

Insect Sense Organs

Distributed on different parts and respond to a given stimulus such as light, sound, touch and chemicals etc

The sense organs may be classified as

1. Visual organs (or) photoreceptors
2. Auditory organs (or) organs of hearing
3. Chemoreceptors which respond to chemicals
4. Tactile receptors which respond to touch
5. Gustatory receptors which respond to taste

1. Visual organs or photoreceptors

I. Compound eyes

Present on either side of the head capsule of an adult insect & nymphs of Exopterygota

Perceive light energy and able to produce a nerve impulse

Absent in Protura or reduced in endoparasitic Hymenoptera, Siphunculata, female coccids etc

Individual units called ommatidia, varies from 1 in the worker of ant, *Ponera punctatissima* to over 10,000 in the eyes of dragonflies

More ommatidia remain closely packed in hexagonal shape If few, they remain loosely packed and they attain circular shape

Ommatidium consists of 2 parts.

1. Dioptic : Acts as lens

2. Receptor: Forms the image

1. The dioptic apparatus has

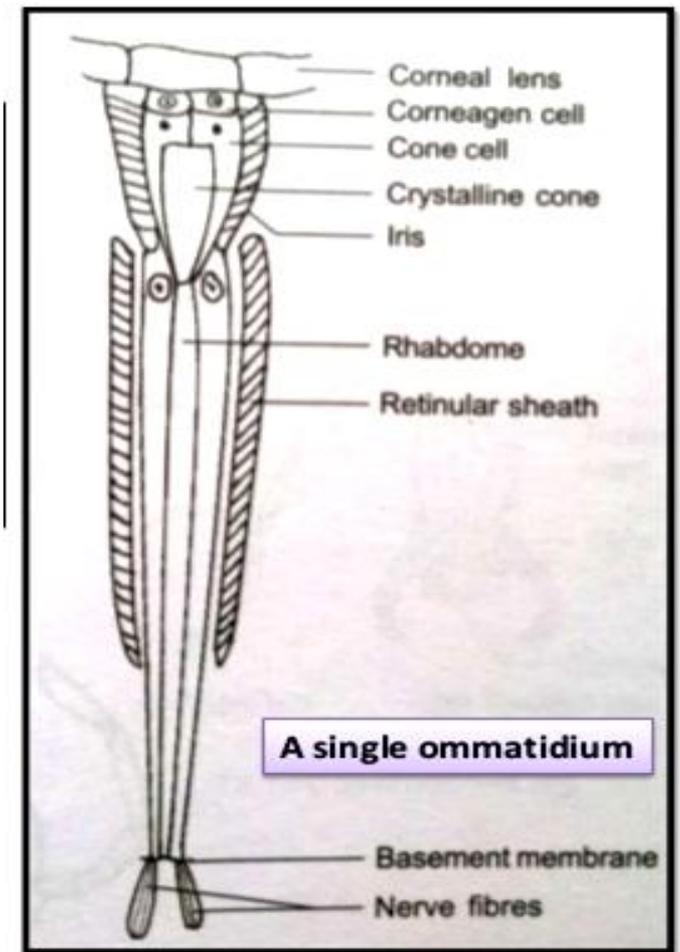
a) **Cornea** : cuticular, transparent and colourless layer that remains continuous with the integument
It forms a biconvex lens receiving the light.

b) **Corneagen cells**: Modified epidermal cells which secrete the cornea and are two in number

c) **Crystalline cone cells** : four cells remain just beneath the cornea and corneagen cells

forms the crystalline cone and consists of a translucent material

d) **Primary pigment cells (or) Iris pigment cells**: Two darkly pigmented cells present around the crystalline cone which separates the ommatidia from one another and also restrict the movement of light passing from the neighboring ommatidia.



