

# Smell(olfaction) & taste(gustation)

- Figures in this ppt are from guyton, ganong, best & taylor, tortora, netters, gray's anatomy, benjamin cummings and google images

# Chemical Senses

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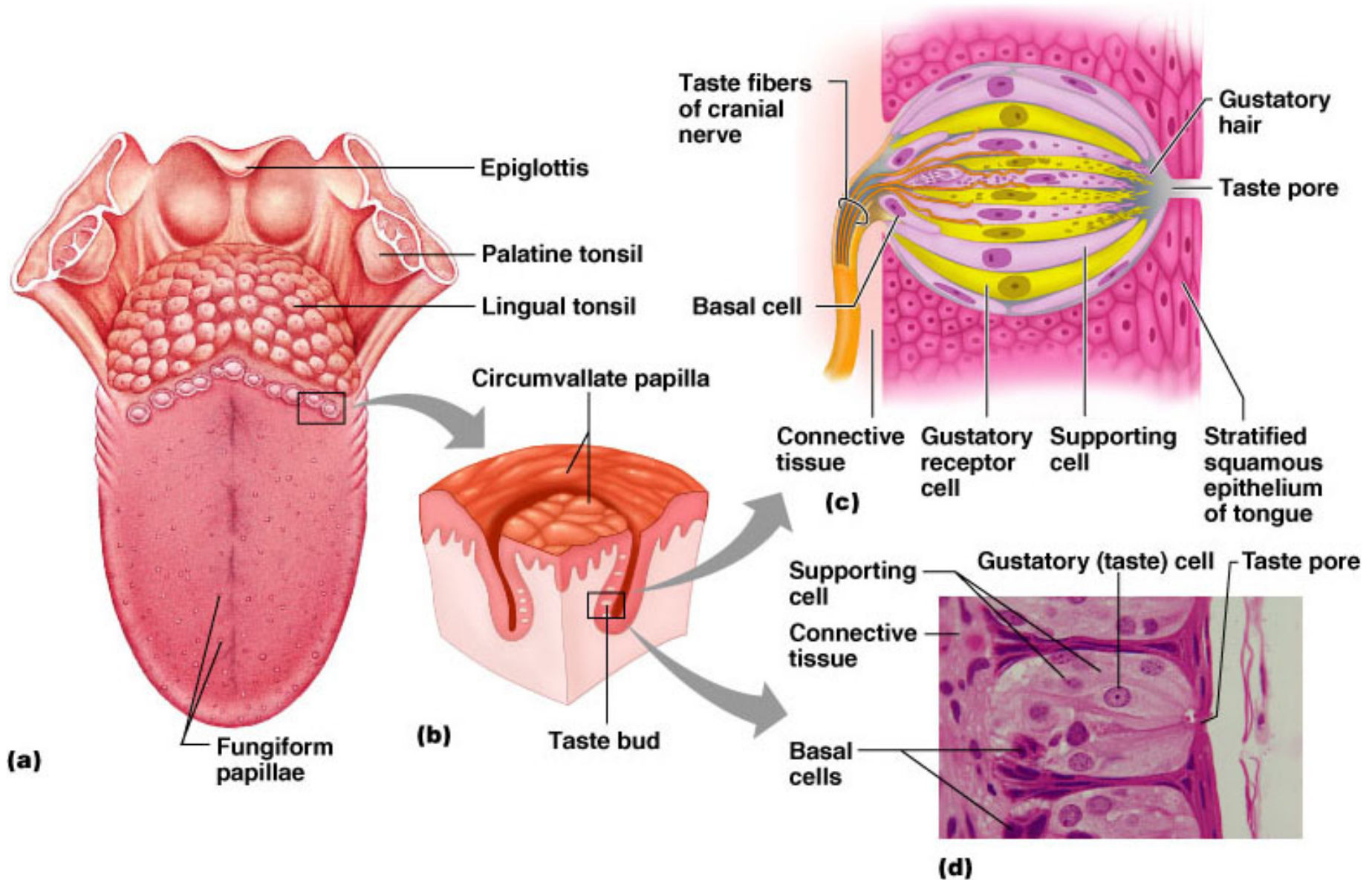
- Chemical senses – gustation (taste) and olfaction (smell)
- Their chemoreceptors respond to chemicals in aqueous solution
  - Taste – to substances dissolved in saliva
  - Smell – to substances dissolved in fluids of the nasal membranes

