




SENSE ORGANS

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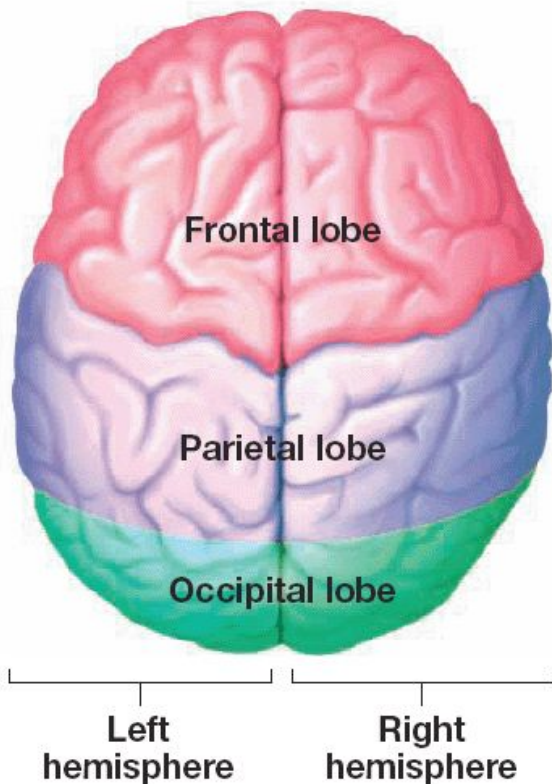
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- Receptors provide information about both external and internal environments.
 - The receptors of the human are located in EYES, EARS, NOSE, TONGUE and SKIN.
 - These organs are called Sense Organs.

Types of sensory receptors

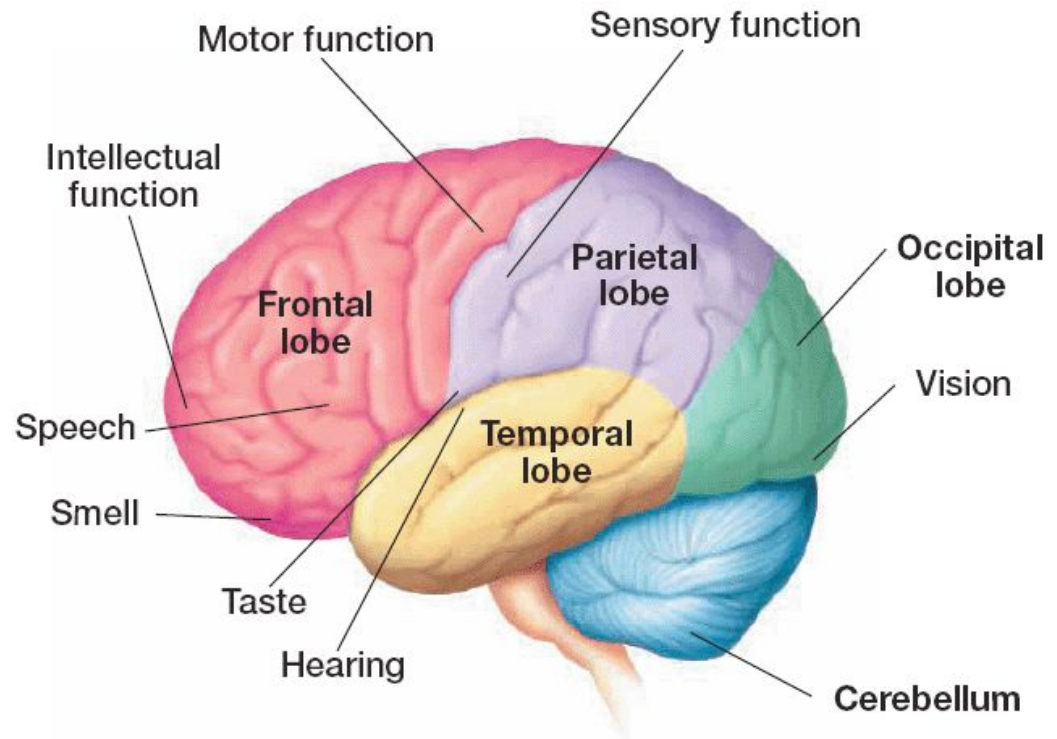
Receptor type	Stimuli	Locations
Thermoreceptors	Temperature change	Skin, hypothalamus
Pain receptors	Tissue damage	All tissues and organs except the brain
Mechanoreceptors	Movement, pressure, tension	Skin, ears, muscles
Photoreceptors	Light	Eyes
Chemoreceptors	Chemical	Tongue, nose

Processing Sites and Lobes of the Cerebral Cortex

Top view of brain

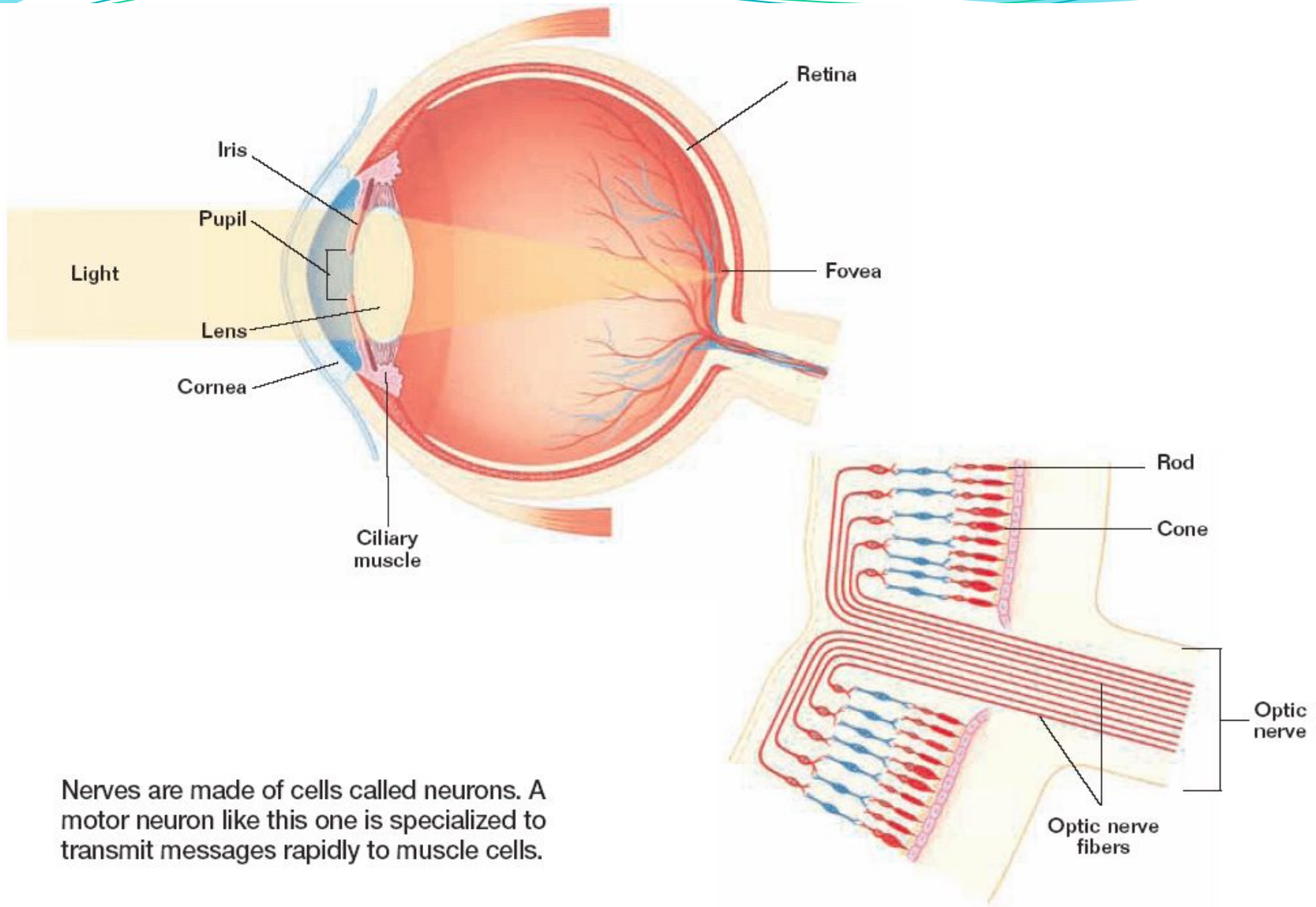


Side view of brain (left hemisphere)



THE EYE

- **It provides more than 80% of the information received about the external environment.**



Nerves are made of cells called neurons. A motor neuron like this one is specialized to transmit messages rapidly to muscle cells.

STRUCTURE OF EYE


- **Eyes contain 3 main parts;**
- Schlerenchyma
- Choroid
- Retina

Schlerenchyma

- It is supportive structure of eye that protects inner structures of the eye.
- In the front, it bulges and becomes the transparent cornea.
- Light enters the eye through cornea.

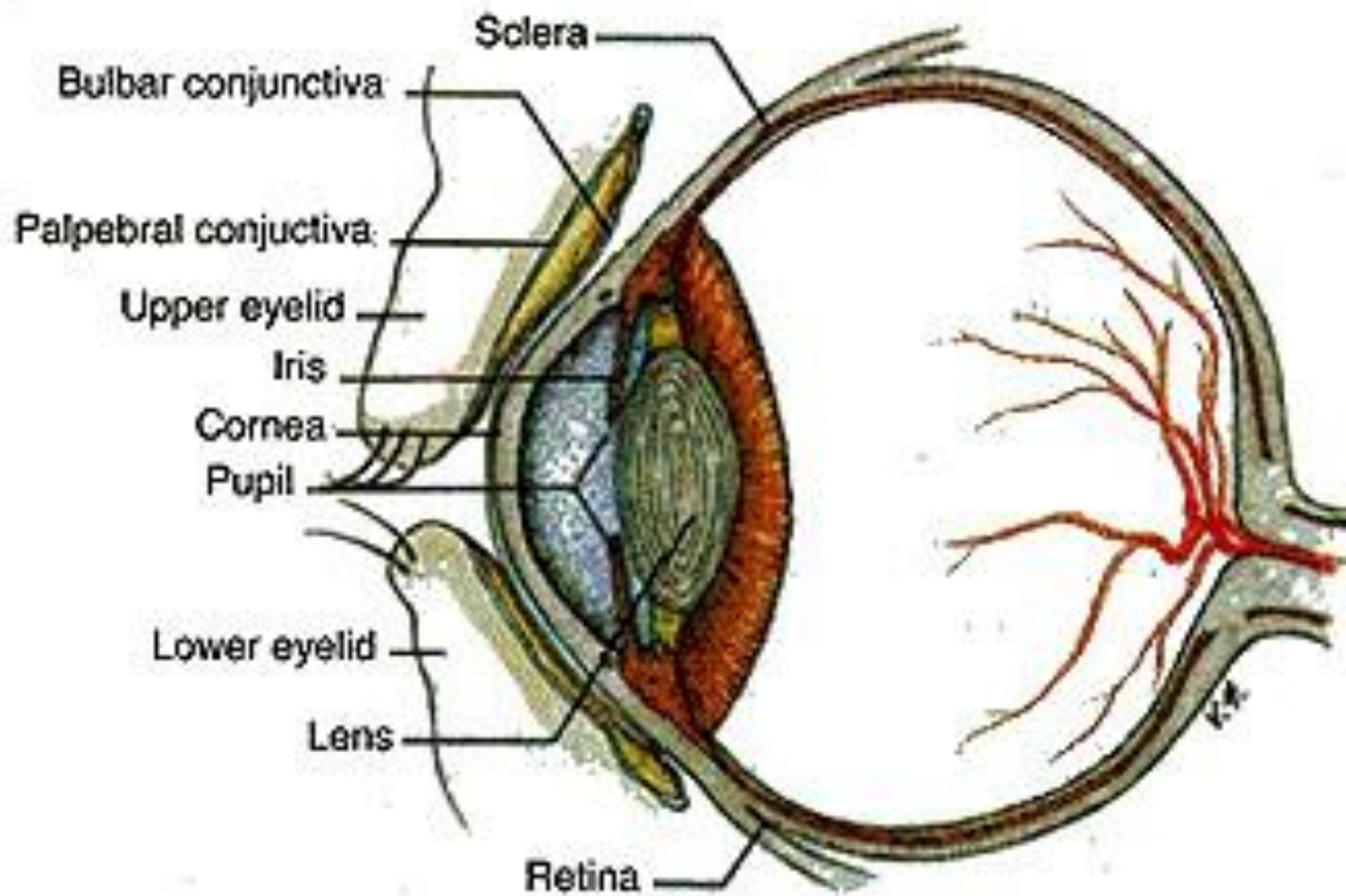
CHOROID

- Just inside the sclera is the choroid.
- This layer contains many blood vessels. At the front the eye the choroid layer forms the iris.
- It is colored part of eye. In the centre of the iris is an opening called PUPIL.

