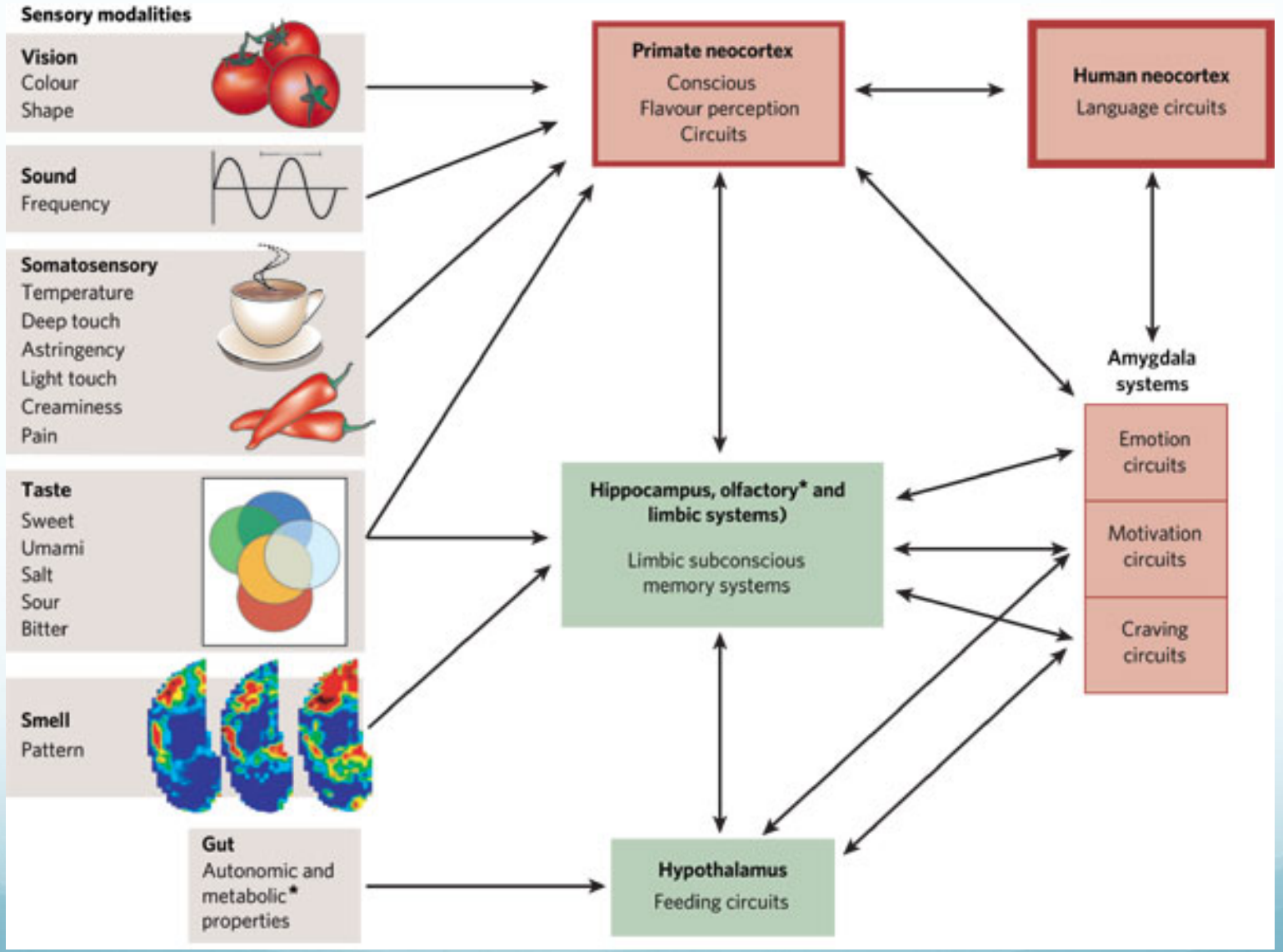
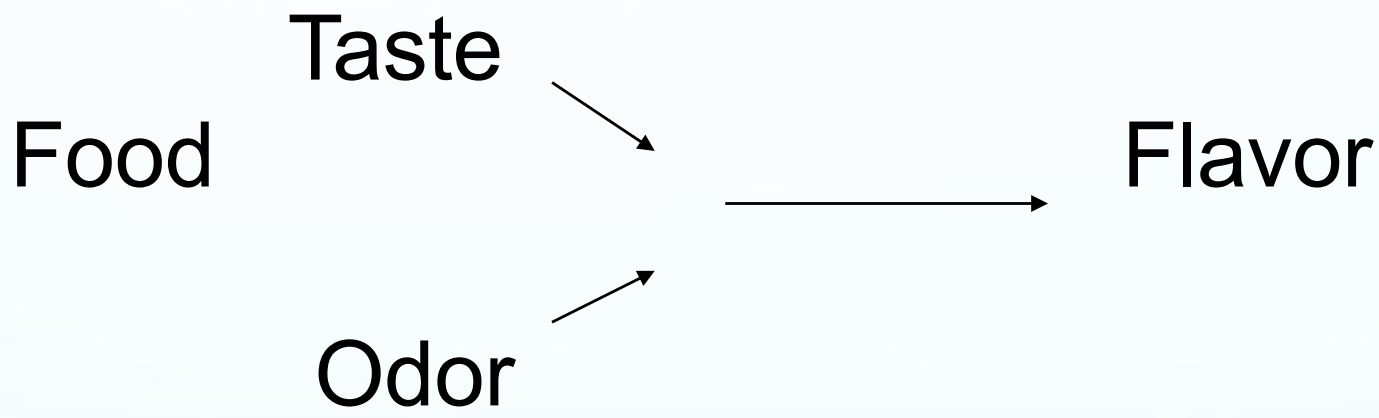
Flavor perception