# Taste Buds

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- Most of the 10,000 or so taste buds are found on the tongue
- Taste buds are found in papillae of the tongue mucosa
- Papillae come in three types: filiform, fungiform, and circumvallate
- Fungiform and circumvallate papillae contain taste buds

# Taste Buds



# Anatomy of a Taste Bud

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- Each gourd-shaped taste bud consists of three major cell types
  - Supporting cells – insulate the receptor
  - Basal cells – dynamic stem cells
  - Gustatory cells – taste cells

# Taste Sensations

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- There are five basic taste sensations
  - Sweet – sugars, saccharin, alcohol, and some amino acids
  - Salt – metal ions
  - Sour – hydrogen ions
  - Bitter – alkaloids such as quinine and nicotine
  - Umami – elicited by the amino acid glutamate

# Physiology of Taste

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- In order to be tasted, a chemical:
  - Must be dissolved in saliva
  - Must contact gustatory hairs
- Binding of the food chemical:
  - Depolarizes the taste cell membrane, releasing neurotransmitter
  - Initiates a generator potential that elicits an action potential

# Taste Transduction

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- The stimulus energy of taste is converted into a nerve impulse by:
  - $\text{Na}^+$  influx in salty tastes
  - $\text{H}^+$  in sour tastes (by directly entering the cell, by opening cation channels, or by blockade of  $\text{K}^+$  channels)
  - Gustducin in sweet and bitter tastes

