Hello Everyone

Hope You Are Having
A Wonderful Physiological Day

☺☺☺


ARE YOU
READY ?
LET'S GET STARTED!

Visual Pathway

Sem 4

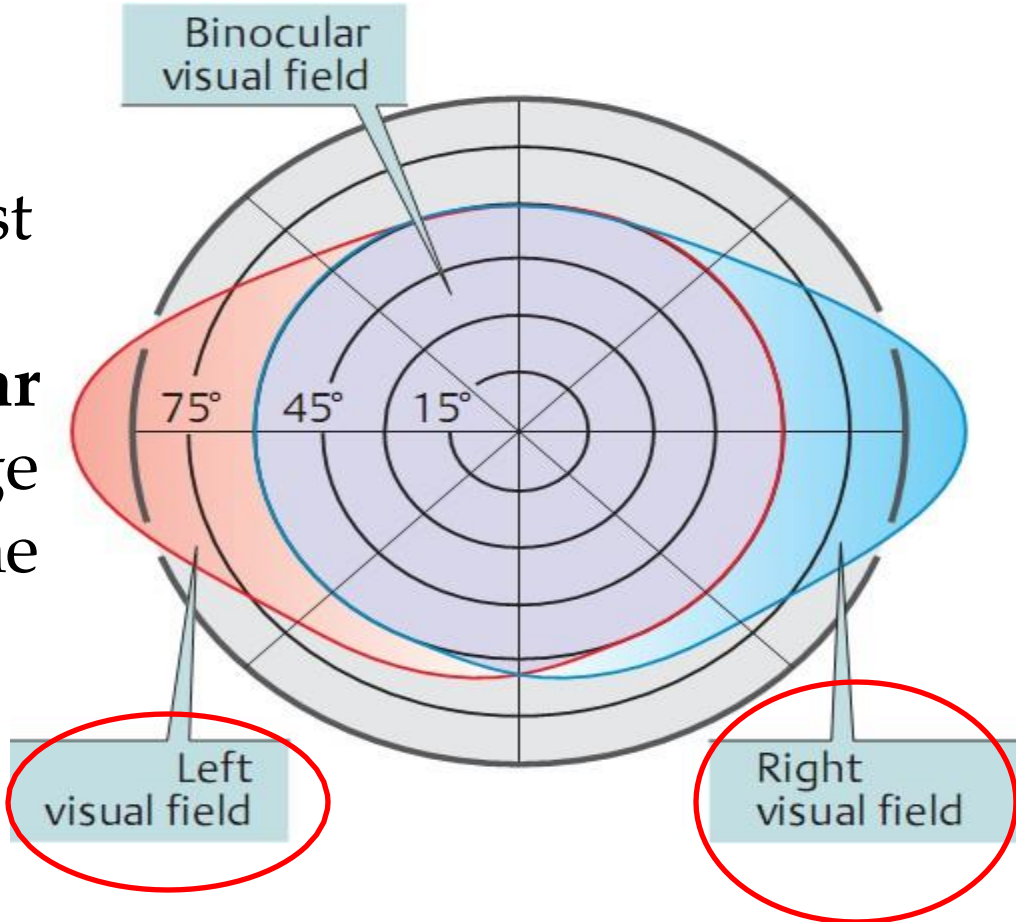
Binocular Vision

Def.

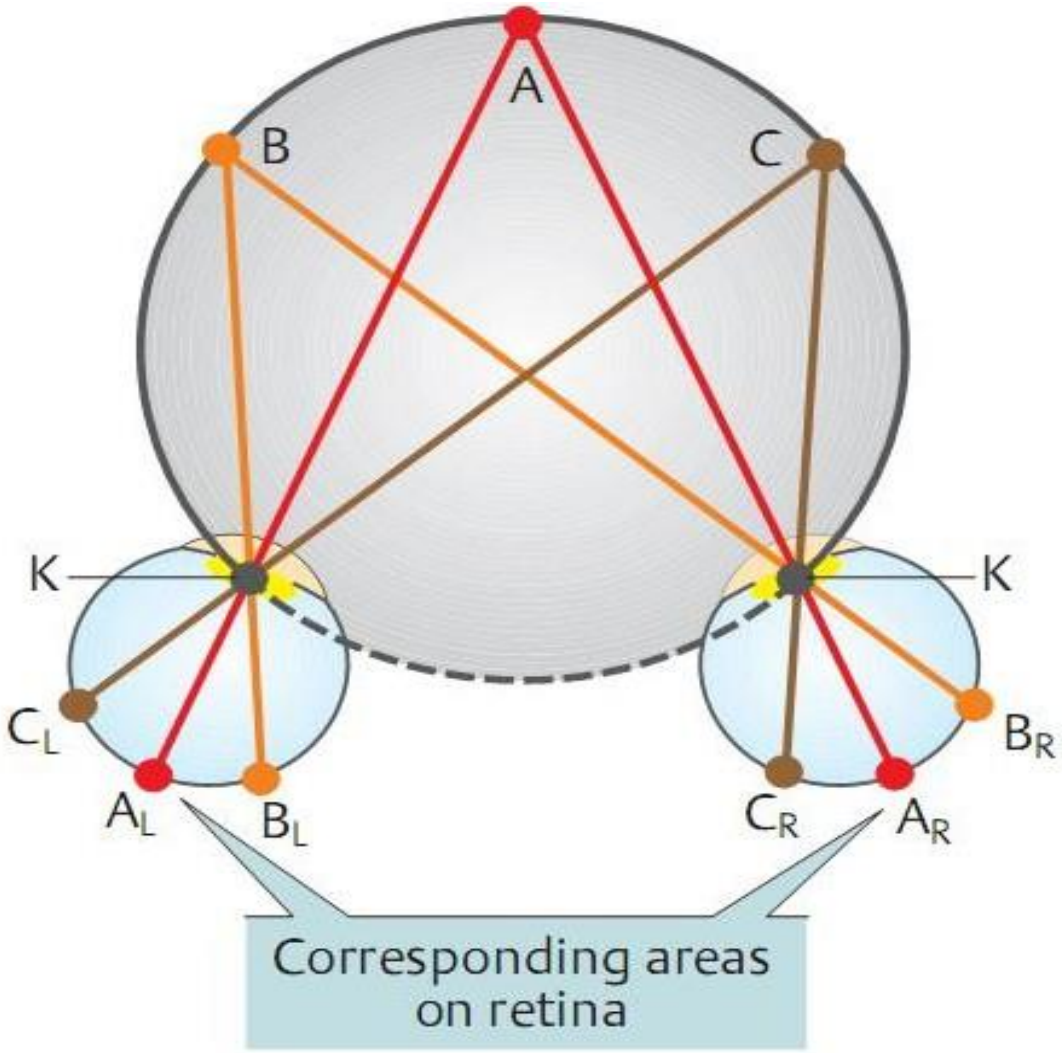
- Is the ability to see an object with 2 eyes without **double vision (diplopia).**

Requirements

1. The **visual fields** must **overlap** to a great extent
2. **Intact neuromuscular** apparatus to allow image to fall on the **corresponding points**