The sensation of flavors is one of the most complex human behaviors. It results from a combination of gustatory, olfactory, visual, auditory and somatosensory inputs.




Taste
Food
Flavor
Odor

How smell works ?

Smell (Olfaction)

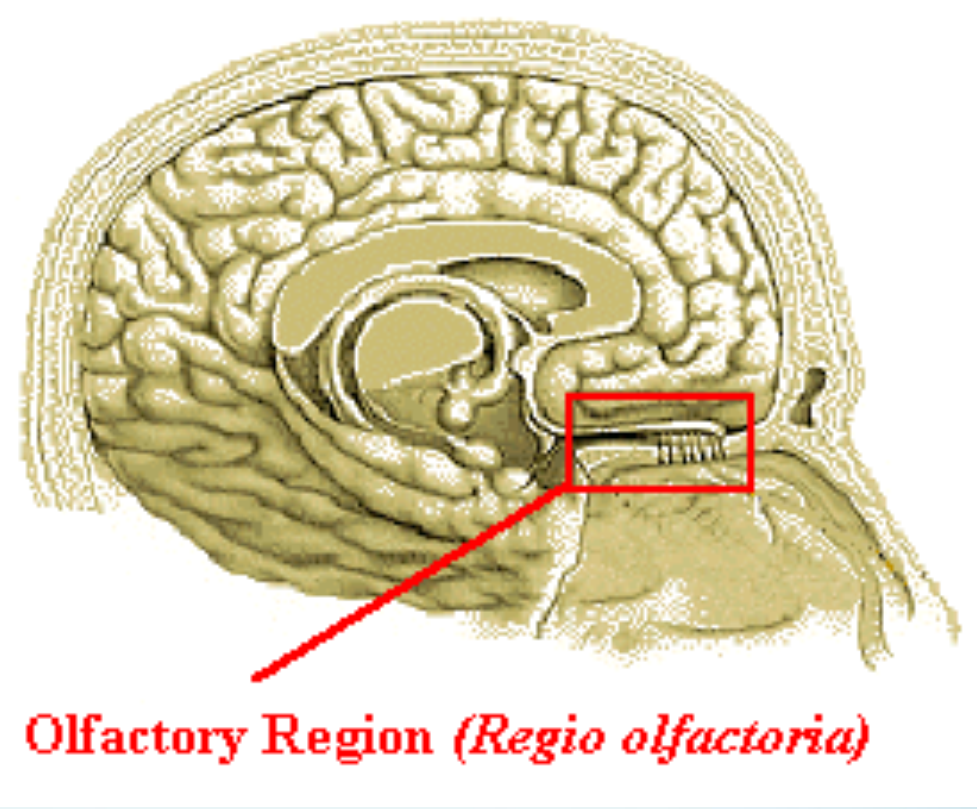
- Detected by thousands of chemoreceptors located in the upper wall of the nasal cavities
- Receptors located in a small space about ½ square inch and are associated with other cells to form the olfactory organs
- These receptors are capable of gathering up to 50 individual sensations which are combined in the brain to an almost infinite number of smells