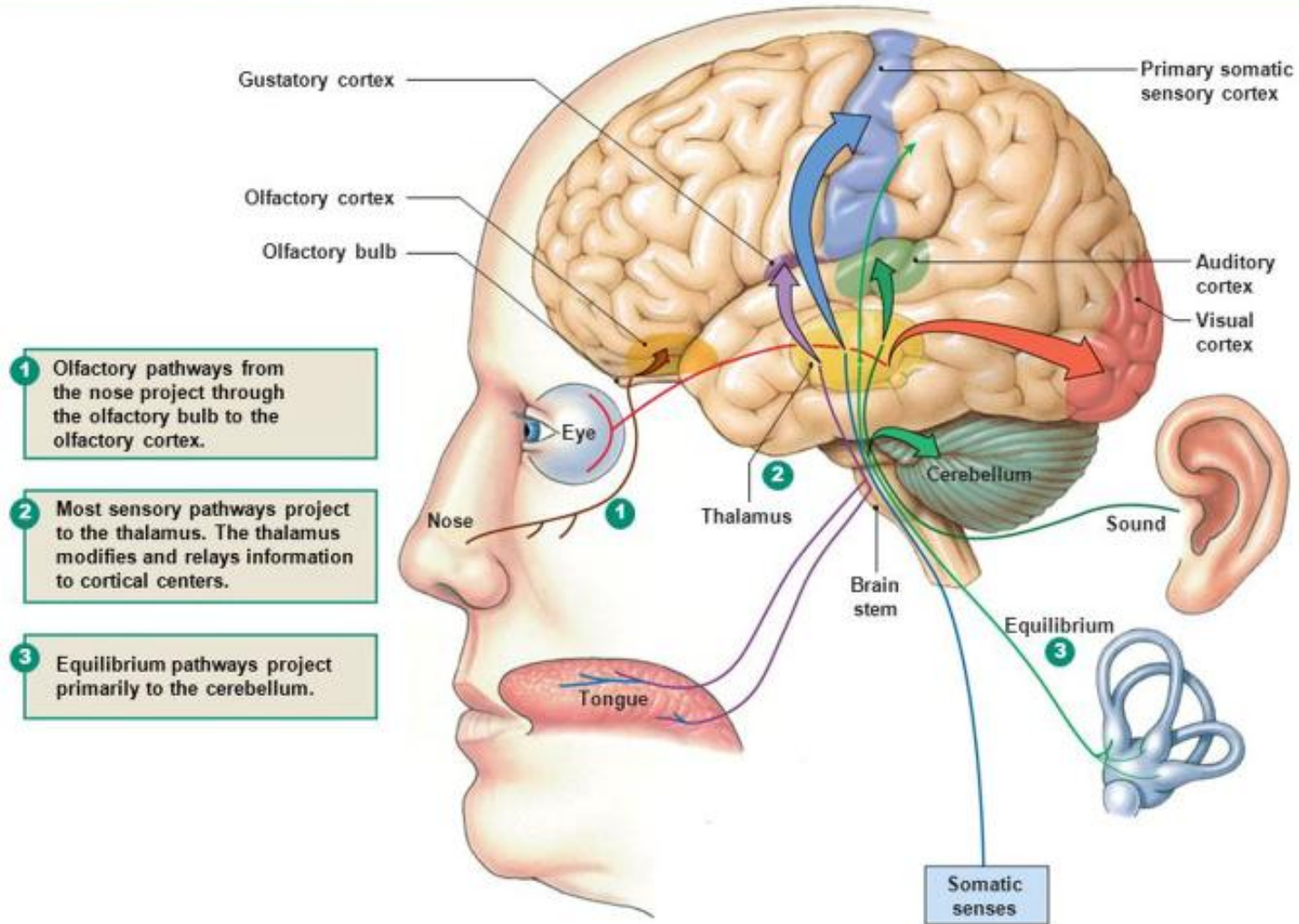


# Gustatory Pathway

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- Cranial Nerves VII and IX carry impulses from taste buds to the solitary nucleus of the medulla
- These impulses then travel to the thalamus, and from there fibers branch to the:
  - Gustatory cortex (taste)
  - Hypothalamus and limbic system (appreciation of taste)