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- The diameter of iris is related to the amount of light.
 - It narrows pupil under intense light but widens in dark conditions.
 - The size of pupil is controlled automatically by central nervous system.

THE RETINA

- Behind the iris is the lens. It focuses the light on the retina (photoreceptor).
- Innermost layer of the eye, the retina contains the light receptors.
- At the rear of the eye, the retina is attached to the optic nerve which carries impulses from the light sensitive cells to the brain.



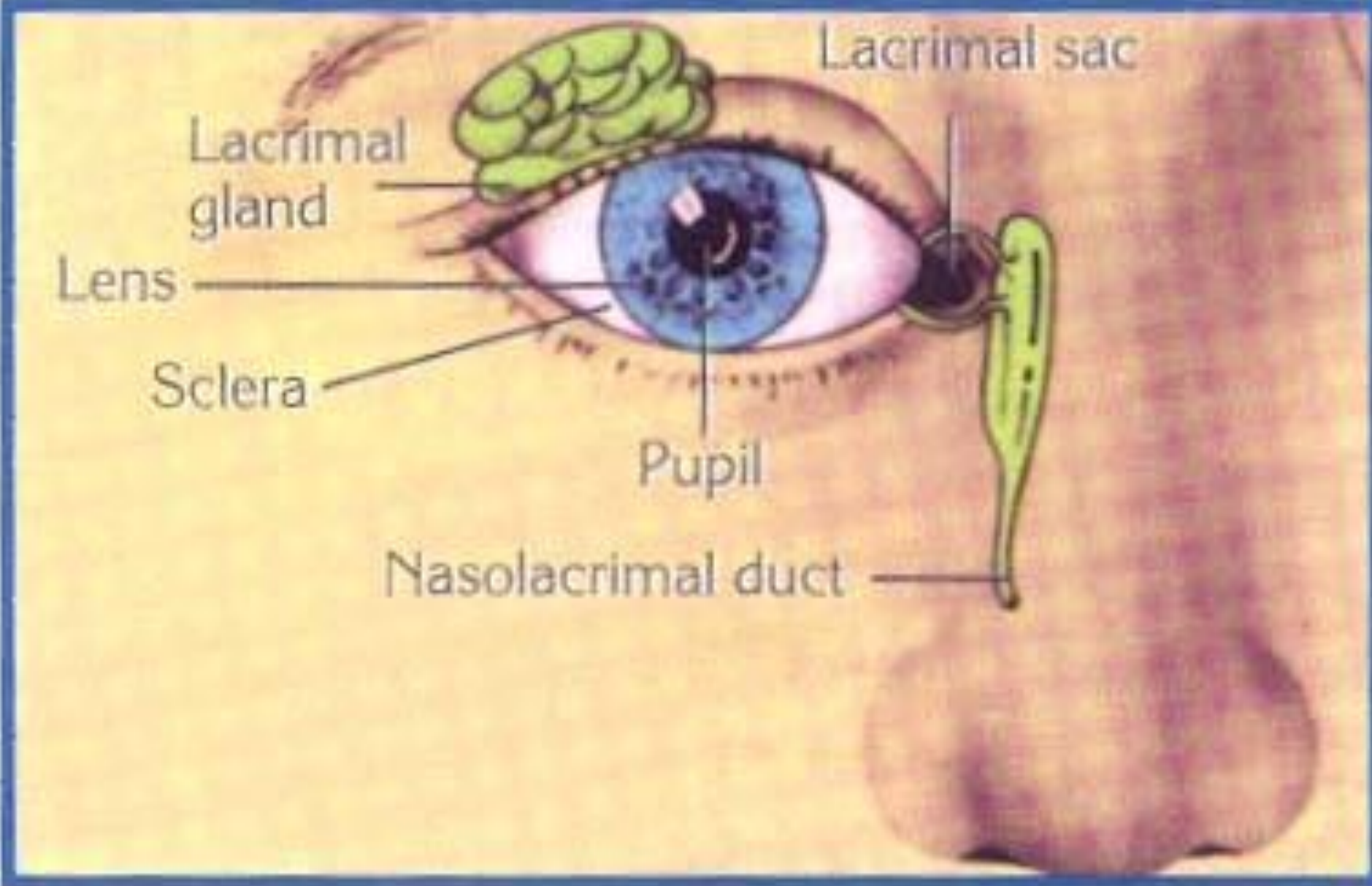


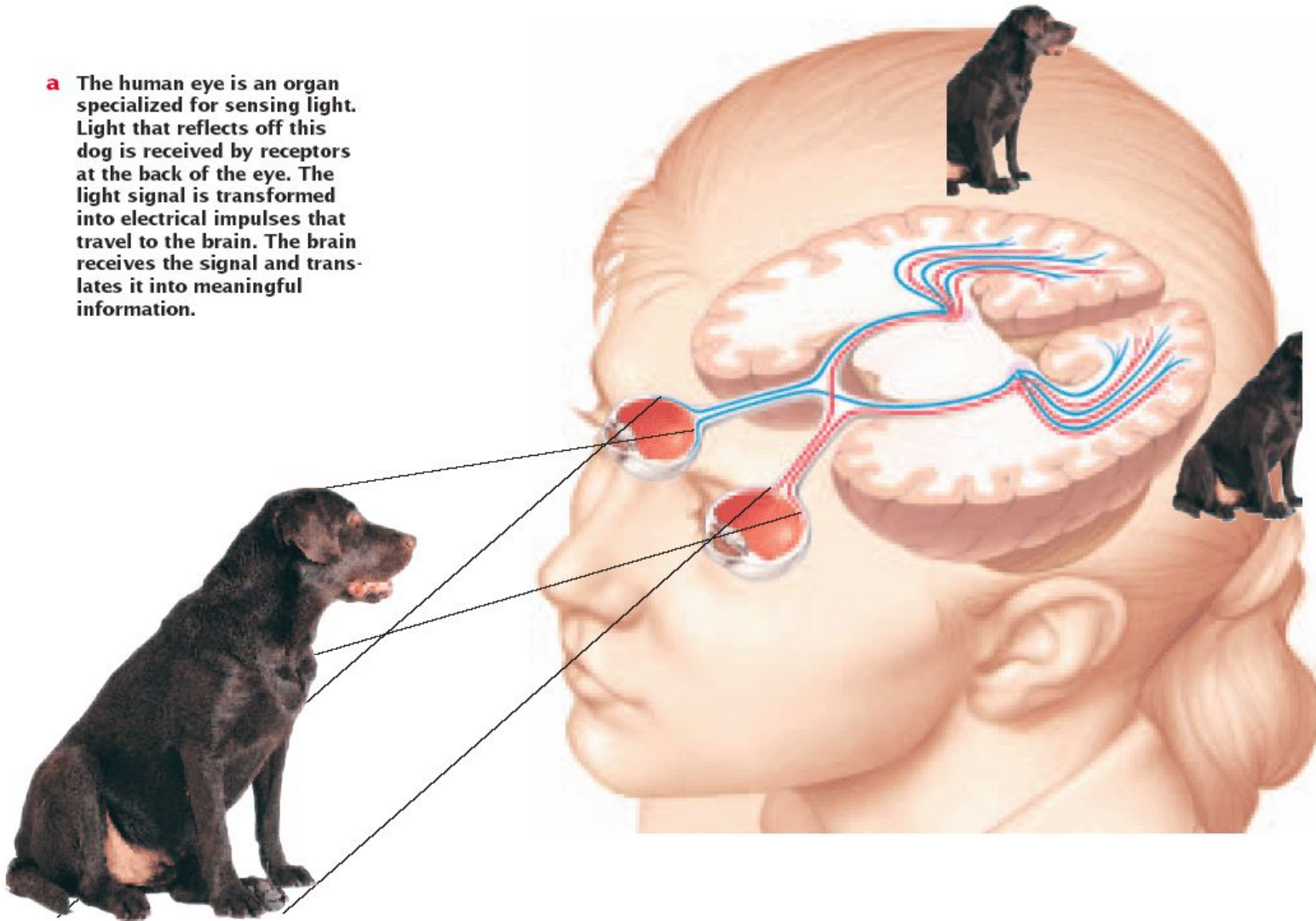
Figure-8.9.: Tear apparatus.

VISION


- Light entering the eye passes through the cornea, pupil, lens, and forms an image on the retina.
- Retina contains light sensitive cells which they are called cones and rods.

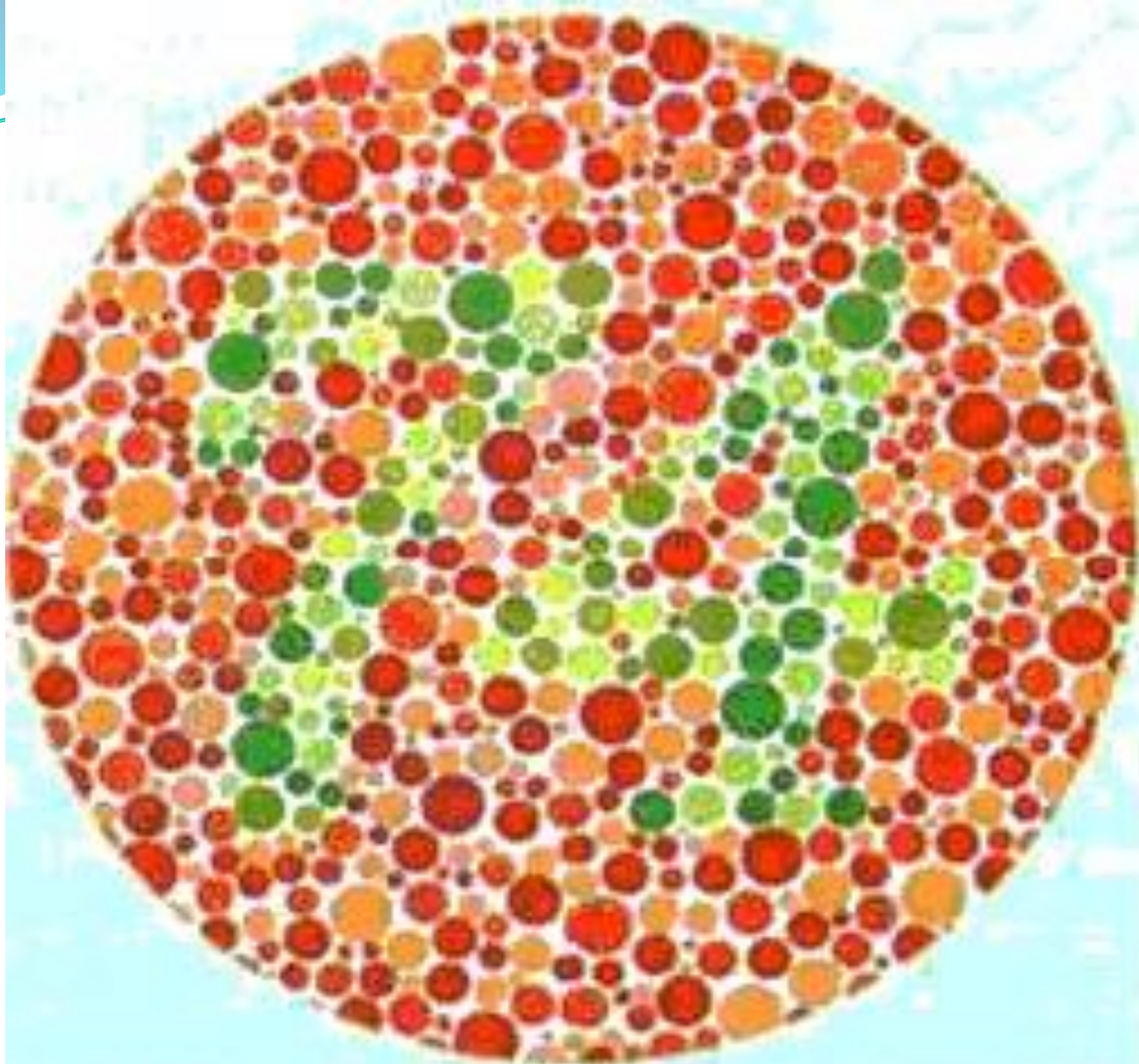
- **Cones are sensitive to color and bright light.**
- **Rods are sensitive to dim light but not to color.**
- **The retina contains 125 million rods and 6,5 million cones.**

a The human eye is an organ specialized for sensing light. Light that reflects off this dog is received by receptors at the back of the eye. The light signal is transformed into electrical impulses that travel to the brain. The brain receives the signal and translates it into meaningful information.




b Each eye receives about three-quarters of the image. The brain combines this information so that you see the entire image.

