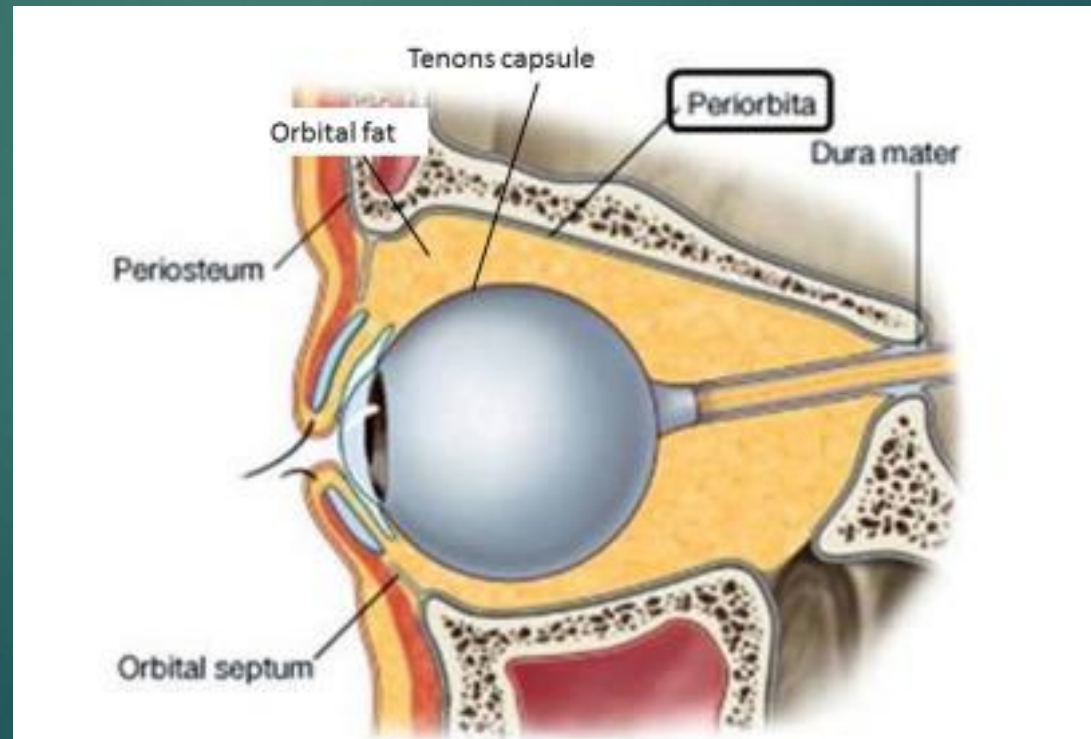


# Protective mechanism in the Eye

- ▶ Several mechanism exist to protect the eye from external injury.
- ▶ Mechanism of potential damages to the eye can ocular as:
  1. Mechanical
  2. Chemical
  3. Biological
  4. Electromagnetic radiation

# 1. Protection from mechanical damage

- ▶ The orbit:
  - ▶ The orbital fat and bony walls support and provide protection for the eye and orbital tissues .
  - ▶ The orbital fat acts as a semi-fluid padding that cushions the eye providing some shock absorption.



# 1. Protection from mechanical damage

- ▶ The eyelids:
  - ▶ The eyelids provide a mechanical barrier between the eye and external environment, rapidly closing on *reflexive* or *voluntary blinking*.
  - ▶ *Cilia* (modified fine hairs) on the eyelid skin are highly sensitive to airborne particles; when stimulated, they elicit a *blink reflex*
- ▶ The corneoscleral shell
  - ▶ The corneoscleral shell provides *tensile strength* to the globe.
  - ▶ *Dense corneal innervation* allows for rapid *blink* and *withdrawal reflexes*.
  - ▶ Corneal innervation also provides trophic factors that promote epithelial healing

# 2. Protection from chemical damage



## 1. Eyelid closure

- ▶ Reflex blinking provides *rapid closure* of the eye in response to splash or foreign body sensation.

## 2. Bell's phenomenon

- ▶ A normal Bell's phenomenon provides involuntary *upward and inward rotation of the globe* on lid closure, removing the cornea from noxious stimuli .

## 3. Tears

- ▶ Tear flow increases in response to mechanical or noxious stimuli.
- ▶ This causes dilution and washout of the irritant.

