

CHEMICAL SENSES: SMELL AND TASTE

Smell = Olfaction - olfactory system

Taste = Gustation - gustatory system

- called “chemical” senses because their function is to monitor **the chemical content of the environment.**

Flavor of food is a composite of both taste and smell sensation.

- when nose is congested by infection, food “tastes” different because the olfactory system is “blocked”

In humans, the senses of taste and smell have lost important survival characteristics

In many animal species, taste (especially of bitterness and sourness) is used to protect organism from poisoning; smell, through the detection of “pheromones”, is crucial for mating and other social behaviors (ex., territorial, aggression)

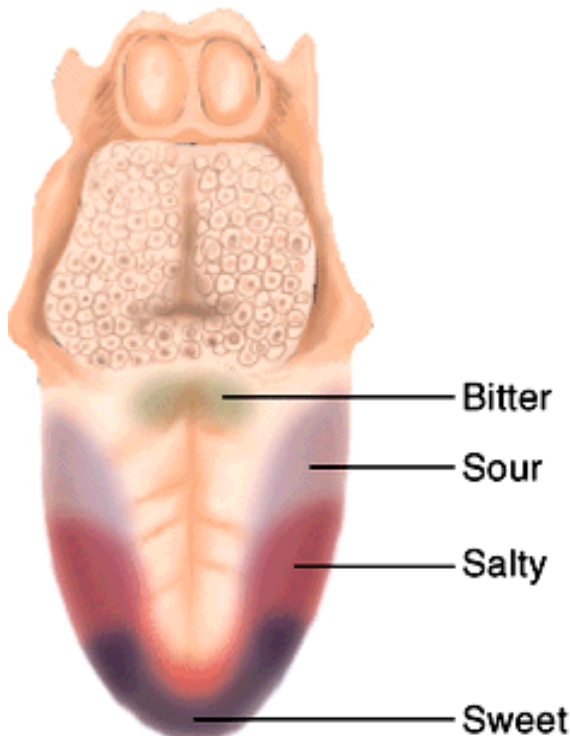
GUSTATORY SYSTEM

For a substance to be tasted, molecules of it must be dissolved in the saliva so as to stimulate the taste receptors on the tongue.

All the tastes we, as humans, experience, are a combination of only 4 different taste “qualities”