2. The receptor apparatus consists of

e) **Retinular cells:** Eight in number, forms the centrally located rod like rhabdom

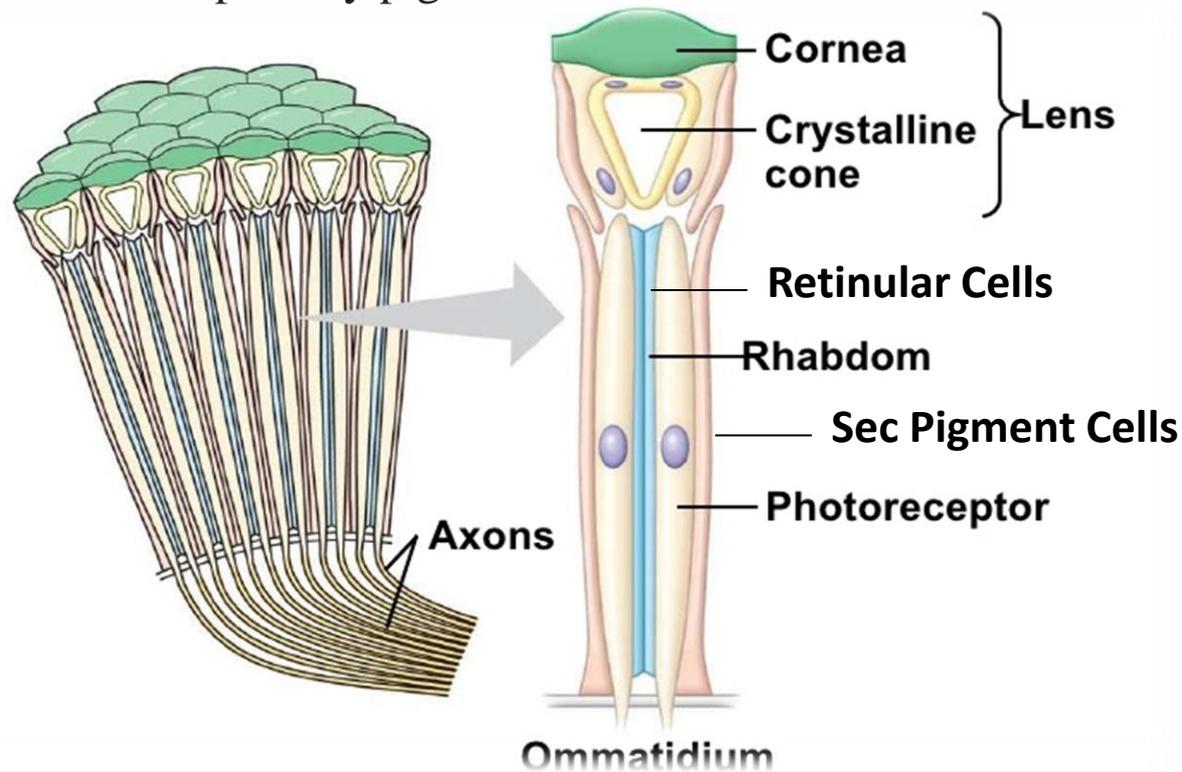
Rhabdomeres formed with inner side margins of retinular cells on which the image is formed

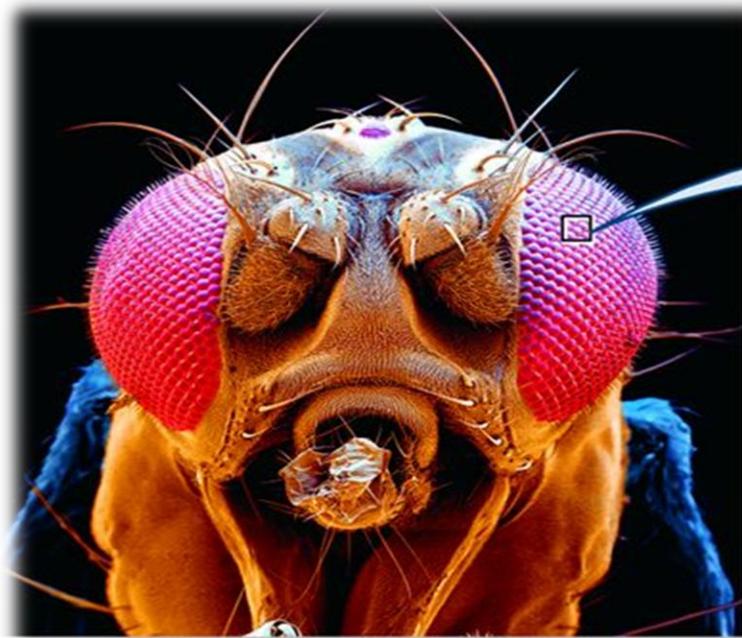
Rhabdom contains a light absorbing pigment called rhodopsin