# Gustatory centers



# Gustatory Pathway

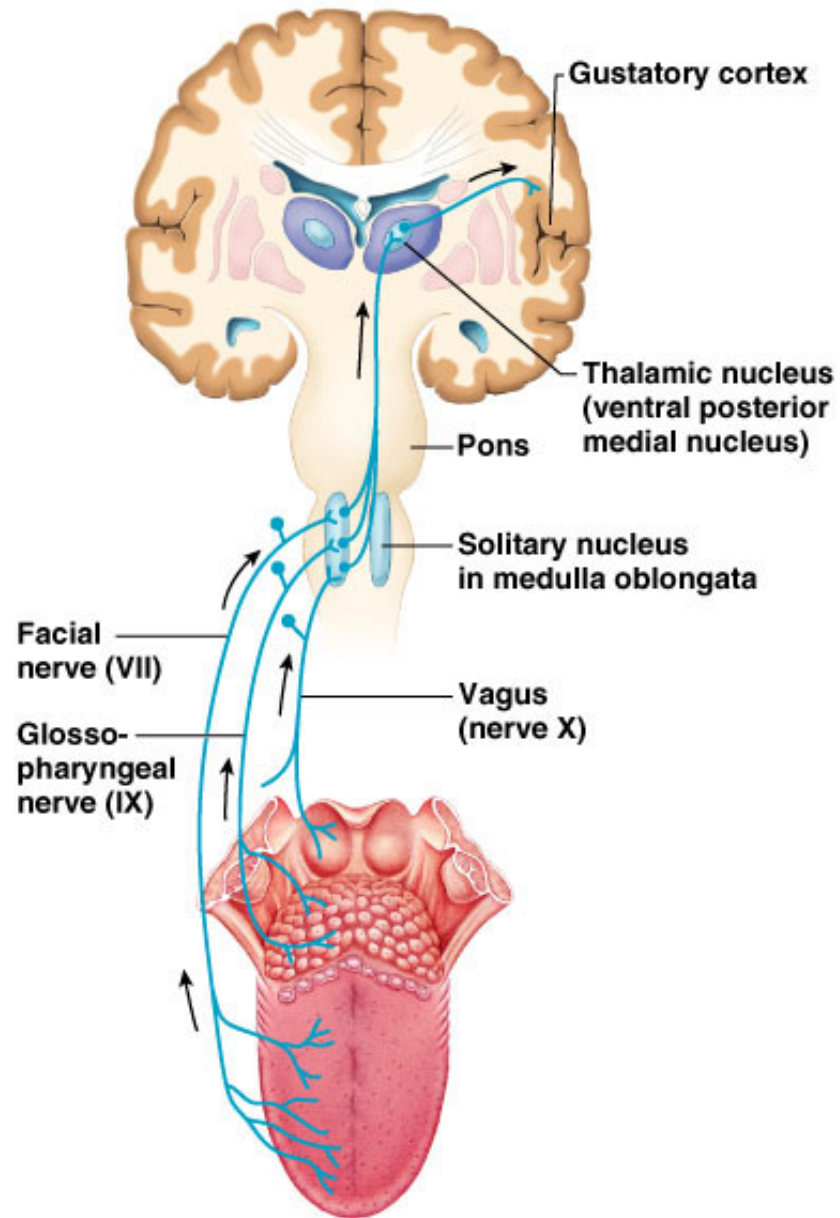


Figure 15.2

# Influence of Other Sensations on Taste

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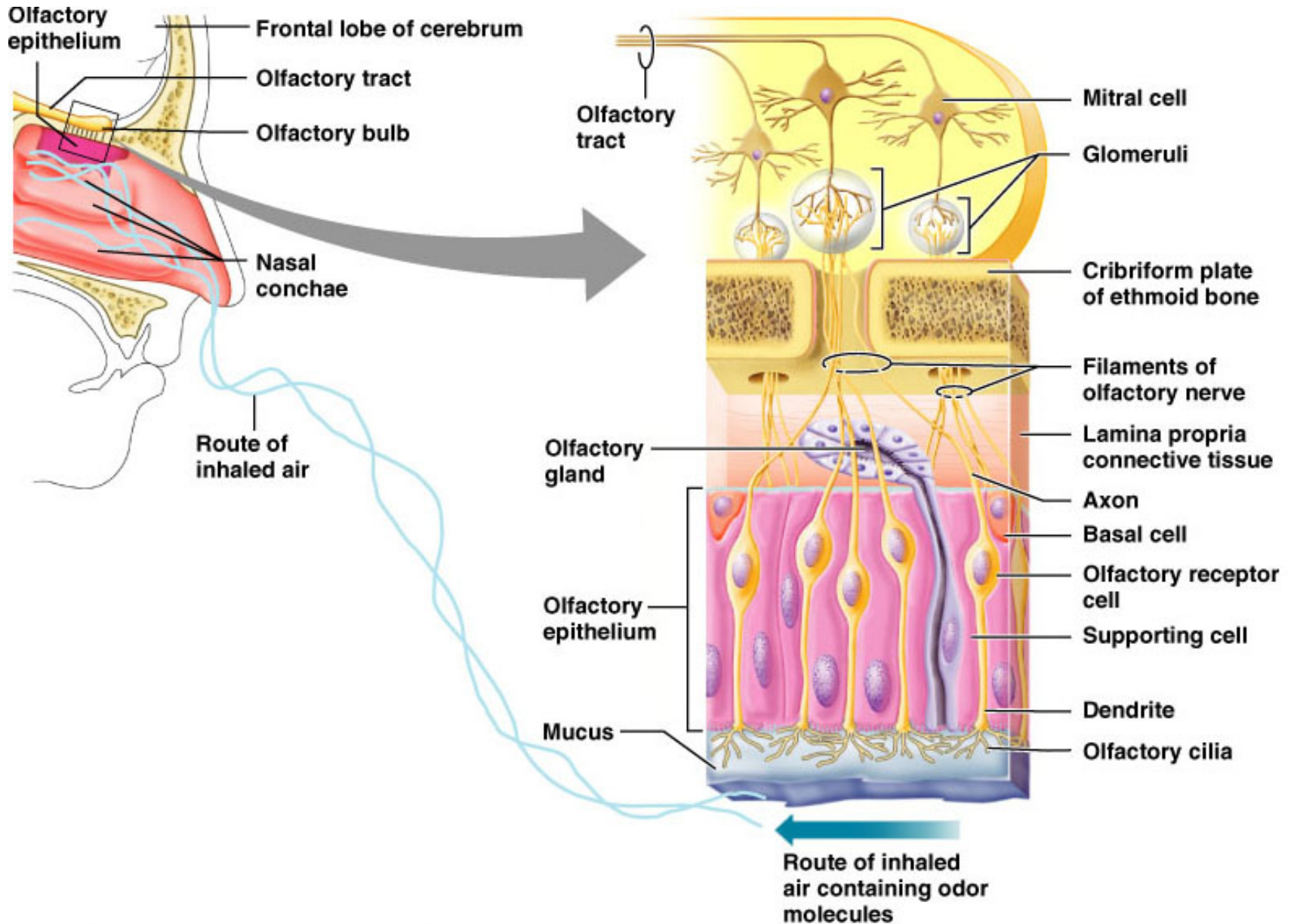
- Taste is 80% smell
- Thermoreceptors, mechanoreceptors, nociceptors also influence tastes
- Temperature and texture enhance or detract from taste