- bitterness
- sourness
- sweetness
- saltiness
- umami

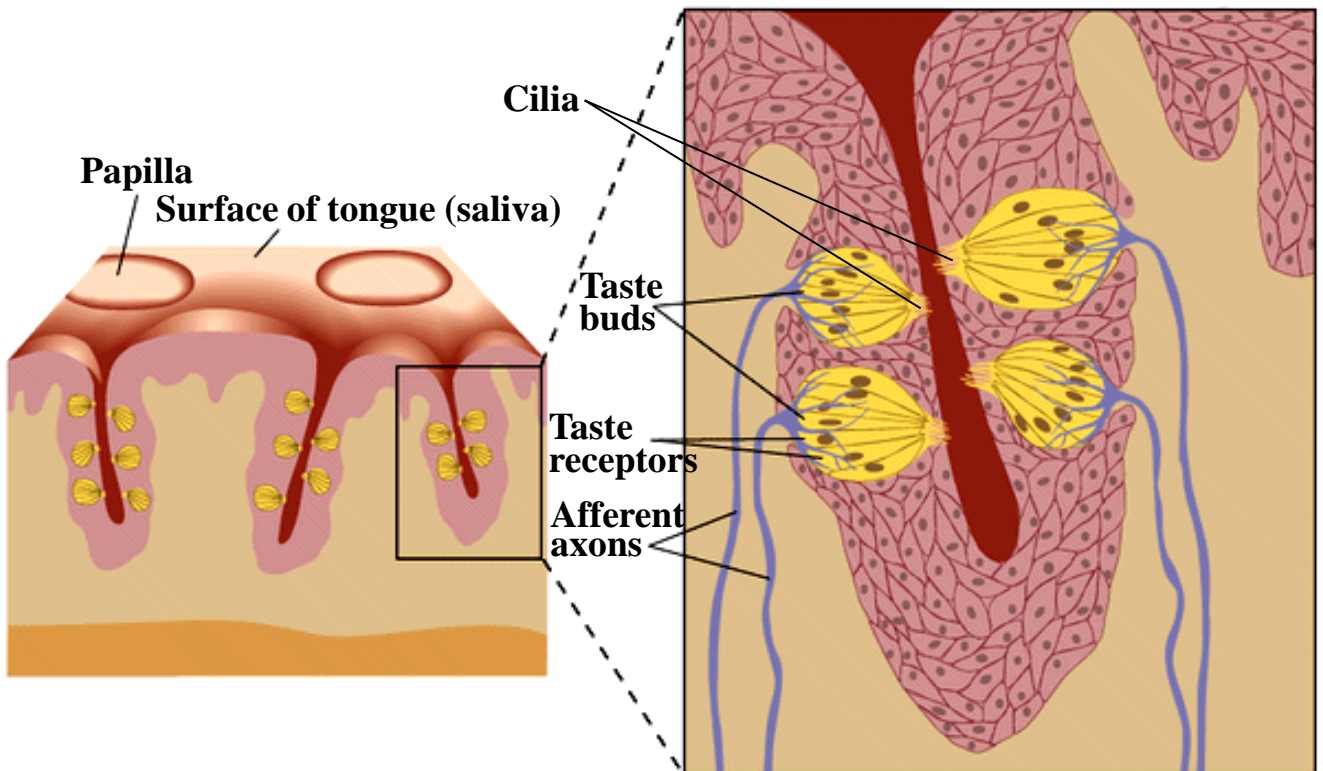
RECEPTORS ON THE TONGUE



Sensitivity of different regions of the tongue to different tastes

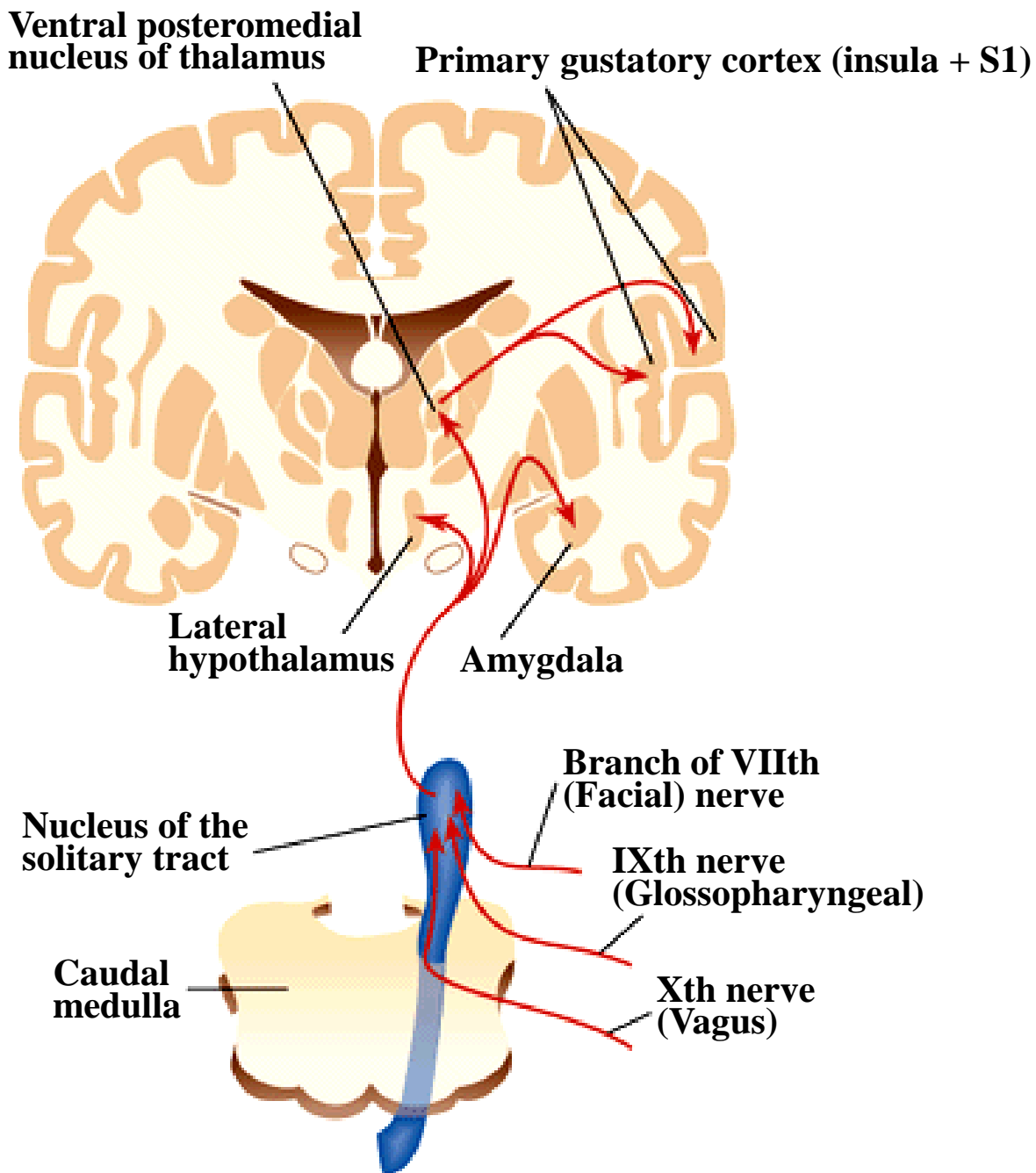
TASTE RECEPTORS

- the tongue, palate, pharynx and larynx contain approximately 10,000 taste buds
- each taste bud contains from 20-50 receptor cells, arranged a bit like the segments of an orange.
- dissolved chemicals in the saliva reach the cilia of receptor cells
- food molecules bind to specific receptor cells and open ion channels which produce “receptor potentials”
- receptor potentials produce post-synaptic potentials in dendrites of sensory neurons that convey gustatory information to the brain
- “life” of a receptor cell is approximately 10 days!