Retinular cells continue with the axons that pass through the basement membrane of an optic nerve which remain connected to the optic lobes of the brain.

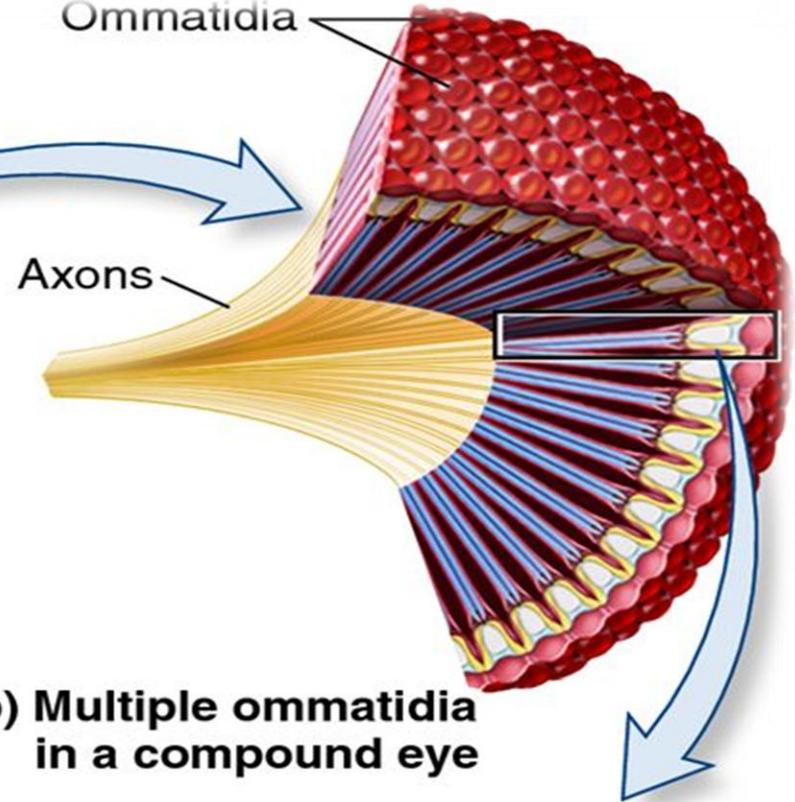
f) **Secondary pigment cells:** Rhabdom is surrounded by secondary pigment cells that help to separate the ommatidia