Corresponding Points

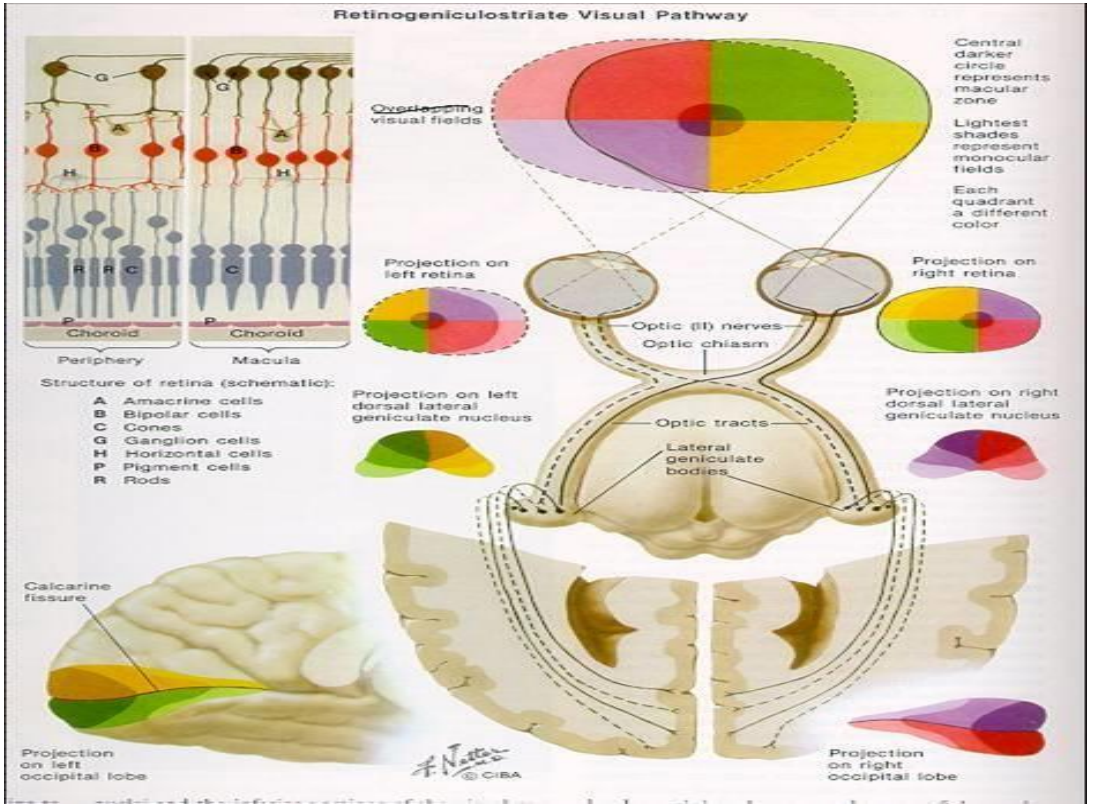


Binocular Vision

Requirements of binocular vision

3. A nearly **normal refractive power** in both eyes

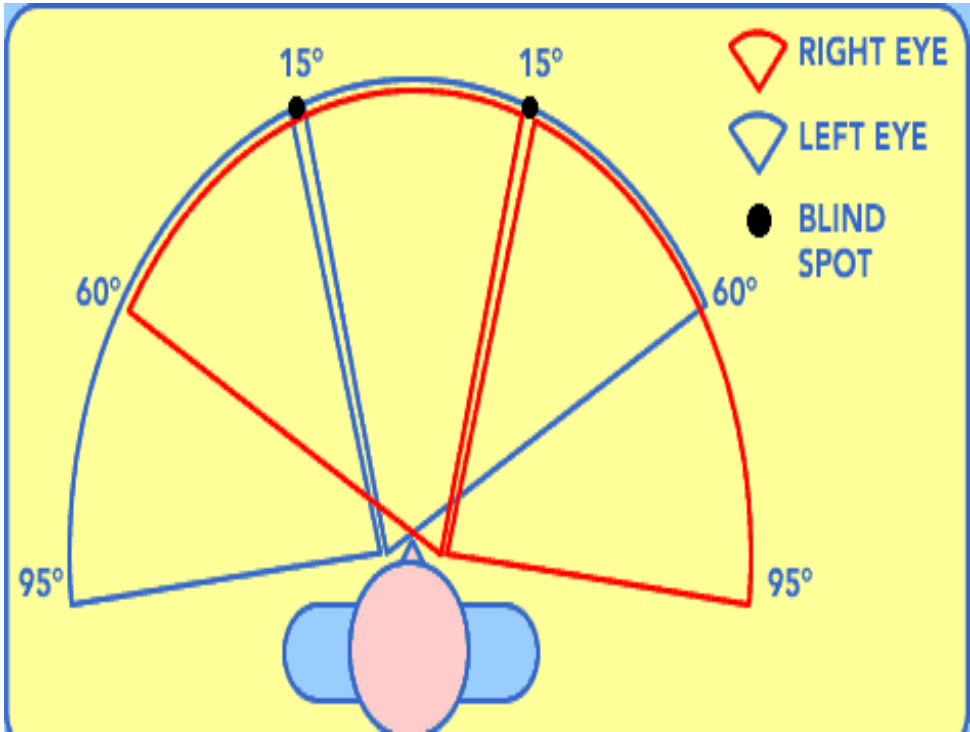
4. Intact visual cortex where fusion of images occur



Binocular Vision

Advantages of binocular vision

1. Increases the visual field **horizontally** from **160 to 200 degrees**
2. Corrects the **minor defects** in one eye by the other eye e.g. **blind spot** of **one eye** is corrected by the **other eye**



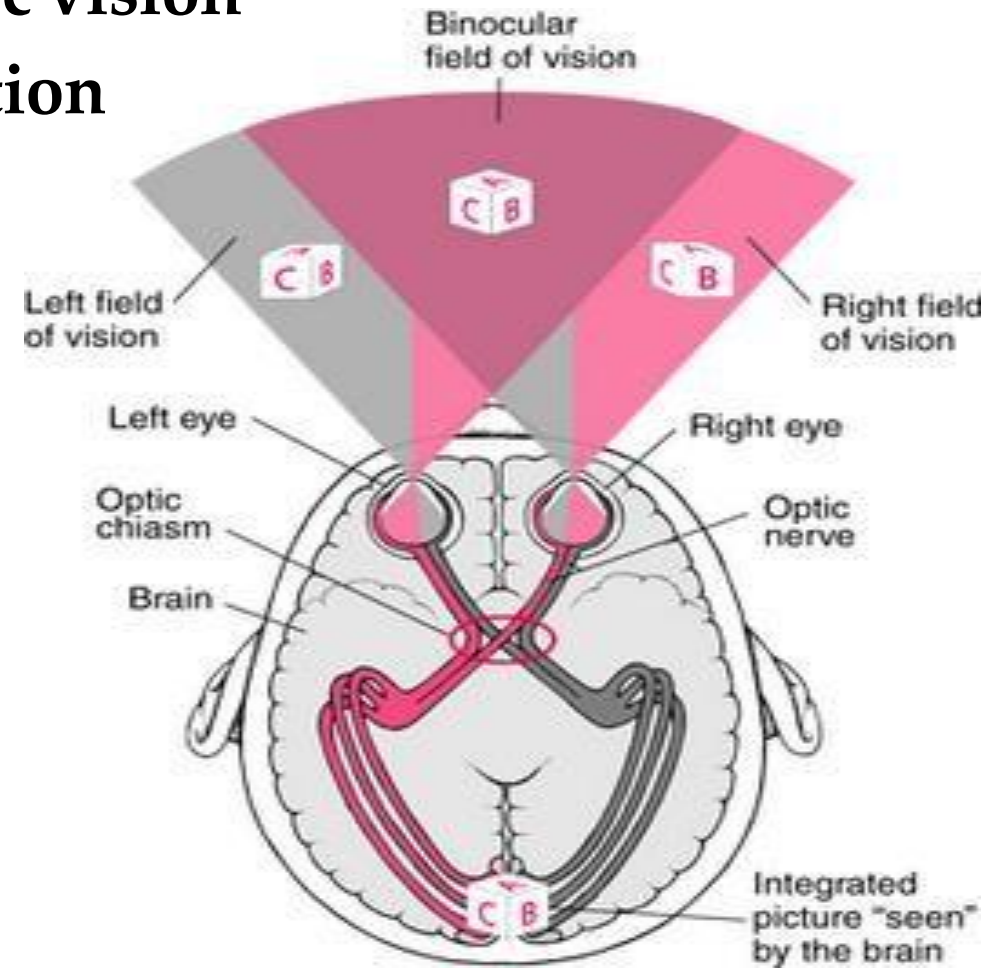
Binocular Vision

Advantages of binocular vision:

3. Is important for **stereoscopic vision**
4. Improves the **depth perception**

Fusion and corresponding points:

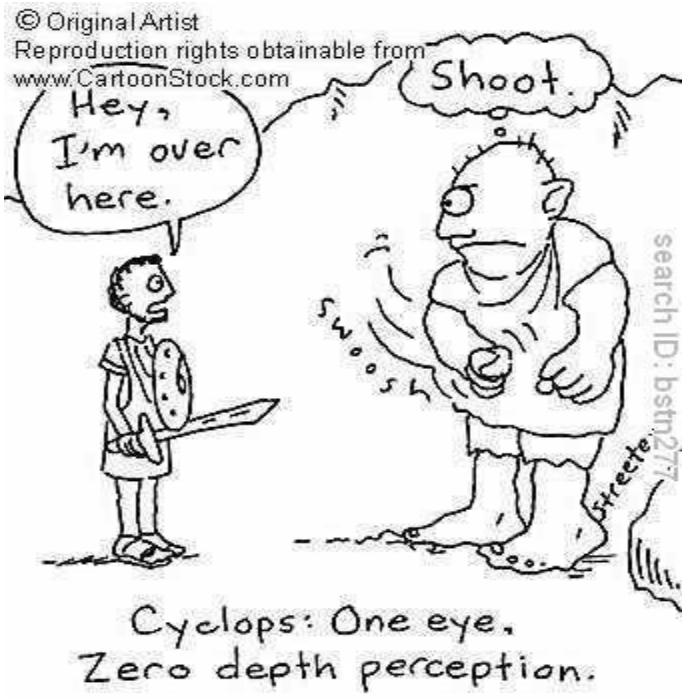
- The 2 images of an object placed in the area of binocular vision (one from each retina) are fused at the level 1ry visual area (17) into a single image



Depth Perception

Def.

