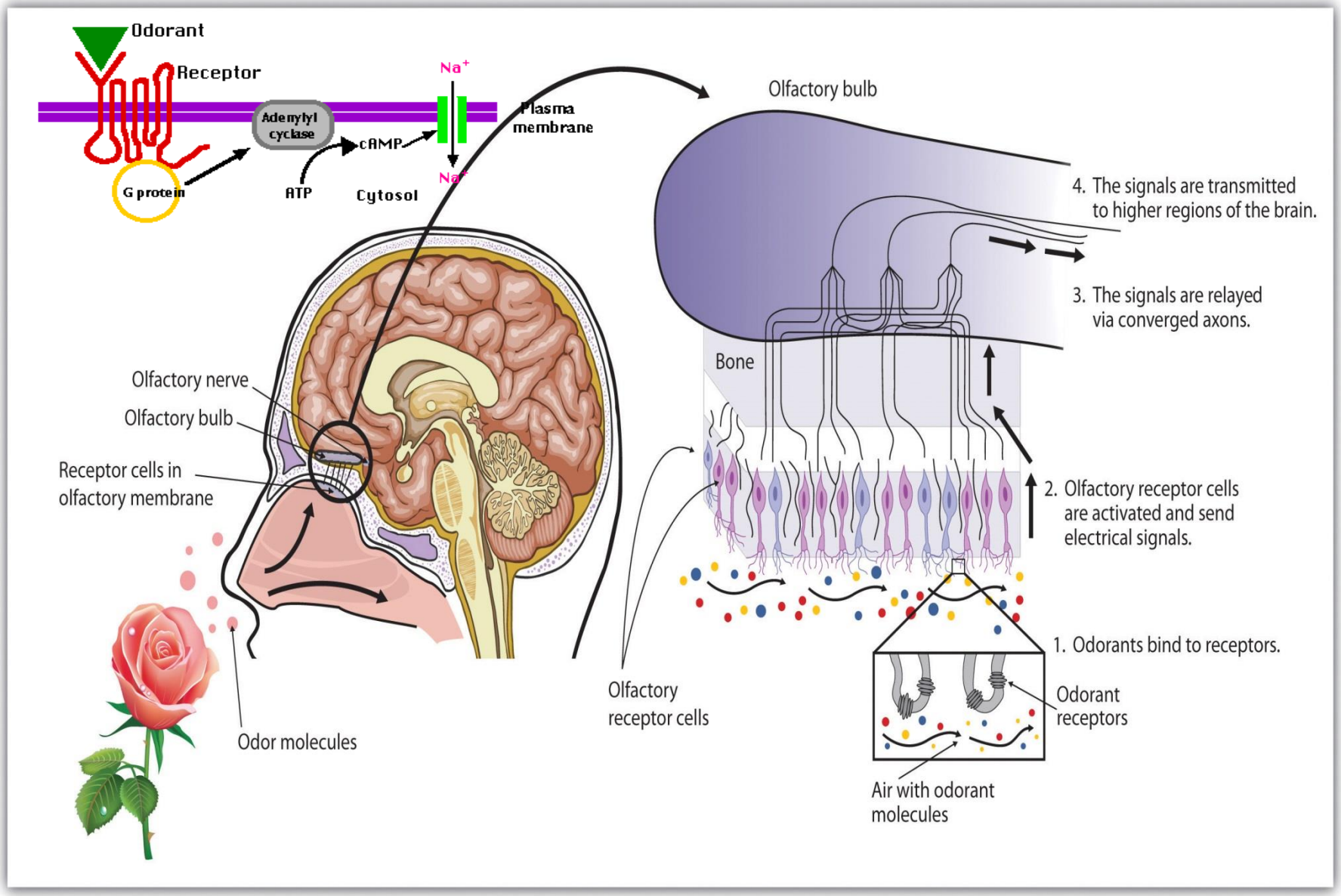
Olfactory Epithelium




Brain
Olfactory bulb
Mitral cells
Glomeruli
To limbic system
and cerebral cortex
Bone
Cilia
Olfactory receptors



ure I–3 Olfactory pathway from olfactory epithelium to the olfactory tract. Numbers 1 to 5 represent the layers olfactory bulb. The olfactory tract includes afferent (second order) axons of tufted and mitral cells; neurons of t erior olfactory nucleus; and efferent axons from the olfactory cortex and from the contralateral olfactory nucleus