They surround the retinular and primary pigment cells and are numerous in number

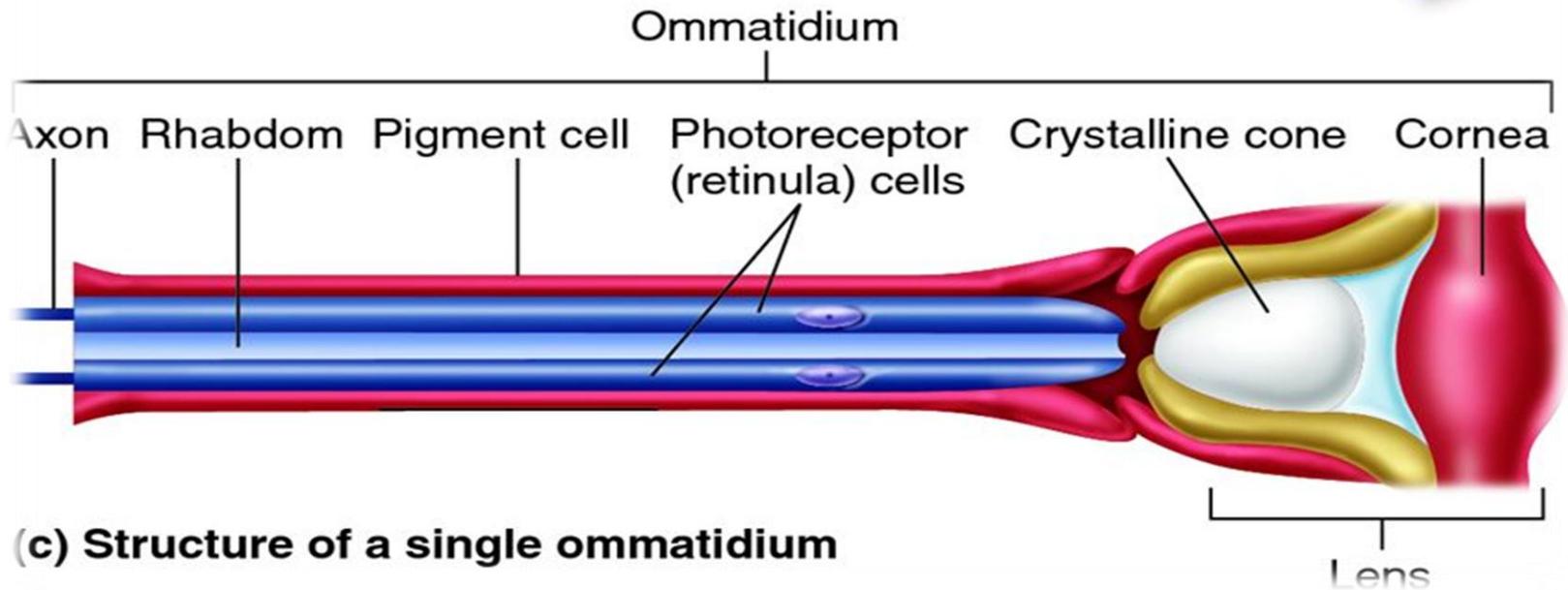




(a) Compound eyes of *Drosophila*



(b) Multiple ommatidia in a compound eye



(c) Structure of a single ommatidium

II. Simple eyes (or) ocelli

1) Dorsal ocelli :

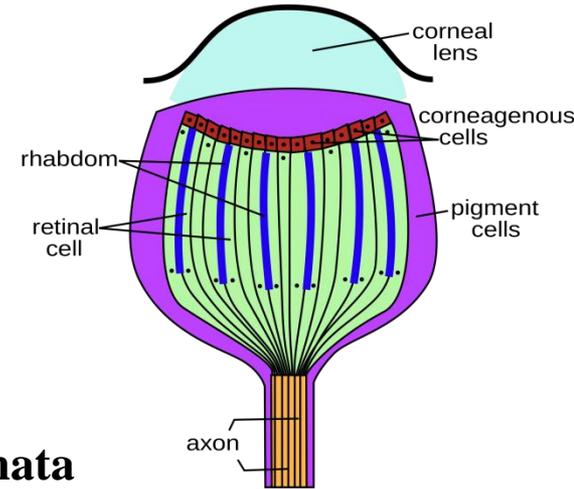
Seen in nymphs and adults of Hemimetabola and adults of Holometabola

3-4, arranged in a triangular fashion between the compound eyes with a median ocellus

Single cornea secreted by the corneagen cells, a group of retinular cells forms rhabdom below

Stimulatory organs to improve the sensitivity of the compound eyes

Dorsal ocelli are represented by fenestrae in cockroach



2) Lateral ocelli: or Stemmata

present on lateral sides of Endopterygote larva head

1-6 in number and some times 7 on each side

Lateral ocelli consist of cornea, a crystalline cone body and retinular cells forming the rhabdom