- 
- **A severe deficiency of vitamin A leads to a condition called night blindness.**
 - **In this condition amount of retinal rods and cones is decreased.**



defects of eye

- While at rest, instead of focusing on the retina, the light rays focus in front of it.
- This type of eye defect is called myopia.
- This condition can be corrected by concave lenses.

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- **At rest, the light rays focus behind instead of on the retina.**
 - **This type of eye defect is termed hypermetropia.**
 - **This condition can be corrected by convex lenses.**

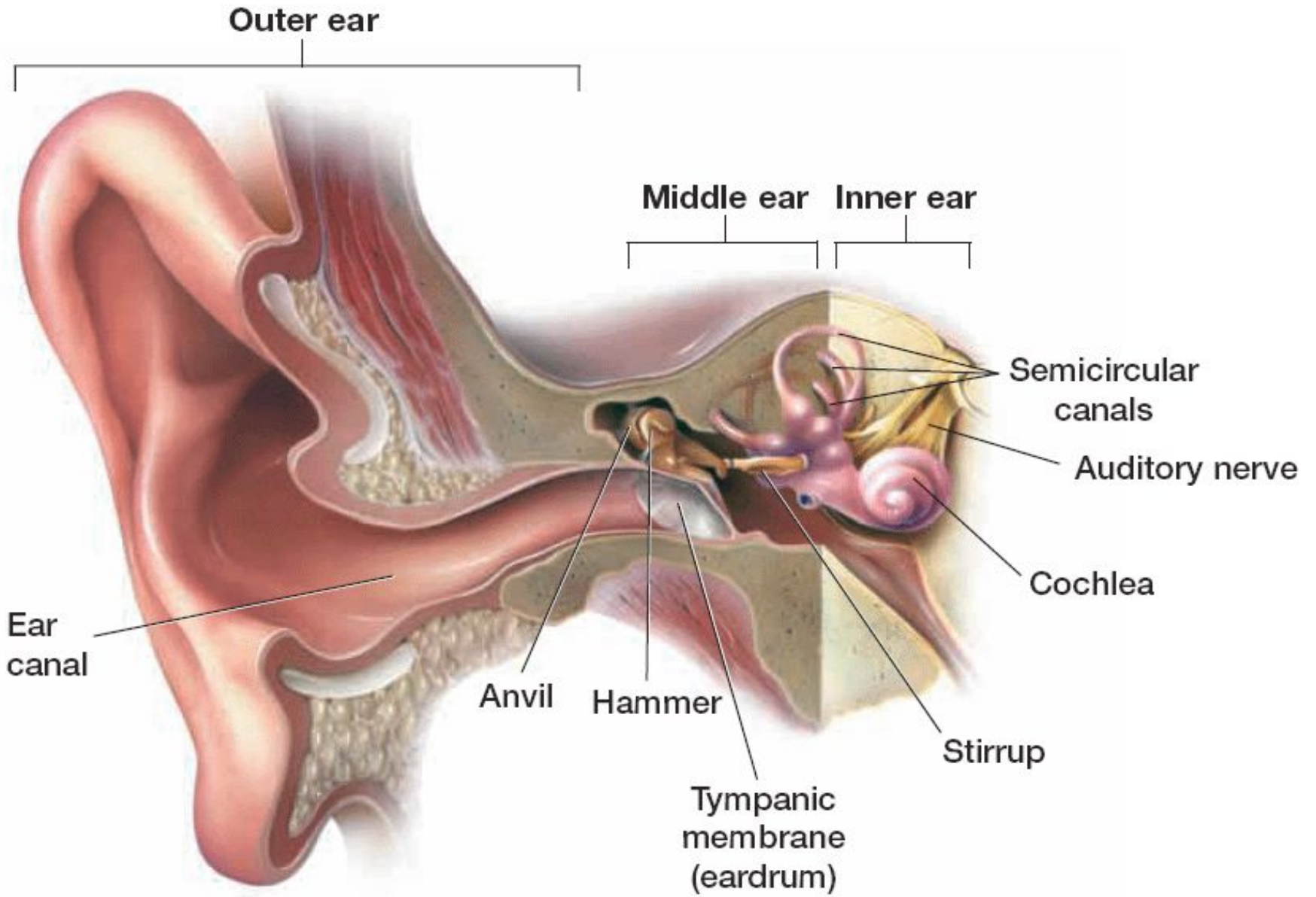
THE EARS

- **The human ear has 2 sensory functions.**
- **One of them is hearing.**
- **Other is maintaining balance or equilibrium.**

Structure of ears

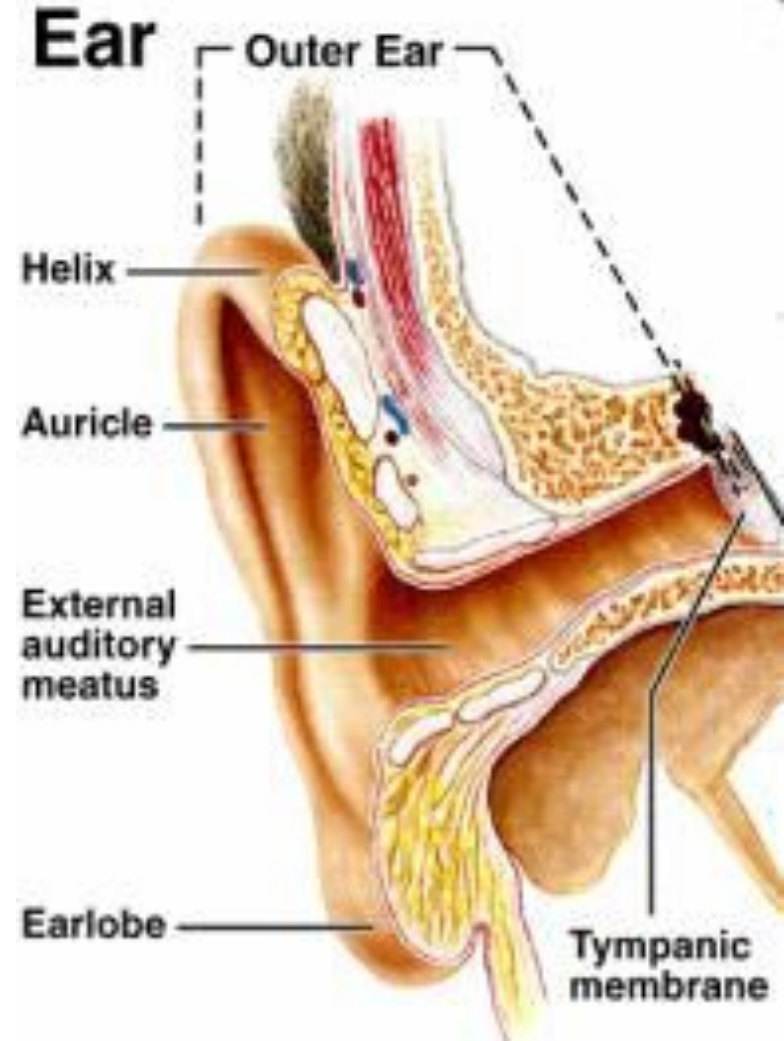
Ears contains 3 main parts;

- 1. Outer ear**
- 2. The middle ear**
- 3. Inner ear**



1. OUTER EAR

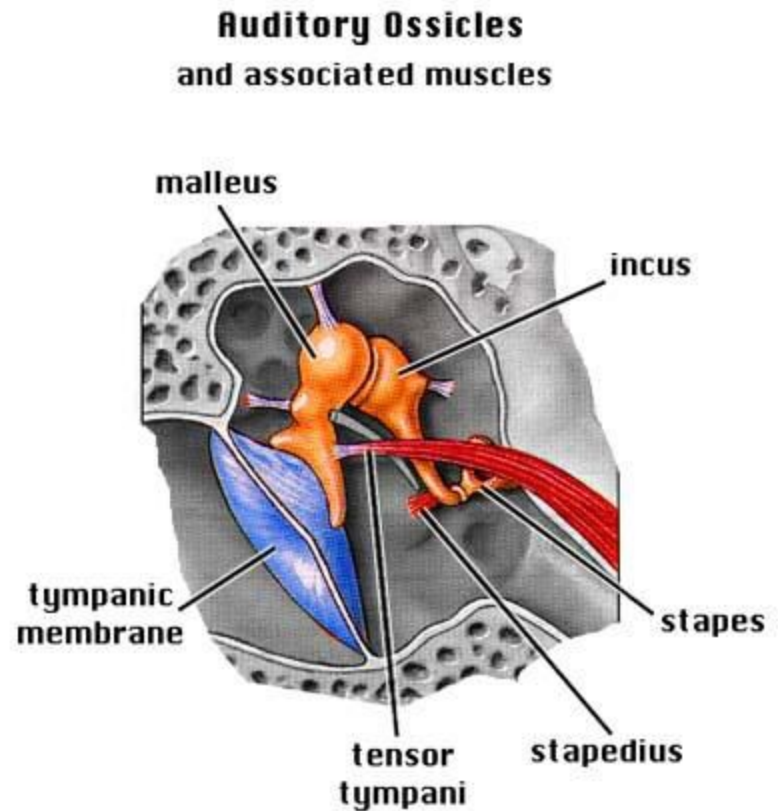
- Outer ear is composed of 3 parts.
- These are **pinna**, **auditory canal** and **eardrum**.
- **Pinna** is a cartilaginous tissue which collects sound waves and determines the source of voices.



