A photograph of a young girl with blonde hair, wearing a green and yellow striped dress, smelling a large yellow flower. The background is bright and slightly blurred.

PHYSIOLOGY OF OLFACTION (Smell)

Prof. Khaled Abdel-Sater, MD





Study Objectives

By the end of the lecture the student will be able to:

- 1 Define olfaction and describe its functional and evolutionary importance.**
- 2 Identify the structure and organization of the olfactory epithelium and receptor cells**
- 3 Explain the molecular mechanisms of odor detection and signal transduction.**
- 4 Discuss physiological concepts of adaptation, masking, and sniffing reflex.**
- 5 Differentiate between the major disorders of smell (anosmia, hyposmia, phantosmia) and their clinical implications.**
- 6 Describe recent innovations such as artificial olfaction (electronic nose) and their biomedical applications.**

Importance of Olfaction in Life



Nutrition

- Appetite drive
- Selection of the type of food
- Initiation of various secretions in the GIT through conditioned reflexes.



Social & sexual behaviour

- Sweat-based communication
- Impact on relationships over development
- Smell-triggered emotion regulation

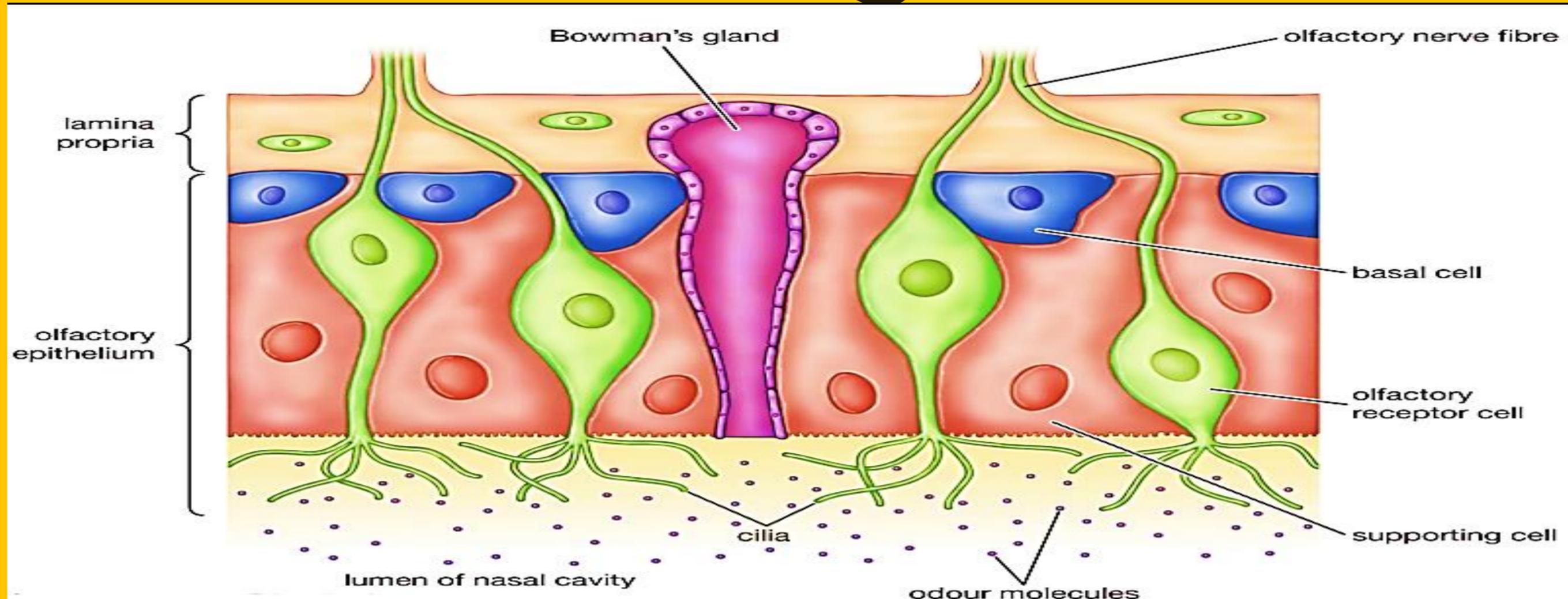


Protection from environmental hazards

[A pheromone](#)