# Sense of Smell

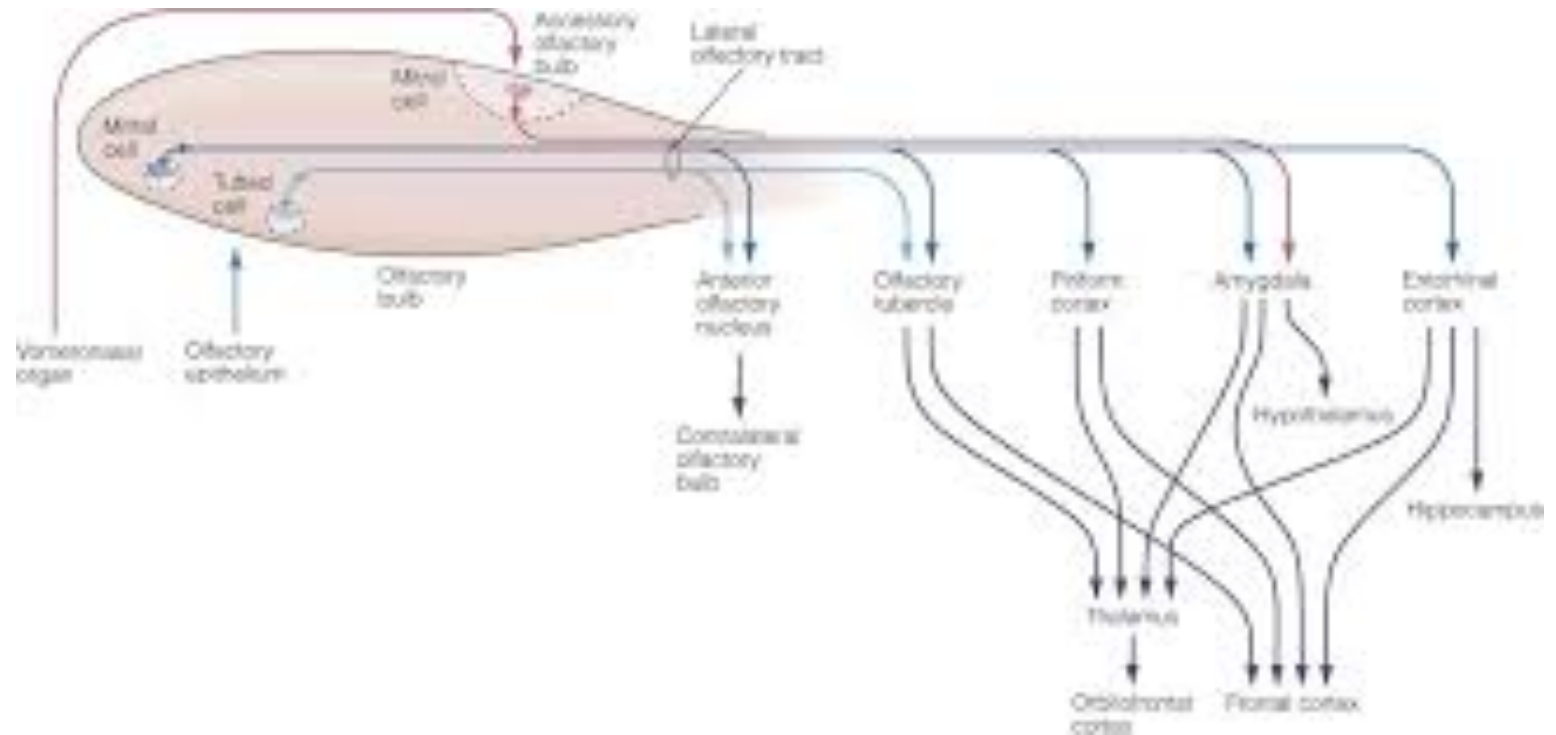
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- The organ of smell is the olfactory epithelium, which covers the superior nasal concha
- Olfactory receptor cells are bipolar neurons with radiating olfactory cilia
- Olfactory receptors are surrounded and cushioned by supporting cells
- Basal cells lie at the base of the epithelium