THE GUSTATORY PATHWAY

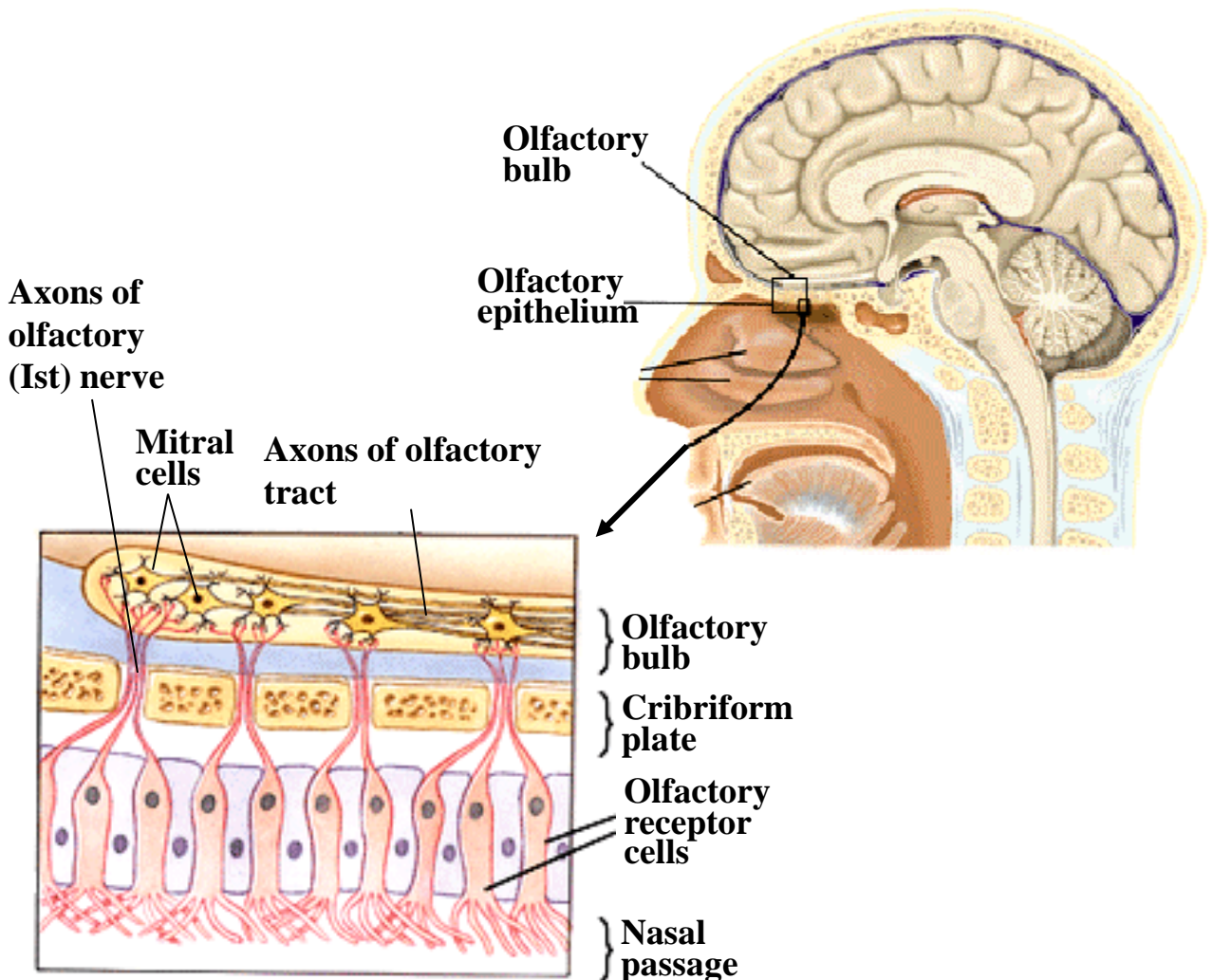
Unlike most other senses, taste is represented ipsilaterally (on the same side) in the brain