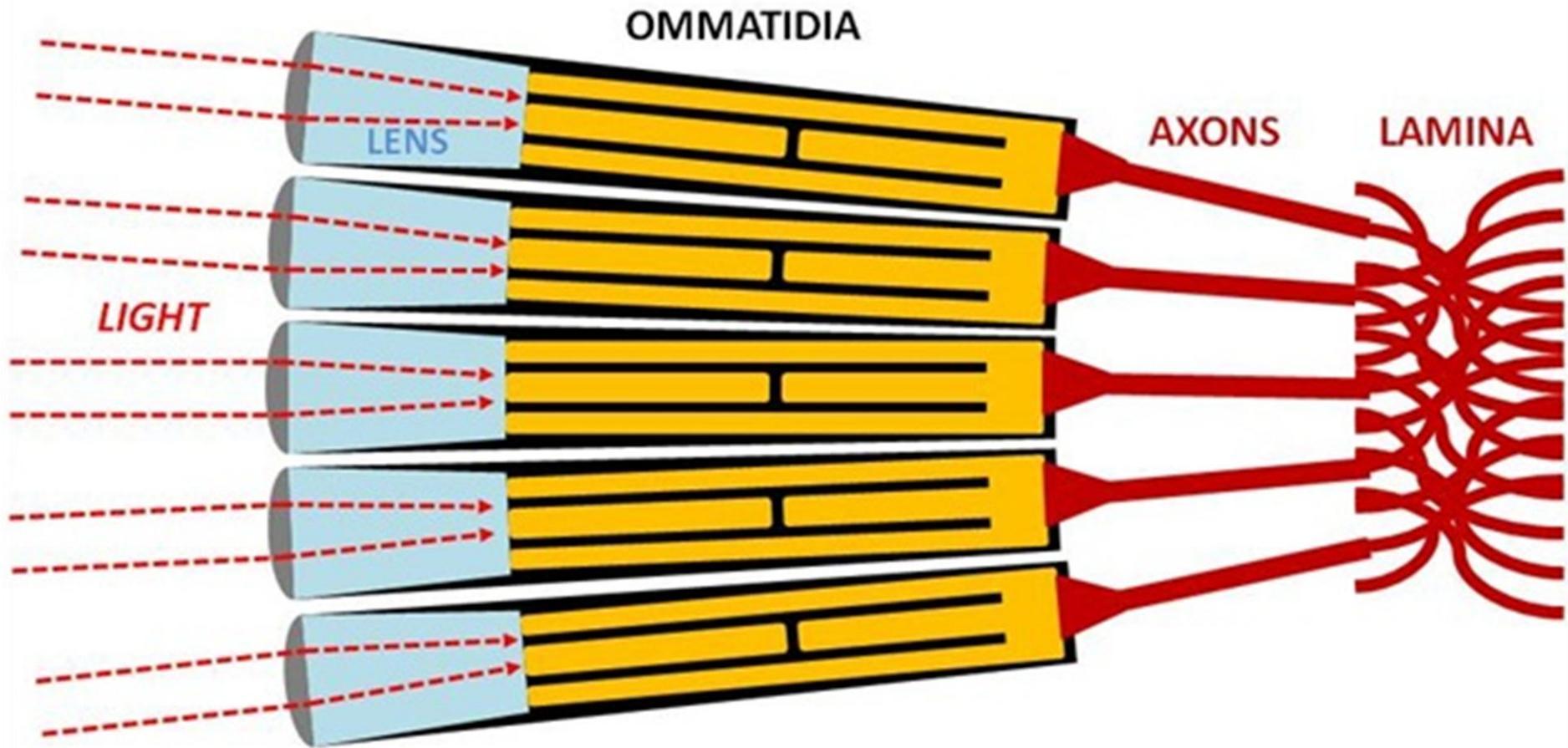
Responds to light, perception of moving objects,