dog and rabbit

Olfactory Cells



Olfactory receptor cells are about 10-20 million

Dogs:
~300,000,000

Humans possess approximately 400 different types of olfactory receptor genes

Dogs: ~1,000

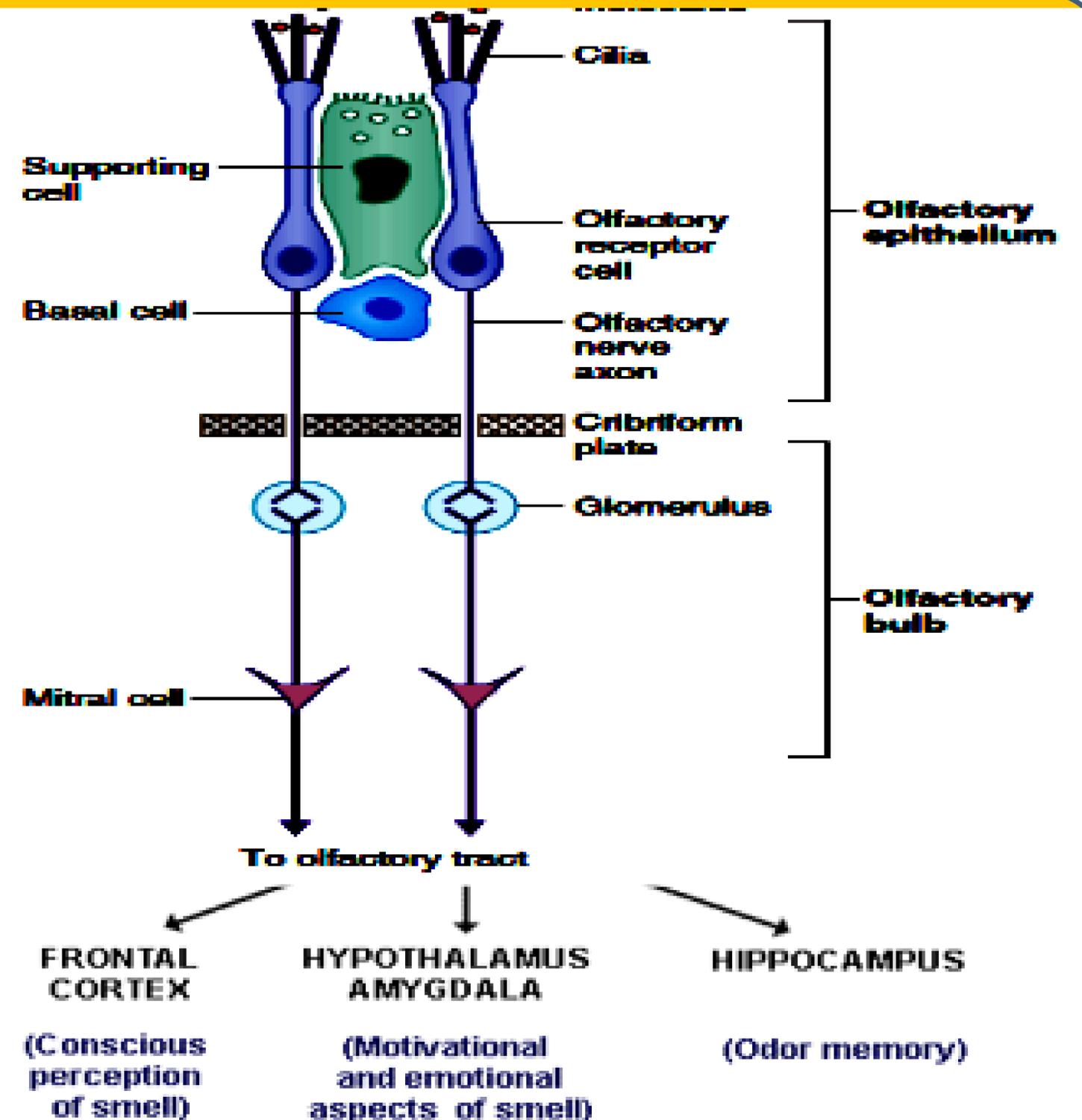
Olfactory Pathway