- Is the ability to known the **relative distance** of the objects from the eyes.
- It is principally a monocular property, but it becomes more accurate by binocular vision.

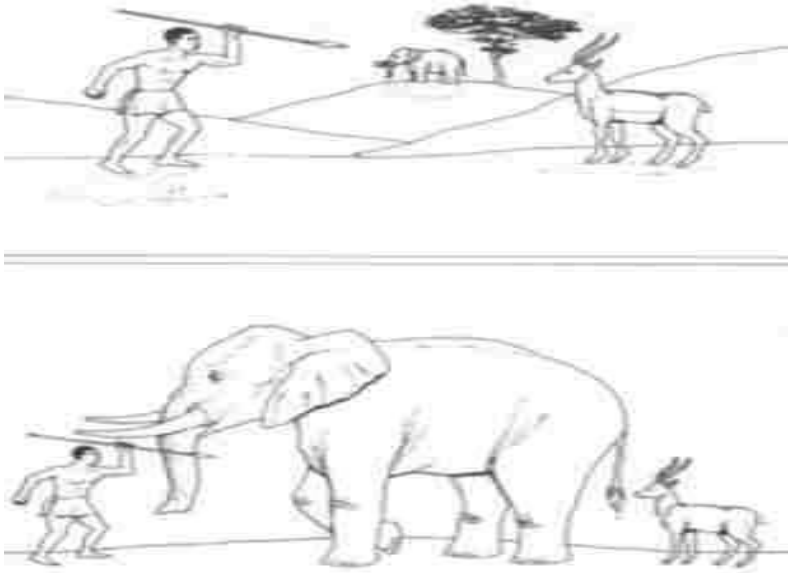


Depth Perception

Mechanisms depth perception:

- The **depth perception** depends on the followings factors;

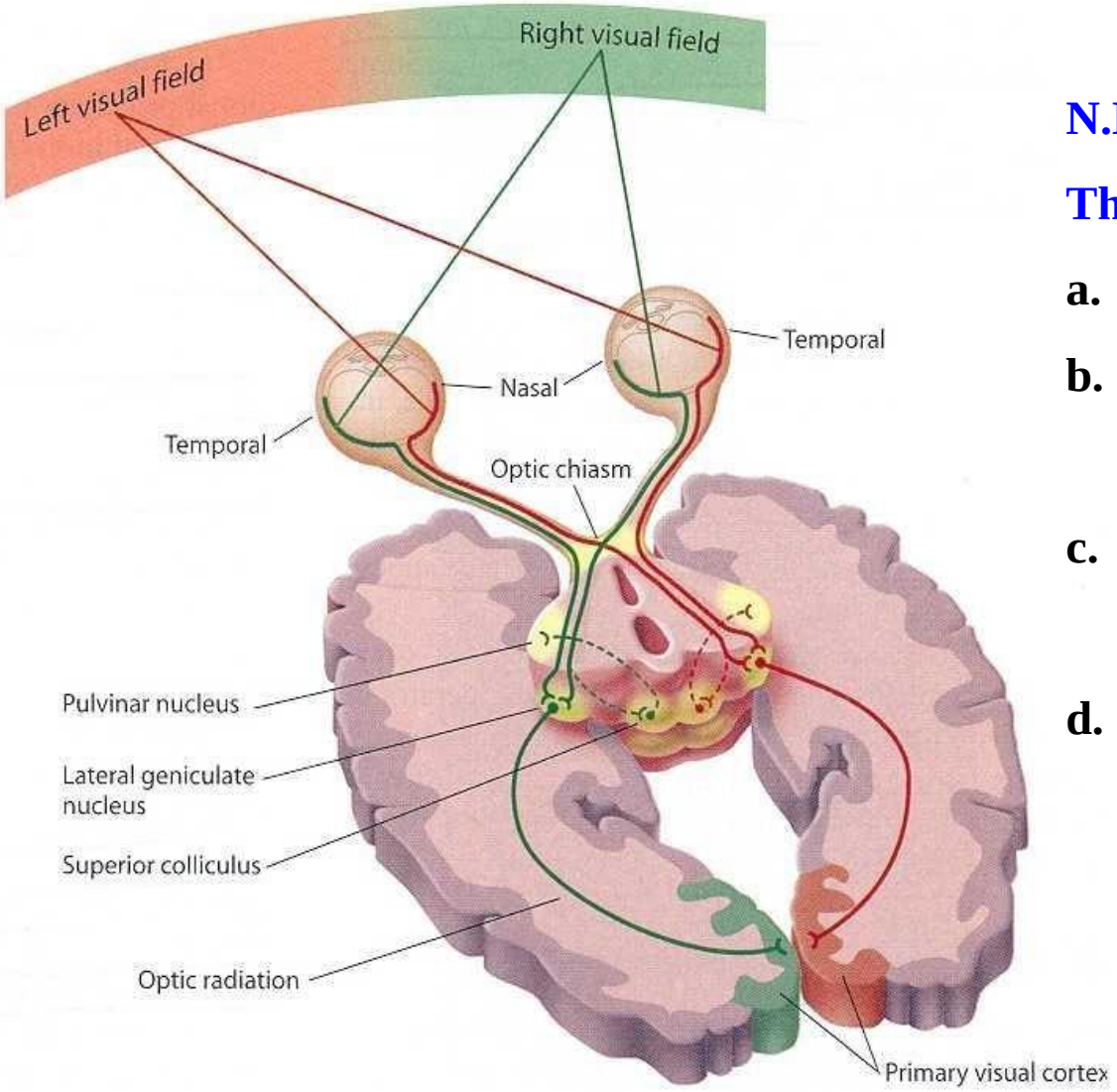
1. **The relative sizes** of objects
2. **The occlusion of part** of a distant object by a nearer one
3. **The fade of the colours** and **details of distant objects** as their distances from the eyes are increased
4. **Parallel lines** appear to converge with distance
5. **Movement parallax:** the nearer objects appear to move in the opposite direction and distant objects move in the same direction



Visual Pathway

- **Photoreceptors** (rods and cones) → **bipolar cells** (1st order neuron) → **ganglion cells** (2nd order neuron) → their axons form the **optic nerve** → **optic chiasma**, where the **nasal fibers cross to the opposite** side while the temporal fibers pass in the same side
- **Optic tract** (ipsilateral temporal fibers + contralateral nasal fibers of retina) → **lateral geniculate body** (3rd order neuron) in thalamus
- **Optic radiation** → **visual cortex** in the occipital lobe (1ry and 2ry visual areas).

Visual Pathway



N.B.

The optic tract fibers terminate on:

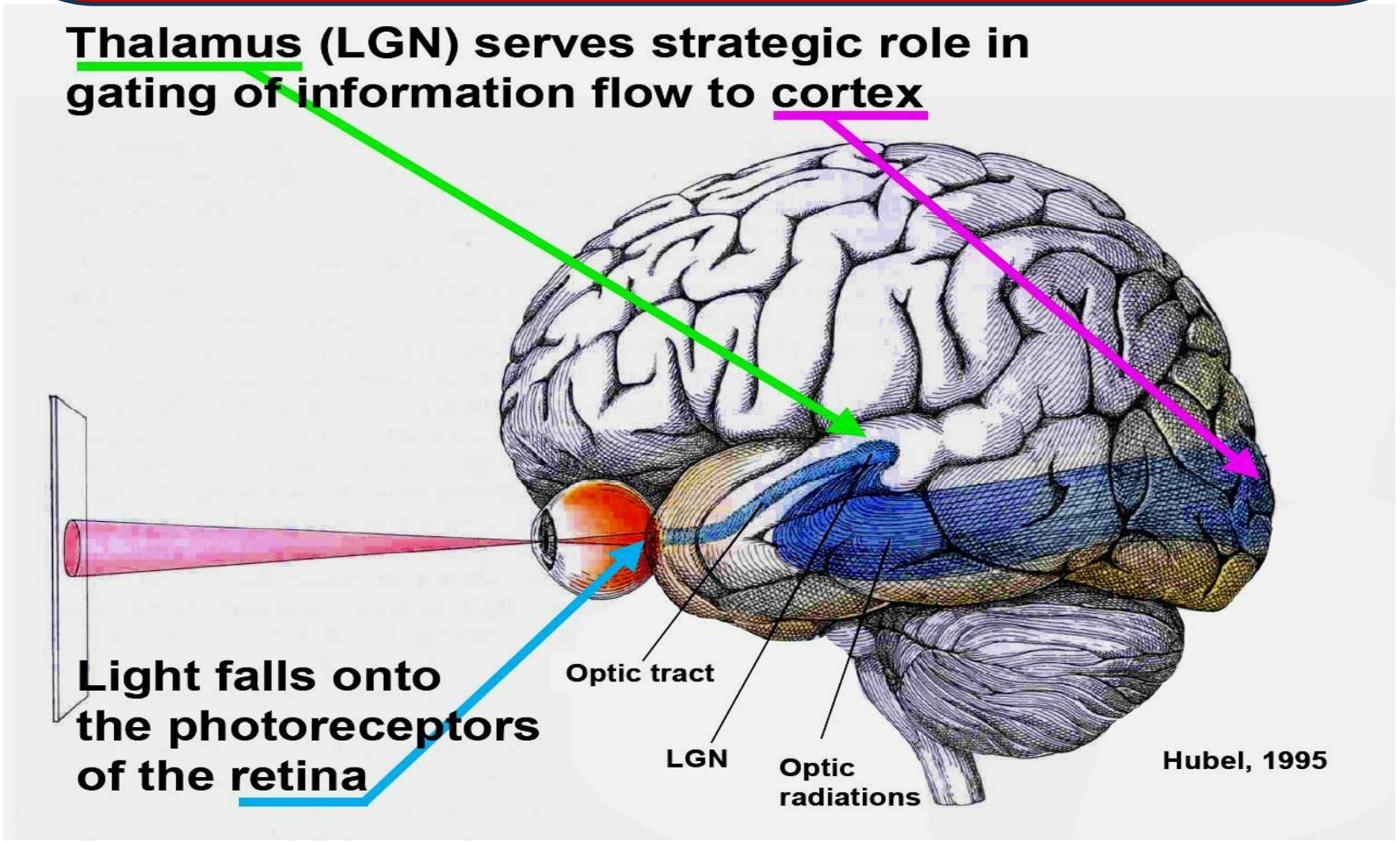
a. **Lateral geniculate body (LGB)**

b. **Pretectal nucleus** in the midbrain (center of pupillary light reflex).

c. **Superior colliculus** in midbrain (center of visuo-spinal reflex).

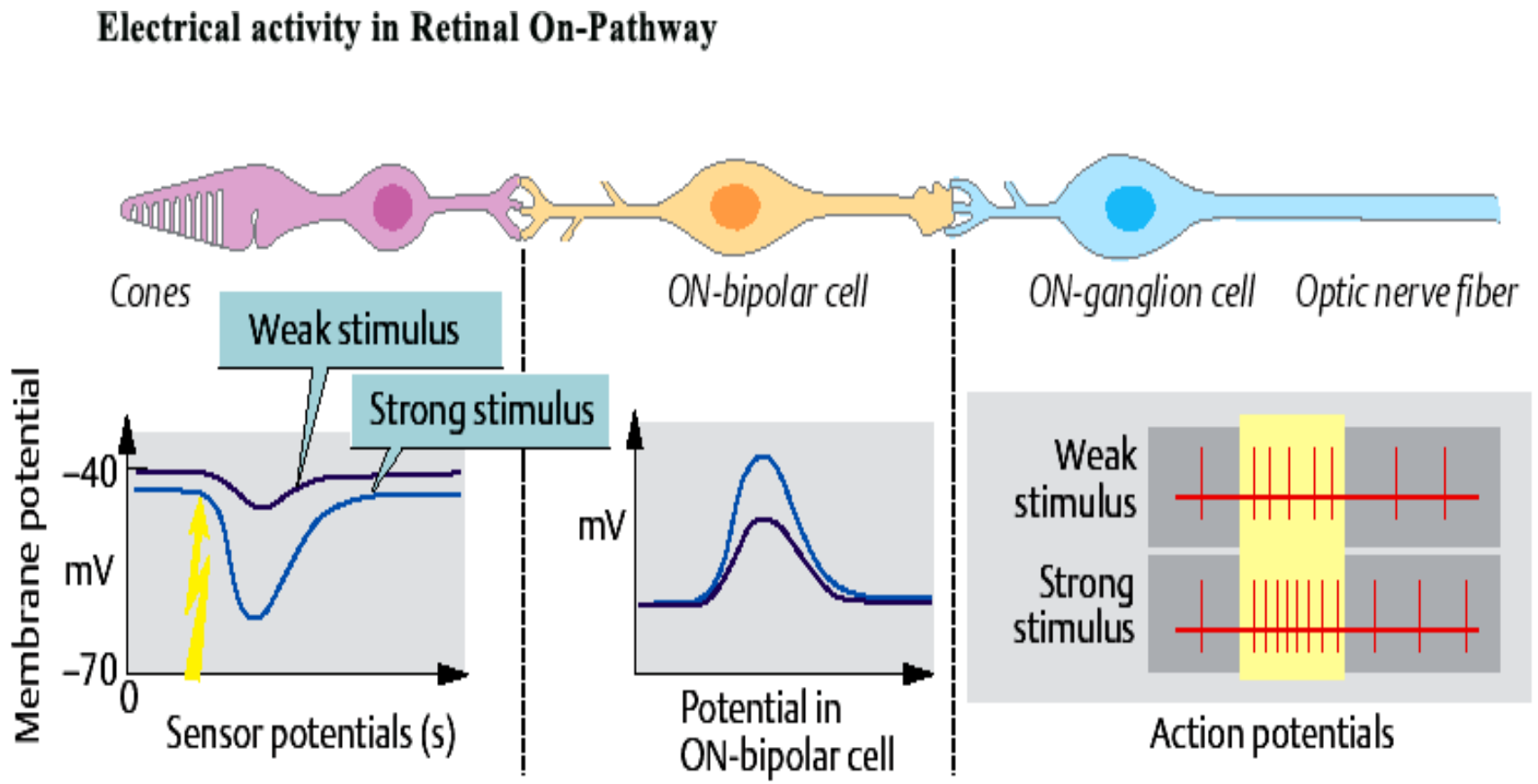
d. **Supra-chismatic hypothalamic nucleus** for control of circadian rhythm.

Role of different parts of Visual Pathway in visual perception



Retinal Cells

- **Analysis of the visual image** occurs early in the retina



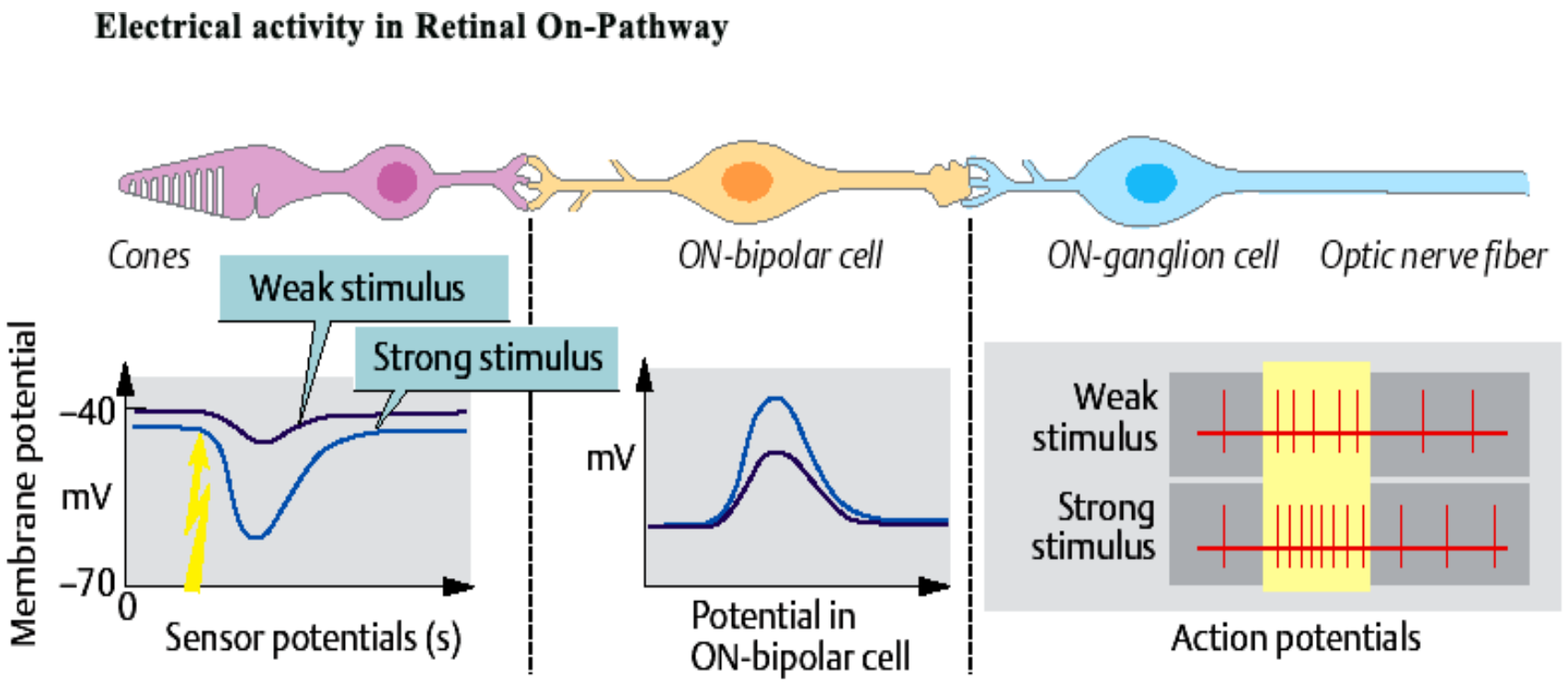
Role of Bipolar Cells

- They **constitute direct pathway** between photoreceptors and ganglion cells, release glutamate