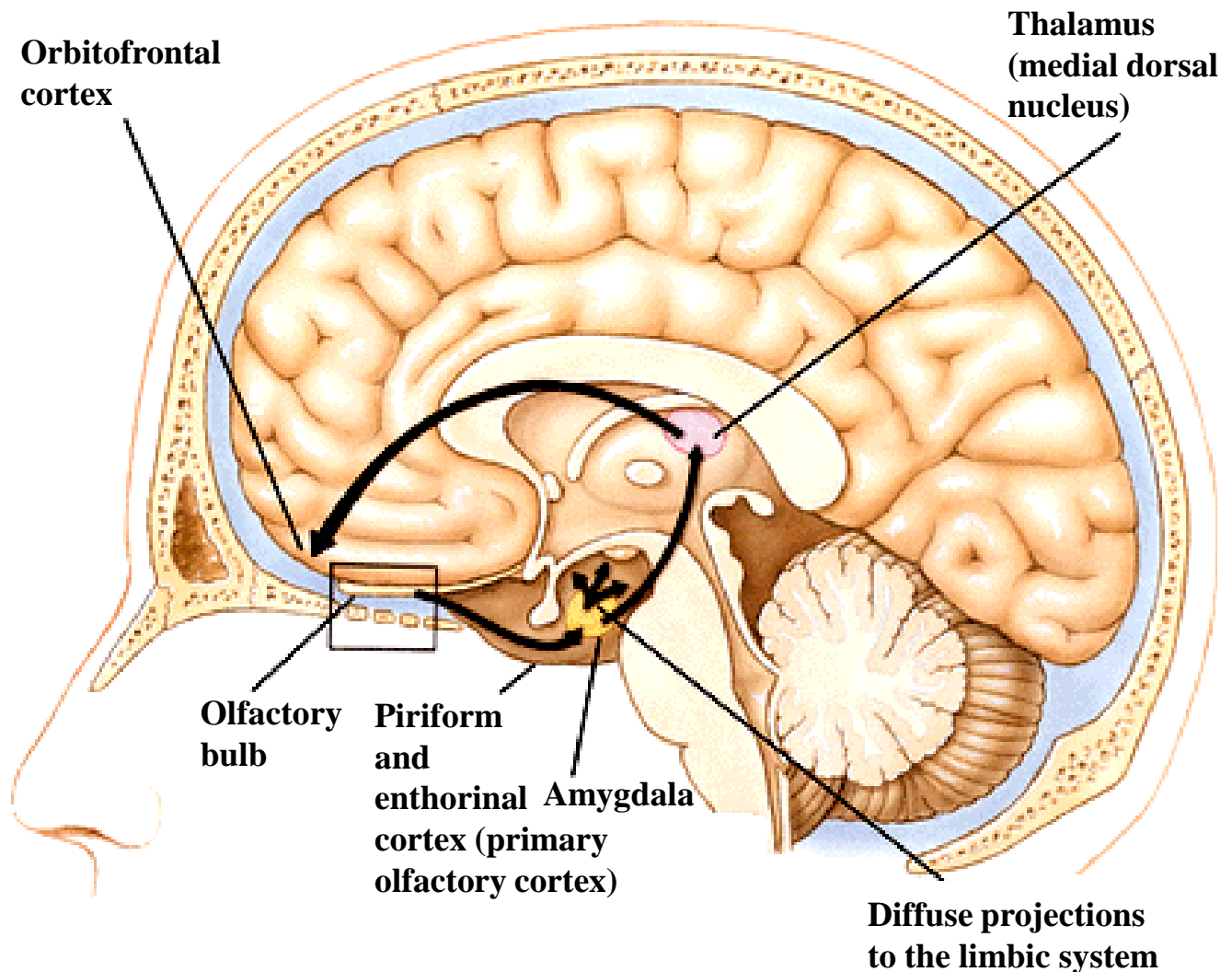
Primary gustatory cortex also send axons to orbitofrontal cortex (secondary gustatory cortex)

OLFACTORY SYSTEM

- in general odor stimuli consist of volatile substances that are mostly lipid soluble.
- because they are lipid soluble, they easily dissolve in mucus of olfactory epithelium (~ 1 square inch/nostril)
- olfactory receptor cells are neurons that send cilia in the mucus
- each cilia contains one of 500-1000 different olfactory receptors which each detect slightly different molecules
- volatile molecules bind to cilia and induce receptor potentials in olfactory cells
- olfactory neurons contact mitral neurons which provide information to the brain via olfactory tract



THE OLFACTORY PATHWAY



- Olfactory system is only system that bypasses a thalamic relay to send information to neocortex (piriform and entorhinal cortex)
- Diffuse projections to amygdala and hypothalamus are believed to be involved in activation of emotions by different smells
- Because both the olfactory and gustatory systems send signals to the orbitofrontal cortex, it is speculated that the conscious perception of flavors occurs there