Unique: Only sensory system that bypasses the thalamus

Amygdala: emotional tagging of odors (pleasant/unpleasant)

Hippocampus: long-term memory formation

The Proust Effect ???



Stimulus

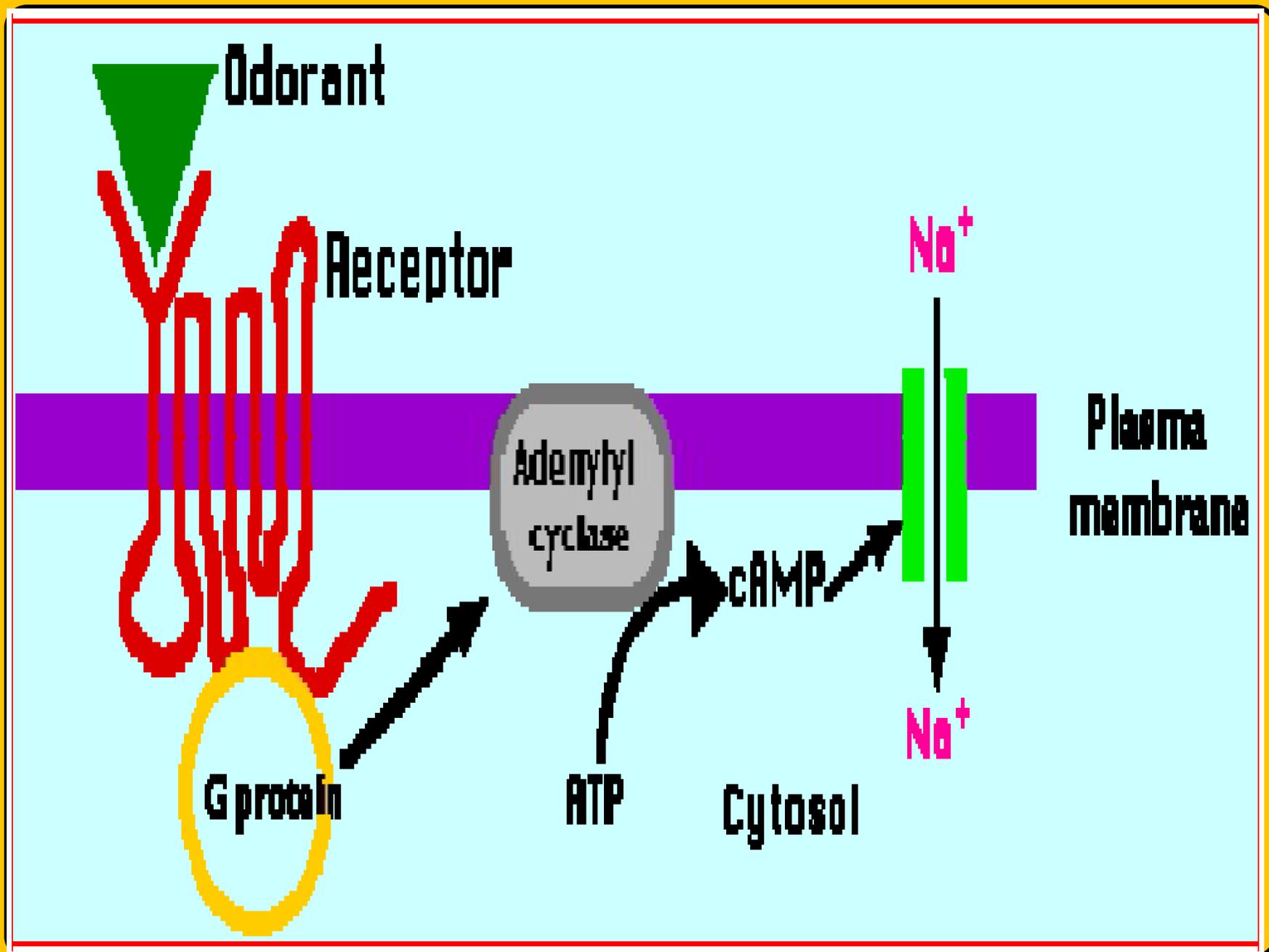
An odorous material should be:

1. **Volatile:** to come in contact with the olfactory mucosa.
2. **Water soluble:** at least slightly to penetrate the watery mucous covering.
3. **Lipid soluble:** to penetrate the cell membrane of olfactory receptors.

Women generally have a sharper sense of smell than men specially during ovulation and pregnancy

Signal Transduction

The signal transduction pathway in olfaction begins when an odorant binds to an olfactory receptor. This interaction activates G-protein coupled receptors, leading to the production of cyclic AMP (cAMP). The increase in cAMP opens ion channels, resulting in neuronal depolarization. This depolarization generates action potentials that transmit olfactory information to the brain.



Tests of Smell Sensation



1-The subject sniffs different irritant odorous substances.



2-Olfactometry.



Adaptation



It occurs very rapidly within 1st second and the complete adaptation occurs after few minutes (10 min). Adaptation is due to CNS effect. It is postulated that after stimulation of receptor and CNS a strong inhibitory impulses return to olfactory receptor.



Sniffing



It is an action which include contraction of the lower part of the nares on the septum to help deflect air stream upward (to increase the amount of air reaching the olfactory mucous membrane region which normally it is very little amount).

-It is a semi reflex occurs when a new odour attracts attention.

Masking of Odour



-The smell of substance may be masked by smell of another odour.

-It is used to removed offensive odour e.g. deodorants and perfumes.

Disorders of Olfaction

An-osmia

is the complete loss of smell, e.g. temporal state in common cold.

Hyp-osmia

reduced of smell sensation

Phant-osmia

is the phenomenon of smelling odors that aren't present,.

You cannot smell while you are in deep sleep.

When Smell Fails – Clinical Implications

- COVID-19: Anosmia due to olfactory epithelium damage.
- Parkinson's: Early hyposmia from Lewy body deposition in olfactory bulb.
- Alzheimer's: Degeneration of olfactory cortex and entorhinal area.
- Head trauma → anosmia due to shearing of olfactory nerve fibers.