colour, form and distance

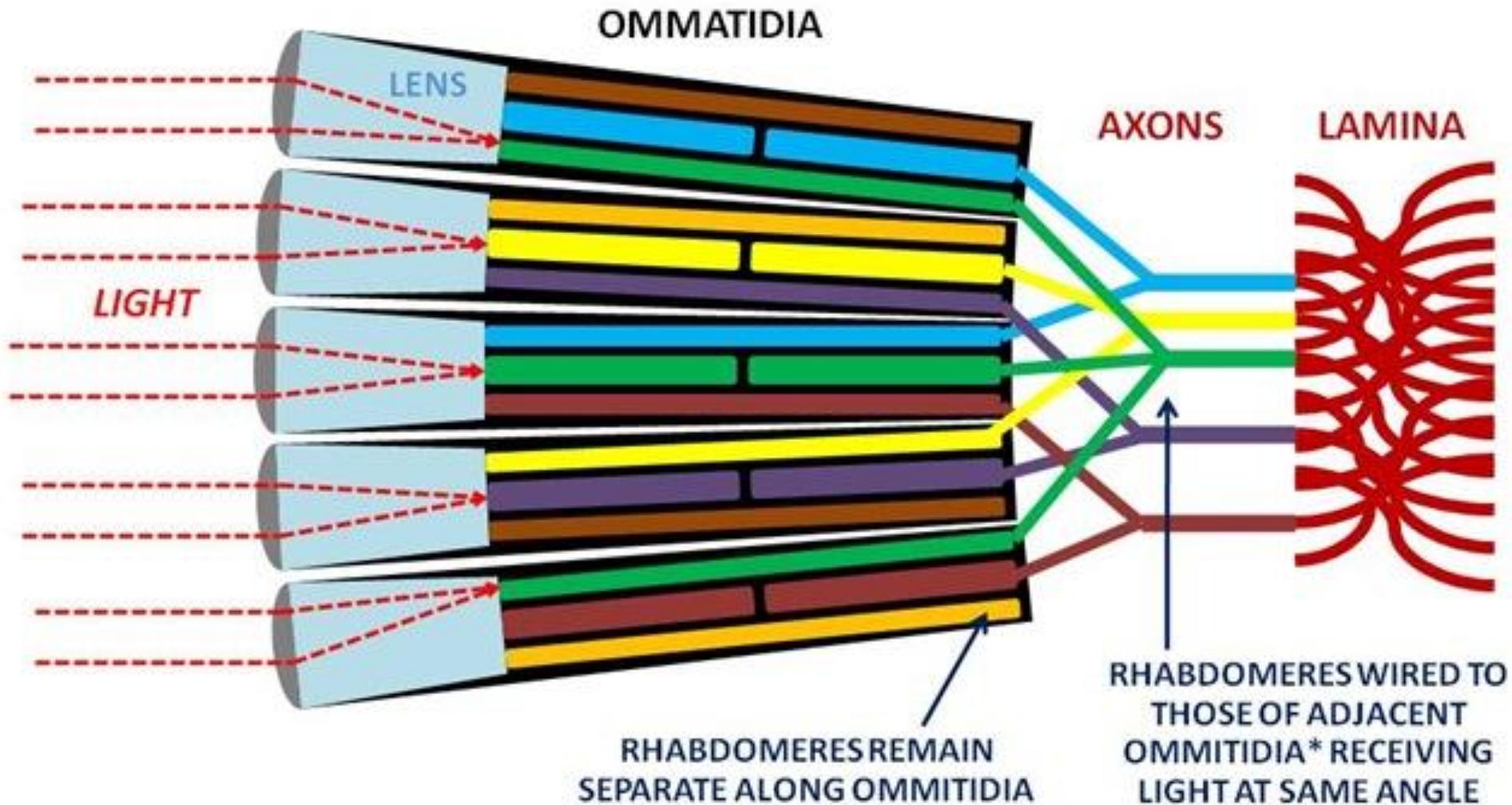


	Apposition eyes	Superposition eyes
1.	These are active during day time (diurnal insects)	These are active during evening and night time (crepuscular and nocturnal insects)
2	The light received by the cornea of single ommatidium passes through the central portion and forms the image on the rhabdom of the same ommatidium	The light received by many ommatidia (or) the neighboring ommatidia forms the image on a single rhabdom
3	The pigment cells remain in the extended position completely surrounding the ommatidium so that they separate the individual ommatidia, and do not allow the light to pass from the