2 types;

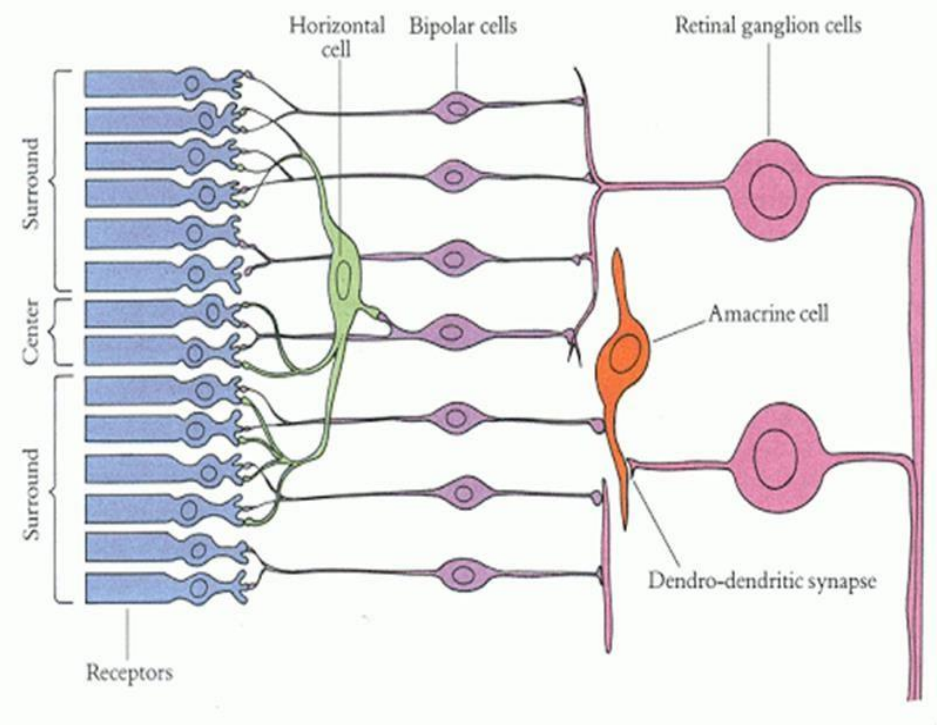
a) Depolarizing bipolar (on-bipolar) cells

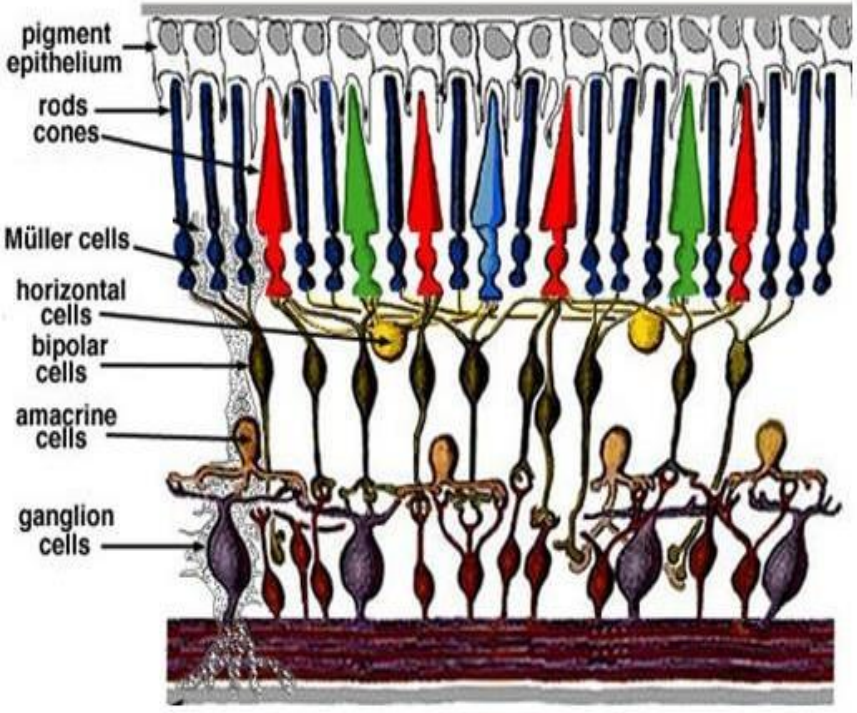
b) Hyperpolarizing bipolar (off-bipolar) cells



Role of Lateral Cells

- **Horizontal cells** represent **lateral inhibitory** pathway in the retina
- **Amacrine Cells** help in the **analysis** of the visual signals before leaving retina





Role of Ganglion Cells

- **About 1.6 millions cells**
- The only retinal cells that respond to stimulation by a **full action potential** i.e depolarization

Types of ganglion cells:

a) Magnocellular (M) (10%):

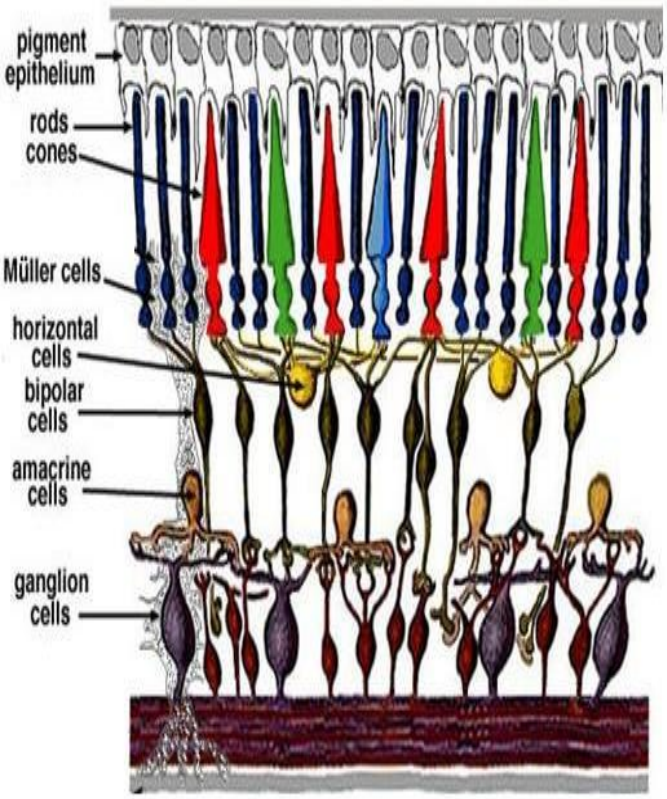
- Large ganglion cells.
- Concerned with **gross analysis & location of objects** in visual field and motion

b) Parvocellular (P) (80%):

- Small ganglion cells.
- Responsible for **fine detailed vision (shape & texture) and color vision**

c) Coniocellular (10%):