# Sense of Smell



# Olfactory centers



# Physiology of Smell

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- Olfactory receptors respond to several different odor-causing chemicals
- When bound to ligand these proteins initiate a G protein mechanism, which uses cAMP as a second messenger
- cAMP opens  $\text{Na}^+$  and  $\text{Ca}^{2+}$  channels, causing depolarization of the receptor membrane that then triggers an action potential

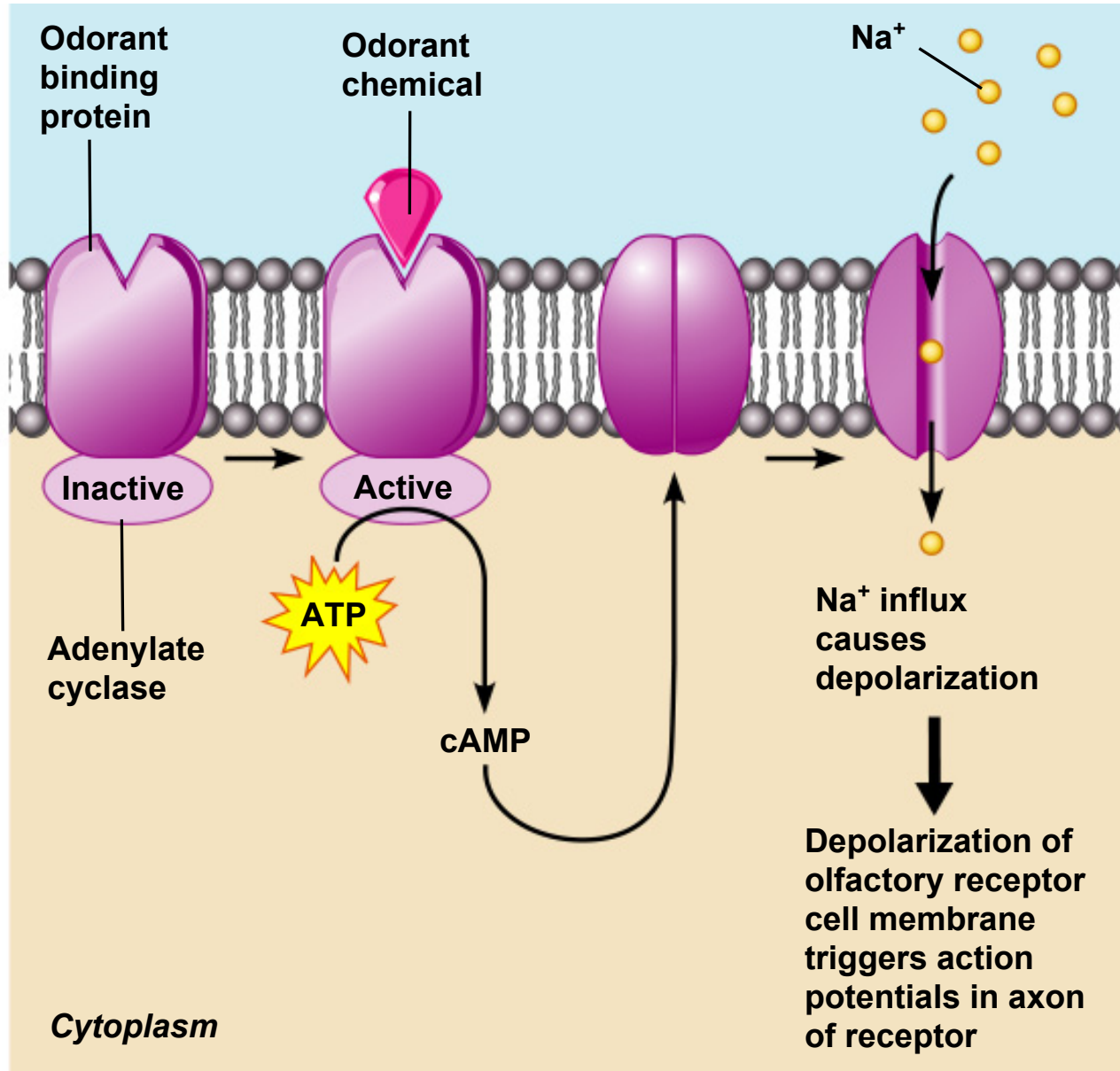