neighboring ommatidia	The pigment cells are constructed such that they allow the light to pass on to a rhabdom from neighboring ommatidia. Primary pigment cells are absent allowing the light to pass between the adjacent ommatidia
4	Image formed is distinct	Image is not clear where only general features of objects are formed.
	Eg: butterflies	Eg: moths

Apposition Compound Eye



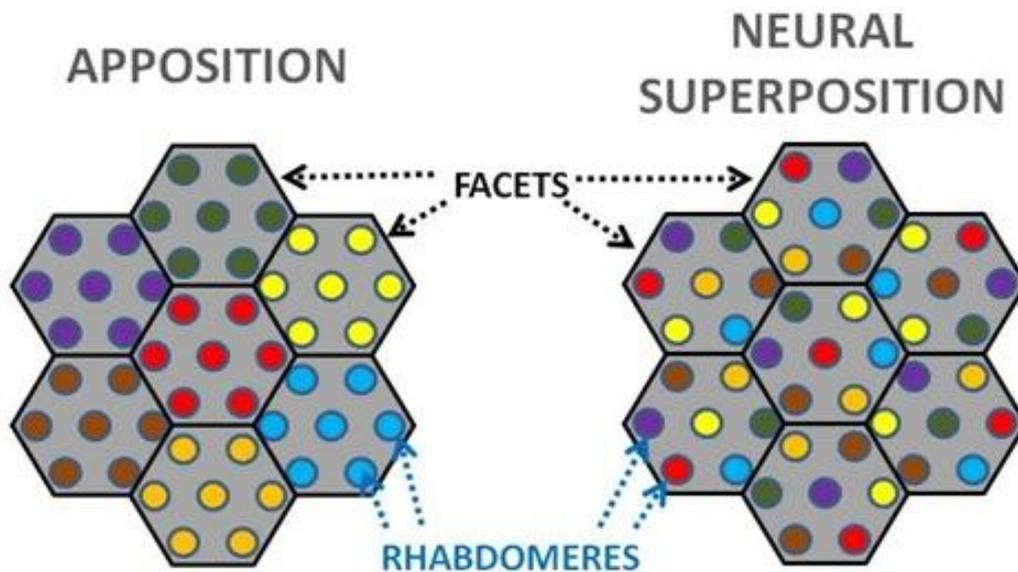
Neural Superposition Eye



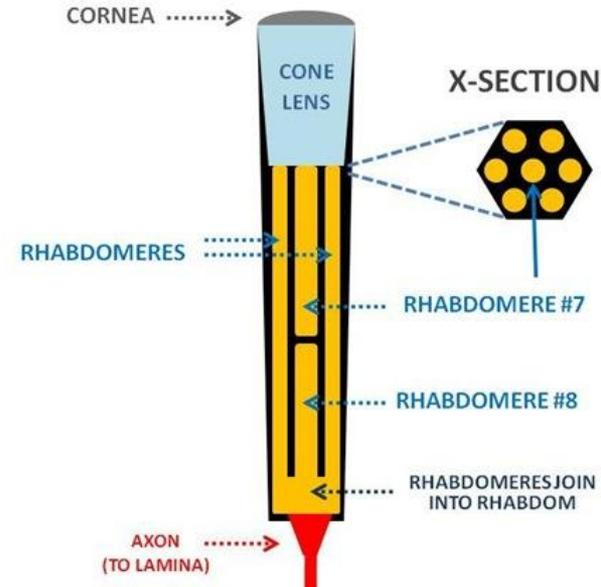
*This graphic has issues. Specifically it doesn't show the wiring correctly, because it's too hard to represent the 3-dimensional relationships**. But you get the idea.
** Too hard for me, anyway.

