OLFACTION (SMELL)

1) Functions and Facts

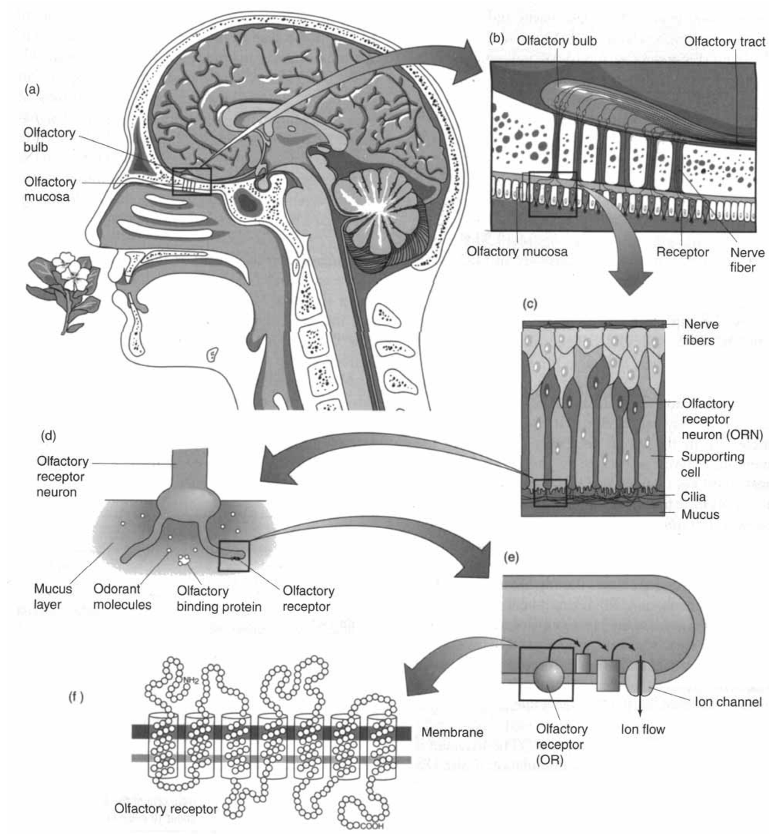


Figure 14.5
(a) The olfactory mucosa, with the olfactory bulb just above (Amoore, Johnston, & Rubin, 1964); (b) & (c) olfactory receptor nerons (ORN) have cilia that protrude into the mucosa; (d) olfactory receptors (OR) on the cilia are where transduction occurs; (e) stimulation of an OR triggers a series of reactions that result in ion flow across the membrane of the cilium; (f) the OR is part of the membrane, crossing it seven times.

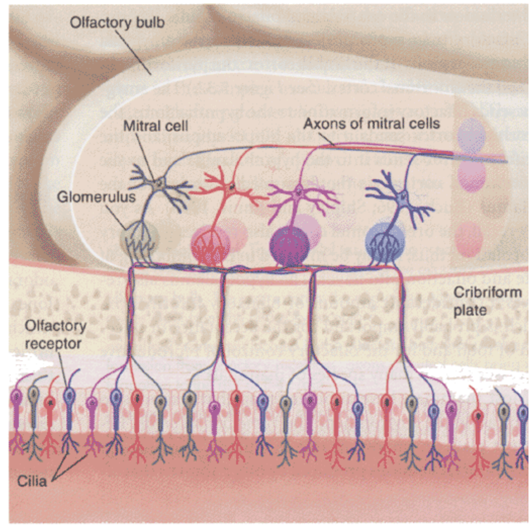
2) Odor Quality

3) Anatomy and Physiology

   a) Olfactory Epithelium

      i) Located on top surface (roof) of the nasal cavity

ii) Cribriform plate



iii) Mucosa contains olfactory receptor cells

iv) Olfactory bulb

b) Receptors

i) Olfactory cells with cilia spread through mucosa

ii) Chemicals in the air absorbed into mucosa

iii) Receptor sites on the cilia

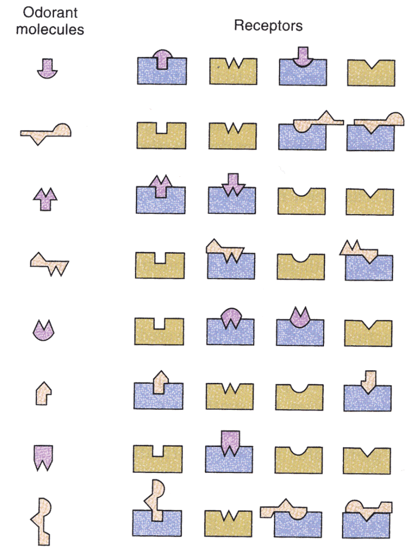


Figure 7.34

A hypothetical explanation of coding of olfactory information. Different odorant molecules attach to different combinations of receptor molecules. (Activated receptor molecules are shown in blue.) Unique patterns of activation represent particular odorants.
(Adapted from Malnic, B., Hirono, J, Sato, T., and Buck, L. B. *Cell*, 1999, *96*, 713–723.)