## 4. Corneal epithelial barrier

- ▶ The corneal epithelium is 5–7 layers thick with cells adjoined by desmosomes.
- ▶ *Tight junctions* (zonulae occludens) surround the most superficial corneal epithelial cells providing a *low conductance barrier* to fluid and solutes

# 3. Protection from biological damage

## 1. Tear film and conjunctiva:

### I. Glycocalyx and mucous layer

- Mucins in the glycocalyx (conjunctival cell membrane-bound mucin) and the mucous layer of the tear film provide a physical barrier to pathogens and can trap microorganisms.

### II. Aqueous layer

- The aqueous layer has several antibacterial constituents including secretory immunoglobulin A (IgA), lysozyme, and lactoferrin.

### III. Normal conjunctival flora

- The normal bacterial flora may inhibit survival of more pathogenic species .

### IV. Natural killer cells

- Present in the conjunctiva, natural killer cells may have a role in restricting the spread of viral infection or tumors.

# 3. Protection from biological damage

## 2. Corneal epithelium and Bowman's layer

- ▶ These act as physical barriers against ocular penetration by microbial pathogens.

## 3. Descemet's membrane

- ▶ Descemet's membrane is resistant to proteolysis in severe corneal infections, maintaining the integrity of the globe

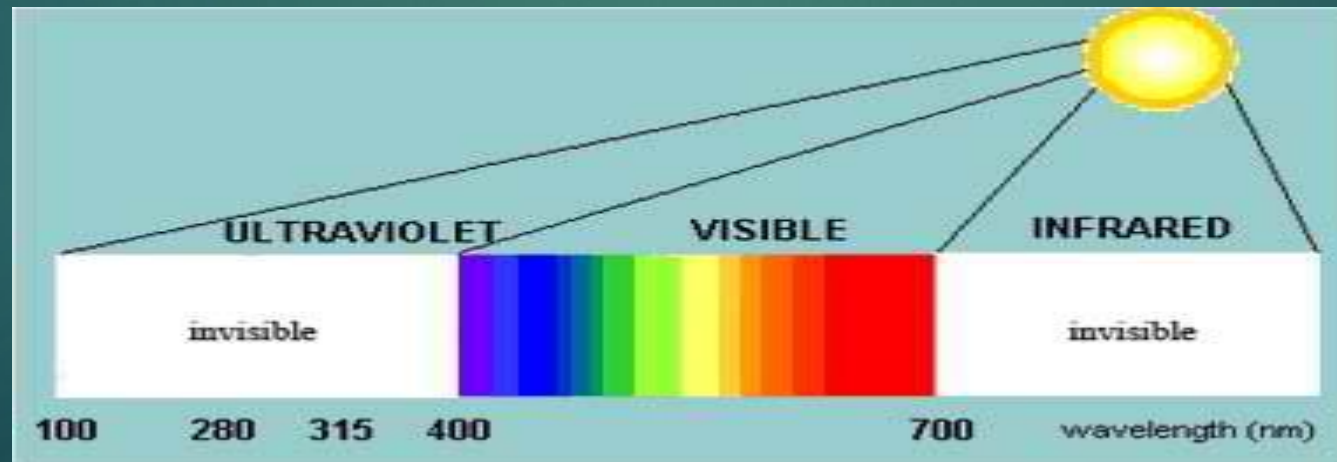
# 4. Protection from electromagnetic radiation

## 1. Eyelid closure

- ▶ The dazzle reflex: bright light induces reflexive blinking

## 2. Pupil constriction

- ▶ Rapid pupil constriction in response to bright light limits excessive radiation exposure to the ocular media internal to the iris





# 4. Protection from electromagnetic radiation

## 3. Light absorption by ocular tissues

- ▶ The cornea and sclera absorb ultraviolet (UV)-B, UV-C, infrared (IR)-B, and IR-C .
- ▶ The crystalline lens absorbs UV-A.
- ▶ Antioxidants in the lens and macula prevent excessive UV-induced oxidative damage.
- ▶ The yellow macular carotenoid xanthophyll pigments in Henle's fibre layer absorb short wavelength radiation
- ▶ Hemoglobin and melanin, principally found in the choroid, absorb excessive light and IR radiation.