Olfaction

- **Sense organs:** Nose & olfactory epithelium
- **Receptor type:** Neuron w/ membrane G-proteins
- Receptor signal transduction mechanism
- Coding of intensity and duration
- Pathway of conduction to the CNS
- Coding for perceived sensation - receptors are specific for only a few ‘smells’

Sense organs: Nose and Olfactory epithelium

- Olfactory area in humans is about 2 cm^2 with approx. 6 million sensory receptor cells.
- Recognize thousands of odors.

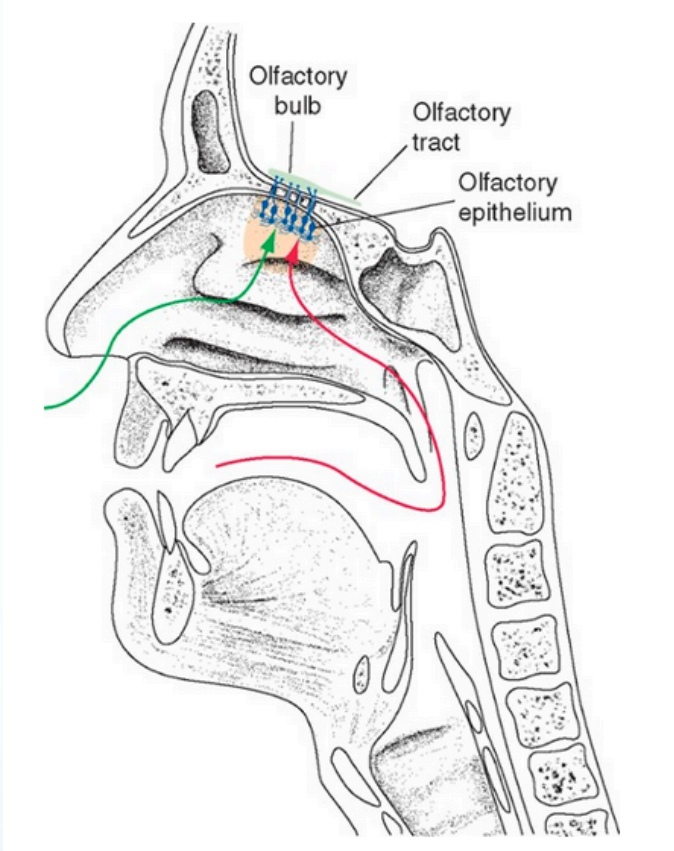


Olfactory Region *(Regio olfactoria)*

Smell

- The number of individual sensations decreases with age and varies with individuals
- The receptor cells are neurons embedded within the mucous membrane of the nasal epithelium
- The dendrites of these cells are known as olfactory hairs, which physically interact with odorants, and the axons extend into the olfactory bulb of the brain

Olfactory receptors



Scanning electron micrograph of the bottom of olfactory receptor cell with receptive olfactory cilia.

The initial events in olfactory perception occur in olfactory sensory neurons in the nose.
The human olfactory epithelium contains several million olfactory sensory neurons, which are short-lived, with an average life span of only 30-60 days, and are continuously replaced.