# Olfactory Pathway

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- Olfactory receptor cells synapse with mitral cells
- Glomerular mitral cells process odor signals
- Mitral cells send impulses to:
  - The olfactory cortex
  - The hypothalamus, amygdala, and limbic system

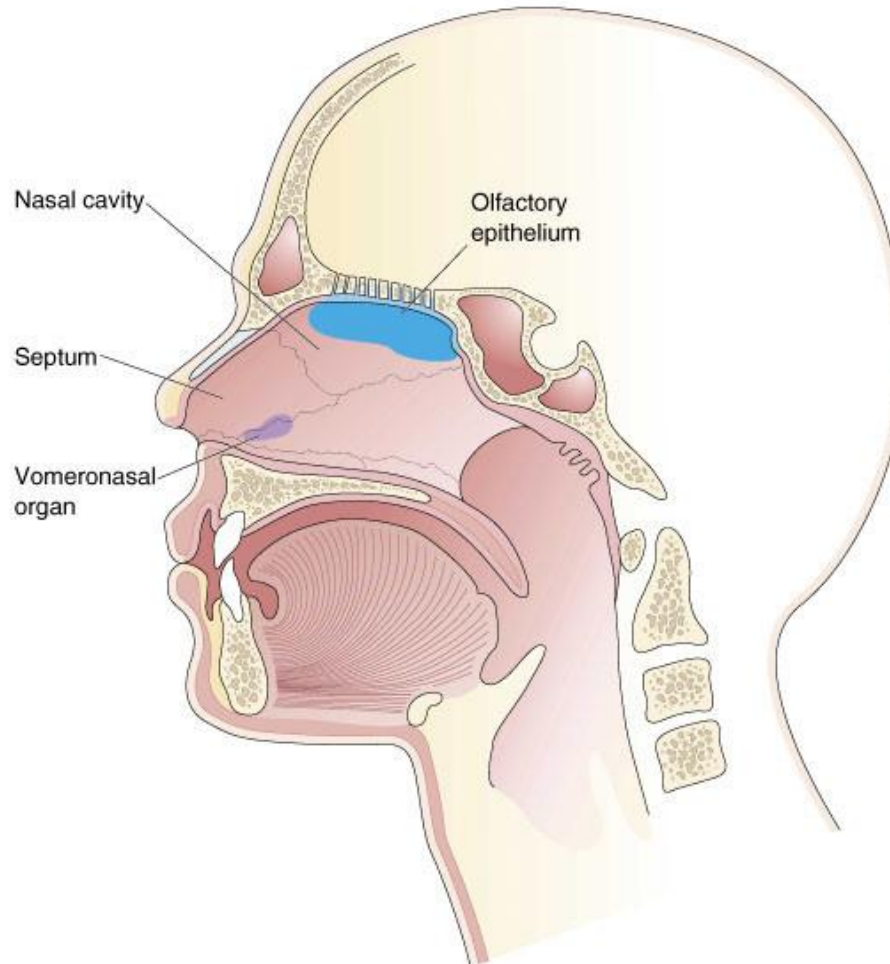
# Olfactory Transduction Process



# Vomero nasal organ

## Box 8.2

Location of the vomeronasal organs, two small pits on either side of the nasal septum.



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# Accessory olfactory pathway

