Chapter 41
Section 3

Sensory Systems

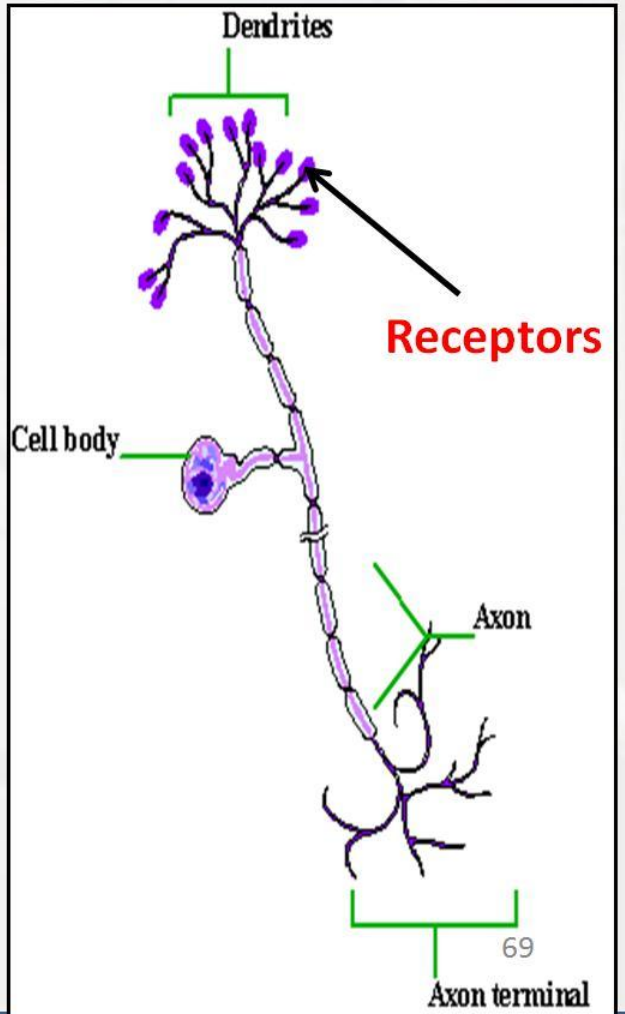
→Receptors :

→ *Specialized structures found on the dendrites of sensory neuron*

→ *Function: detect the stimuli and send electrical impulses*

Receptor type	Stimuli	Location
Theromoreceptors	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

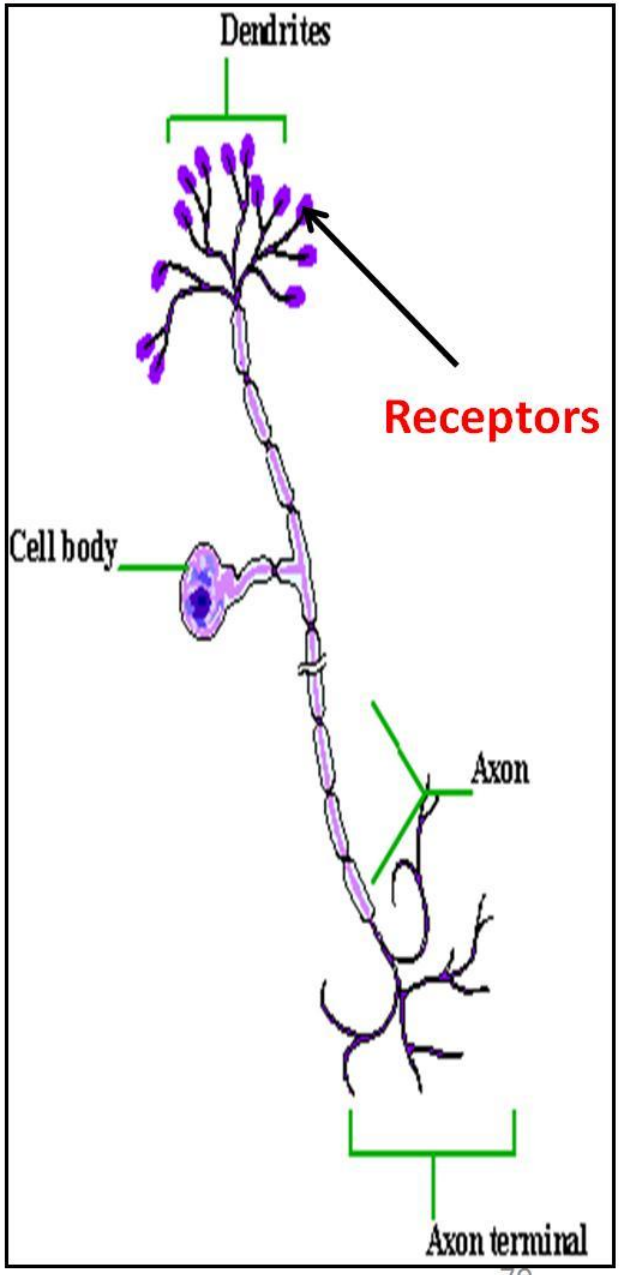
Sensory neuron



- **Sensory stimuli:**
  - detectable changes in the environment within or around the body.

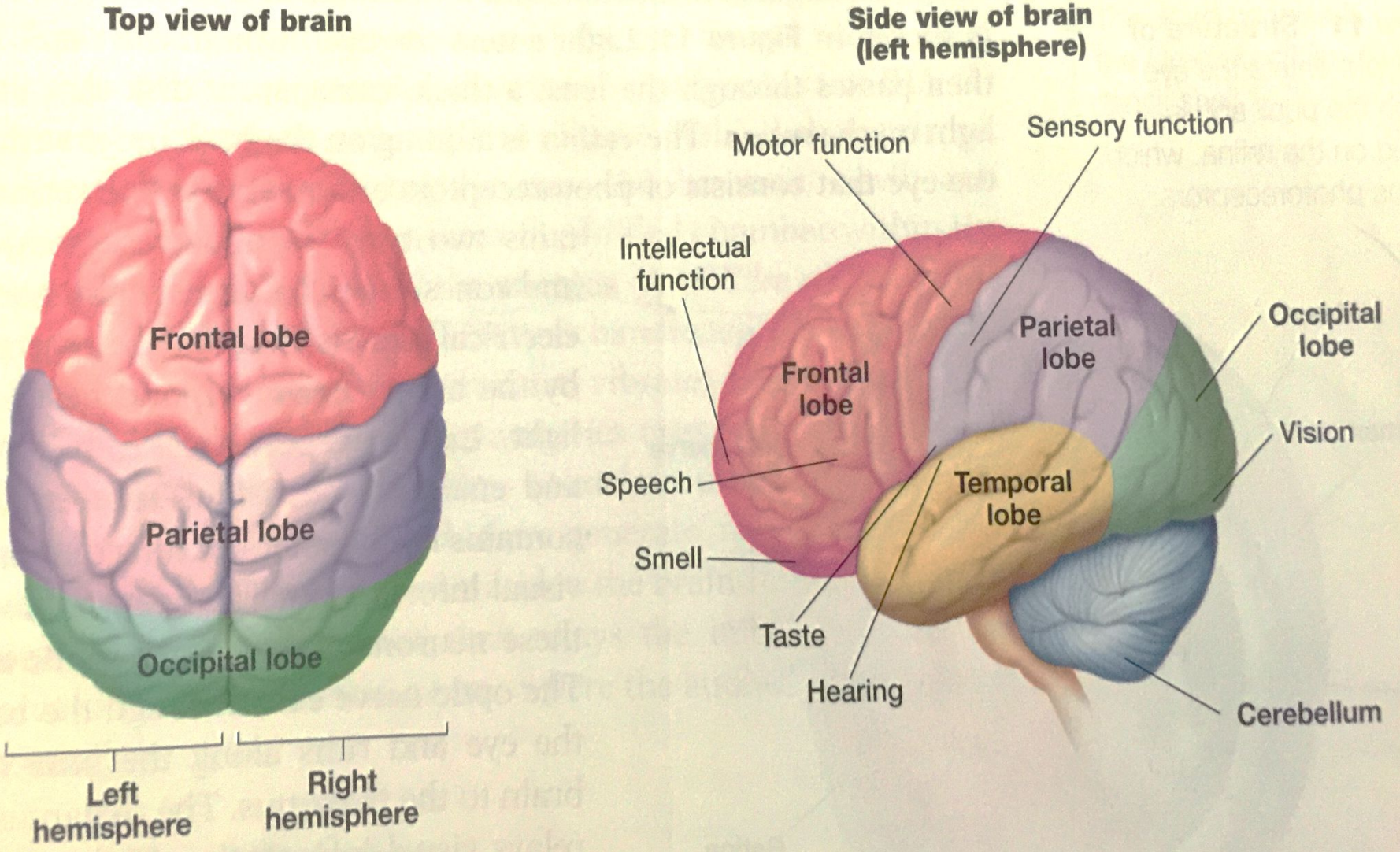
- **Sensory receptors:**
  - specialized neurons that detect stimuli and convert them to nerve impulses that can be interpreted by the brain.

Sensory neuron



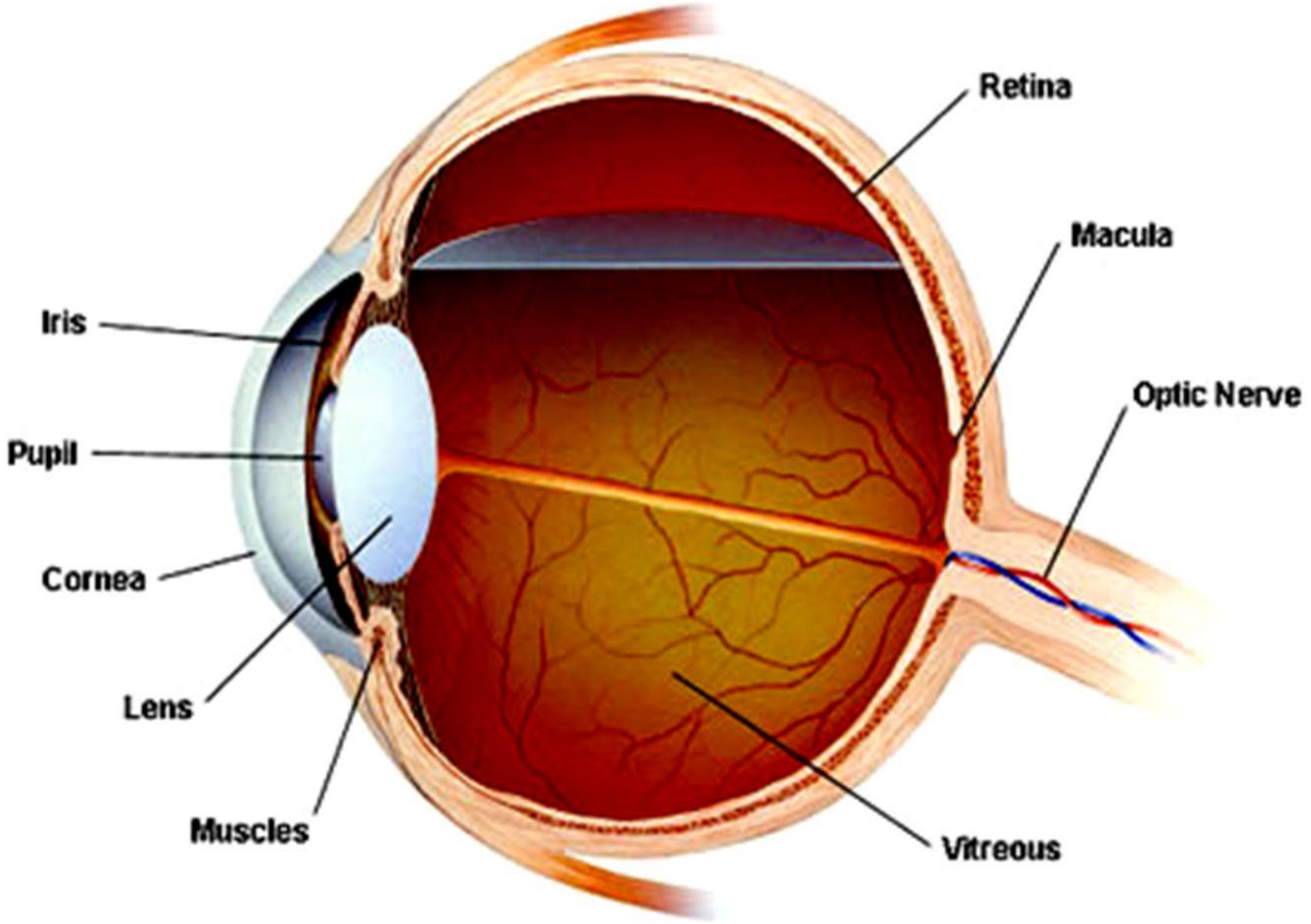
gure 10 Processing sites and lobes of the cerebral cortex

ecific areas of the cerebral cortex control different functions of the body.