Compound Eyes- Frontal View

Same-Colored Rhabdomeres share axons



Ommatidium Schematic



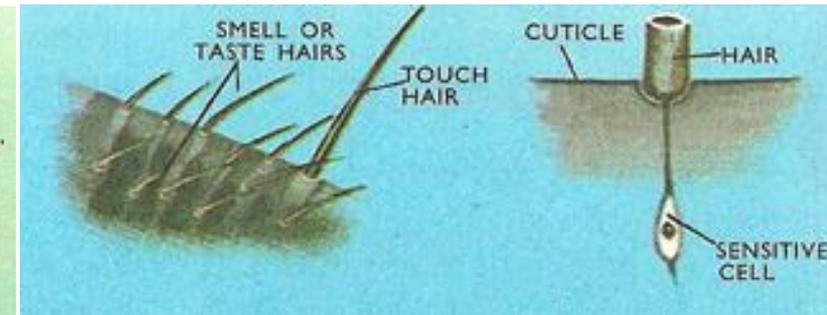
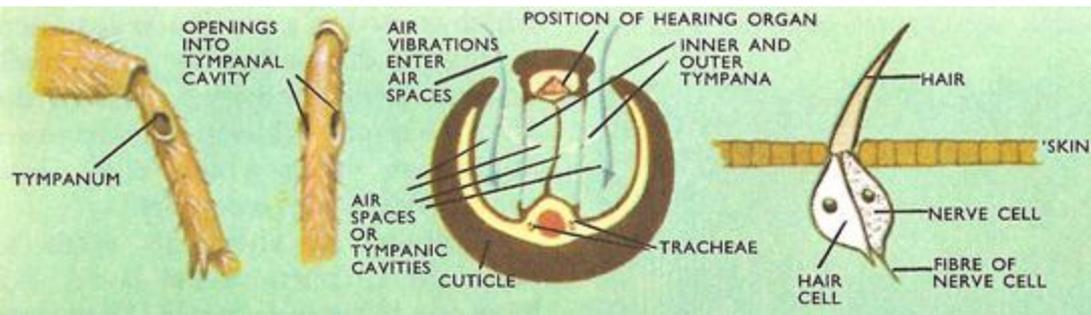
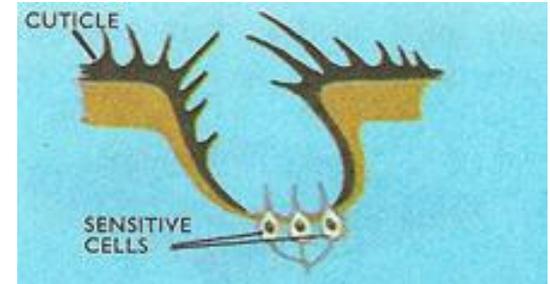
2. Auditory organs

1. Auditory hairs : body of larvae of Lepidoptera developed from modified epidermal cells
These respond to the sounds of air (or) water currents mediated by the hair sensillae (or) trichoid

2. Tympanal organ : A cuticular membrane which internally consists of a 'mullers' organ
Tympanum is present one

on either side of the 1st abdominal segment of
short horned grasshoppers

on the base of foretibia in long horned grasshoppers and crickets
on thorax or abdomen in Lepidoptera



3. Jhonston's organ : It is present on the pedicel of antennae and functions as an auditory organ
responding to air (or) water currents

They are absent in Collembola and Diplura

4. Pilifer of hawk moths (sphinxid moths) : An unique auditory organ, sensitive to ultrasonic
frequencies is found in the head of several species of Sphingidae