Odorant
Receptor
Adenylyl cyclase
G protein
ATP
cAMP
Cytosol
Na+
Na+
Plasma membrane
Olfactory bulb
4. The signals are transmitted to higher regions of the brain.
3. The signals are relayed via converged axons.
Bone
Olfactory nerve
Olfactory bulb
Receptor cells in olfactory membrane
2. Olfactory receptor cells are activated and send electrical signals.
1. Odorants bind to receptors.
Odorant receptors
Olfactory receptor cells
Odor molecules
Air with odorant molecules

Mechanism of olfactory cell stimulation

Odourant + receptor protein

↓

Activation of G protein

↓

Activation of adenylate cyclase

↓

ATP → cAMP

↓

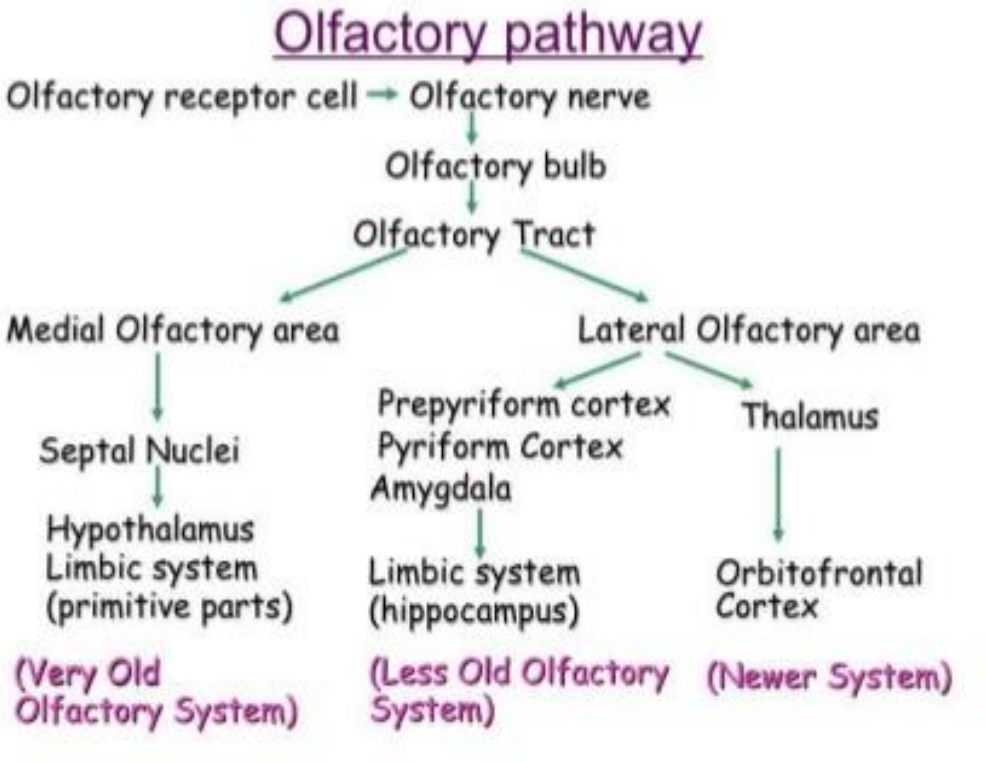
Opening of Na^+ channels

↓

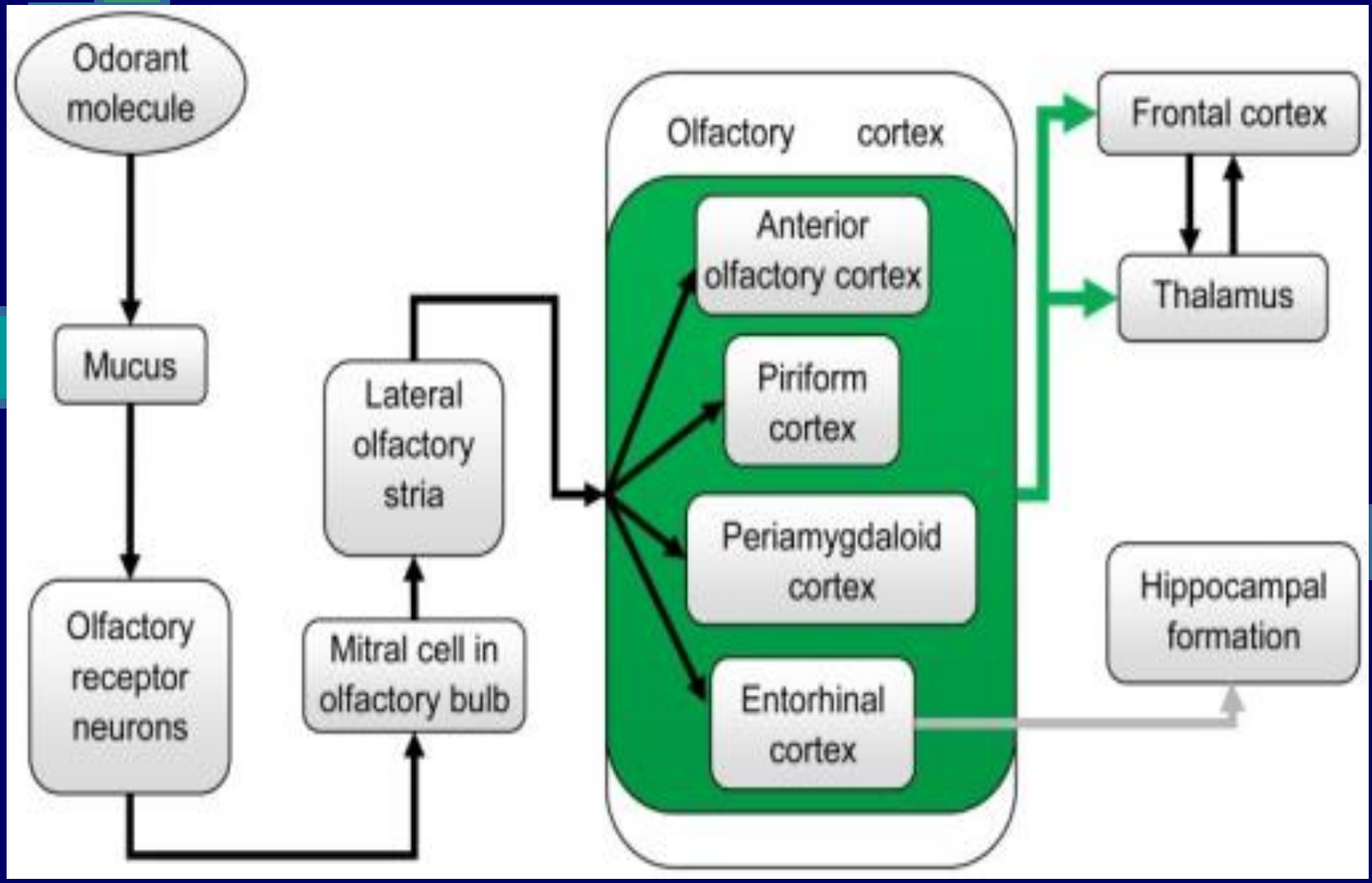
Na^+ influx

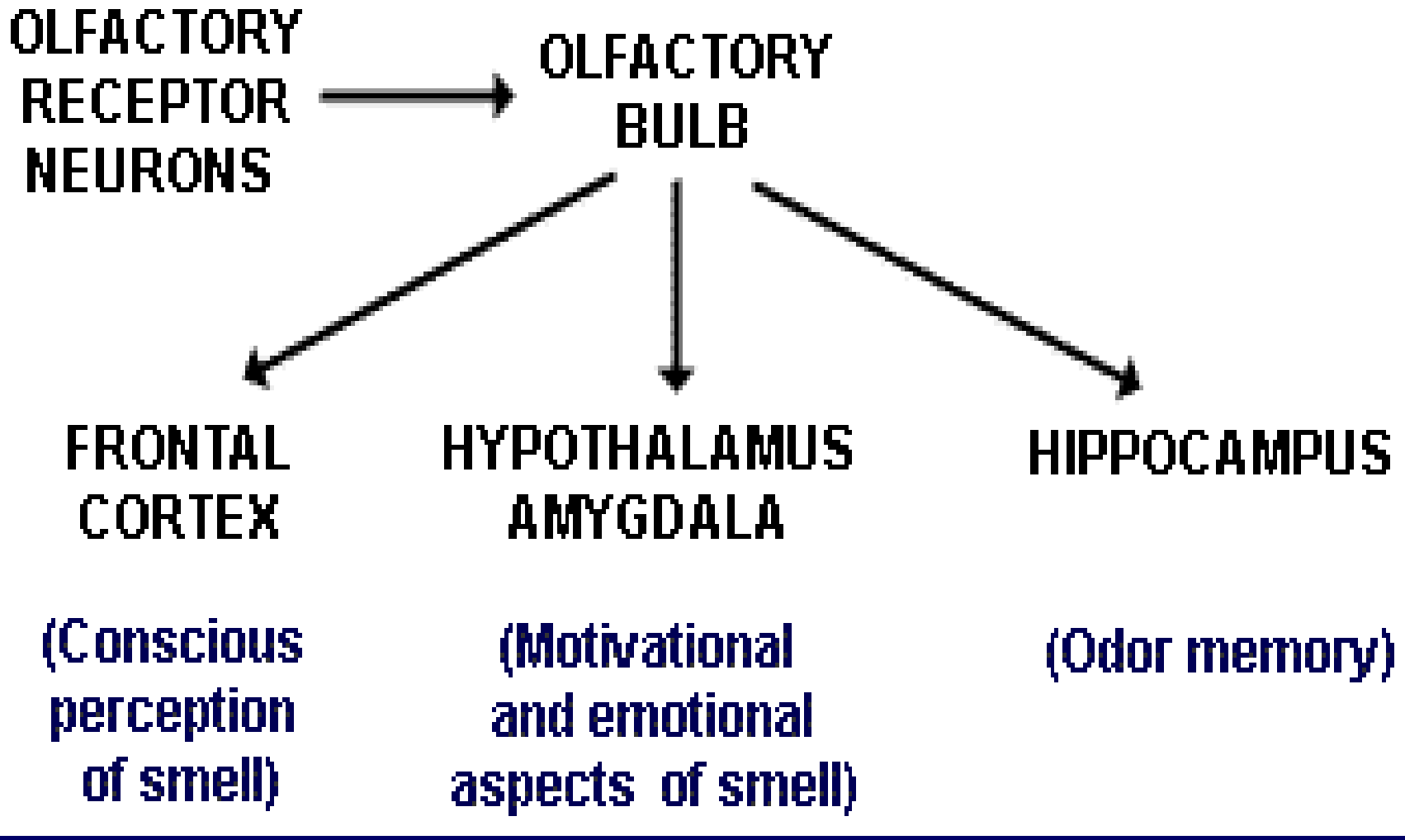
↓

depolarization



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


Odorant molecule
Mucus
Olfactory receptor neurons
Lateral olfactory stria
Mitral cell in olfactory bulb
Olfactory cortex
Anterior olfactory cortex
Piriform cortex
Periamygdaloid cortex
Entorhinal cortex
Frontal cortex
Thalamus
Hippocampal formation


OLFACTORY RECEPTOR NEURONS
OLFACTORY BULB
FRONTAL CORTEX
(Conscious perception of smell)
HYPOTHALAMUS AMYGDALA
(Motivational and emotional aspects of smell)
HIPPOCAMPUS
(Odor memory)

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

- **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