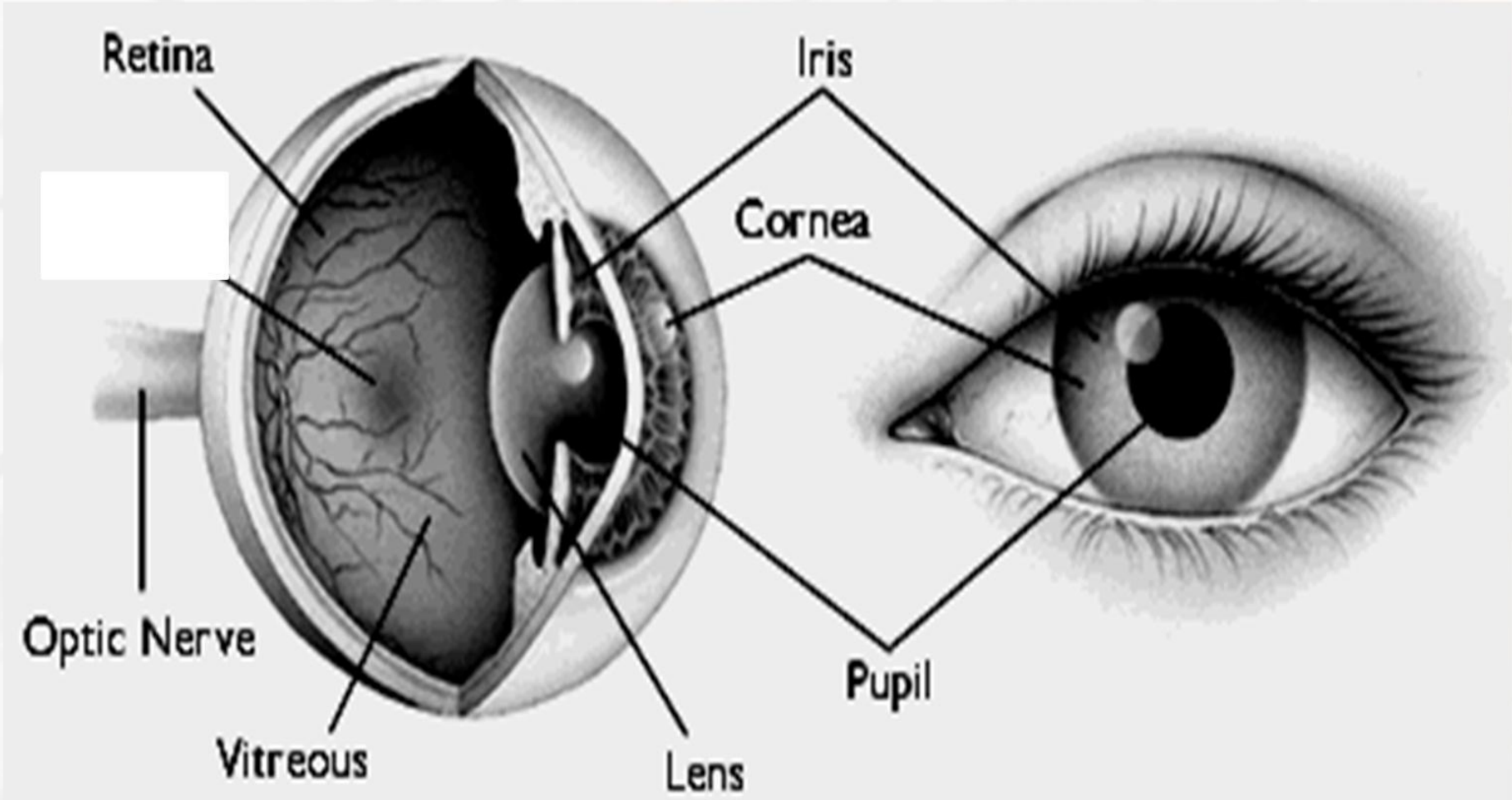


Eyes

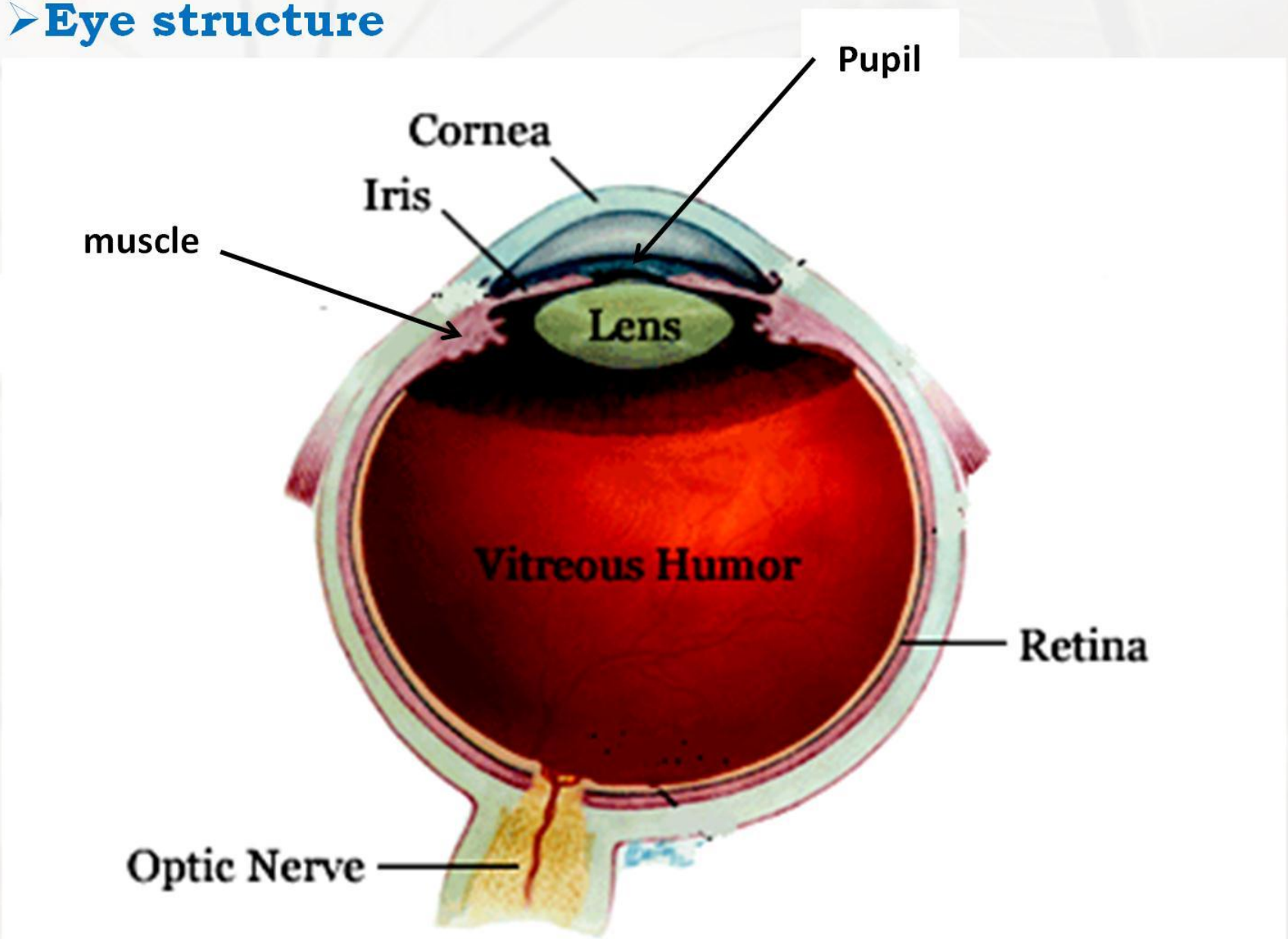
➢Eye structure



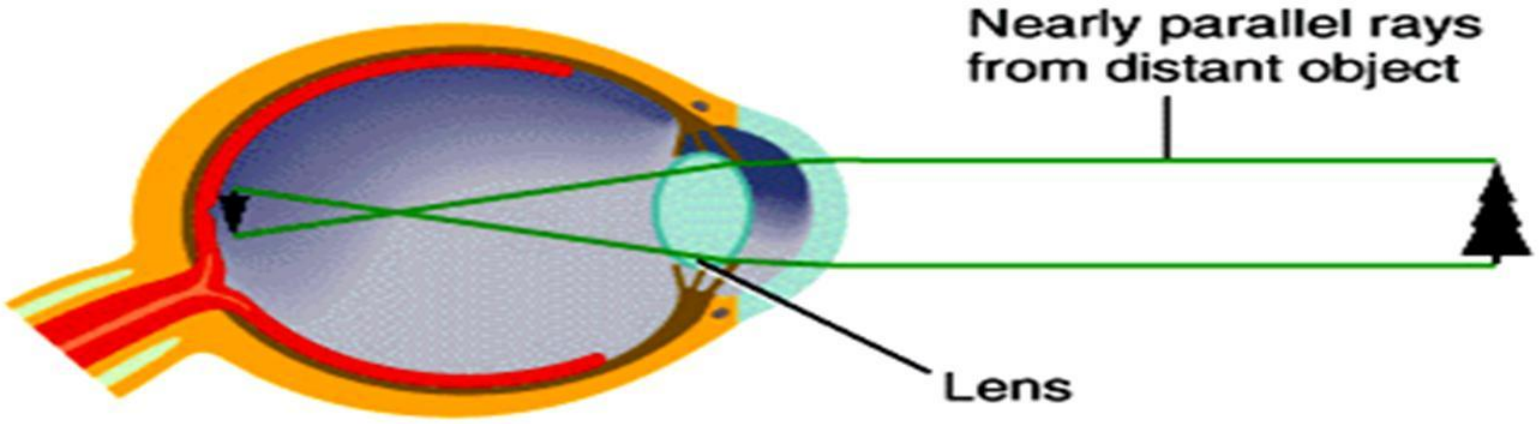
➢Eye structure



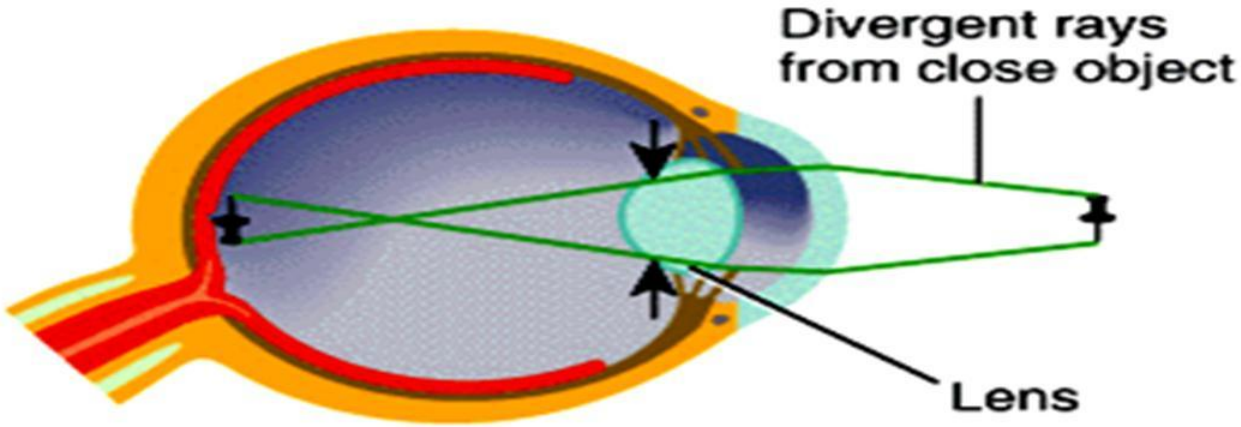
➢Eye structure



➢Eye structure



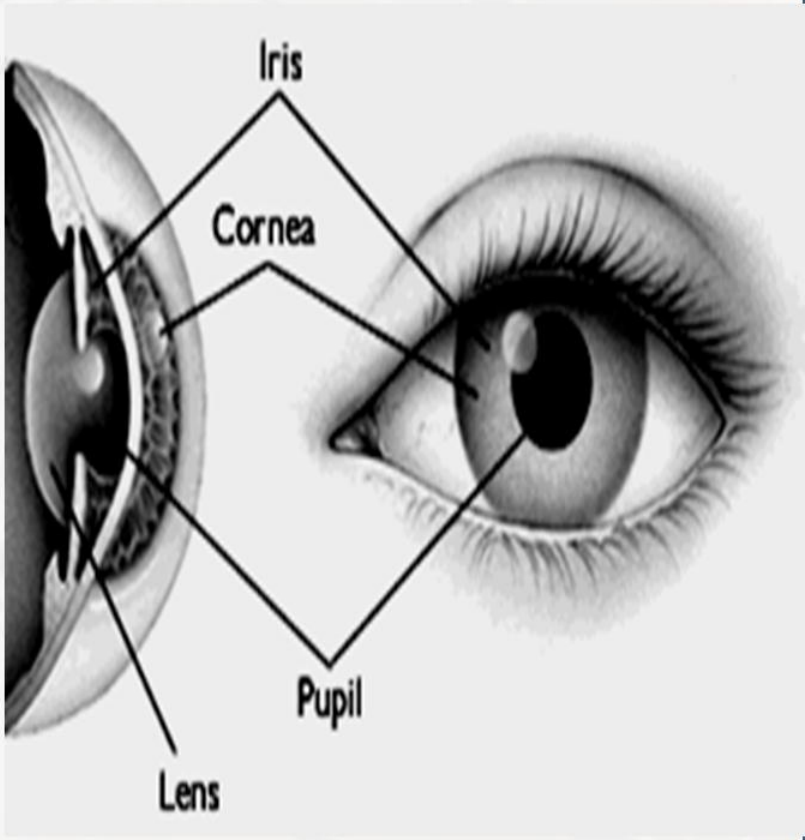
(b) Viewing distant object



(c) Accommodation

- **Eyes :**
- **Function:**
  - **enable us to see in color, distinguish fine details and movements.**

- **Structure of the eye :**
- **1- Cornea**
  - **Transparent structure (layer) covering the front of the eye, its where refraction of light occurs.**
- **2- pupil :**
  - **an opening in the iris through which light enters the eyes.**



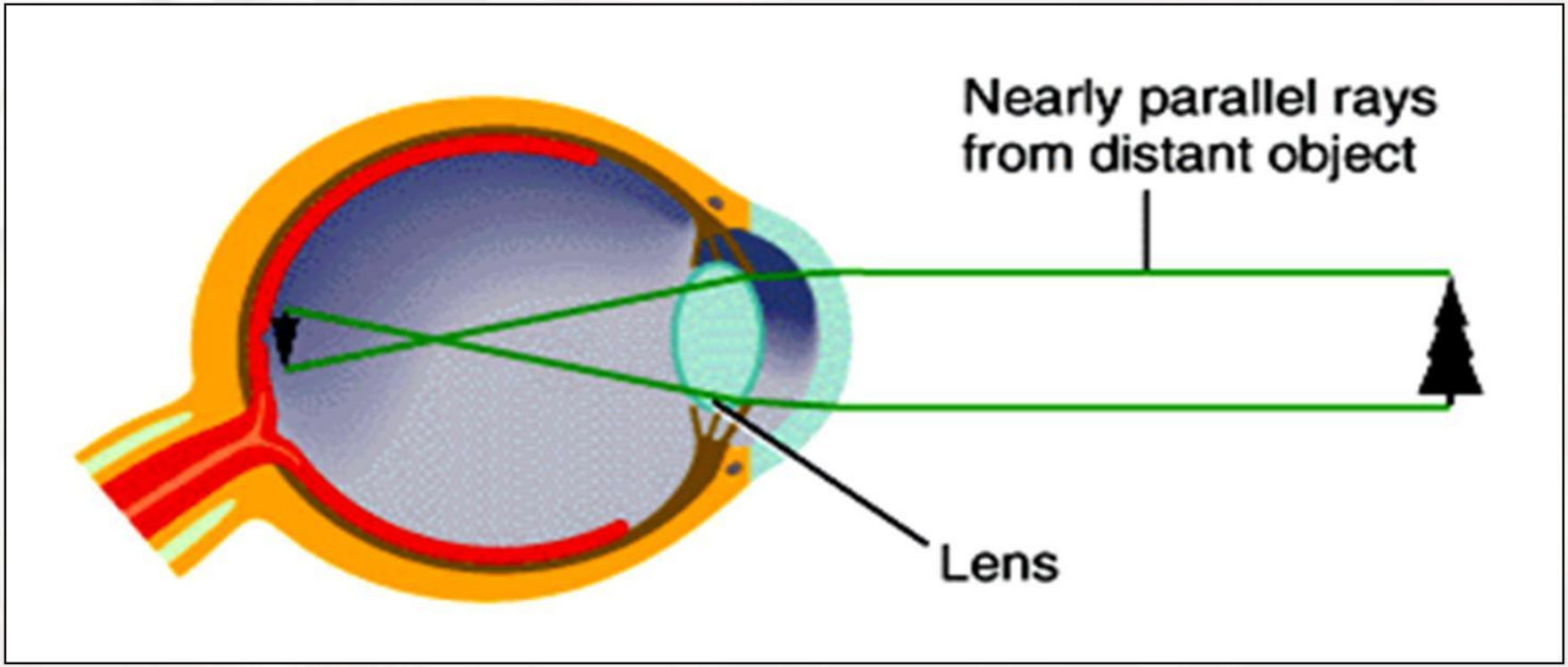
Eyes :

➢3- Iris:

- ➢a ring like muscular structure that surrounds the pupil and controls its size.
- ➢Located in front of lens.
- ➢Colored part of the eye.