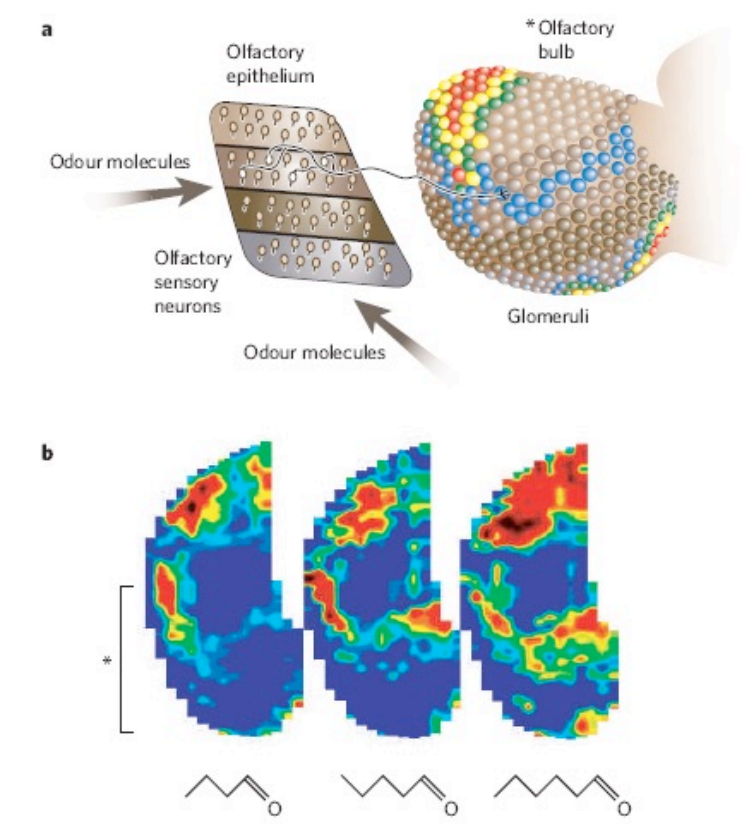
How Olfaction Works

- Smell (Olfaction): operates much like the sense of taste.
  - The physical stimuli are chemical substances carried in the air that are dissolved in fluid, the mucus in the nose.
- Pathway: Olfactory cilia -> neural impulse -> olfactory nerve -> olfactory bulb (Brain)
  - Olfactory receptors (olfactory cilia) and are located in the upper portion of the nasal passages.
  - The olfactory receptors instantly alert brain through axon fibers the brain.

How Olfaction Works

- Receptor proteins are embedded on the surface of nasal cavity neurons
  - **As a key slips into a lock → odor molecules slip into receptors**
  - Some odors trigger a combination of receptors
- Odors are not easily classified.
  - Humans can distinguish among about 10,000 odors, but for some reason have a hard time attaching names to odors quite frequently.

Odours are coded as activity ‘images’ in the olfactory bulb



Different odorants activate different sets of glomeruli in patterns that systematically map out the chemical properties of odorants across the surface of the olfactory bulb. A. Diagram showing the relationship between the olfactory receptor cells in the nose and the glomeruli of the olfactory bulb. B. fMRI images of the different but overlapping activity patterns seen in the glomerular layer of the olfactory bulb of a mouse exposed to members of the straight-chain aldehyde series, varying from four to six carbon atoms.