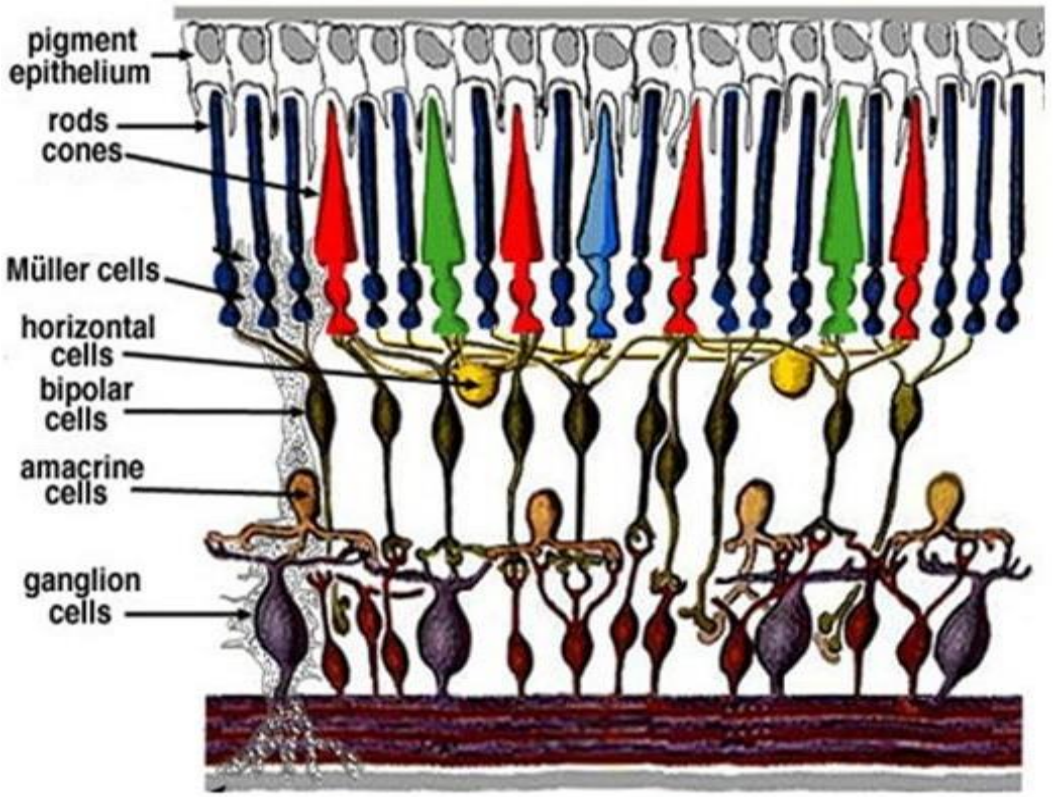
- Medium in size
- Concerned with controlling **pupillary reflexes**



Role of Ganglion Cells

Functions of Ganglion Cells:

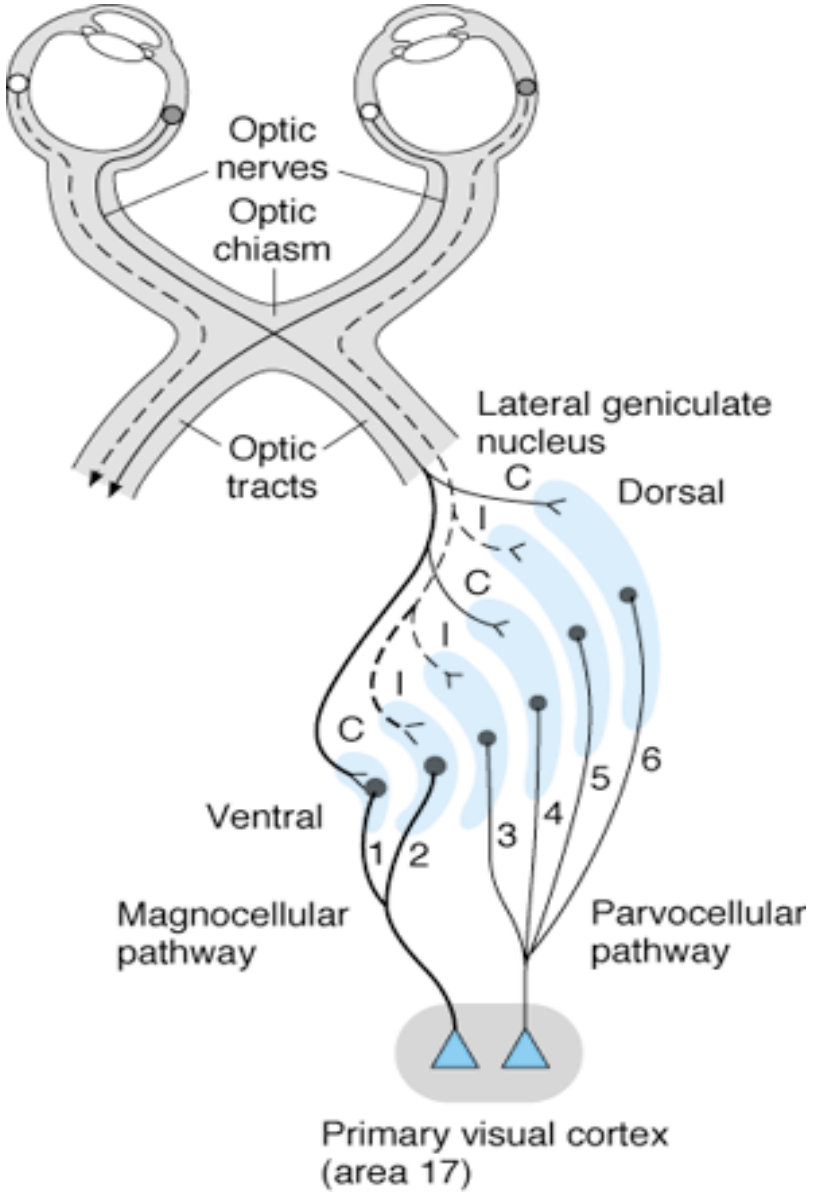
1. **Detection of 2 point discrimination** in the visual scene
2. **Detection of the contrast** in the visual scene
3. **Detection of the movement** and its orientation in the visual scene
4. **Colour analysis**



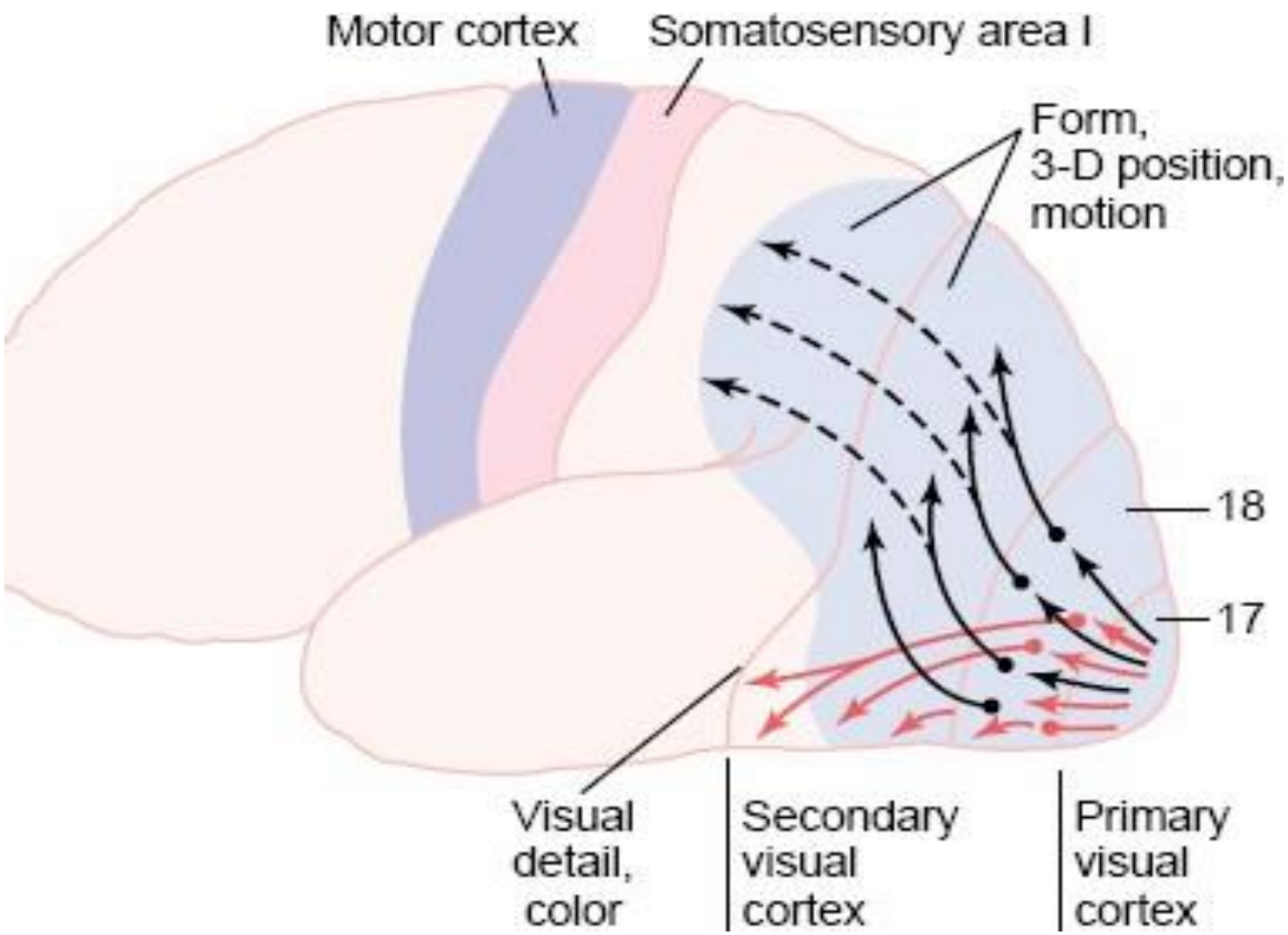
Lateral Genculate Body (LGB)