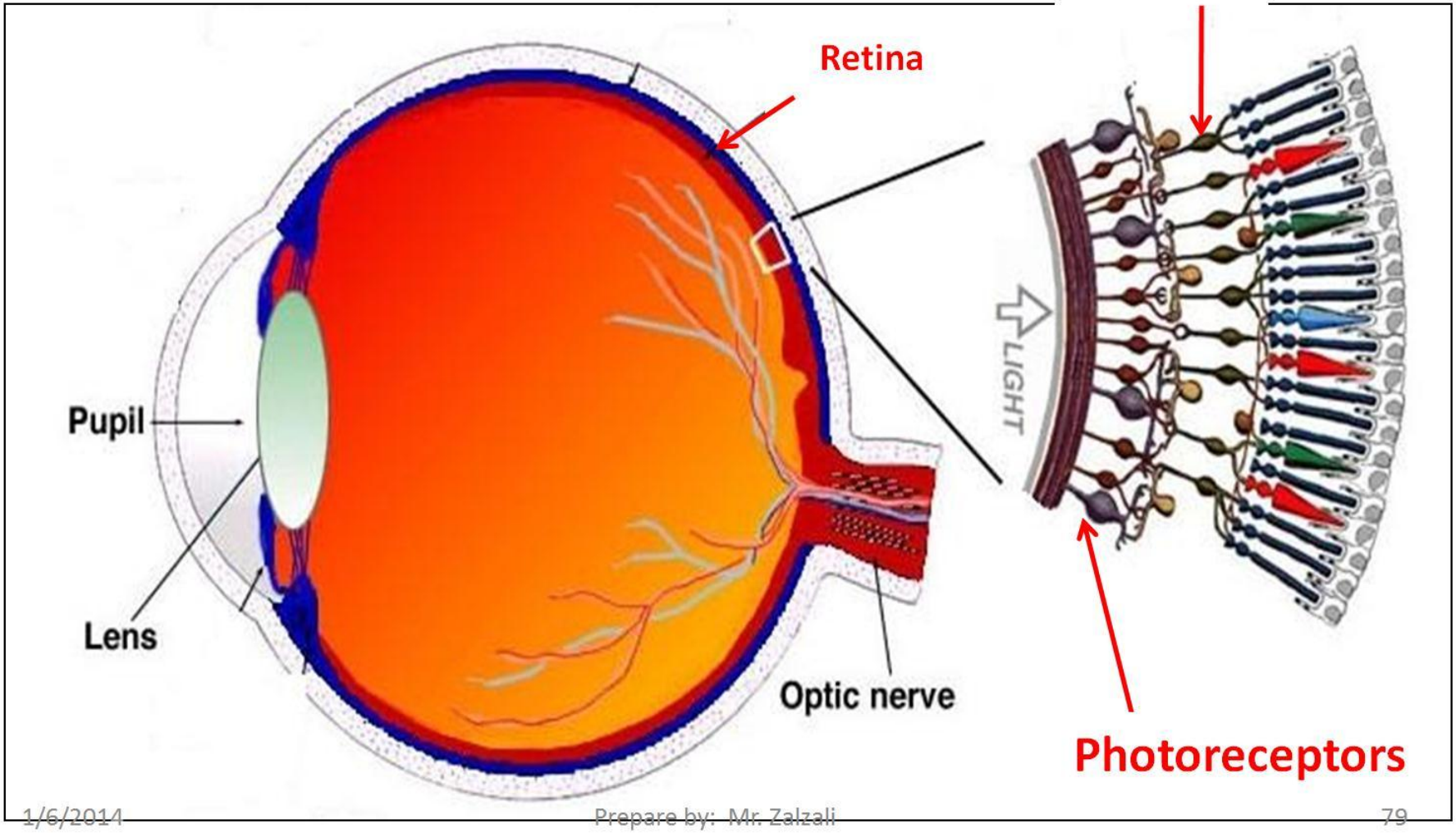
Eyes :

- **3- lens:**
  - **A thick, transparent disk that focuses light on the retina .**

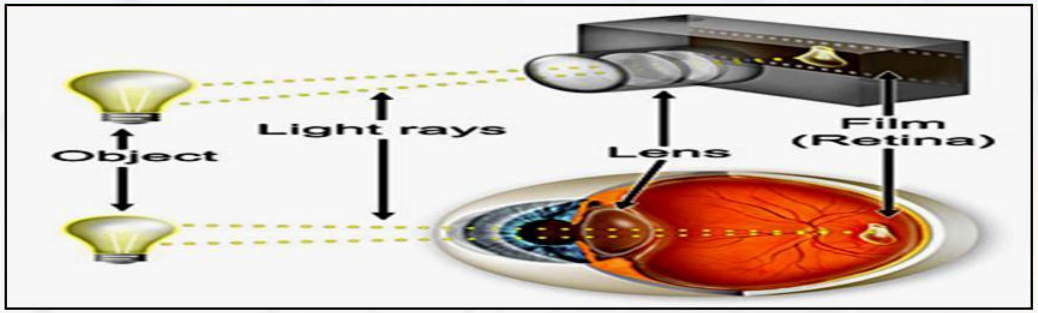


➢4-Retina :

➢Lining of **photoreceptors** and **neurons** on the back inner surface of the eye.

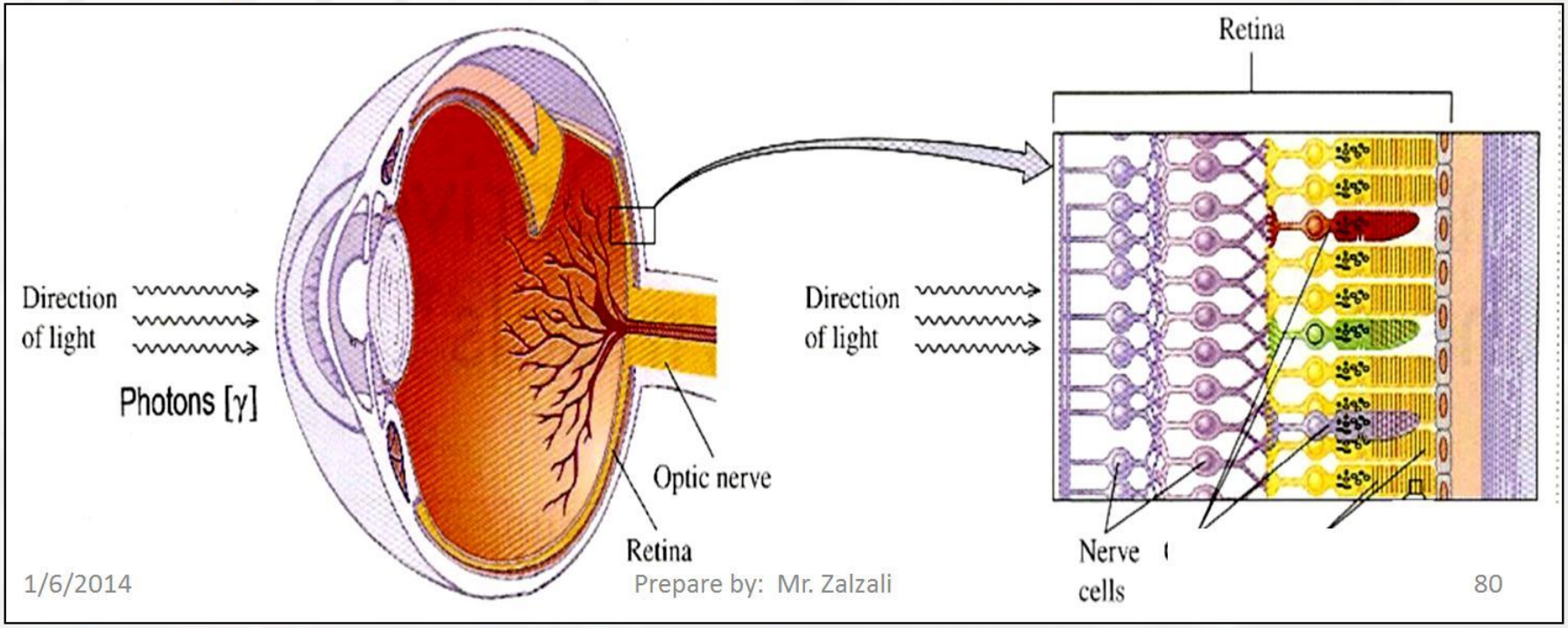


- **Function :**



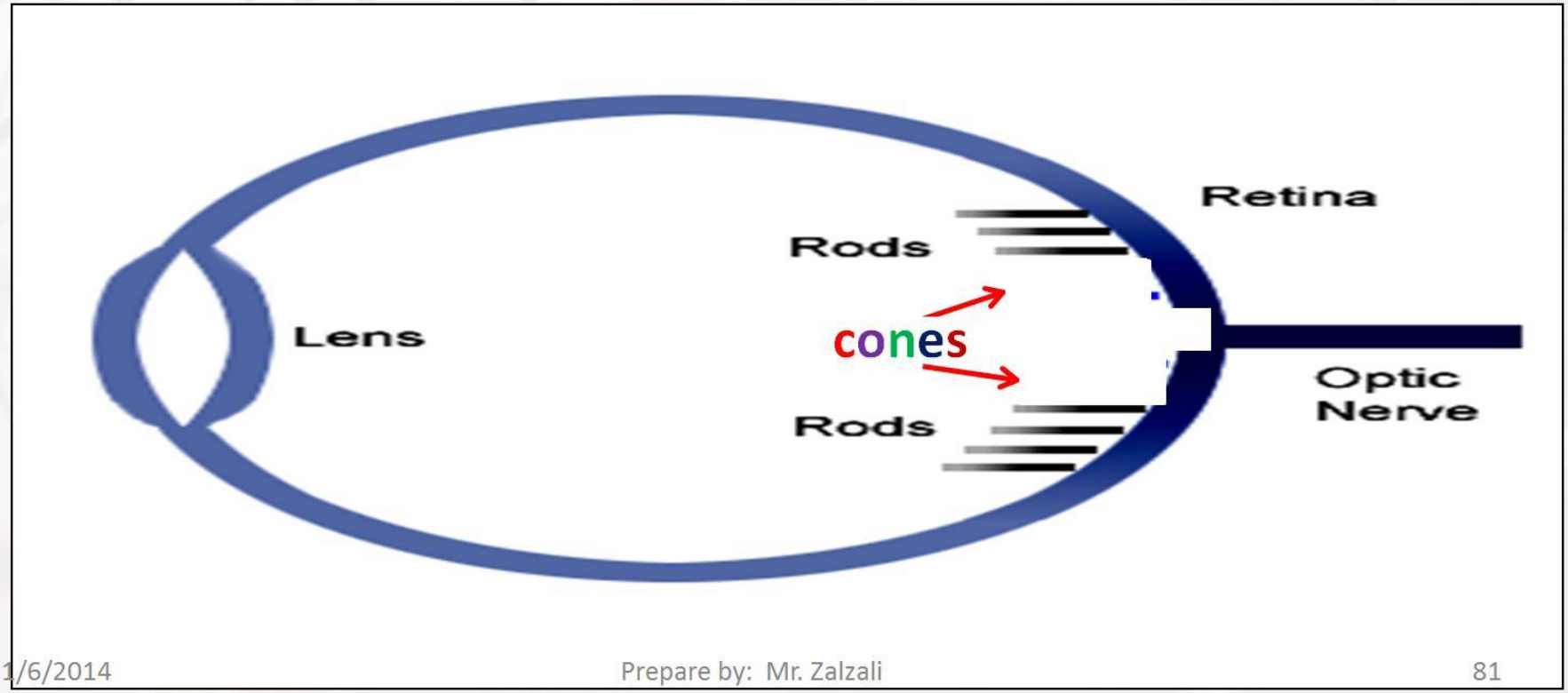
- **Photoreceptors**
  - convert light to nerve impulses that can be interpreted by the brain.

- **neurons**
  - process visual information

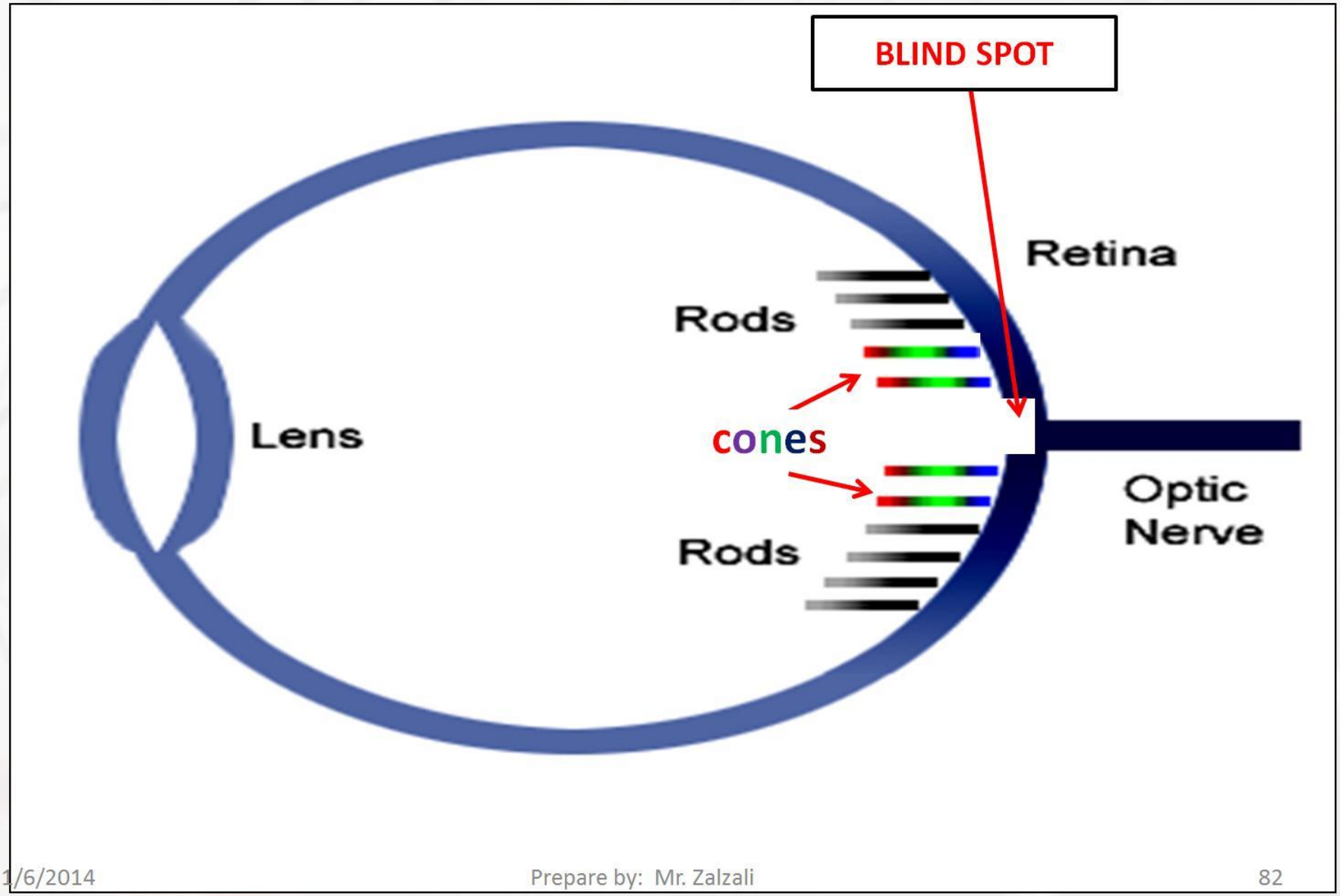


Two types of photoreceptors

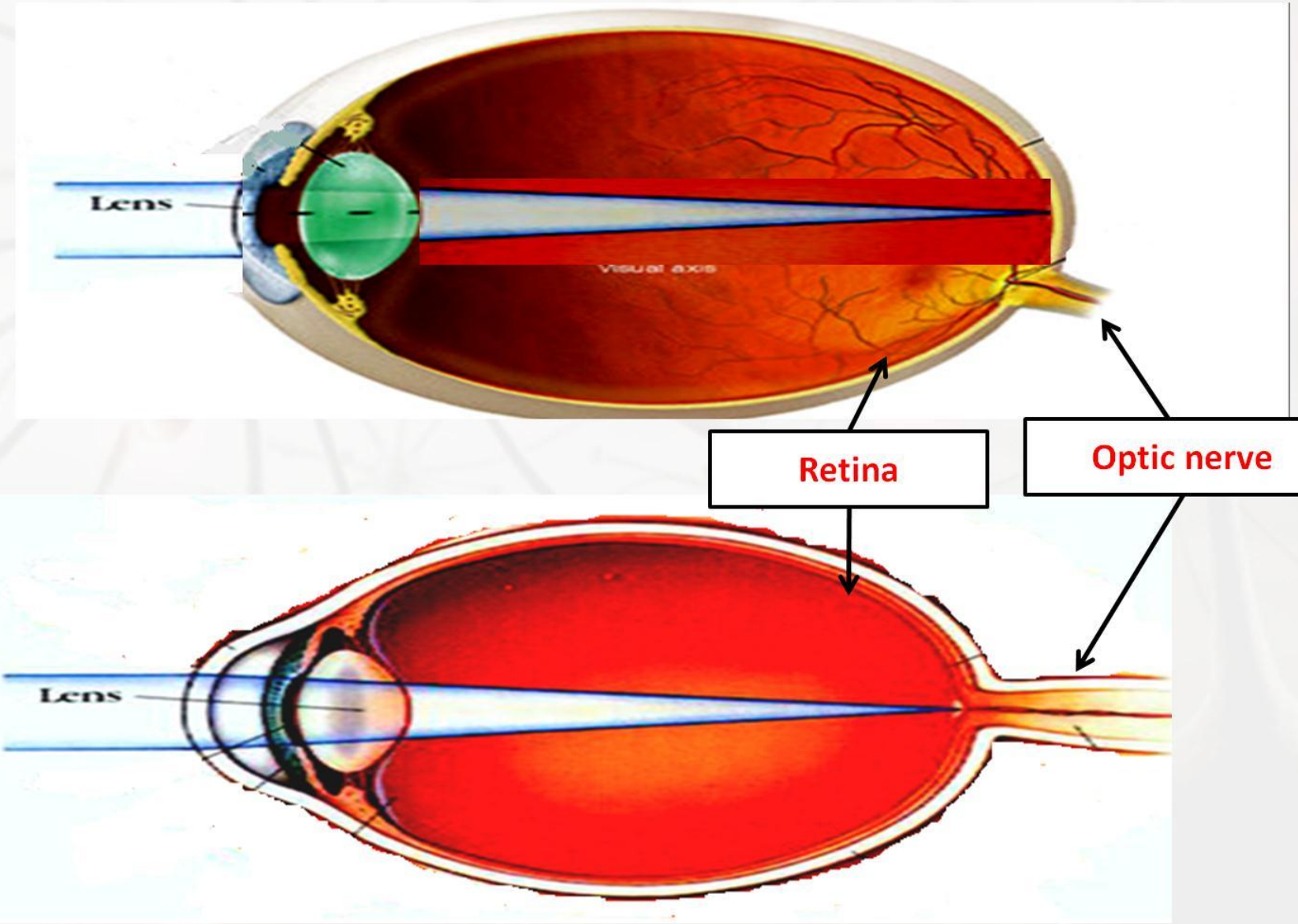
- **a- RODS :**
  - Respond best to dim light. (black and white)
- **b-CONES:**
  - Respond best to bright light and enable color vision.