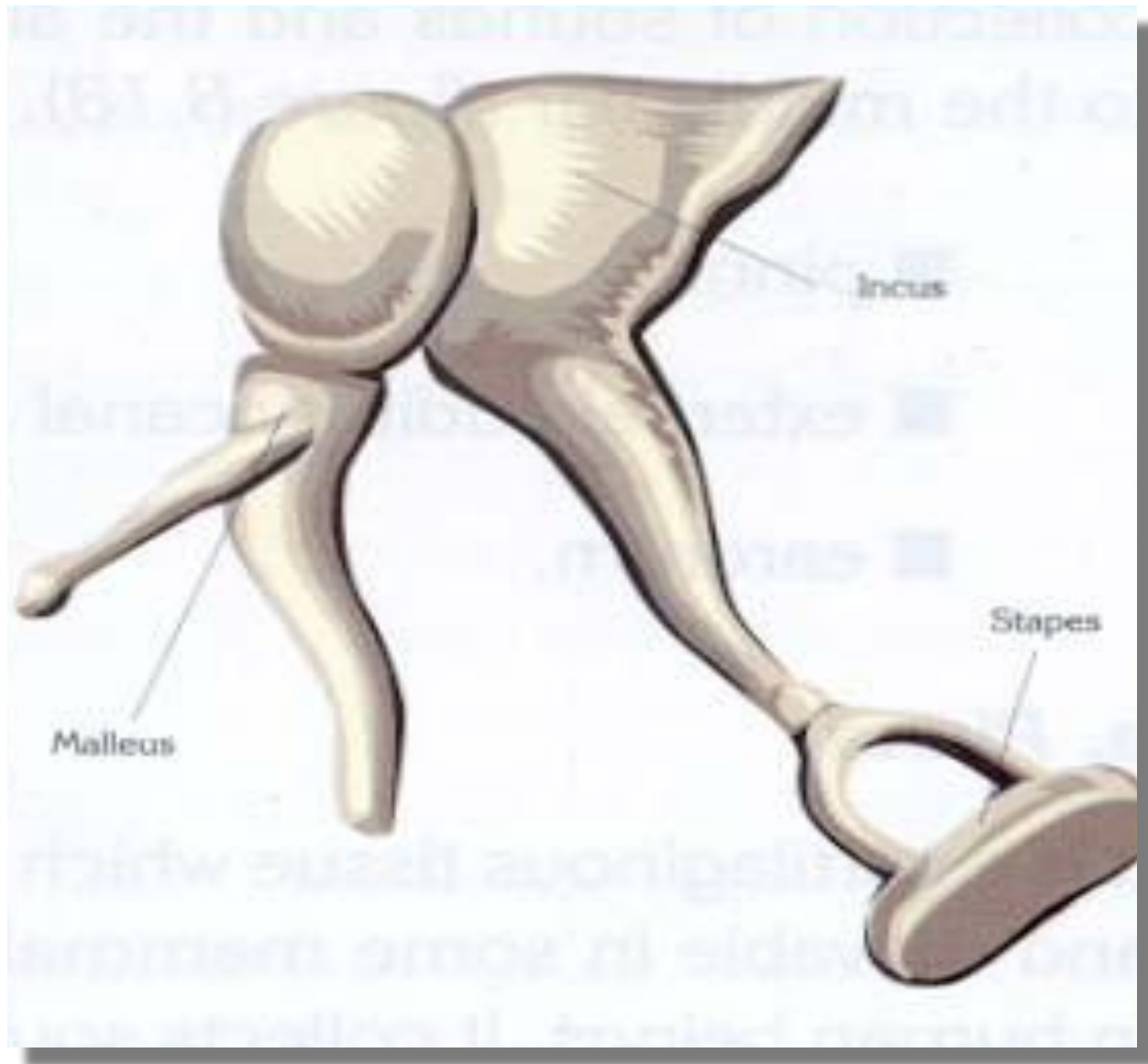
- **Auditory canal** is a canal which is found between pinna and eardrum.
- It has hairs and produces wax-like substance to filter dust and solid particles.
- The **eardrum** separates outer ear from the middle ear.
- It is thin half transparent.

2. MIDDLE EAR

- It contains three small bones which are called the **hammer-malleus**, **anvil-incus** and **stirrup-stapes**.
- These bones form a chain across the middle ear linking the eardrum (hammer) to another membrane, the oval window(stirrup).



Modified from Fig. 18-10, Prentice Hall, Martini/Timmons 1997

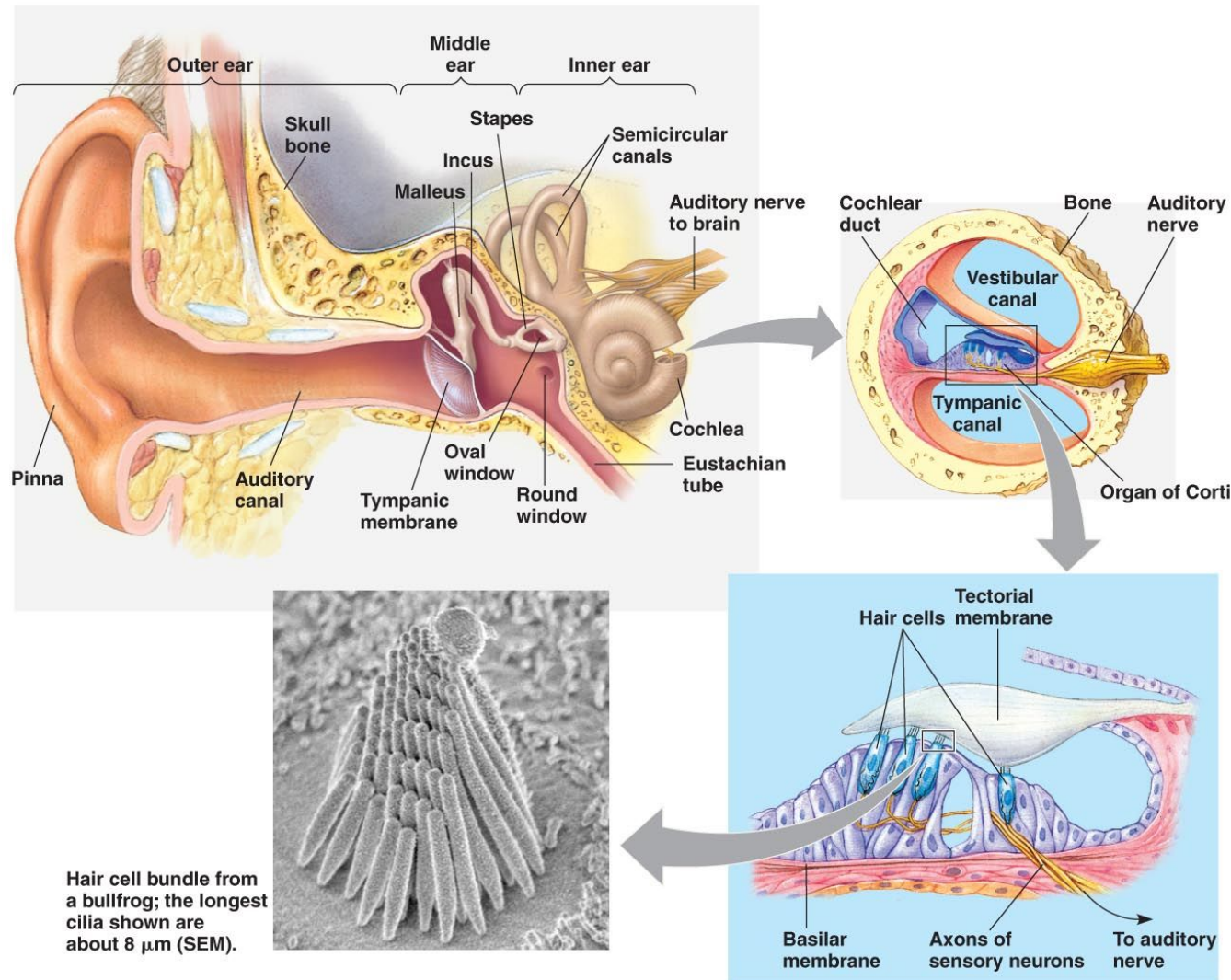


EUSTACHIAN TUBE

- It is located between pharynx and the middle ear.
- It equalizes air pressure between the middle ear and the atmosphere.

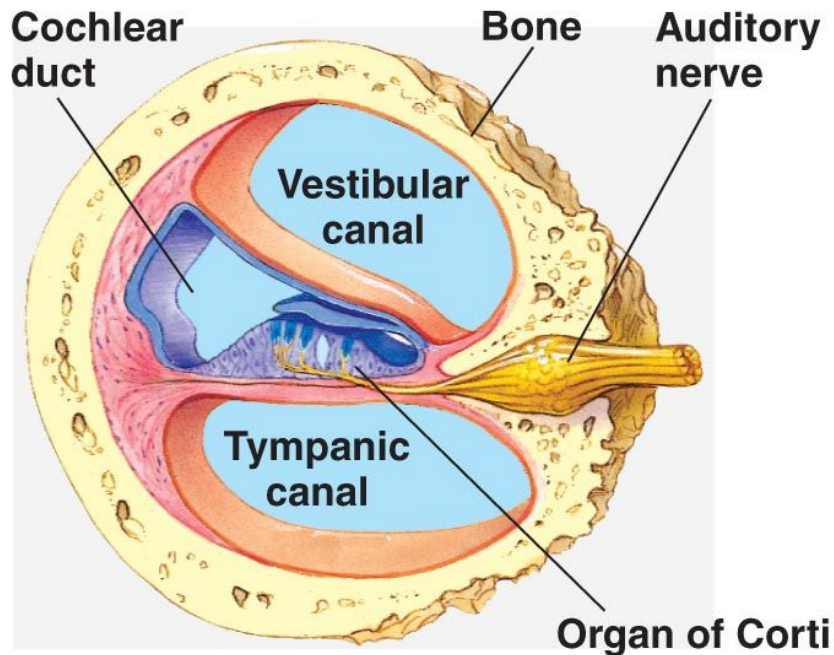
3. THE INNER EAR

- It consists of the cochlea and semicircular canals.
- Cochlea is organ of hearing which consists of coiled, liquid-filled tubes.

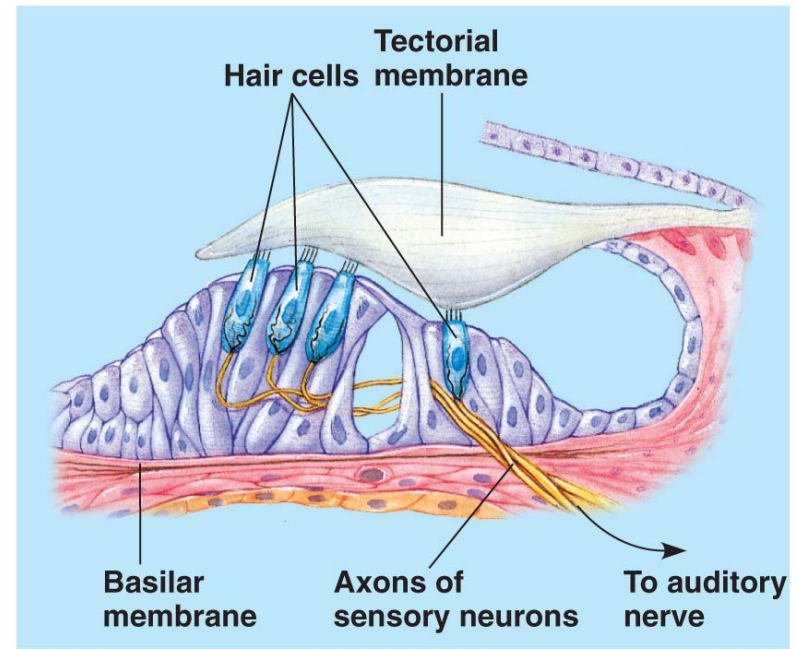


Hair cell bundle from a bullfrog; the longest cilia shown are about 8 μm (SEM).