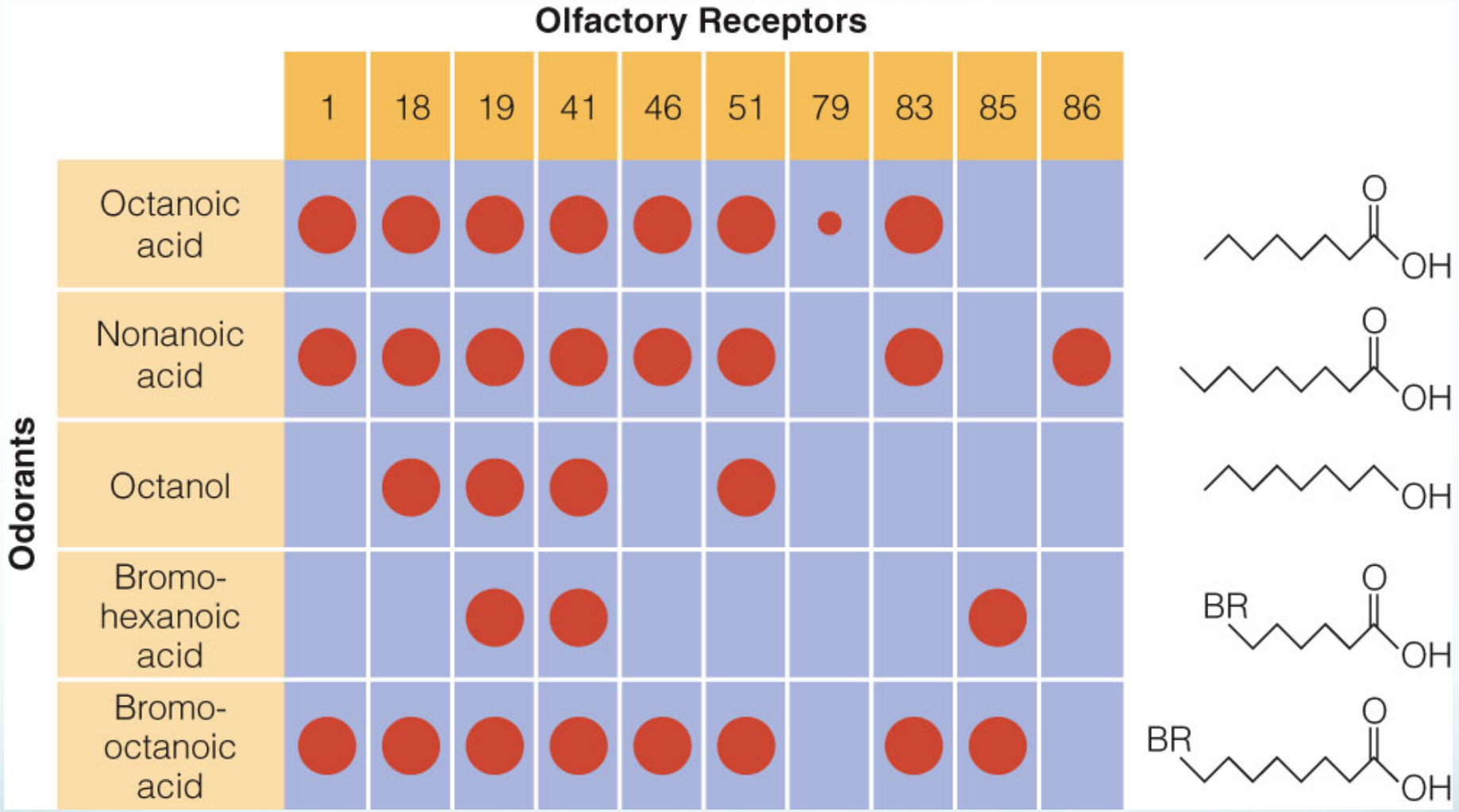
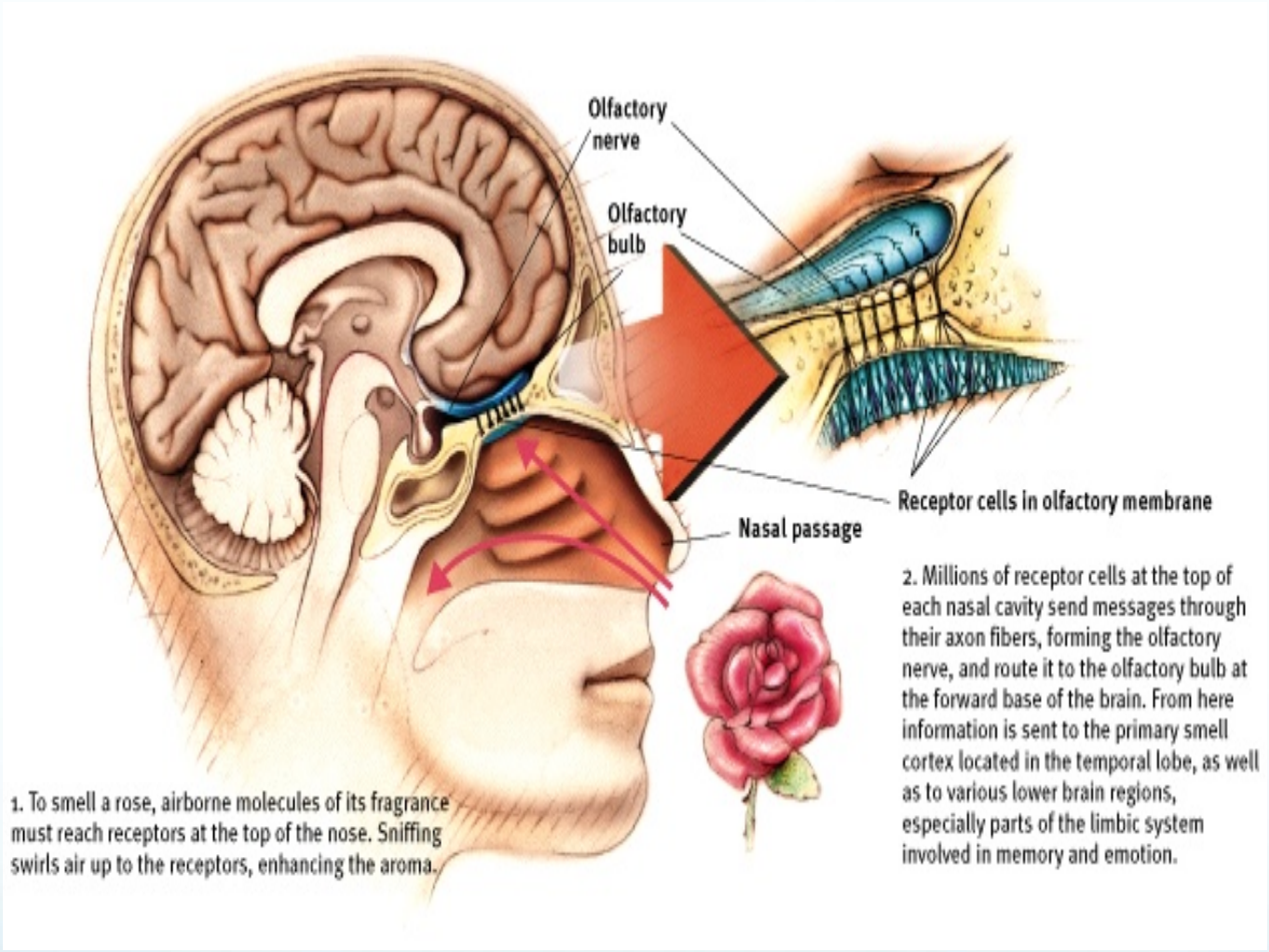


Figure 15.6 Recognition profiles for some odorants. Large dots indicate that the odorant causes a high firing rate for the receptor listed along the top; a small dot indicates a lower firing rate for the receptor. The structures of the compounds are shown on the right. (*Adapted from Malnic et al., 1999.*)


Olfactory nerve
Olfactory bulb
Receptor cells in olfactory membrane
Nasal passage
1. To smell a rose, airborne molecules of its fragrance must reach receptors at the top of the nose. Sniffing swirls air up to the receptors, enhancing the aroma.
2. Millions of receptor cells at the top of each nasal cavity send messages through their axon fibers, forming the olfactory nerve, and route it to the olfactory bulb at the forward base of the brain. From here information is sent to the primary smell cortex located in the temporal lobe, as well as to various lower brain regions, especially parts of the limbic system involved in memory and emotion.