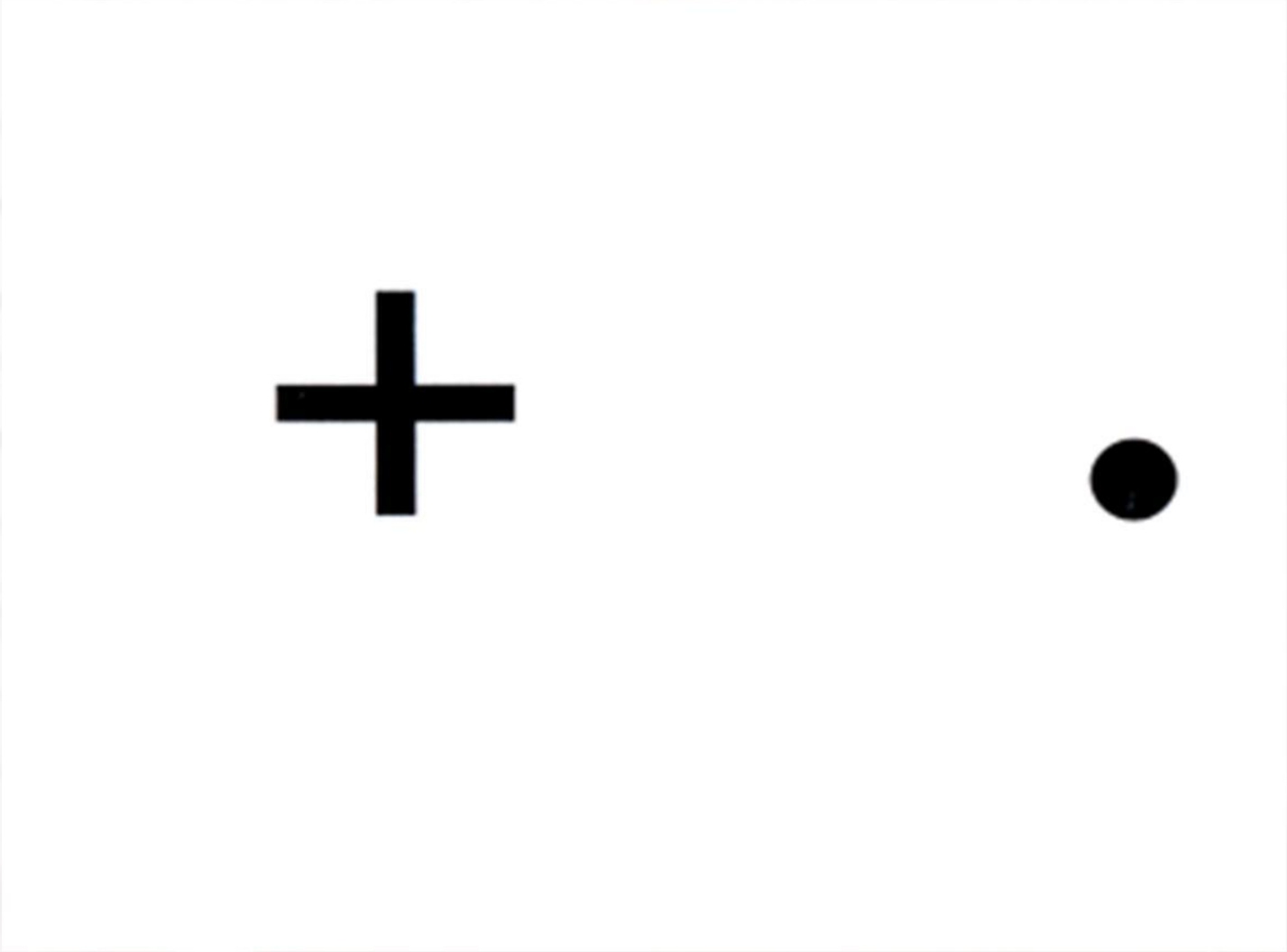
Blind spot



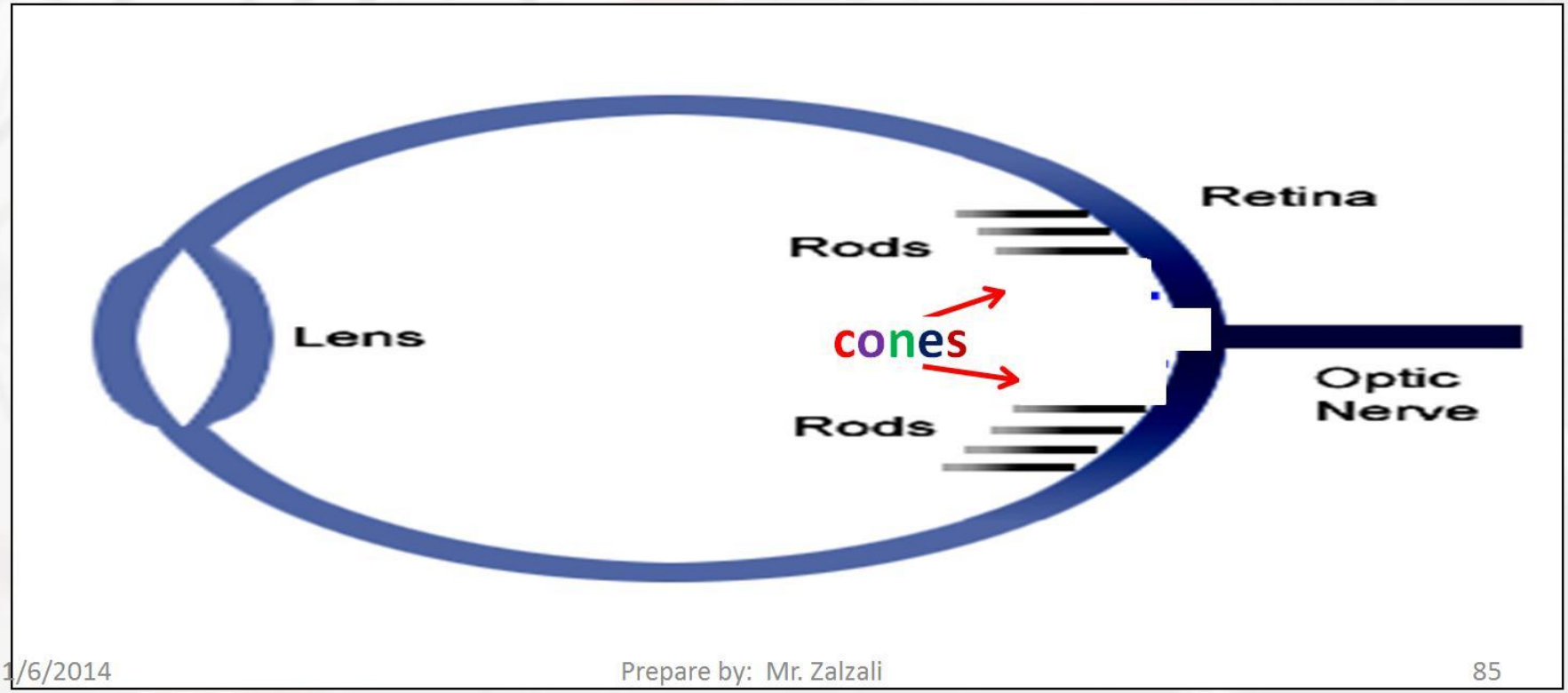
Blind spot



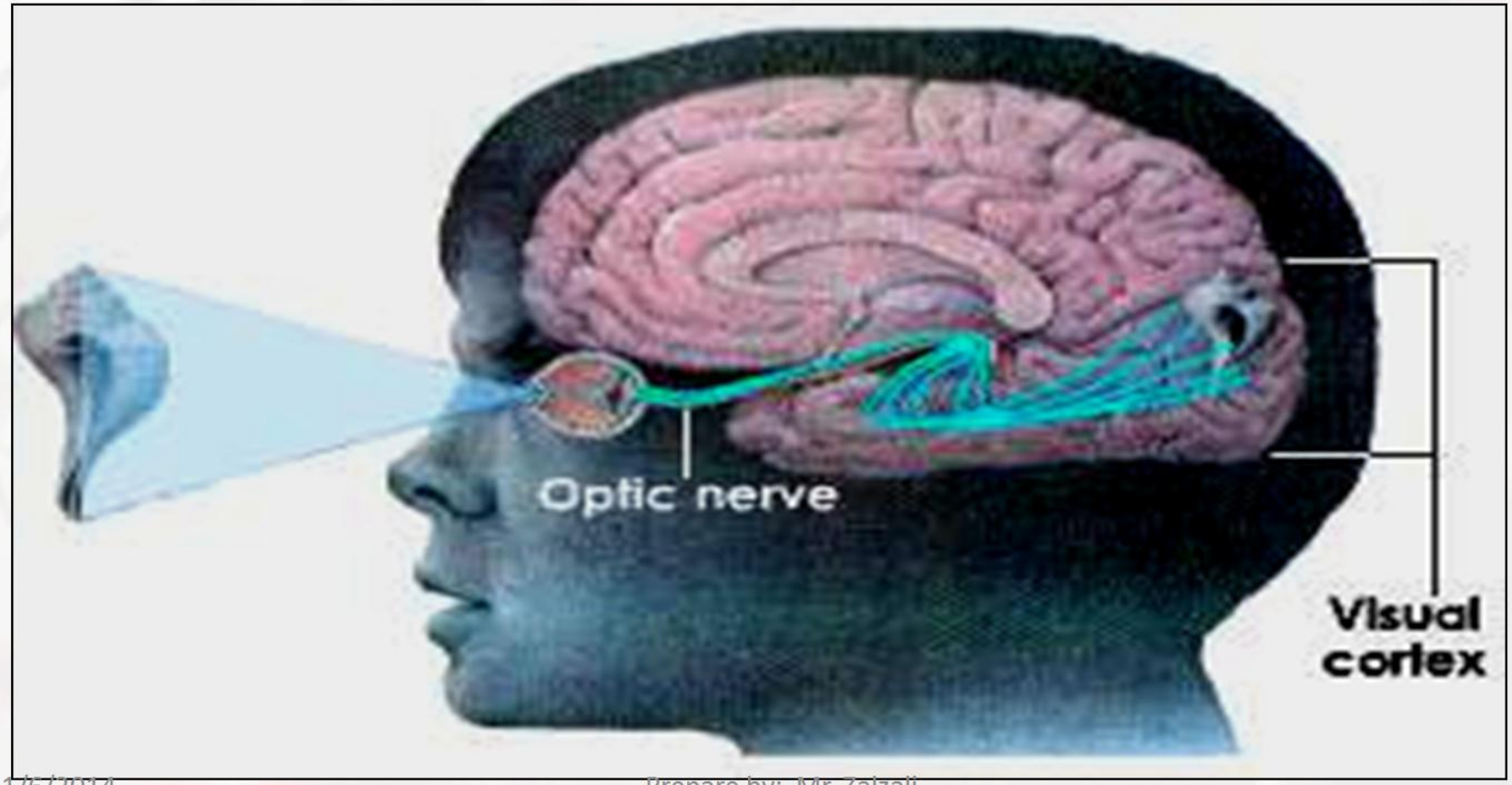
➢Demonstrating the blind spot



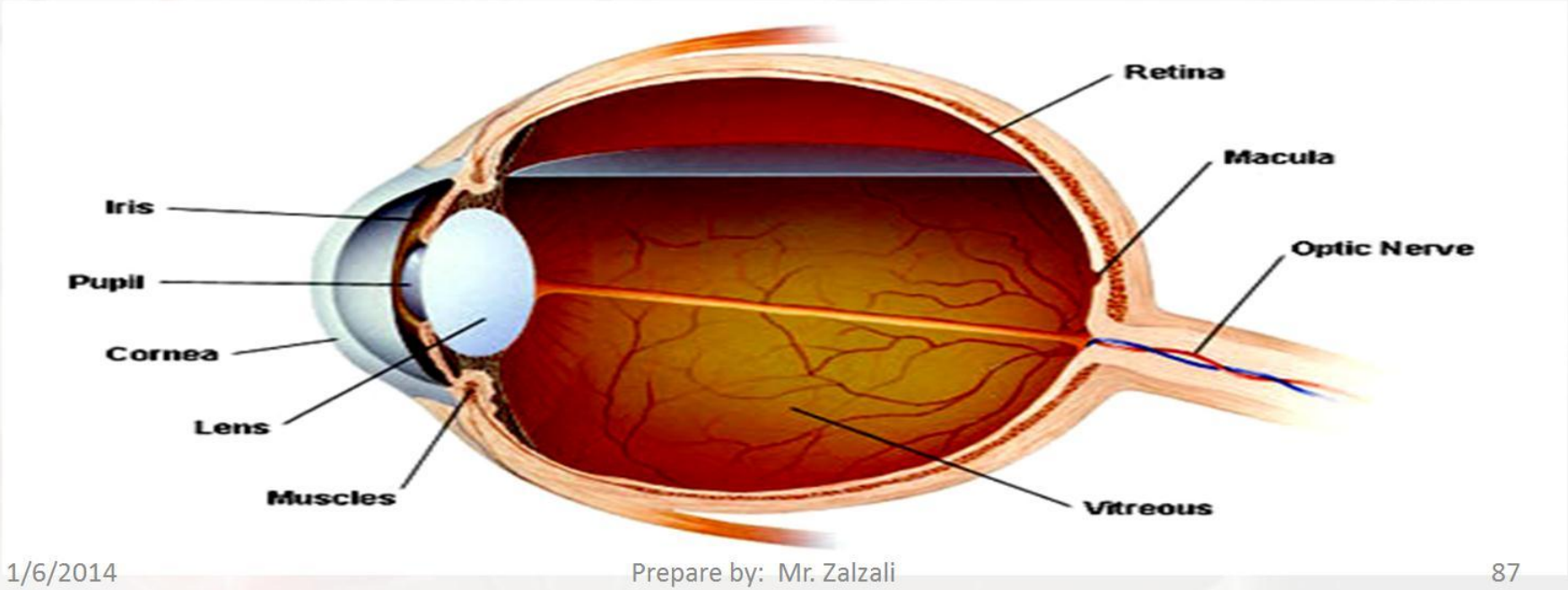
- **Blind spot:**
  - Is the site where the optic nerve exits the back of the eye.
  - There are no photoreceptors at this site.
  - When light is focused at this site → no image is imprinted.



- **6- optic nerve:**
  - It is made up of the axons of neurons in the retina
  - It exits through the back of the eye
  - It transfer the electrical impulses to the brain.



