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NAAC ACCREDITED GRADE—'A'

TOPIC : COMPOUND EYES IN COCKROACH

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COMPOUND EYES IN COCKROACH

The compound eyes are large and occupy a considerable portion of the sides of the head capsules.

- **Location**: In cockroach a pair of compound eyes are present on the dorsolateral sides of head.
- **Structure**: They are kidney or bean shaped structures.
  - ✓ Each compound eye consists of 2000 ommatidia.
  - ✓ Ommatidia are structural and **functional units** or visual units in the compound eye.
  - ✓ Cornea is the outermost layer and allows light rays.
  - ✓ It is a transparent layer which acts as a biconvex lens.
  - ✓ Cornea is shed during Ecdysis of Nymph.

- **Structure of ommatidium**:

1. **Cornea:-**Cornea is the outer most part of an ommatidium .It corresponds to a hexagonal facet of the compound eye. It is a biconvex transparent part of the cuticle. It allows light rays to pass through it.Cornea is the refractive region of ommatidium. It is secreted by specialised cells of epidermis **two corneagen cells** or lenticular cells present beneath the cornea.

2. **Corneagen cells or Lenticular cells:-** These are two transparent specialised epidermal cells. They secrete cornea. These cells later become withdrawn to the sides of the ommatidium and form the primary pigment cells.

3. **Vitrillae or cone cells (Semper cells):-**These are the four transparent conical cells. They lie below the corneagen cells. They surround the transparent crystalline cone. Cryastalline cone is secreted by the cone cells.

4. **Crystalline cone :-**Crystalline cone is the transparent conical structure that secreted by the vitrellae and is surrounded by them.Light absorbing dark primary pigment cells called Iris pigmented sheath surround the vitrellae. The region containing the cornea and crystalline cone constitute the dioptrical or focussing region of the ommatidium. Crystalline cone focuses the light on to the next part of the ommatidium.

5. **Retinulae and Rhabdome** :- Retinulae are innermost and elongated cells of an ommatidium. Retinulae are 7-8 in number. These are the photoreceptor cells of ommatidium. They rest on the basement membrane with their inner ends of the long axis.

   - Each retinular cell bears microvilli towards the inner surface of the cell. Microvilli of each retinular cell collectively form a rhabdomere that contains photoreceptor pigment. These rhabdomeres fuse along the axis of the ommatidium to form the rhabdome in the centre.
   - Retinulae are the nerve cells from which sensory nerve fibres leave as optic nerve to reach the protocerebrum. Rhabdome and retinulae form the retinal or receptor region. Receptor region is surrounded by light absorbing seven secondary pigment cells called retinular pigmented cells. They serve to isolate each ommatidium.

❖ Working of compound eye or formation of images:

- Diurnal insects form **apposition image** or mosaic vision by ommatidia.
- Noctural insects forms **superposition image.**

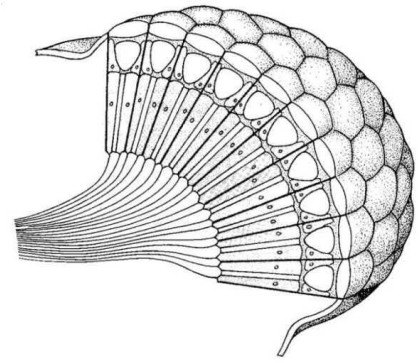
Apposition image

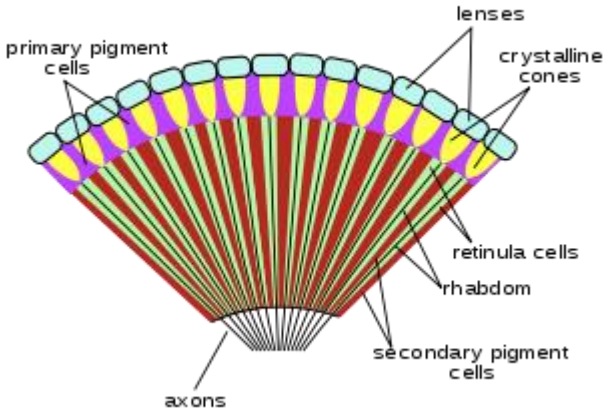
1. These images are formed in **diurnal insects** like houseflies in which the retinulae lie immediately below the vitrellae and crystalline cone.
2. They are surrounded by a dark pigmented sheath called retinal sheath, which absorbs light rays and prevent them from passing to the adjoining ommatidium.
3. Crystalline cone is surrounded by iris sheath. Therefore, only light rays entering the cornea of ommatidium converge on the rhabdome.
4. Thus, a small separate image of a part of the object is formed in each ommatidium.
5. The total image formed in the compound eye is a **mosaic** of several small images.

Such an image is called **apposition image** because it is formed by the juxtaposition of small discrete images formed in each of the ommatidia. This type of vision is called mosaic vision.

Superposition images

1. Super position images are formed in nocturnal insects like cockroach.
2. In which the retinulae are present deep below the vitrillae and crystalline cone.
3. Retinal sheath is absent.
4. Therefore , the rhabdome and retinulae of an ommatidium receive not only light rays that enter through its own cornea but also light rays that enter through the corneas of the adjoining ommatidia.
5. This results in the overlapping of images. The image formed by overlapping of images is called superposition image. It is a blurred image.





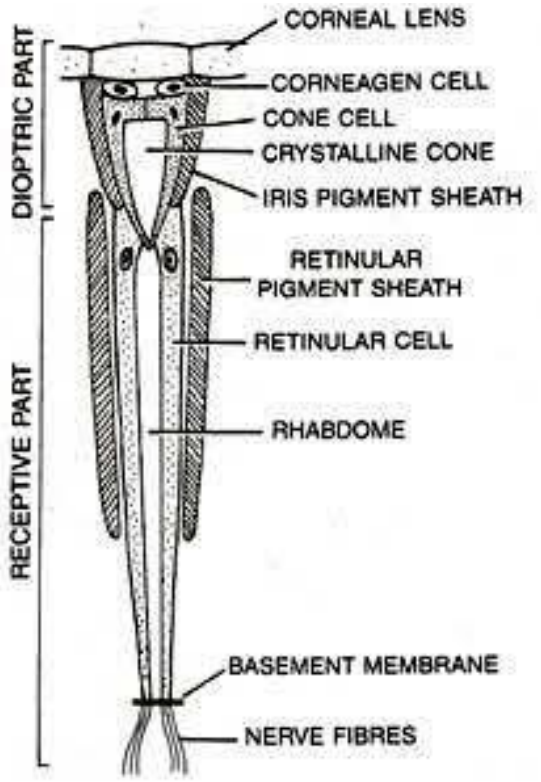


Fig. 7A. 40. V.S. of an ommatidium.