Functions of LGB

1. Plays a part in **fusion of retinal images** from the 2 eyes.
2. Plays a part in **stereoscopic vision** by comparing the visual images from both eyes and detection of minimal differences.
3. **Magnocellular neurons** are concerned with perception of white and black, shape and motion.
4. **Parvocellular neurons** are concerned with perception of color vision and accurate point-point spatial information



Visual Cortical areas

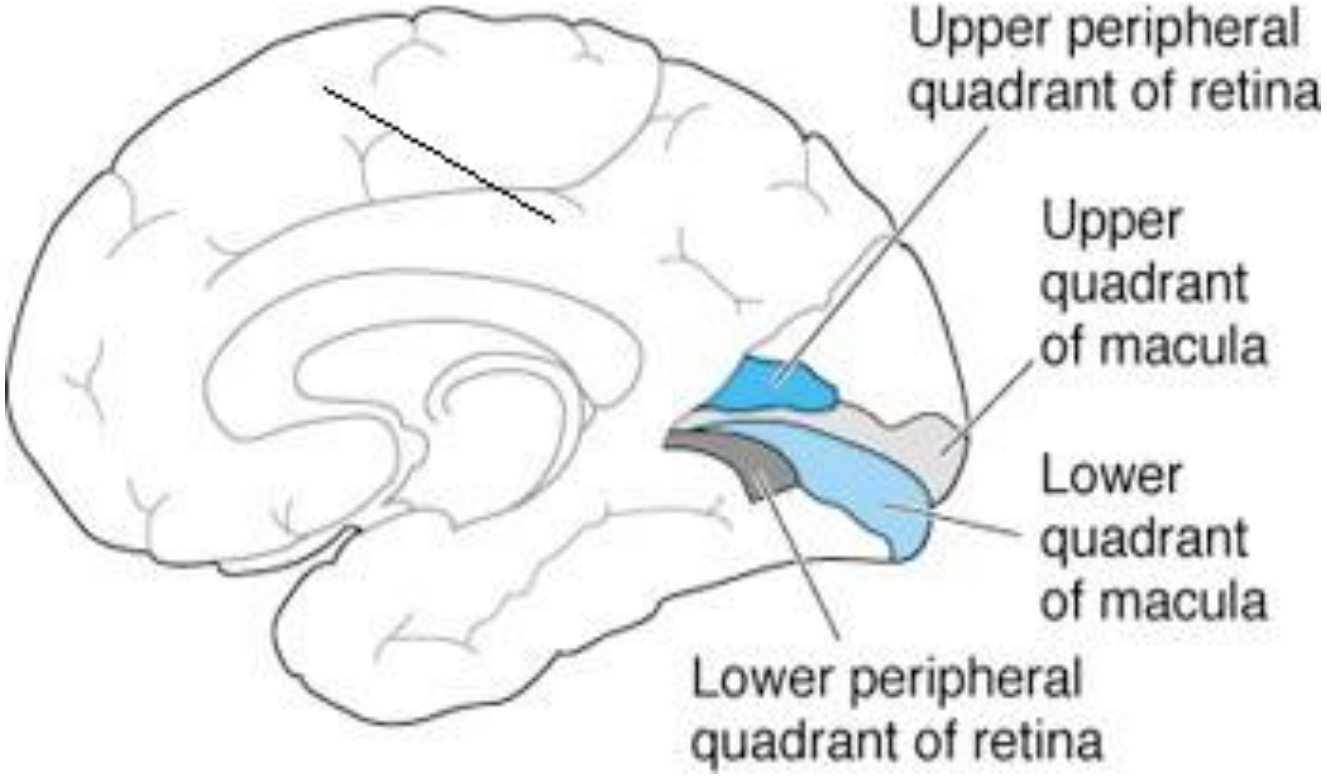


1ry Visual area (area 17)

Site

- Surrounds the **calcarine fissure** on the occipital lobe

Representation of retina in area 17



1ry Visual area (area 17)

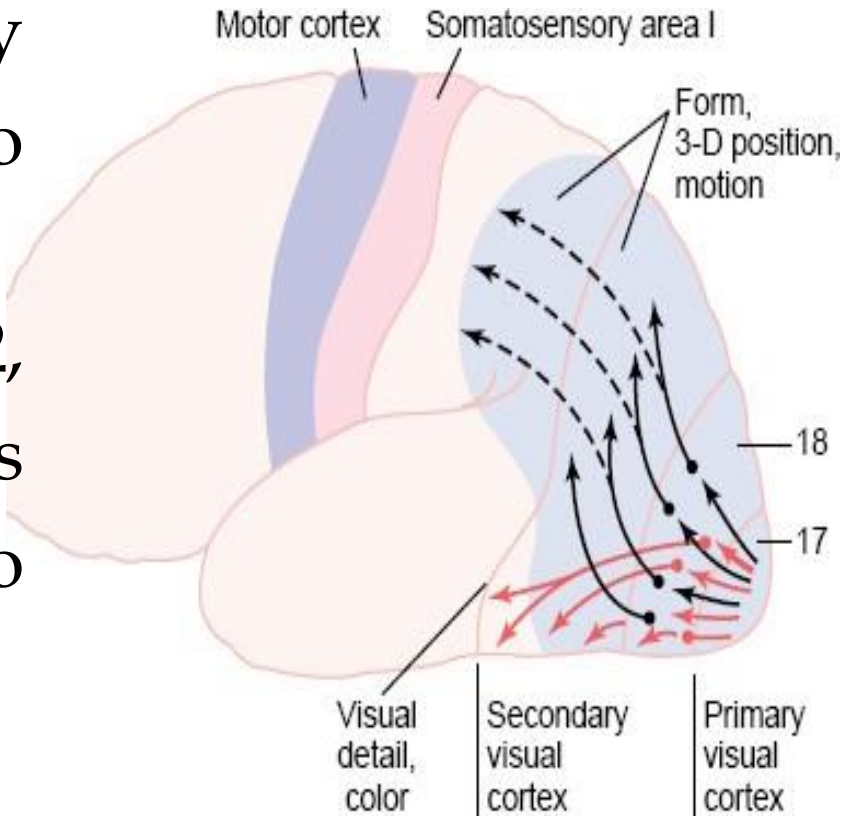
Function:

1. Detection of **lines and borders**
2. Detection of the **orientation of lines and borders**
3. **Analysis of colors**
4. Fusion of the **images from the 2 eyes**
5. Perception **of luministy**

2ry Visual area (areas 18-19)

Site:

- Occipital lobe around 1ry visual area and extend to parietal & temporal lobes
- Areas 18 is called area V-2, more distant 2ry visual areas are assigned V-3,V-4 and so no.