- **How do eyes help us to see ?**
- 1-light energy enters through pupil.
- 2- the lens focuses the image on the retina
- 3- the retina converts light energy to nerve impulses
- 4- nerve impulses move to the brain via the optic nerve
- The brain process the visual information, and vision occurs

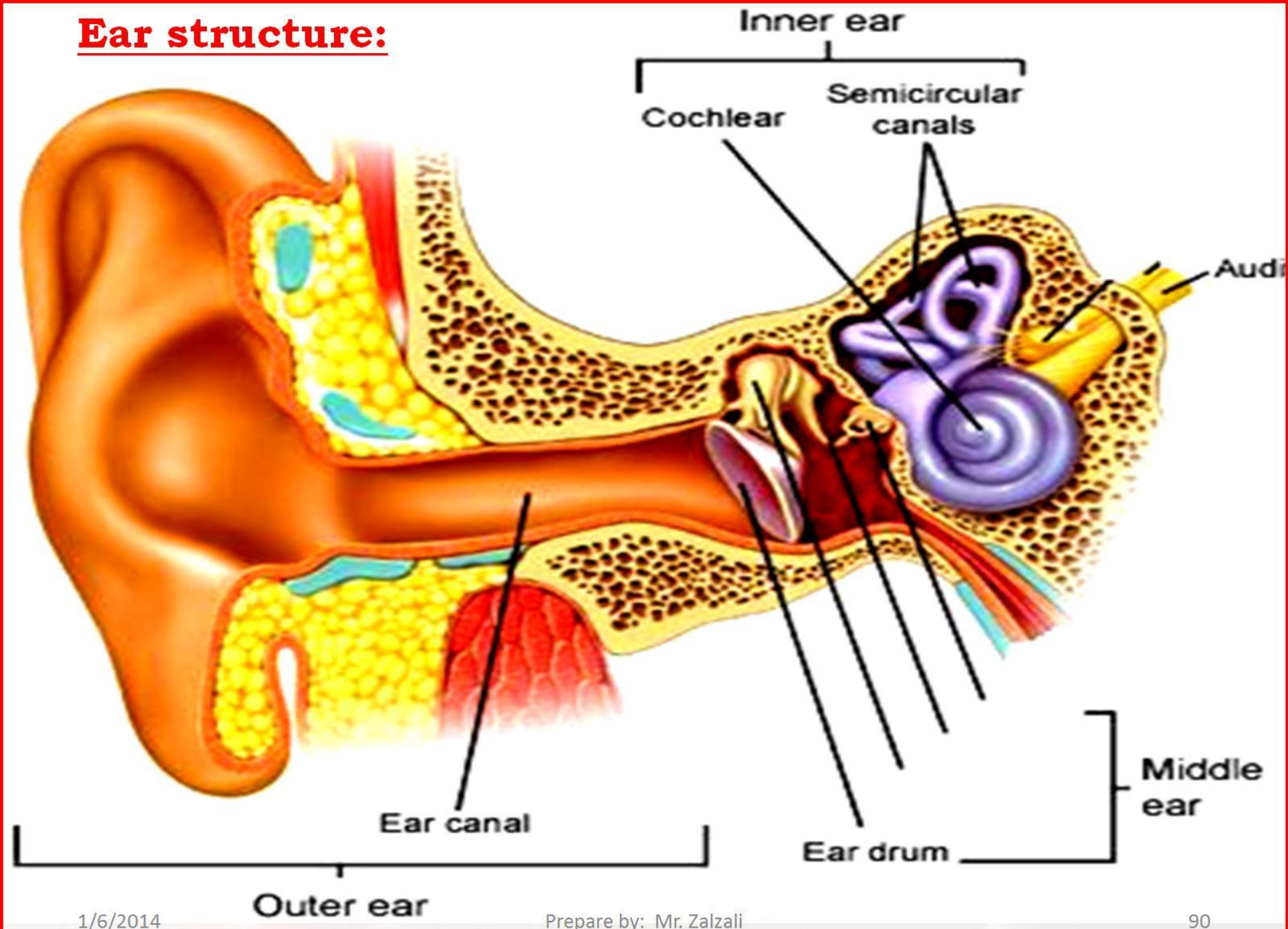


Ears

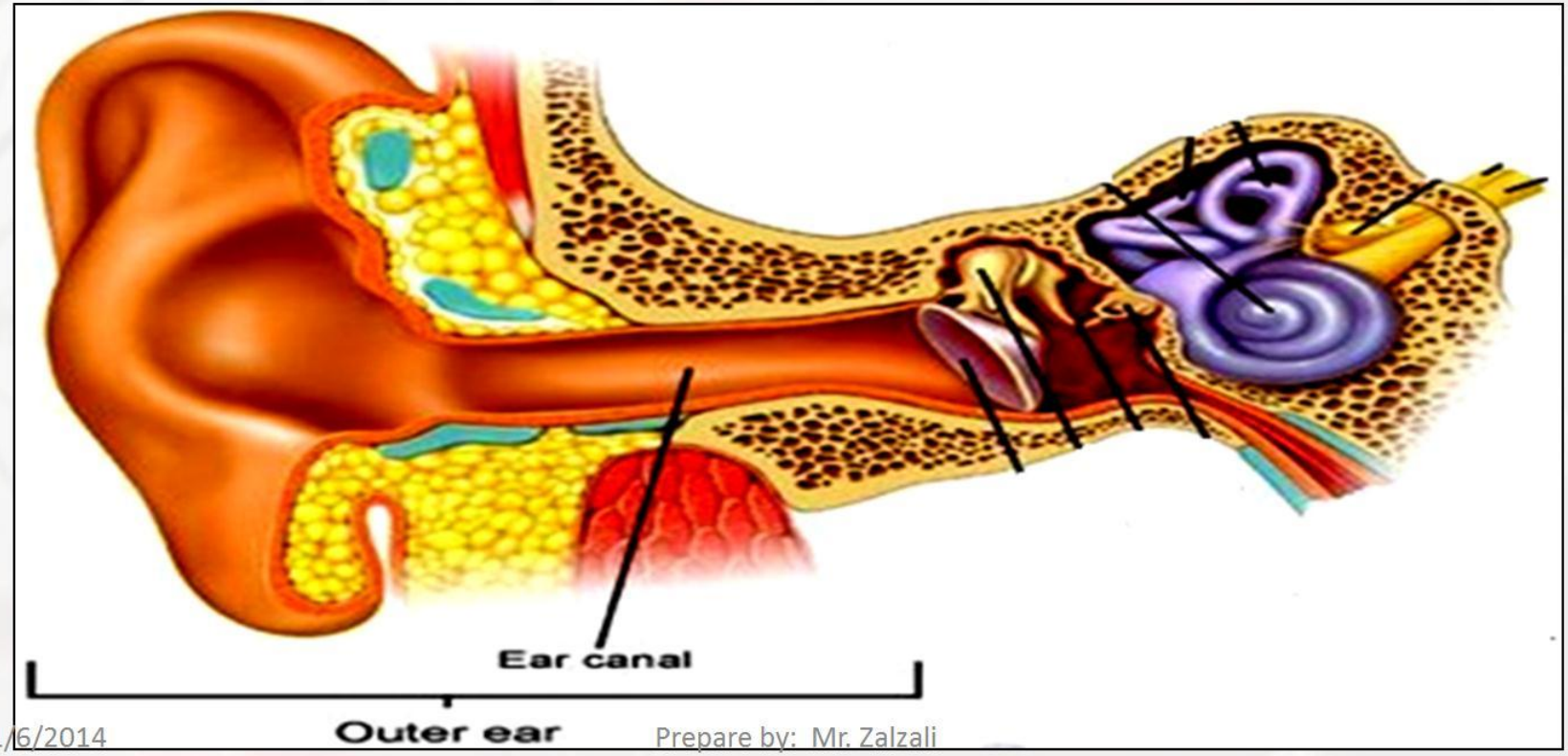
→ *Function :*

→ *Converts sound energy to electrical energy signals that can be interpreted by the brain*

Ear structure:



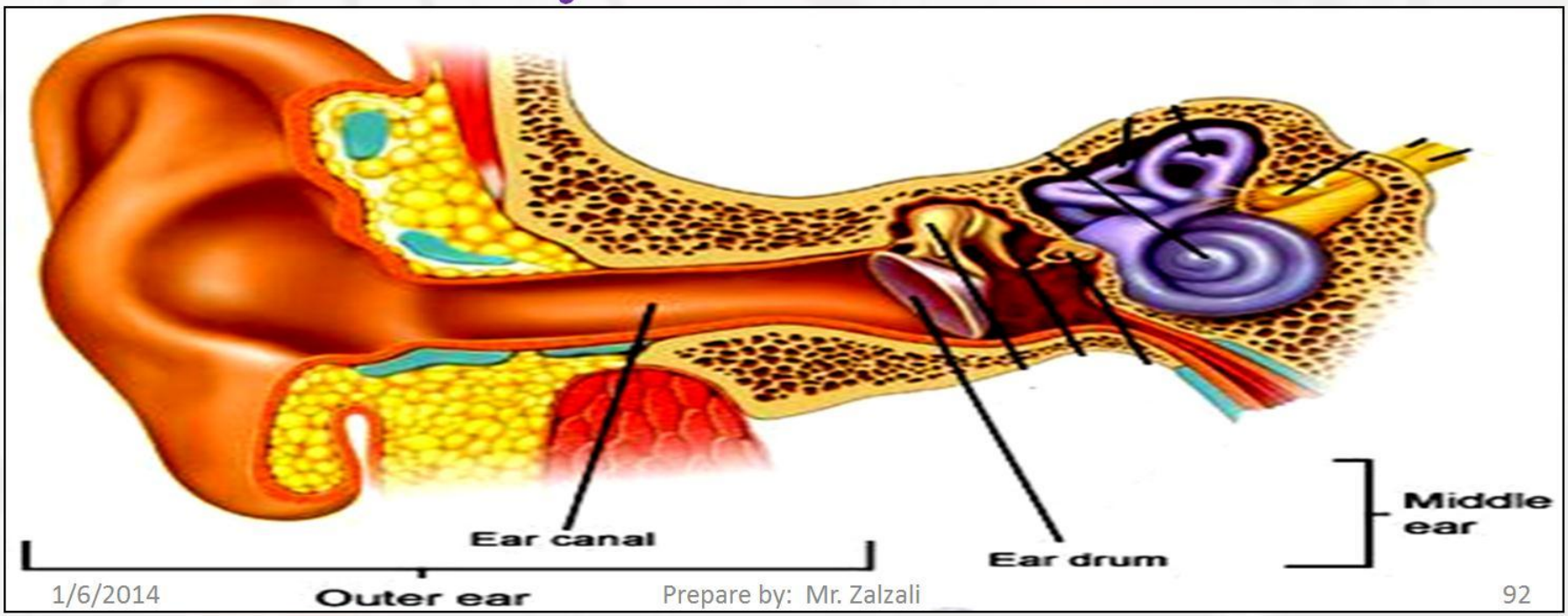
- **Structure of the ear:**
  - **1- Outer ear :**
    - **The part that is outside the body.**
    - **Ear canal :**
      - **a tube through which sound waves enter.**



➢Structure of the ear:

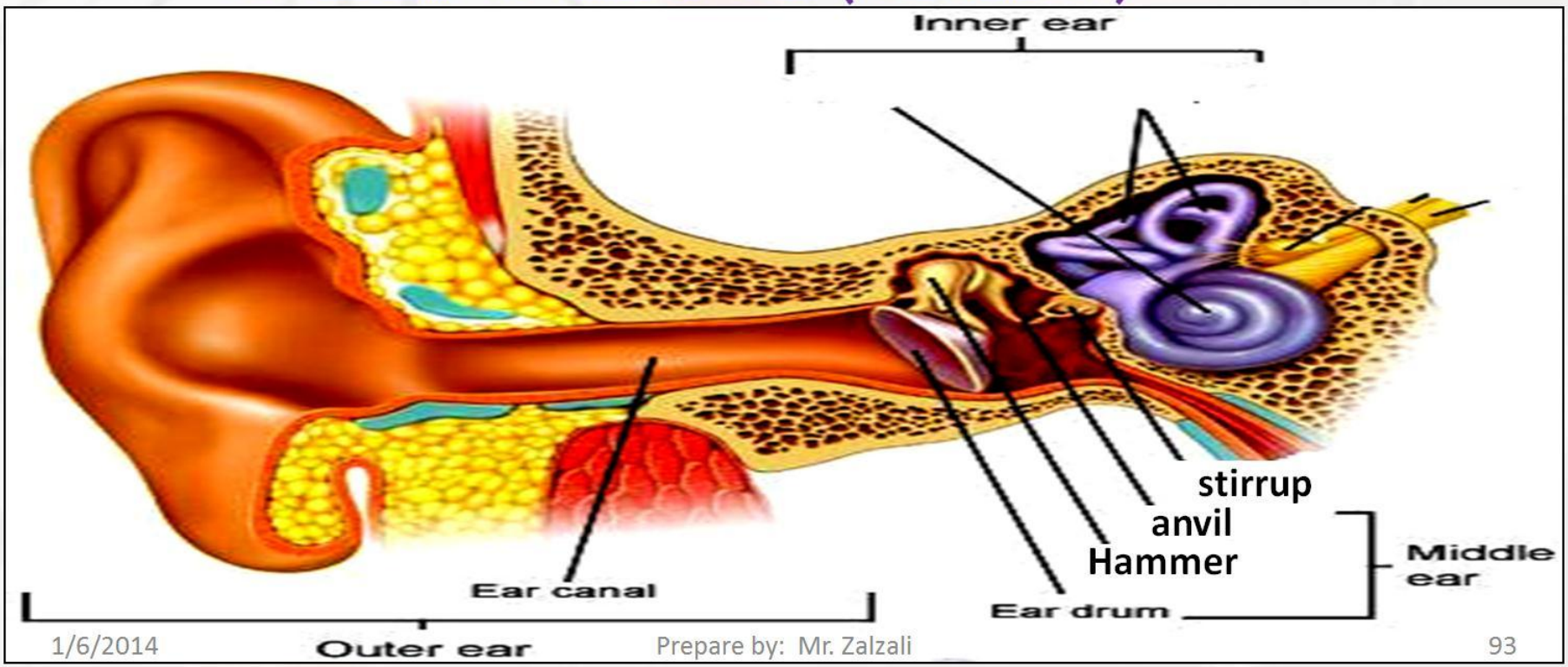
➢ 2- Tympanic membrane (Eardrum)

- ➢A membrane stretched at the end of the ear canal,
- ➢vibrates when stroked by sound.
- ➢Separates the ear canal from the middle ear cavity.