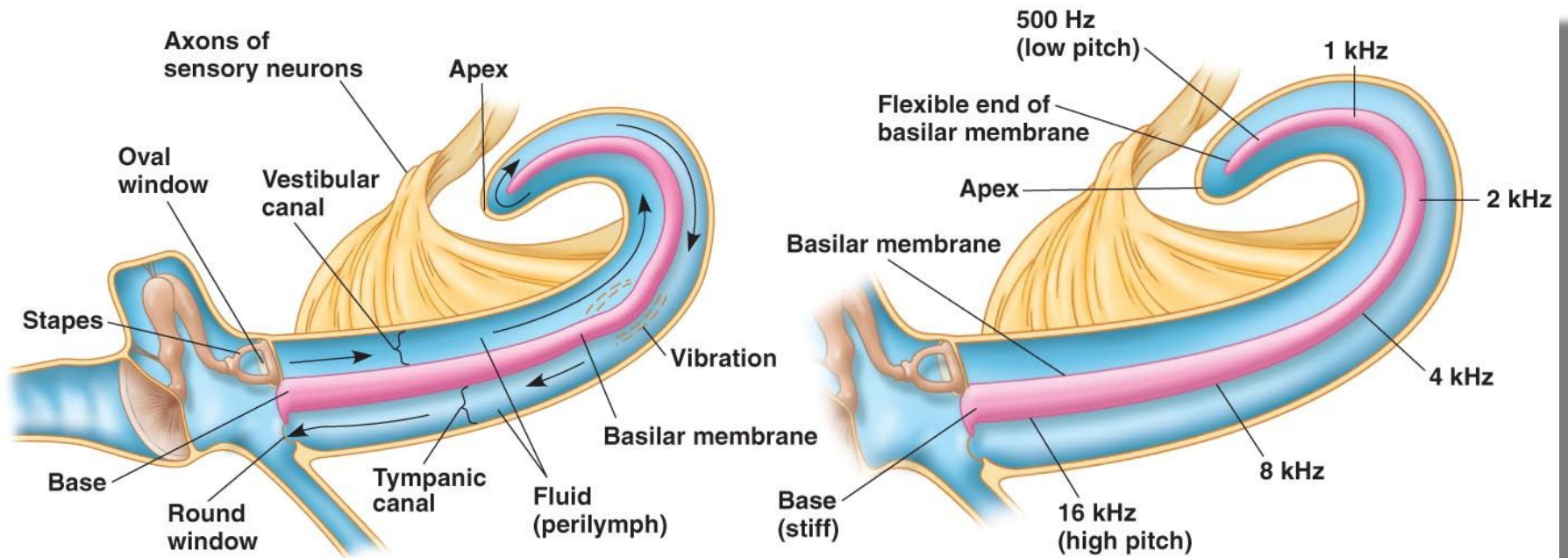
- They are separated from another by membranes.
- Lining of the membranes are specialized hair cells that are sensitive to **vibration**.



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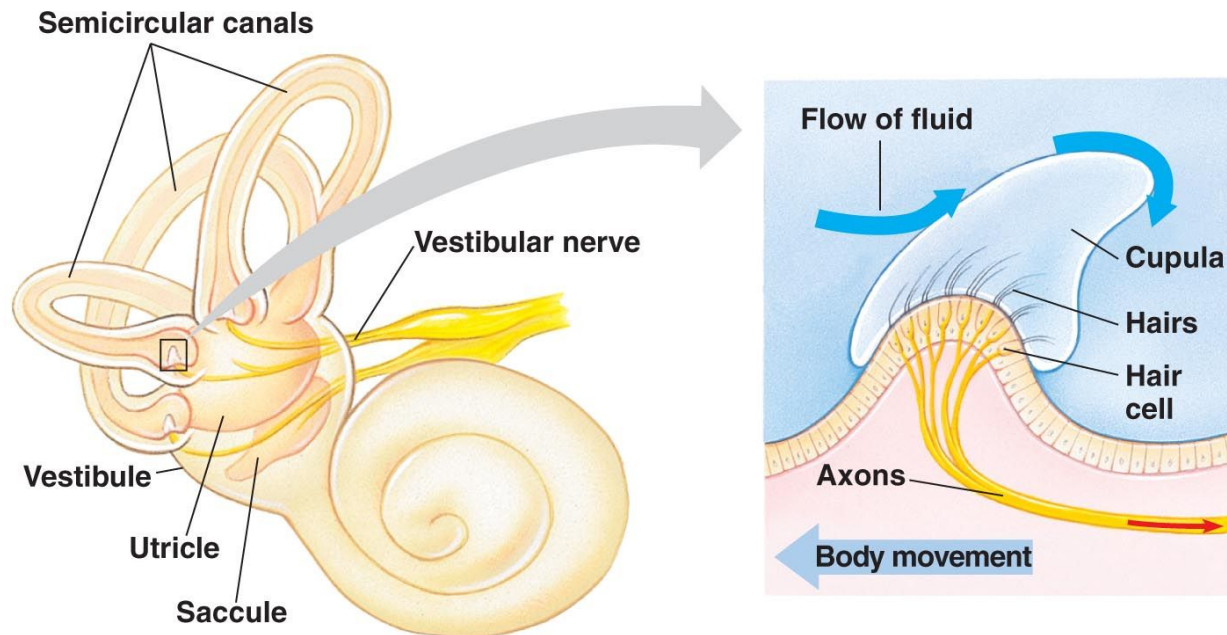


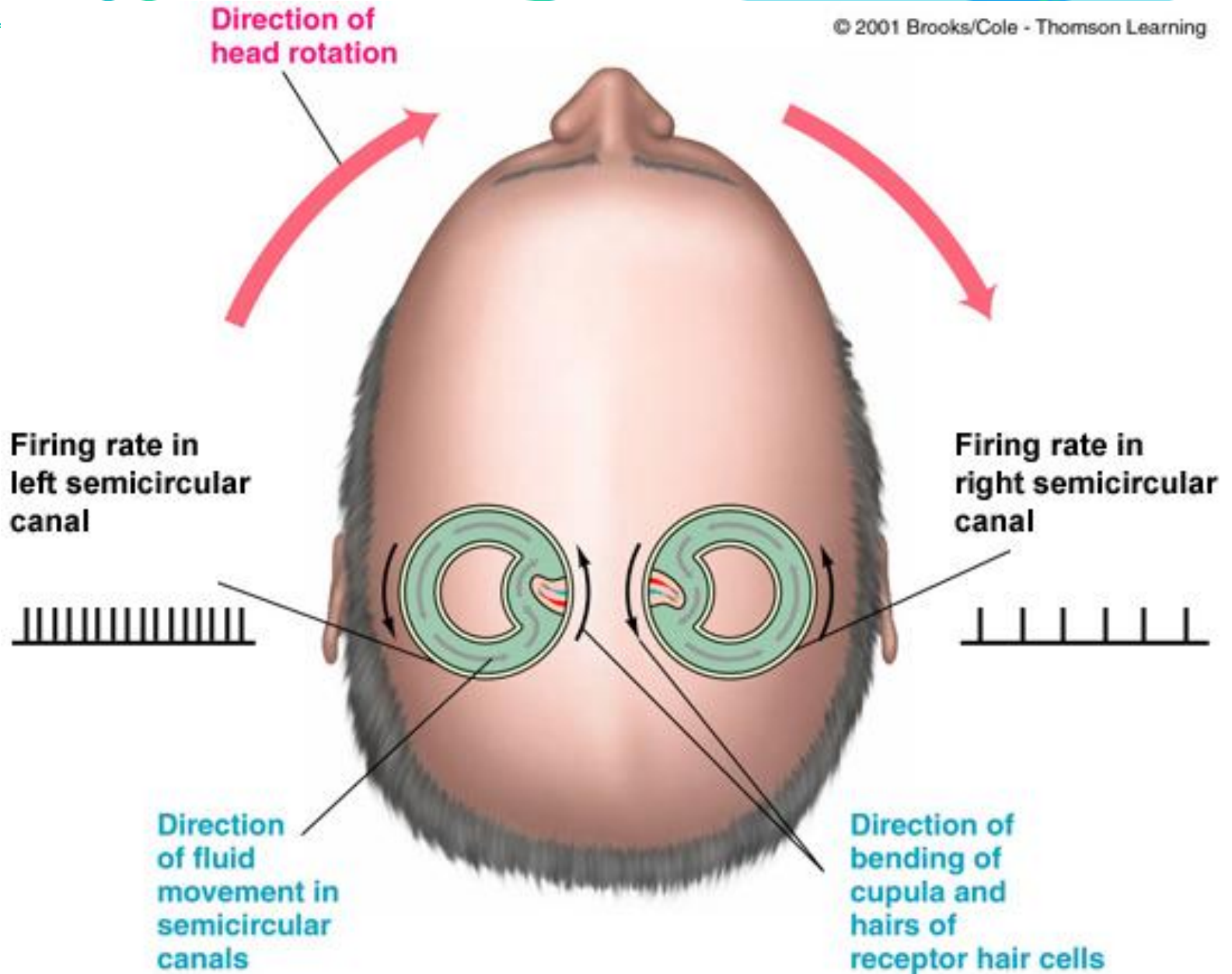
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Semicircular canals

- **Semicircular canals** enable the body to maintain balance.
- These canals contain fluid and hairlike projections that detect changes in body and head position.





Direction of head rotation

Firing rate in left semicircular canal

Firing rate in right semicircular canal

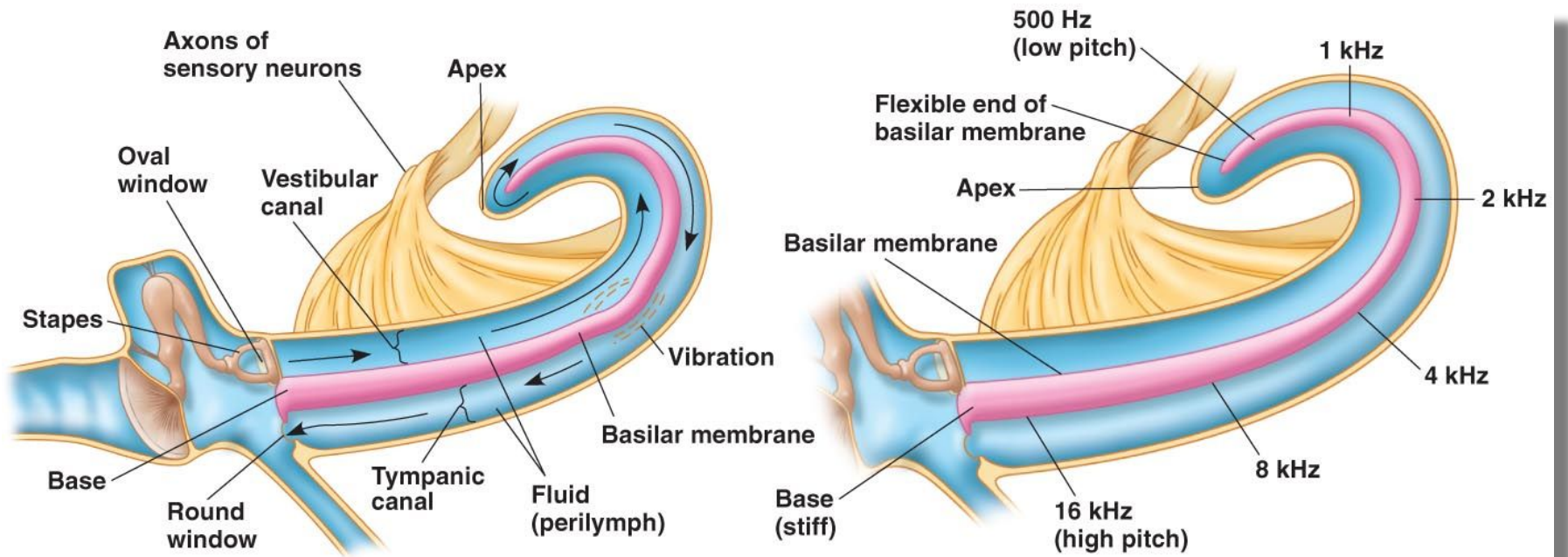
Direction of fluid movement in semicircular canals

Direction of bending of cupula and hairs of receptor hair cells

HEARING

- Sound waves collected by outer ear pass down the auditory canal to the eardrum.
- They cause the eardrum to vibrate.
- The vibrations are transmitted across the middle ear by the hammer, anvil and stirrup.