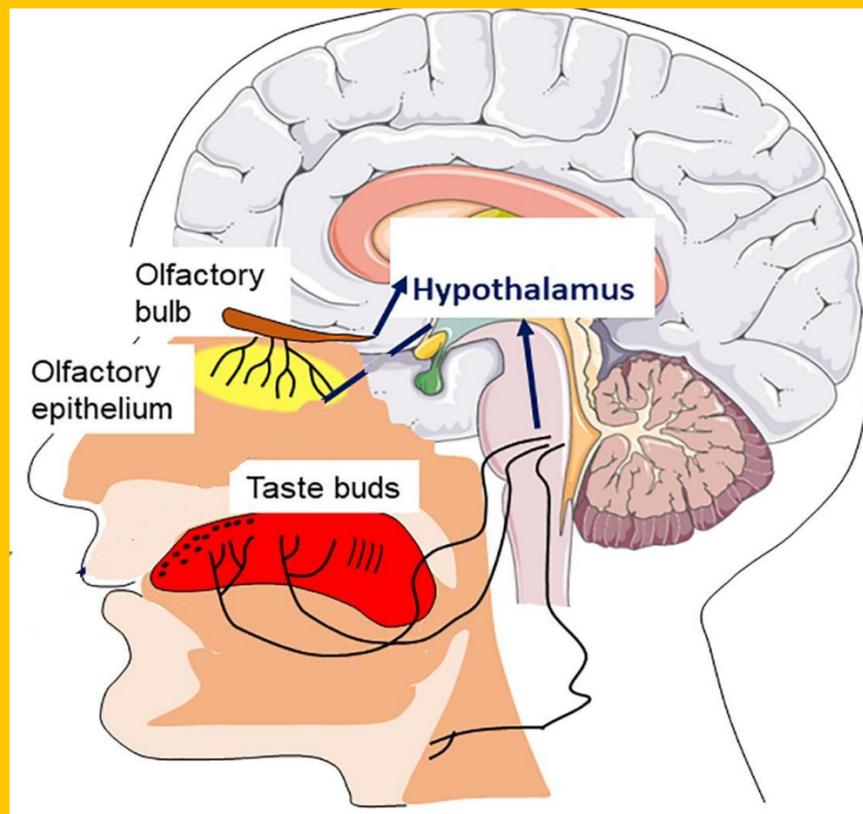
Effect of Aging



- Smell sensitivity decreases with age, leading to conditions such as anosmia and hyposmia.
- This decline in olfactory sensitivity can impact nutrition, safety, and overall quality of life.

Each person's odor fingerprint is unique—like DNA.

Olfaction and Taste

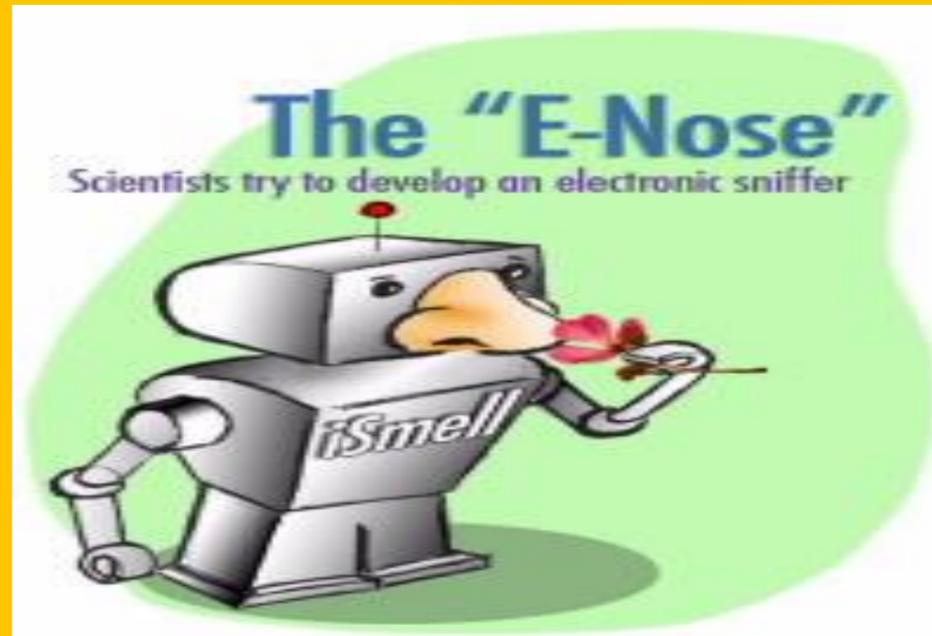


The Oral–Nasal Connection

- The sense of smell significantly enhances taste perception.
- This relationship is crucial not only for enjoyment of food but also for nutrition and safety in dietary choices.
- In diseases of olfactory receptors e.g. in common cold the acuity of taste sensation is reduced.

Artificial Olfaction

Electronic noses are innovative devices designed to mimic human olfaction.





Thank You

Appreciate your attention and inquiries about olfaction

EMAIL

kabdelsater@mutah.edu.jo

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@Khaled Abdel-Sater