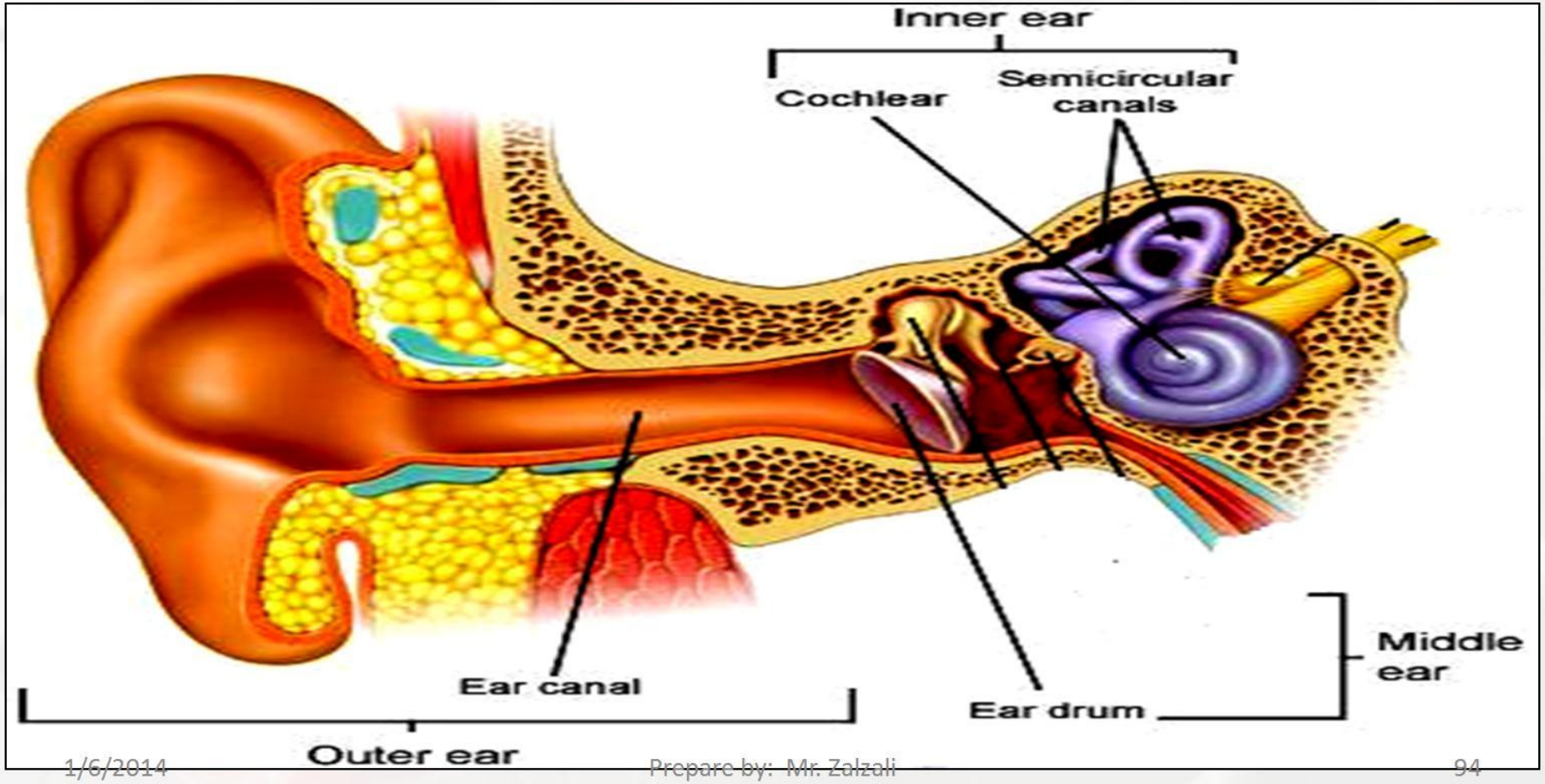
Structure of the ear:

- **3- middle ear:**
  - Located behind the eardrum
  - Contains three small bones
    - 1- hammer 2- anvil 3- stirrup
  - Middle ear bones transfer vibrations from eardrum to inner ear (cochlea)

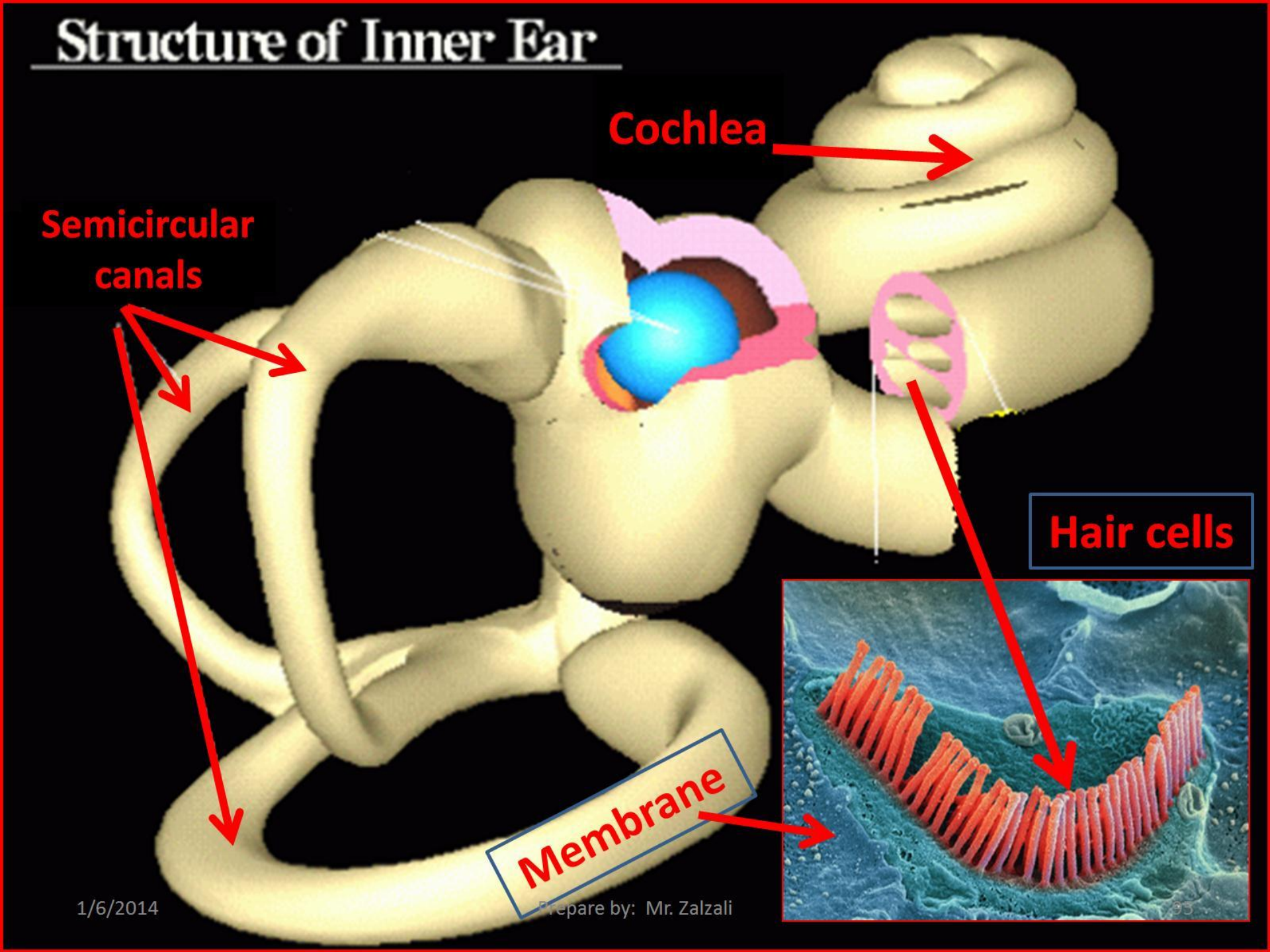


Structure of the ear:

- **3- Inner ear:**
  - 1- Cochlea
  - 2-semicircular canals

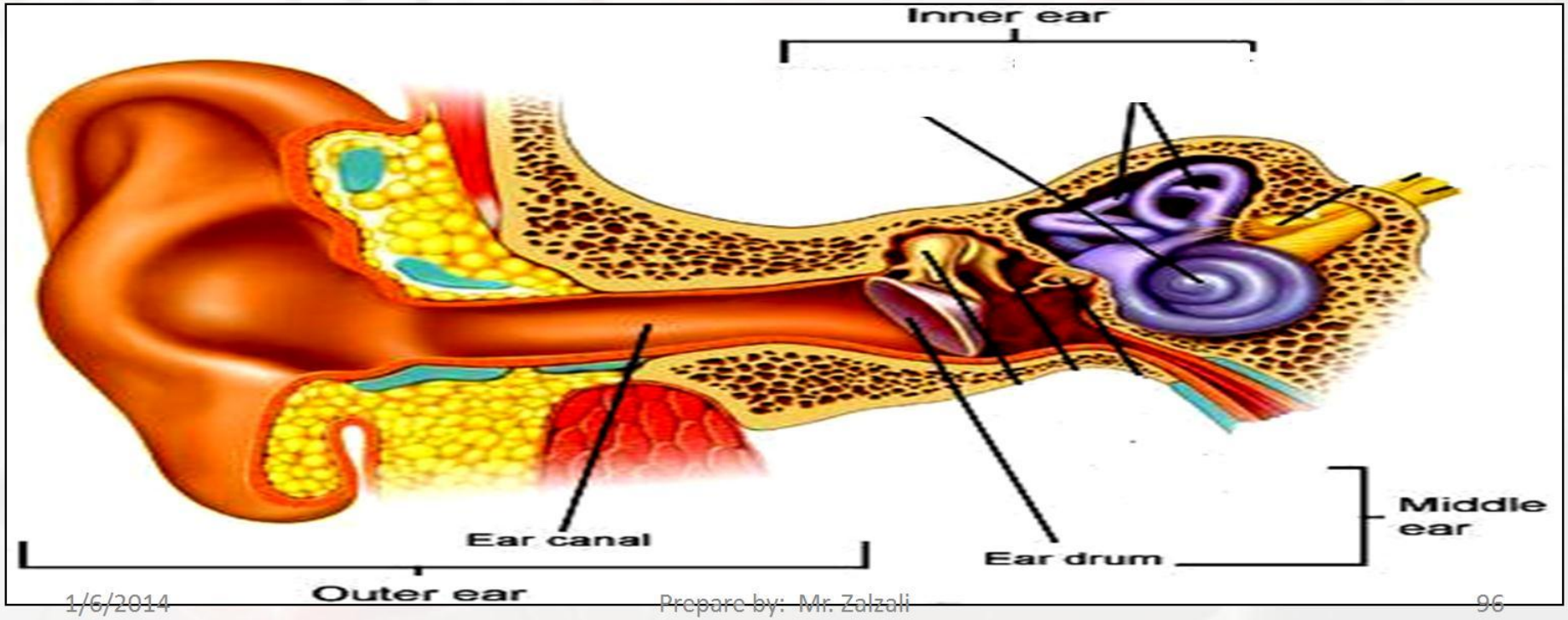


Structure of Inner Ear



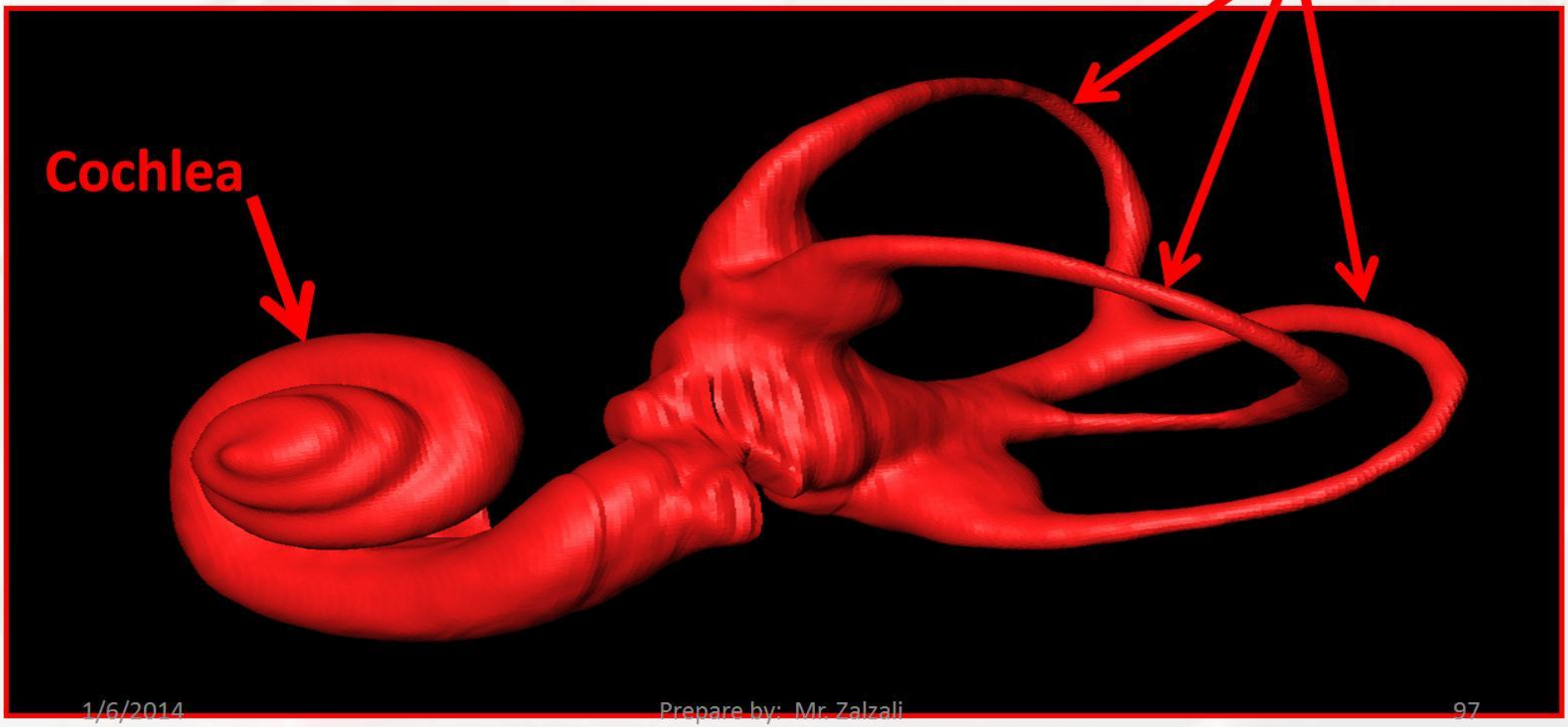
Structure of the ear:

- **3- Inner ear:**
- **A- Cochlea:**
  - **Fluid filled chamber coiled like snail's shell.**
  - **Contains "mechanoreceptors" called HAIR CELLS attached to a membrane that vibrates when waves enter the cochlea.**



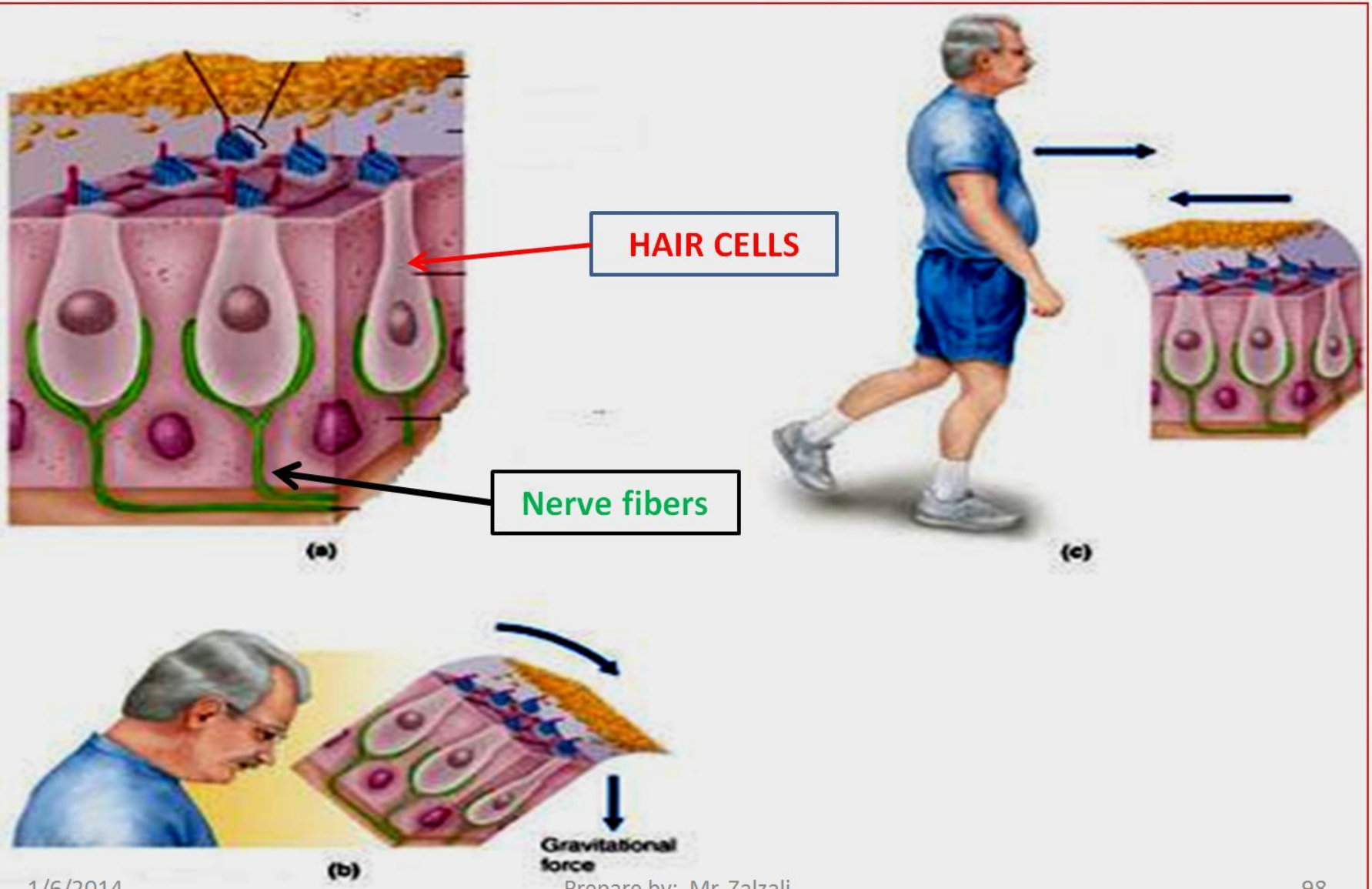
Structure of the ear:

- 3- Inner ear:
- B- Semicircular canals:



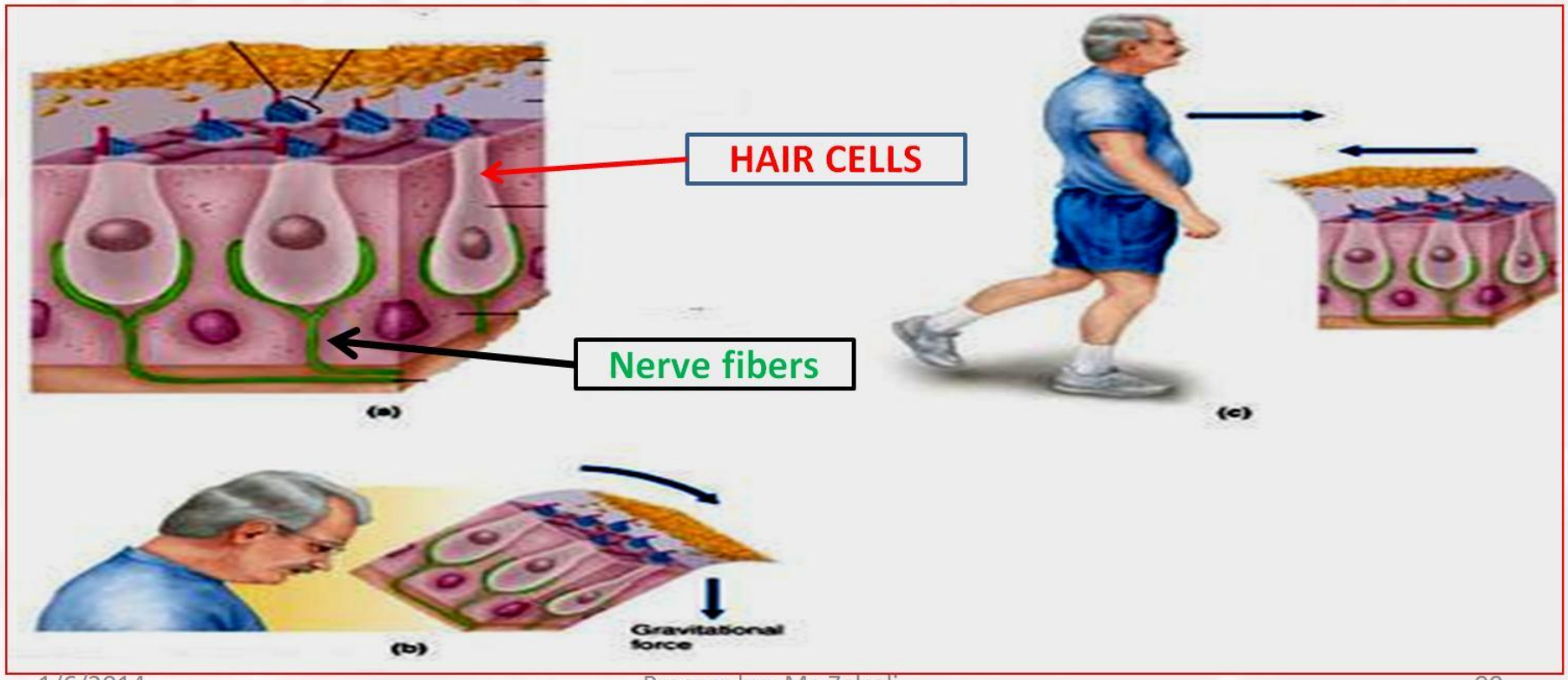
➢B- Semicircular canals:

➢Maintenance of equilibrium:



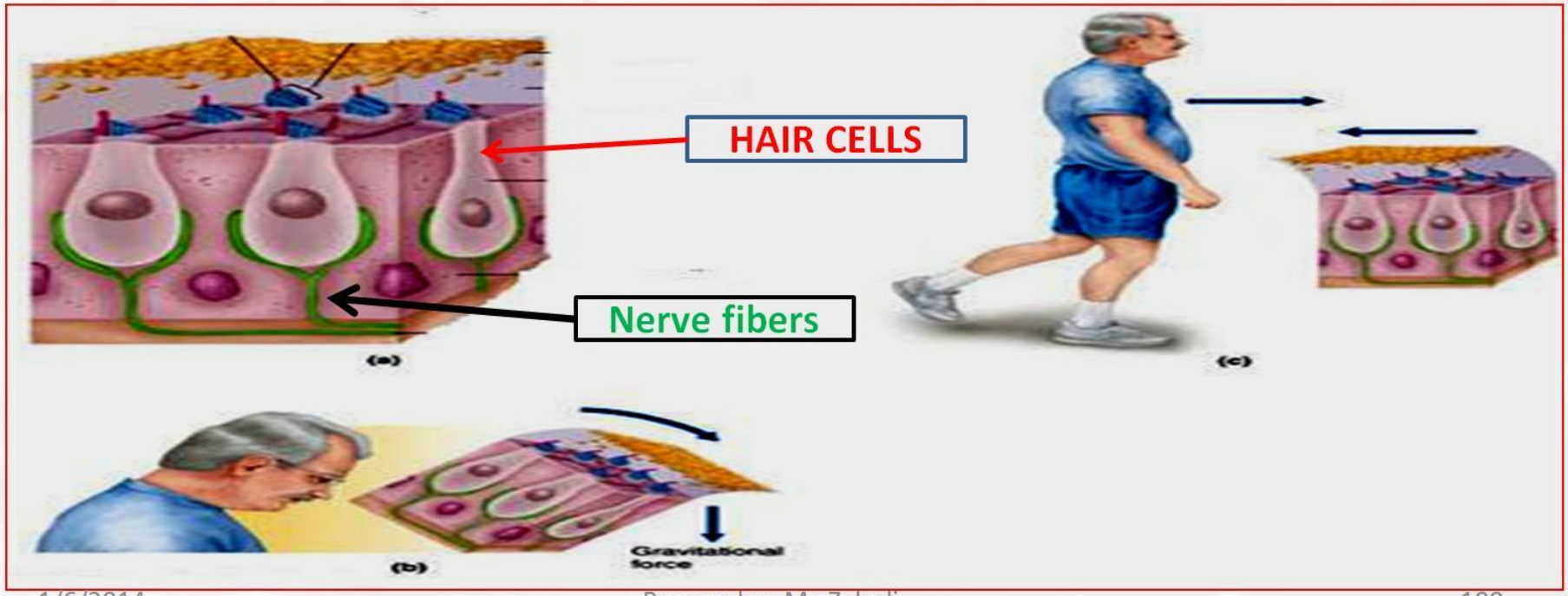
Structure of the ear:

- **3- Inner ear:**
- **b- Semicircular canals:**
  - **Fluid filled chambers**
  - **Contain hair cells that respond to head position with respect to gravity to maintain equilibrium.**



How to maintain equilibrium?

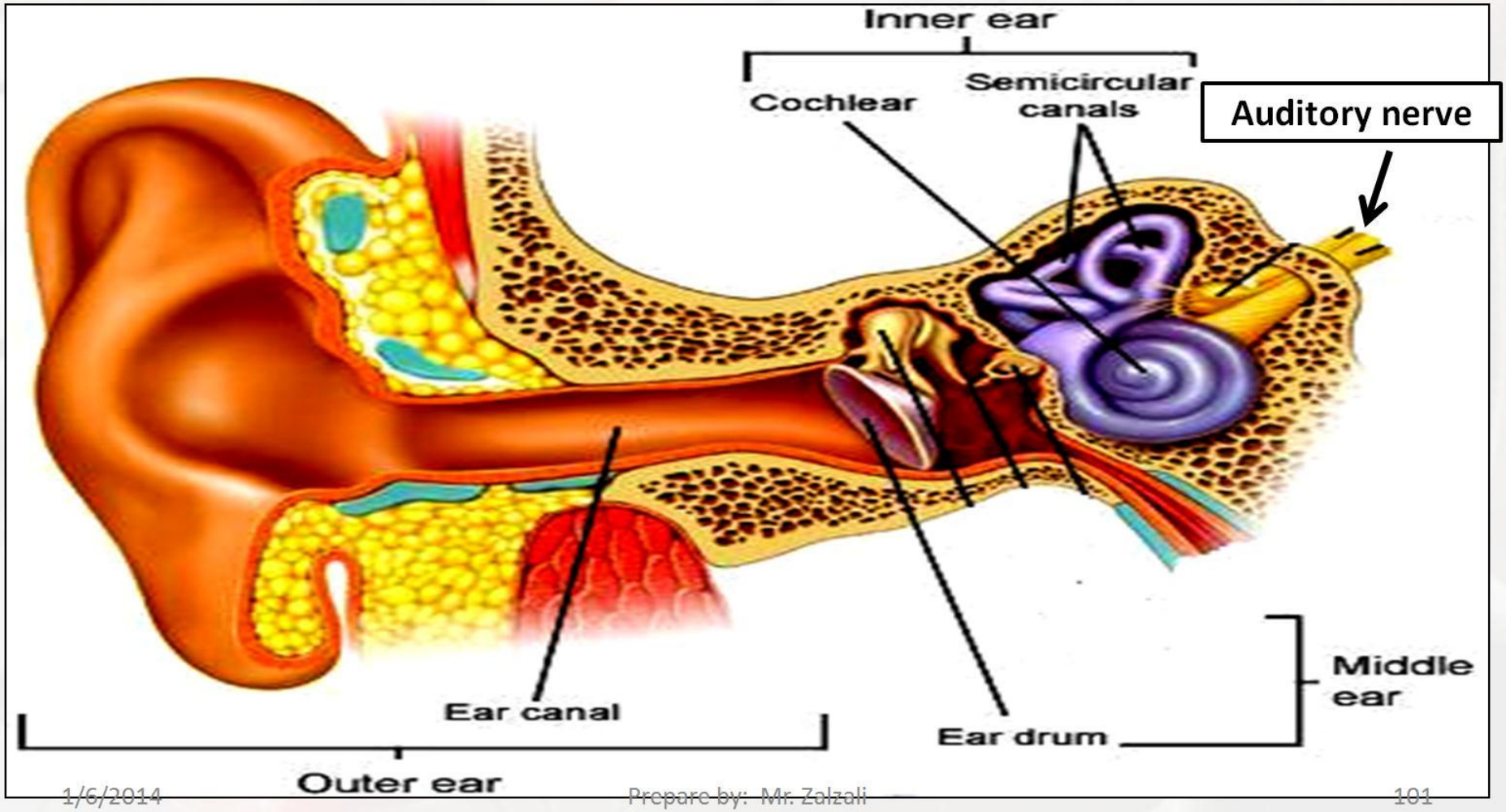
- 1- when head/body moves.
- 2- fluids inside these canals move.
- 3- hair cells stimulated by fluids movement and generate impulses.
- 4- impulses enable the brain to determine orientation and position of the head.



Structure of the ear:

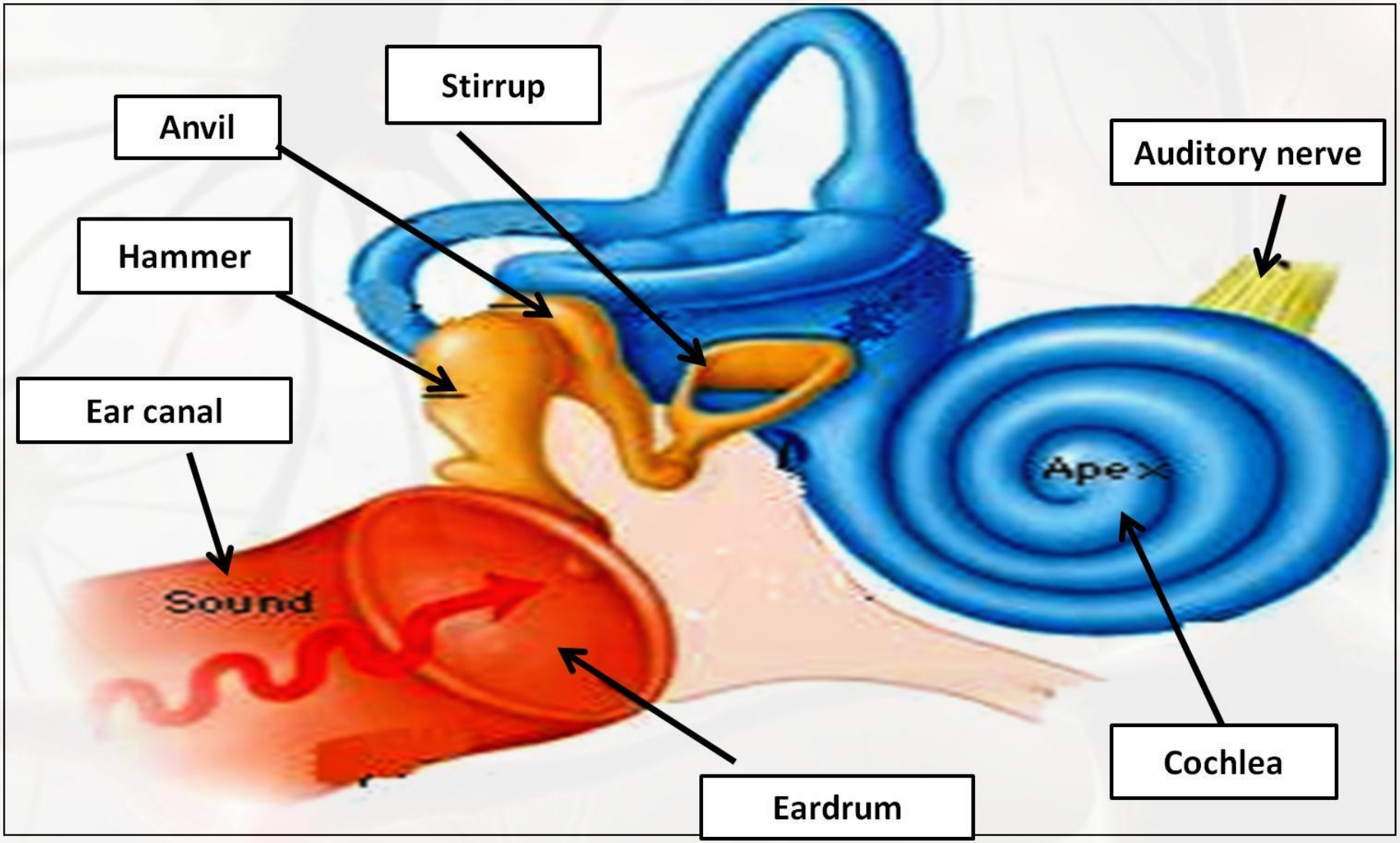
4- Auditory nerve:

- A nerve that carries impulses from cochlea to brain stem.