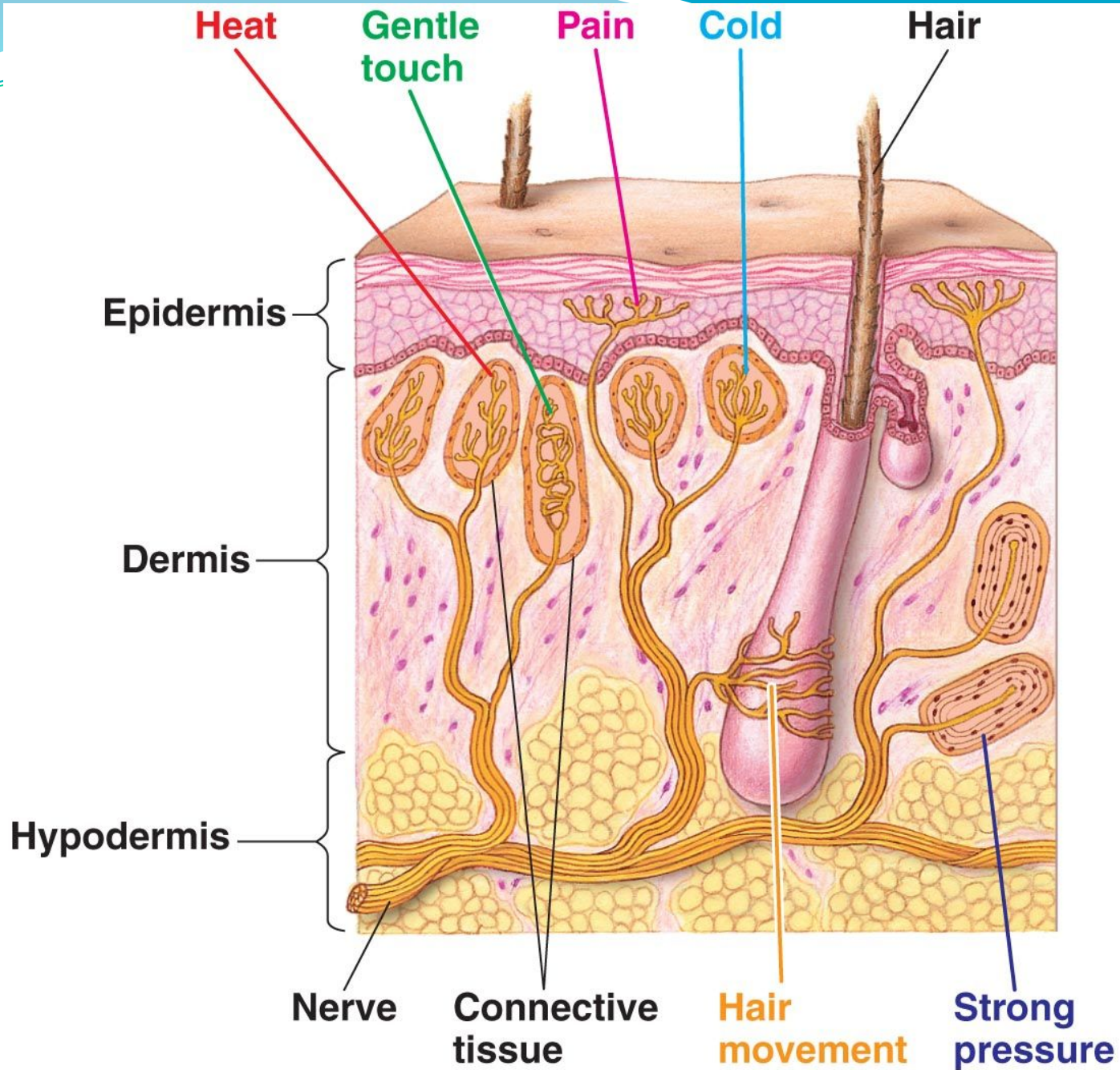
- **Vibration of stirrup cause vibrations in the oval window which in turn cause the fluid within the cochlea.**
- **The initiates in nerve endings around the hair cells.**
- **These impulses are carried to the cerebral cortex, where their meaning is interpreted.**



THE SKIN

- All multicellular organisms have a skin composed of one or more layers.

Receptor type	Stimuli	Locations
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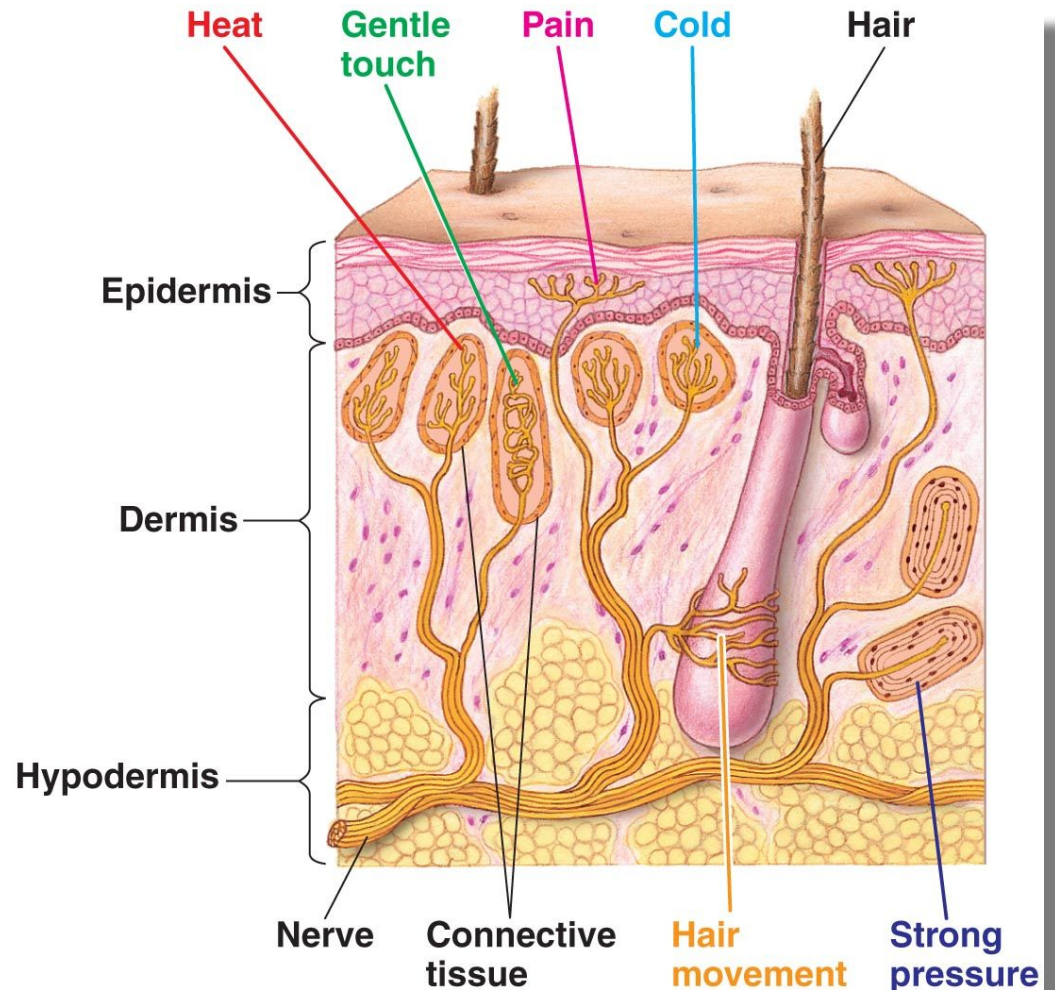
Functions of Skin

1. It protects the inner layers of the body from physical and chemical effects.
2. It prevents body from microbes
3. It prevents water loss in terrestrial organisms.
4. It prevents body cells from ultraviolet light.

Skin Structure

Skin is composed of 3 tissue layers:

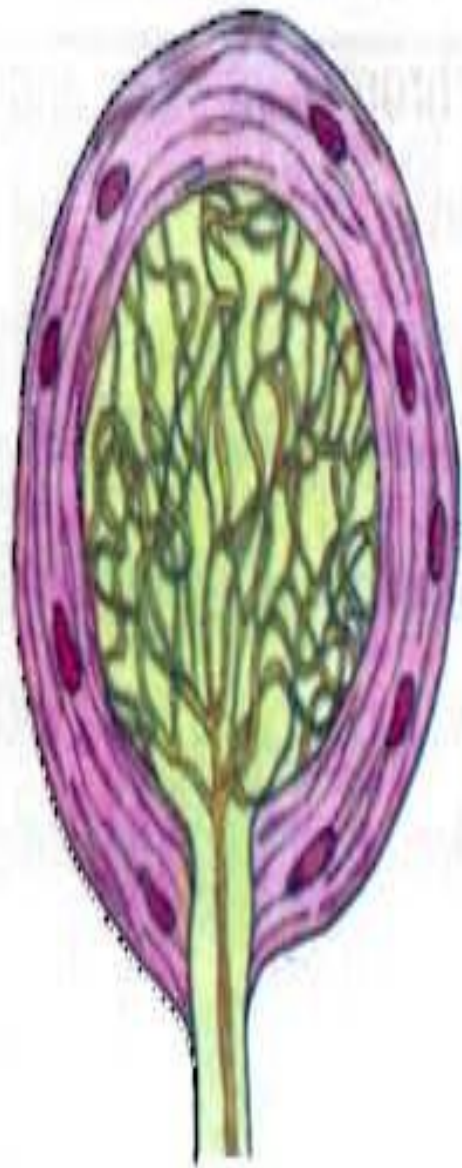
1. Epidermis
2. Dermis
3. Hypodermis



- **EPIDERMIS** is outermost layer of skin.
- This layer composed of keratinised epithelial cells.
- Epidermis do not contain blood vessels.
- Upper section of epidermis is composed of **non-living cells**.
- The color of skin is conferred by **melanin** pigment.
- **DERMIS** is rich in blood vessels and nerve endings.
- The receptors located in the skin are connected to these nerve ending.
- Dermis also contain smooth muscle, sweat glands, hair follicles and lymph vessels.
- **HYPODERMIS** innermost layer of skin

RECEPTORS

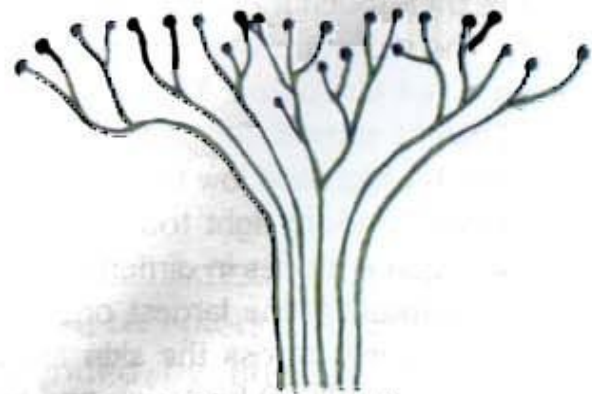
- **Meisner corpuscles:** They are involved in reception of touch of the palm sole and lips.
- **Paccinian corpuscles:** They are involved in reception of mechanical stimuli.
- **Krouse corpuscles:** They are involved in reception of cold and pressure.
- **Ruffini corpuscles:** They are involved in reception of heat, touch and pressure.



50 μ Krouse corpuscle



200 μ m Ruffini corpuscle

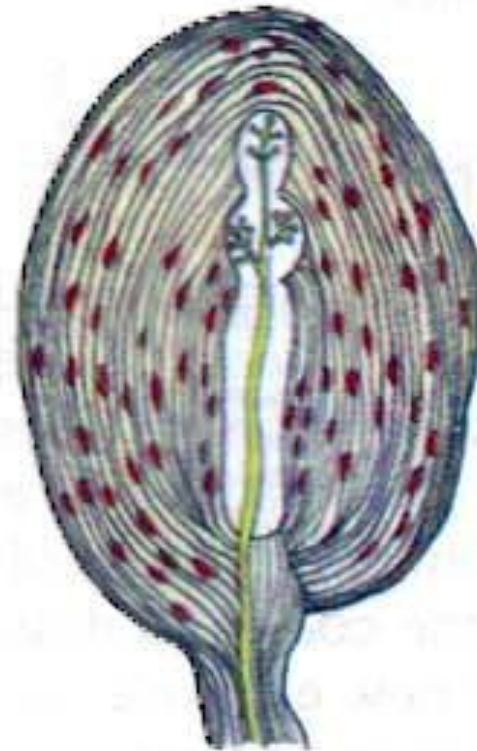


Free nerve endings

Figure-8.28.: Sensory organs of the skin and their size.