2ry Visual area (areas 18-19)

Functions:

Area 18

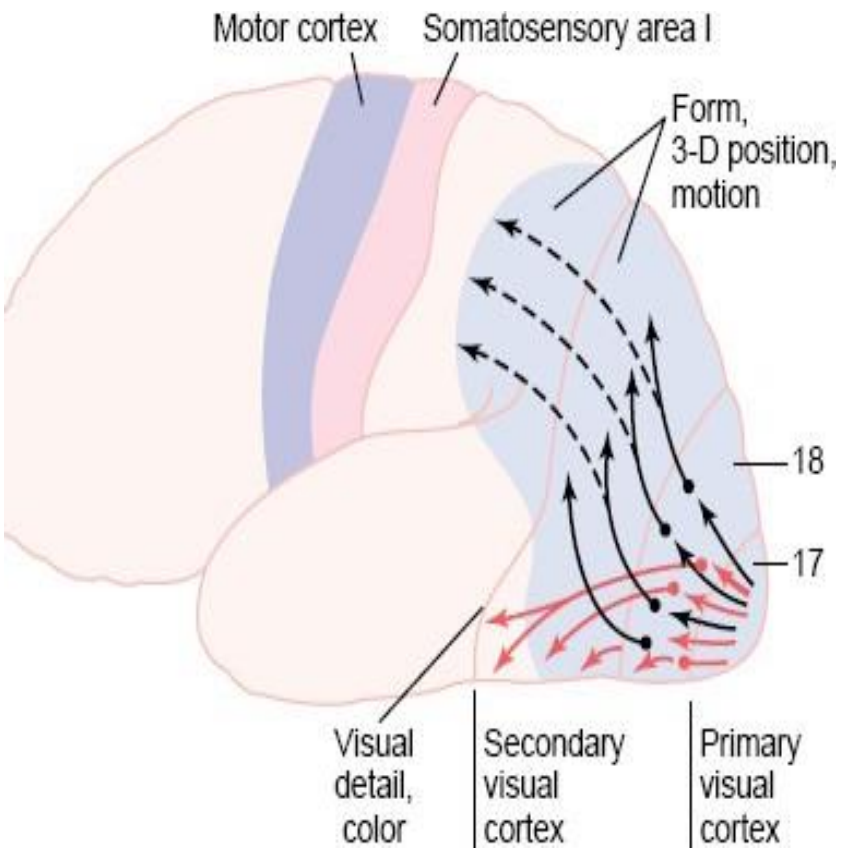
- It is also known as visuopsychic area which is concerned with;

a. Recognition the **nature of the objects** and **correlates their colours**

b. Interpretation of **visual sensations**

c. Localization of object in space i.e. **depth perception**

Lesion → visual agnosia



2ry Visual area (areas 18-19)

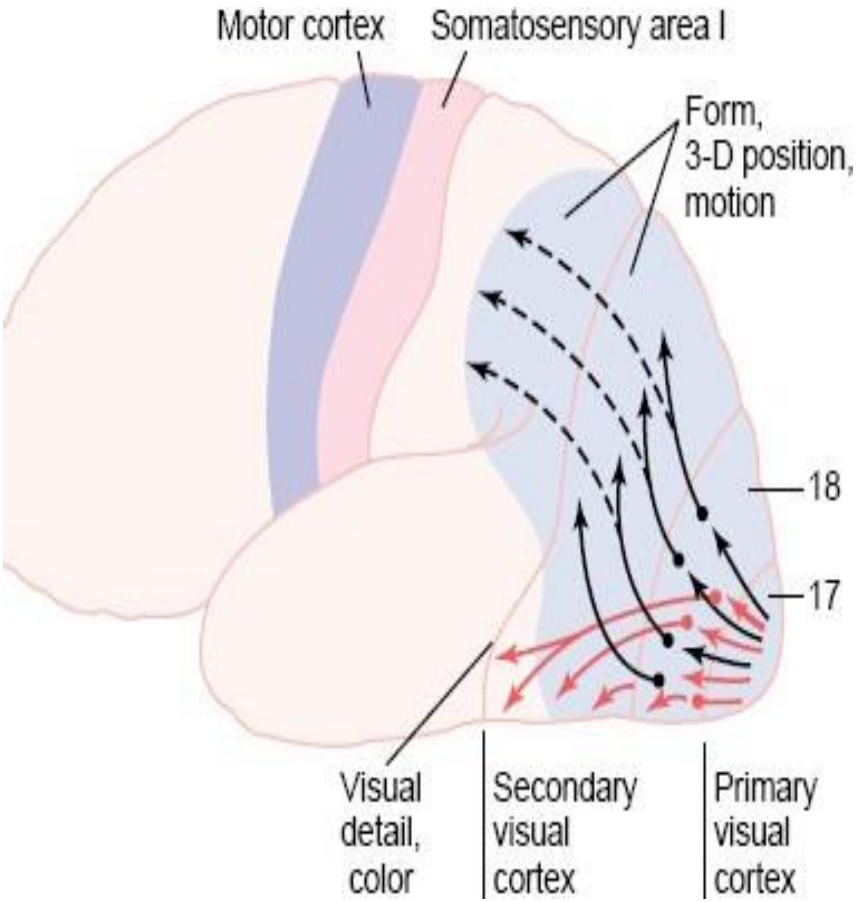
Functions:

Area 19

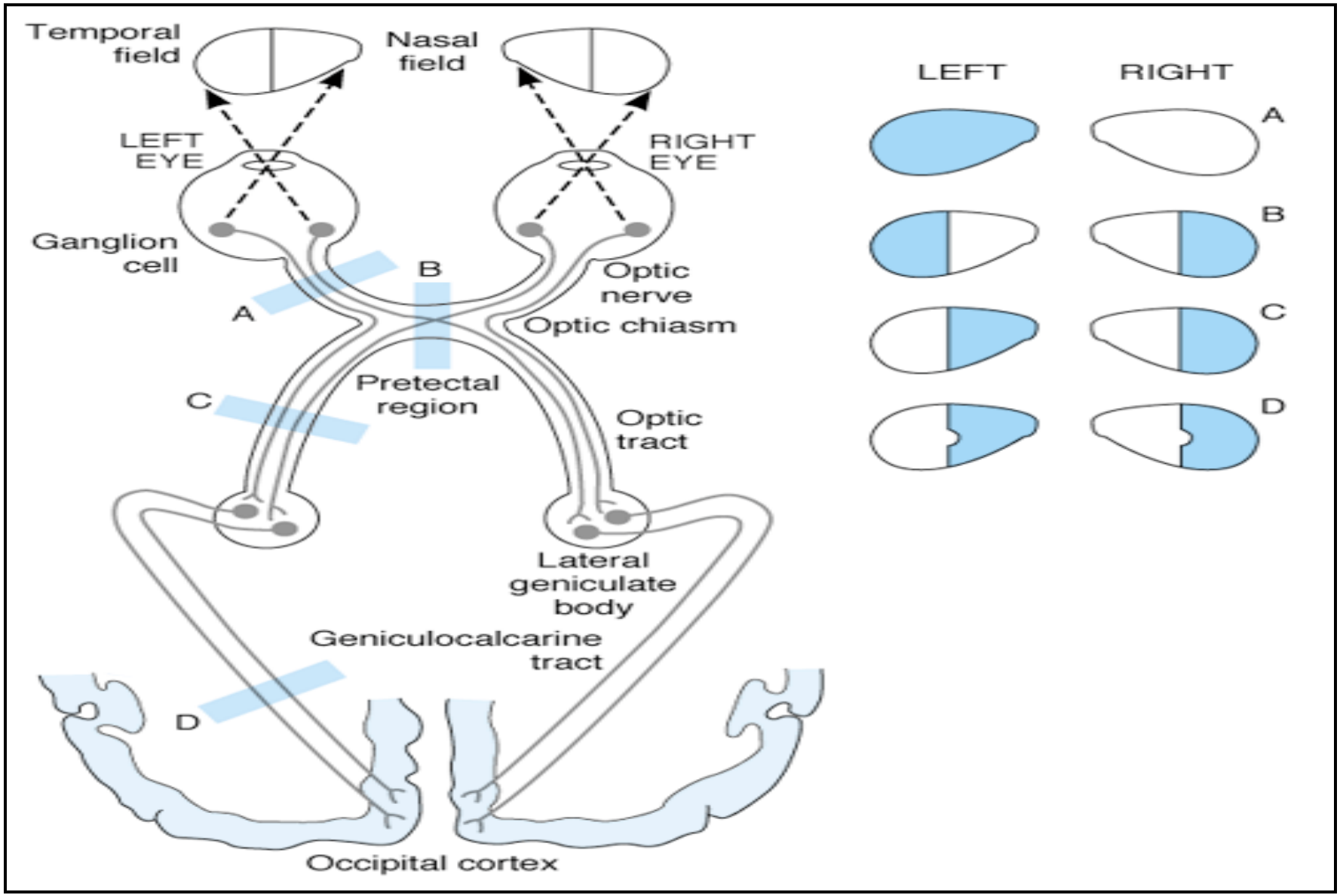
- It is also known as the **occipital eye field area**.

a. It shares area **18** its functions.

b. It **controls** the different types of eyeball movements.

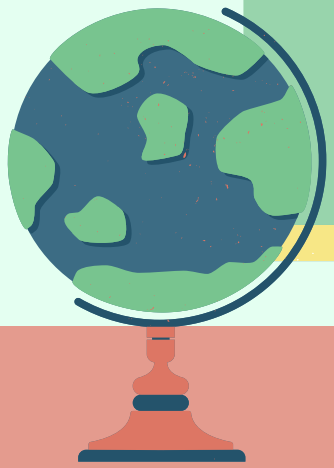


Lesions in the Visual Pathway



Any Questions

??




Thank
You