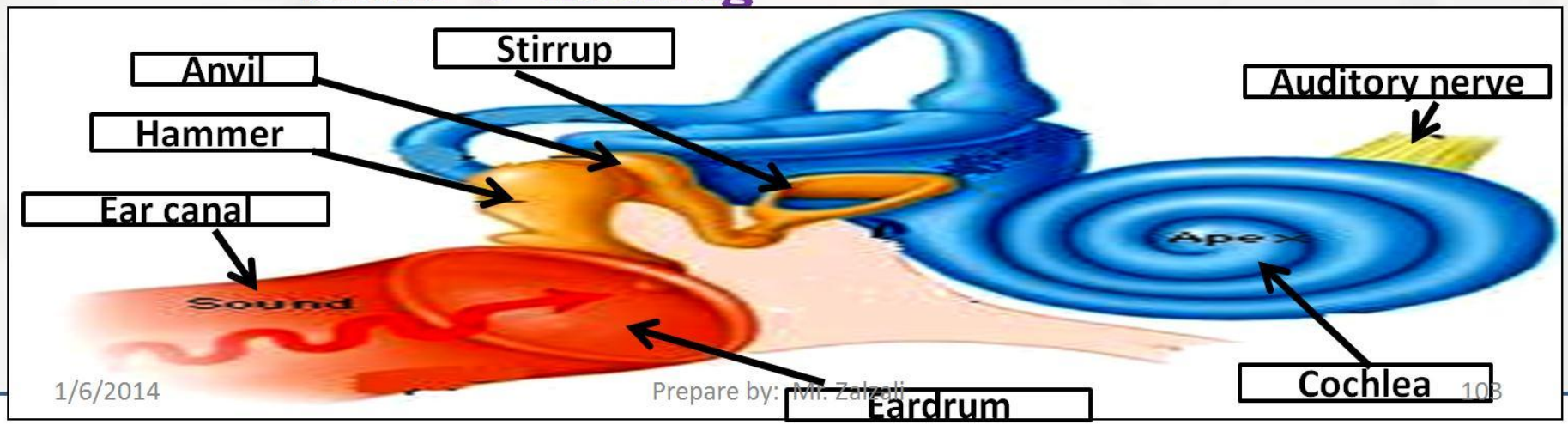
Structure of the ear:

➢How do your ears enable you to hear?



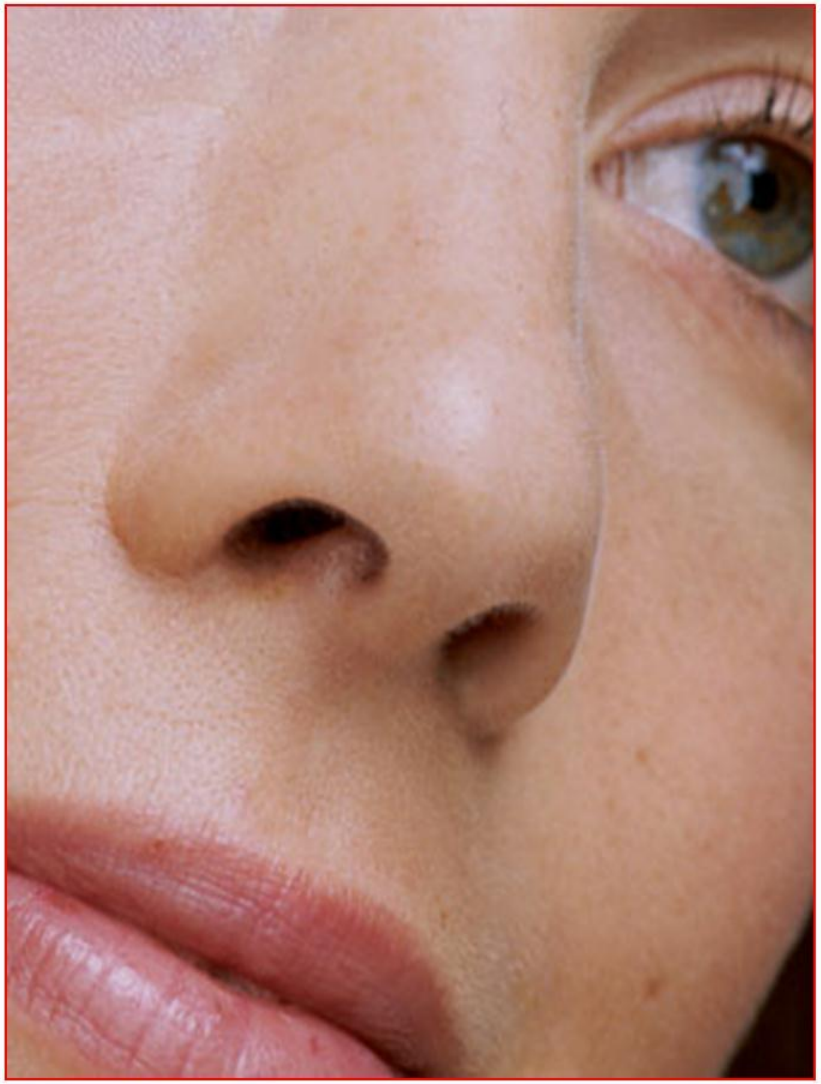
Structure of the ear:

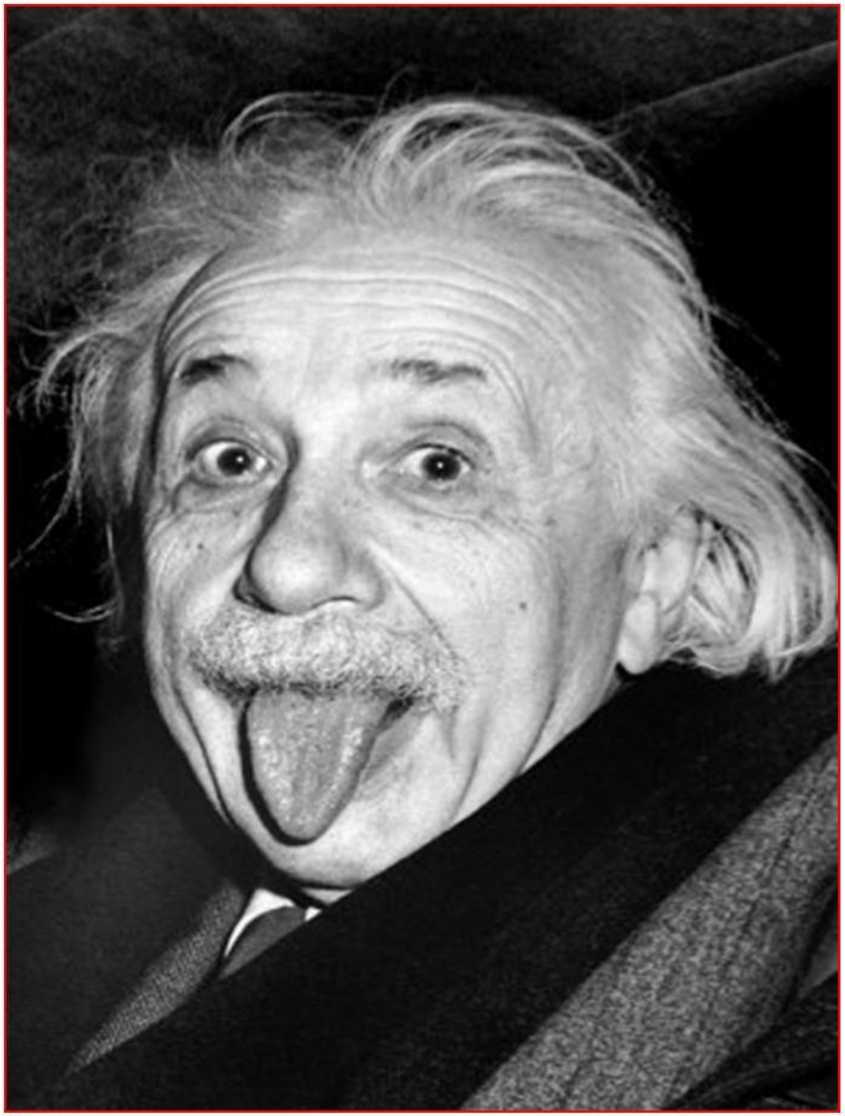
- **How do your ears enable you to hear?**
- 1- Sound waves enter ear canal.
- 2- Eardrum vibrates.
- 3- Three bones (hammer, anvil, stirrup) transfer vibrations to the cochlea.
- 4- Hair cells in the cochlea are stimulated and generate electrical impulses.
- 5- Nerve impulses move to the brain via the auditory nerve
- 6- Processing auditory information occurs in the brain → hearing



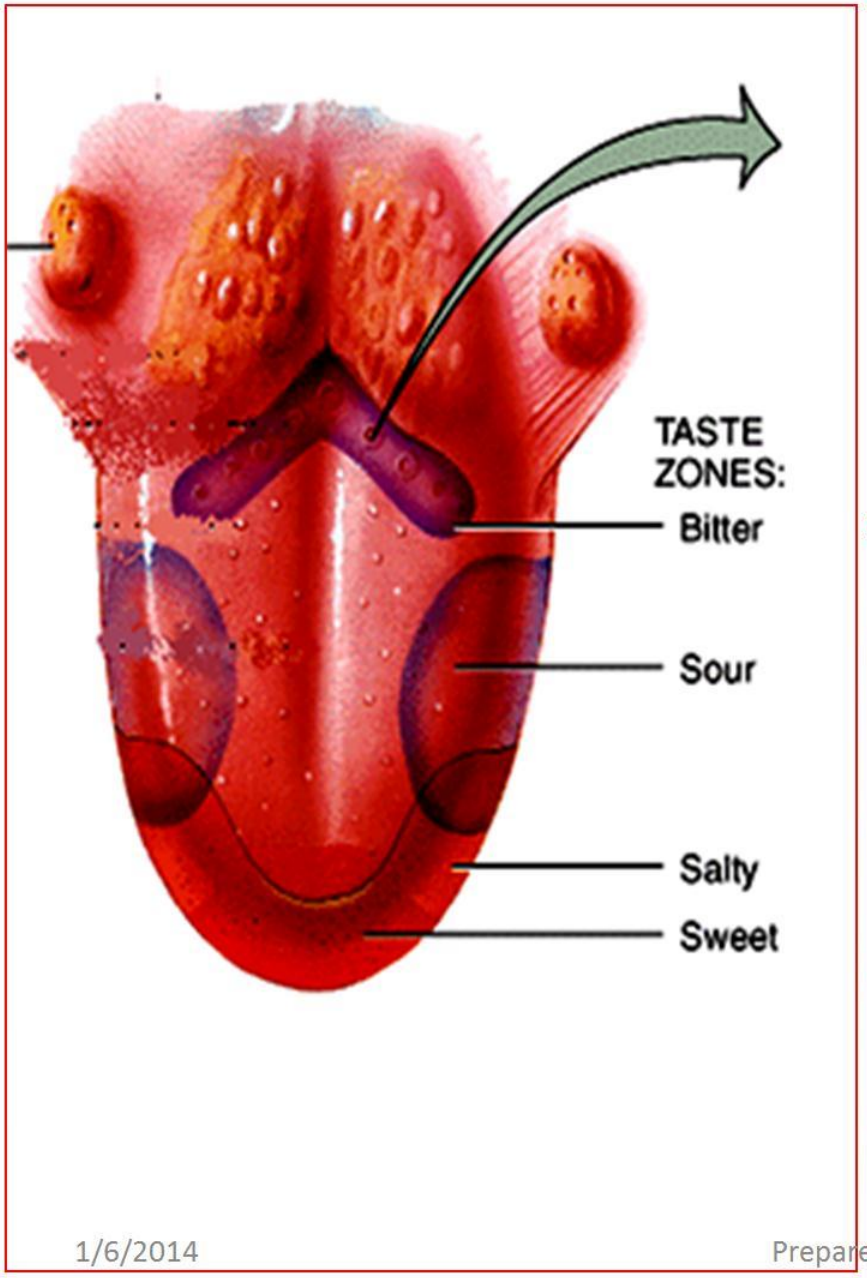
Chemical senses :

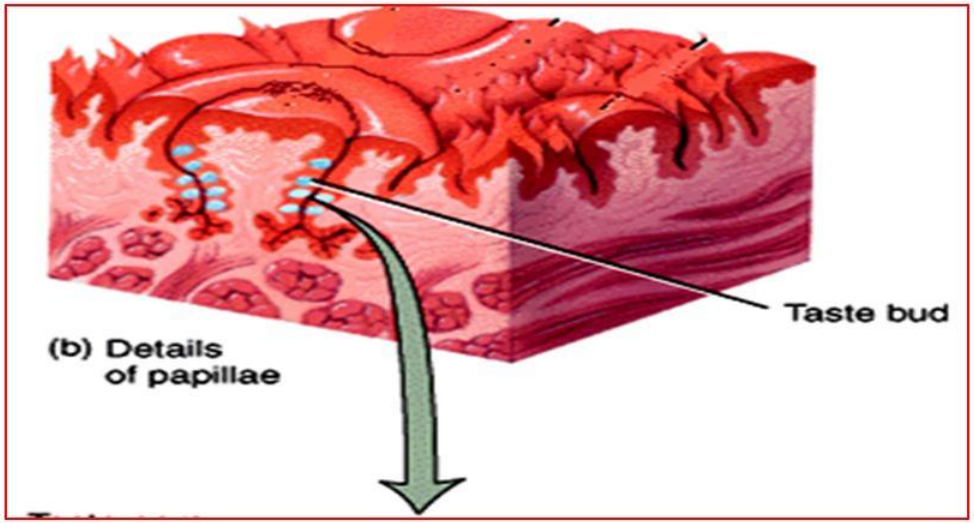
Taste and smell

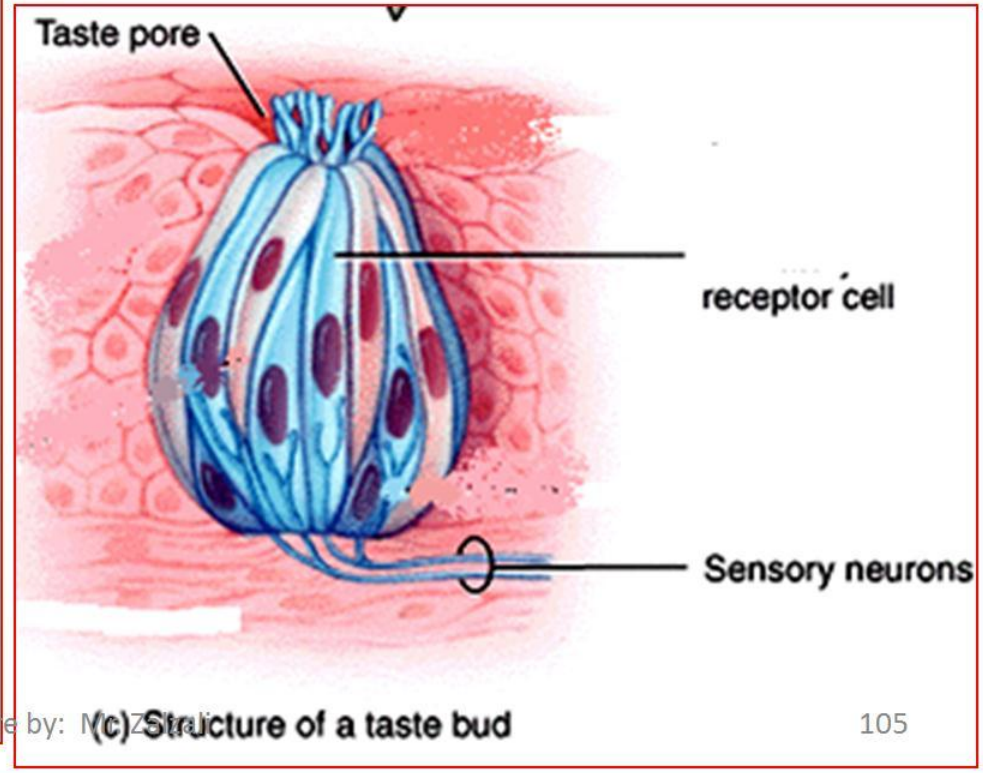




Taste


TASTE ZONES:
Bitter
Sour
Salty
Sweet


Taste bud
(b) Details of papillae


Taste pore
receptor cell
Sensory neurons
(c) Structure of a taste bud

- **Taste buds:**
  - Are located on projections on the surface of the tongue.
  - They are made up of taste cells, which are chemoreceptors that detect chemical substances.

  - They detect at least four basic chemicals:
  - -sugars (sweet)
  - Acids (sour)
  - Alkaloids (bitter)
  - -salts (salty)

  - When food molecules that are dissolved in saliva bind to taste cells→ this generates impulses that can be interpreted by the brain.

- **NOSE**
- **Olfactory receptors :**
- **-Are chemoreceptors that detect odors**
- **They are located in the roof of the nasal cavity**
- **They are stimulated by chemicals in the air, then they send impulses to the brain to be interpreted.**