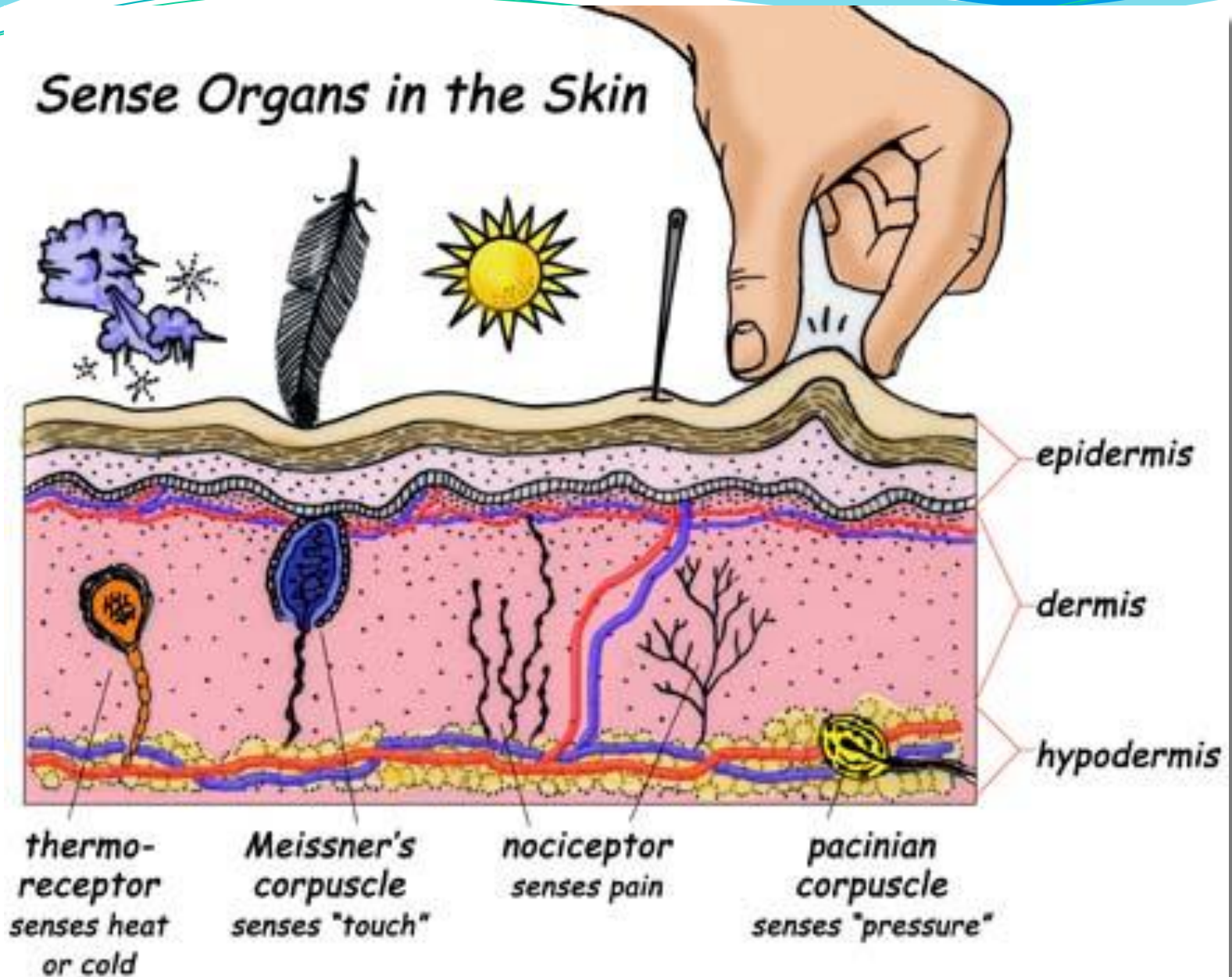


100 μ m Meissner corpuscle

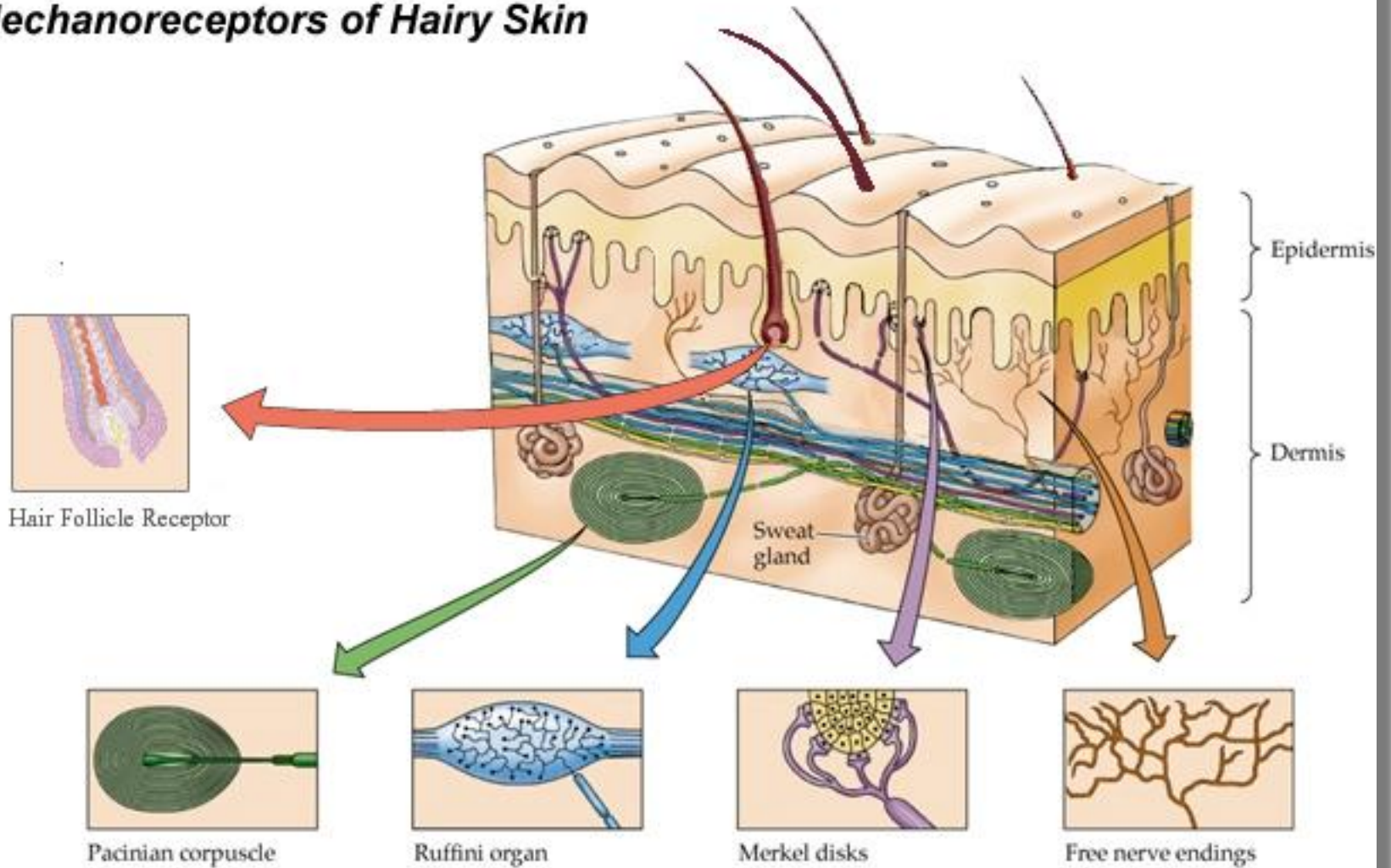


4 mm Paccinian corpuscle

Sense Organs in the Skin



Mechanoreceptors of Hairy Skin

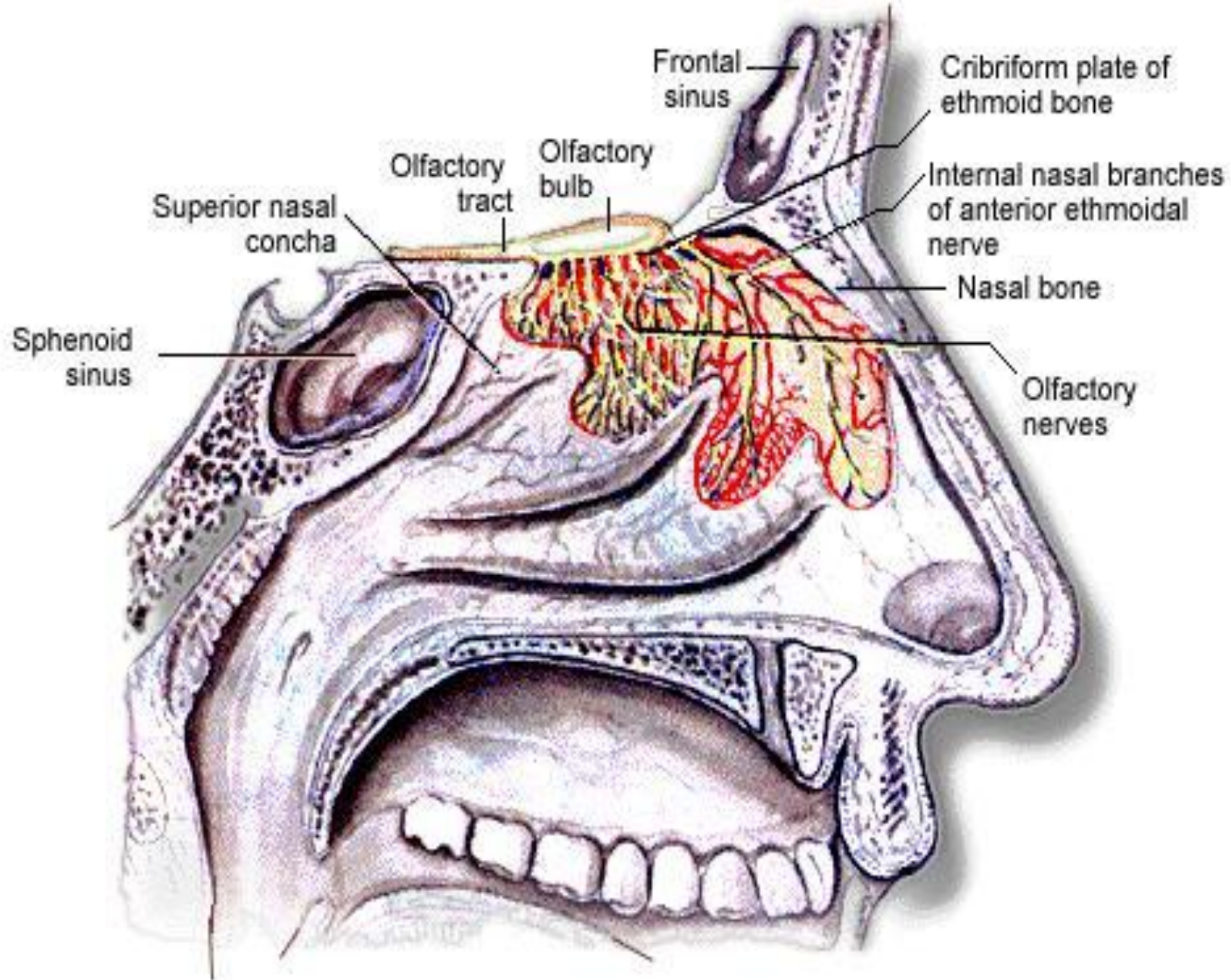


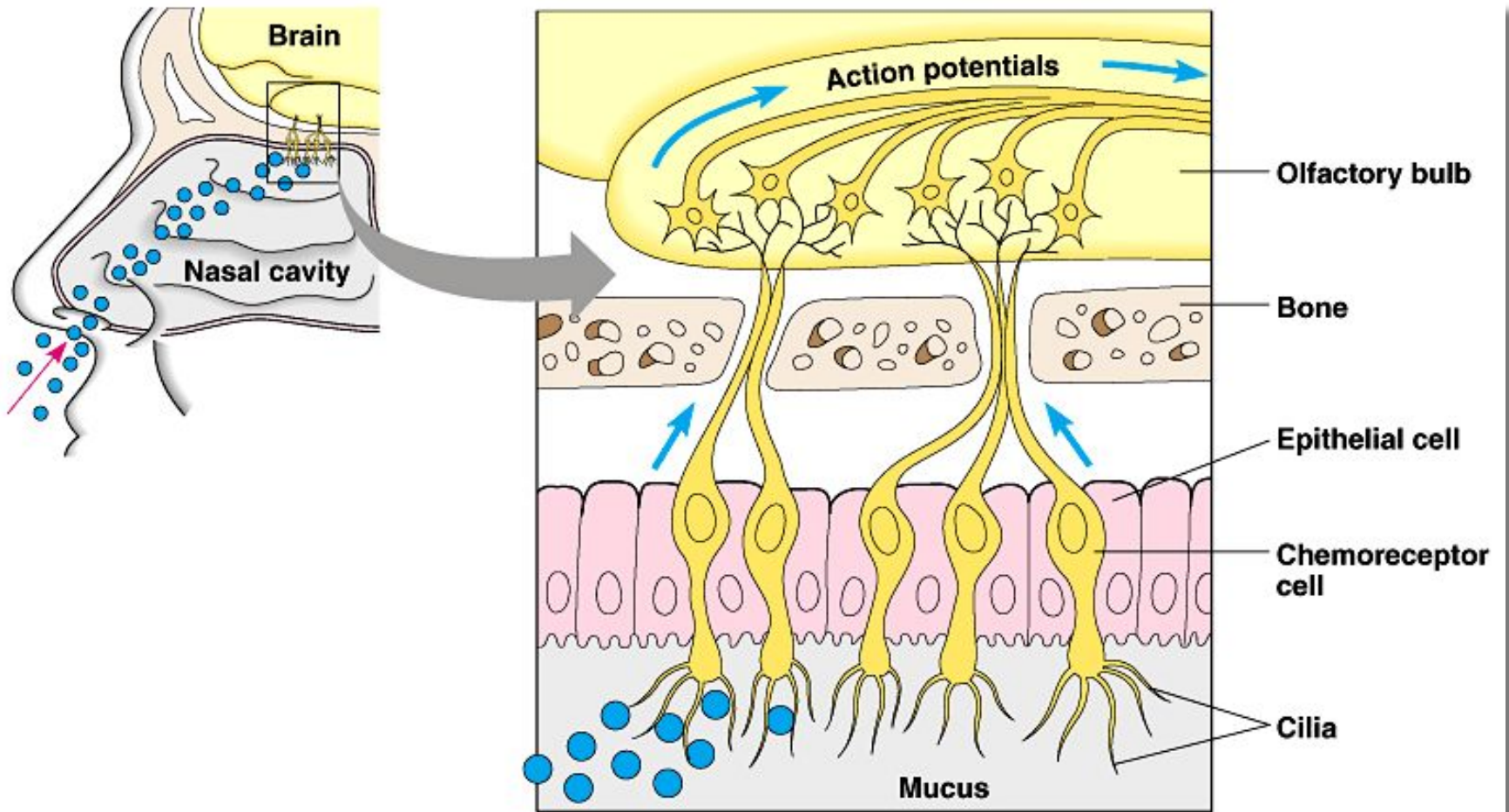
Sweat glands:

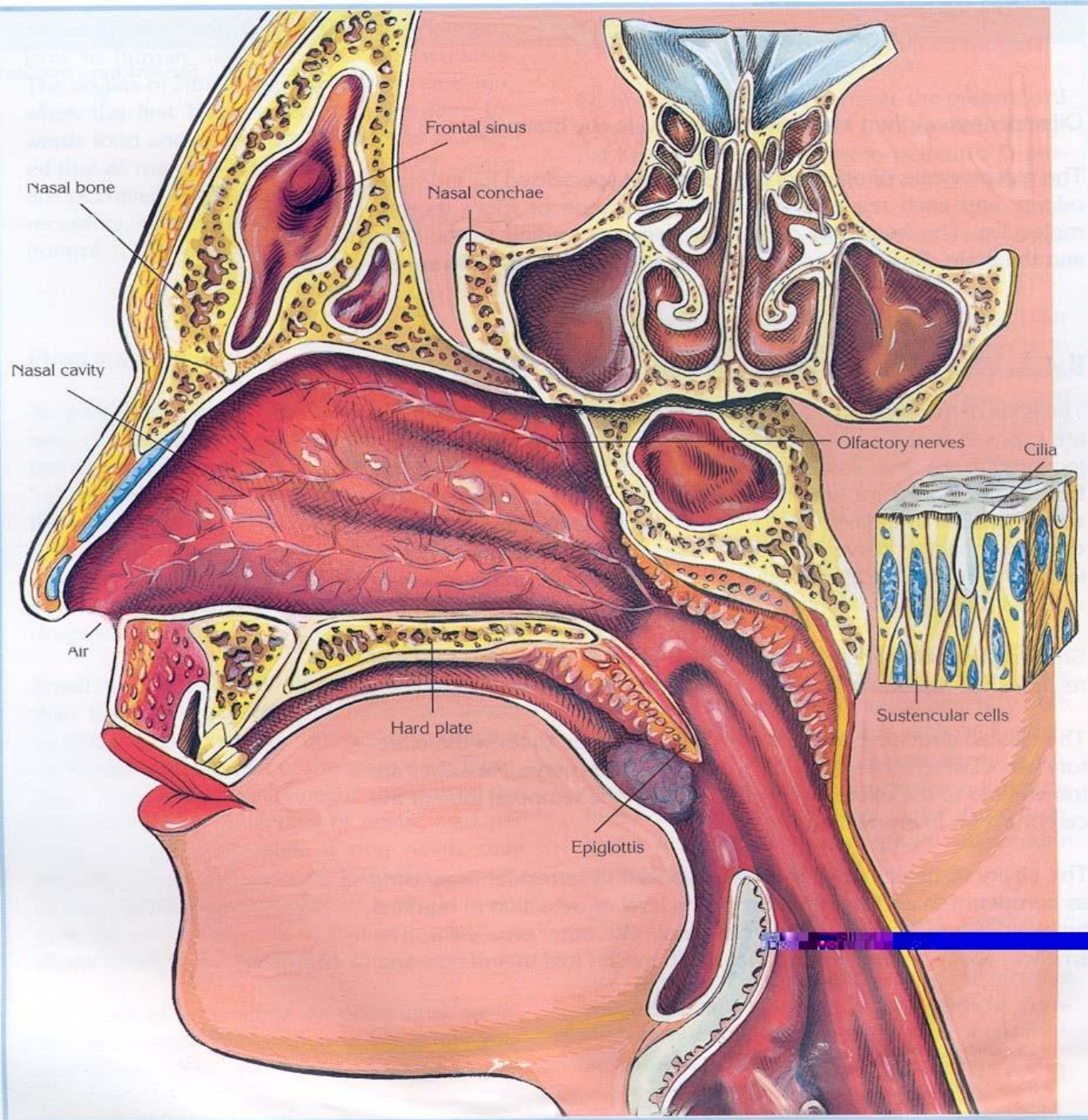
- They are present in all regions of the skin. They open onto the surface of skin by pores.
- They are involved in removal of water, minerals, urea and other substances.
- The main function of sweat glands is the regulation of body temperature by evaporation of water.

THE NOSE

- Nose is the organ of the body involved in both respiration and smell.
- The reception of smell takes place in chemoreceptors located in nasal cavity.
- These chemoreceptors are called as **olfactory receptors**