c) Organization of receptor cells in the mucosa

i) 4 zones in mucosa

ii) Axons from one zone all go to same area of olfactory bulb

d) Olfactory bulb

i) Brain projection

ii) Composed of glomeruli

iii) Inputs to a given glomerulus come from…

iv) About 1000-2000 glomeruli

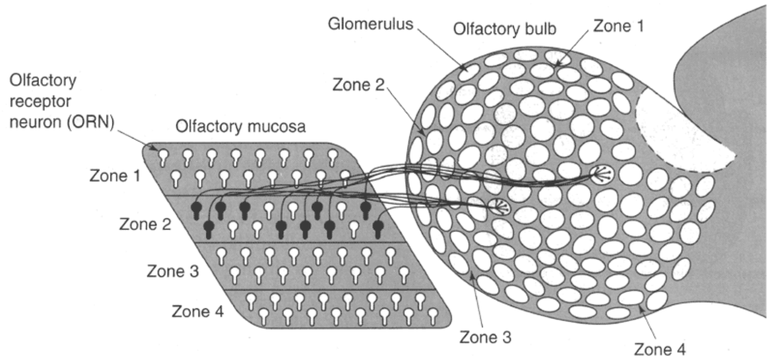


Figure 14.6
Organization of the olfactory mucosa. The olfactory mucosa, on the left, is divided into four zones. Each zone contains a mixture of different kinds of olfactory receptor neurons, as indicated by the black-and-white neurons in Zone 1. However, a particular kind of olfactory receptor neuron is found only in one zone. The olfactory bulb, on the right, is also divided into zones. Each type of olfactory receptor neuron in the olfactory mucosa sends its axons to just one or two glomeruli in the olfactory bulb. (Adapted from Mori et al., 1999.)

e) Pathway

i) Olfactory bulb

ii) Primary olfactory cortex (piriform)

iii) Secondary olfactory cortex (orbitofrontal)

iv) Amygdala – deep in cortex

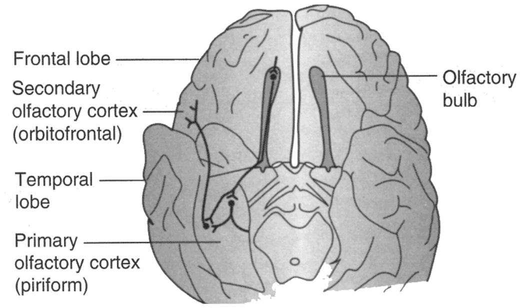


Figure 14.7
The underside of the brain, showing the neural pathways for olfaction. On the left side, the temporal lobe has been deflected to expose the olfactory cortex. (From Frank & Rabin, 1989.)

4) Neural coding

a) Intensity

b) Quality

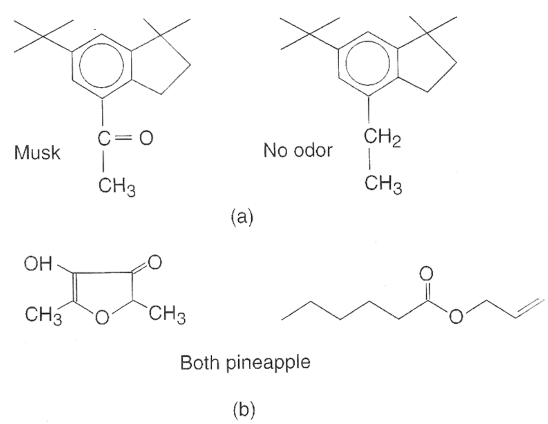


Figure 14.8
(a) Two molecules that have the same structures, but one smells like musk and the other is odorless; (b) two molecules with different structures but similar odors.

5) Thresholds

a) Detection

b) Gender

c) Age

d) Adaptation

6) Odor and memory

a) Can serve as a very potent and long-lasting memory cue

b) Episodic odor

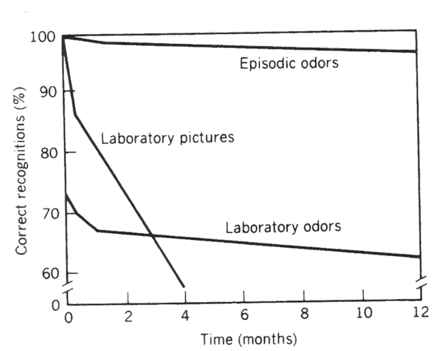


figure 18.6 Correct recognition of visual stimuli and laboratory and episodic odors (odors from real-life experiences) as a function of time. The memory for episodic odors remains stable and close to its initial high level over time. However, the memory for pictorial materials, while initially as high as the memory for episodic odors, falls off quite rapidly with time. Laboratory odors, though lower in initial recognition, like episodic odors show little loss over time. (*Source:* Based on Engen, 1987; Engen & Ross, 1973; Shepard, 1967.)

7) Pheromones

   a) Releaser pheromones

   b) Primer pheromones

   c) Marker pheromones

   d) Alarm pheromones

8) Common chemical sense

   a) Free nerve endings in the mucosal membranes (nose, mouth, eyes, respiratory tract)

9) Flavor

a) Combination of both smell and taste

b) Phenomena:

c) Physiology

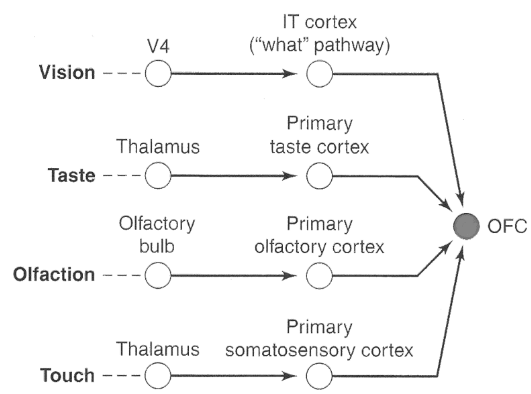


Figure 14.28
The orbital frontal cortex (OFC) receives inputs from vision, taste, olfaction, and touch, as shown. It is the first area where signals from the taste and smell systems meet. (Adapted from Rolls, 2000.)