- Nose also provides the control of temperature
- And the control of humidity and the elimination of infectious microbes

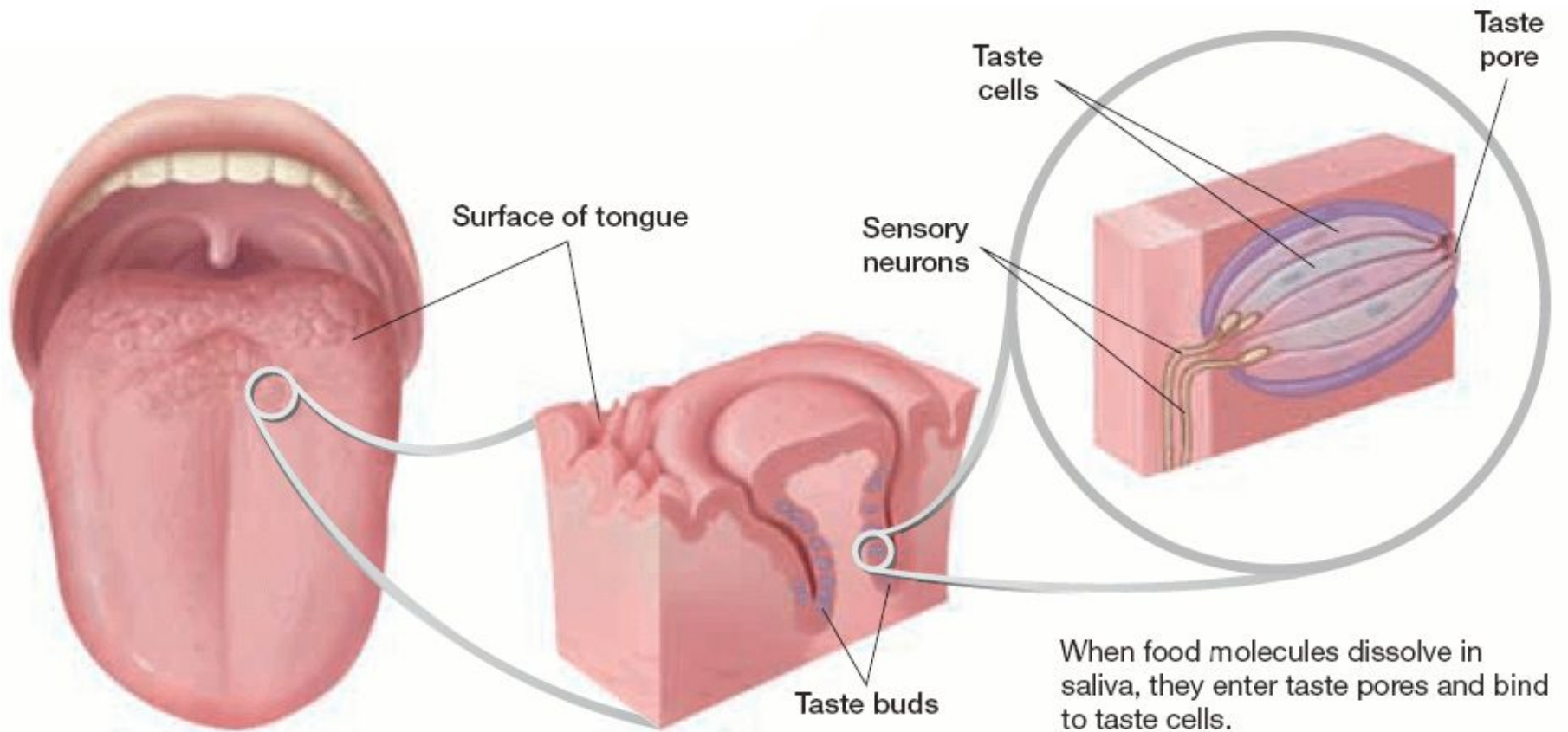








THE TASTE

- The surface of the tongue is covered with small projections called papillae.
- There are the taste receptors or taste buds within the papillae.
- Nerve fibers branch among the cells of the taste bud and each cell is in contact with one or more neurons.



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- Only substances that are in solution can stimulate the taste buds.
 - The taste buds are sensitive to only four basic tastes;
 - SWEET, SOUR, SALT AND BITTER
 - Each taste bud is particularly sensitive to one of these tastes.

- 
- **When taste buds are stimulated, impulses are initiated by the sensory cells of the structure and carried to the brain.**

