

# Anatomy & Physiology of the Visual Pathways

## Physiological functions:

**Retina:** first place to process visual data  
**EDGE CONTRAST:** a ganglion cell will suppress its neighbours when it is excited on its own; thus there is CONTRAST

**Optic Nerve** does no processing of its own. Axons are myelinated after the optic nerve exits the eyeball at the back through the **Lamina Cribrosa**

**Optic Chiasm:** The **NASAL** retinal field **DECUSSATES** and the **TEMPORAL** does NOT. The Optic nerve sends fibres to the **HYPOTHALAMUS**

**Hypothalamus: Suprachiasmatic Nucleus**  
 Devoted to maintaining the **CIRCADIAN RHYTHMS**

**Optic Tract:** delivers all the information from the contralateral visual field to the LG.

**Superior Colliculus** of midbrain = receives fibres before the lateral; geniculate avoidance; involved in **MOTOR AVOIDANCE** i.e incoming missiles, plus **SACCHADES** (for smooth pursuit) and **glancing at an unexpected touch**, i.e attention focus

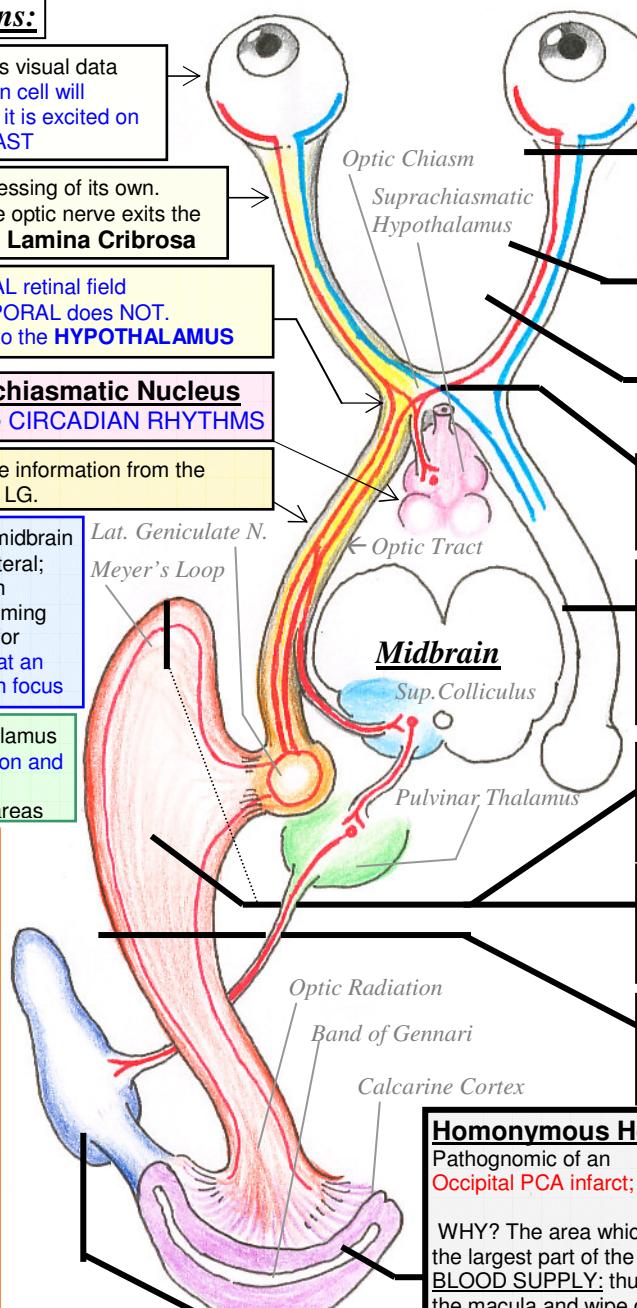
**Pulvinar Nucleus** of Thalamus is involved in **focussing attention and prioritising eye movements**; it projects to the visual assoc. areas

**Lateral Geniculate Nucleus** is the **FIRST PLACE** where the is **accurate topographical representation** of what the retina sees. PLUS L.G. also **sorts function streams**, i.e sorts the colour data from edge detection data, etc; PLUS L.G sorts data from each eye into its separate stream.  
**!! VERY IMPORTANT!!**  
 Both eyes' images must be superimposed for **"REGISTRATION"** to happen, i.e depth perception- the inference of where the object is in space.

**Meyer's Loop**=fibres to the calcarine cortex curve around the lateral wall of the lateral ventricle, forming a broad sheet which sweeps across, covering much of the post. and inf. horns  
**INF VIS. FIELD** = the fibres furthest → parietal  
**SUP VIS FIELD** = the fibrest furthest temporally  
**MACULA** = the broad central area

**CALCARINE CORTEX: primary visual cortex**  
 First real **ANALYSIS** of visual information; the cortex contains **neurons which respond to various features of the image**; the neurons respond most strongly to edges of a particular orientation. This yields a **decomposition of the image according to its edges**. NOT SOMETHING YER BORN WITH: these features develop in infancy; ref. them kittens who were kept in the dark from birth and went blind despite having healthy eyes.

**SECONDARY VISUAL ASSOCIATION CORTEX: SEPARATION INTO COMPUTATIONAL STREAMS:**  
**Where is it?"** stream proceeds from the **superior occipital lobe through the middle temporal gyrus to the parietal lobe**. This stream places objects in space and detects whether they are moving, relative to their background or to other objects, or whether the background itself is moving.  
 = **ORIENTATION**  
**"What is it?"** stream proceeds through the inferior occipital to the inferior temporal lobe. **RECOGNITION** of all the separate objects, faces, and people, which or whom we are able to recognize. **COLOUR** information is extracted nearby in the V4 area (temporo-occipital)



## their LESIONS and the Commonest Causes thereof

**Big Blind Spot**  
 Optic nerve head enlargement, eg. via **papilloedema**

**Tunnel Vision** →  
 Concentric diminution  
**Glaucoma, papilloedema and syphilis**

**Central Scotoma**  
 Internal optic nerve destruction, eg. **optic neuritis**

**Unilateral Blindness**  
 Total loss of one field:  
**Tumour, retinal artery infarct, Trauma**

**Bitemporal Hemianopia**  
 Loss of fields which cross over in the chiasm: **Pituitary Tumour, trauma**

**Homonymous Hemianopia**  
 Loss of one side of perception  
 Lesion is post-chiasm and could be anywhere, until the lat. geniculate  
 eg. **MCA infarct, tumour, Aneurism post-chiasm**

**Superior Quadrantinopia**  
**TEMPORAL LOBE LESION**  
**MCA lacunar infarct in penetrating arteries, tumour...**

**Inferior Quadrantinopia**  
**PARIENTAL LOBE LESION**  
**MCA lacunar infarct in penetrating arteries, tumour...**

**Homonymous Hemianopia**  
 Loss of one side of perception  
**MCA infarct or tumour**

**Homonymous Hemianopia with Macular Sparing**  
 Pathognomic of an **Occipital PCA infarct**;  
 WHY? The area which process information from the **MACULA** is the largest part of the calcarine (primary visual) cortex has a **DUAL BLOOD SUPPLY**; thus any infarct here will more than likely spare the macula and wipe out everything else.  
**SYMPTOMS ARE STRANGE: "Blind Sighted"**  
 These patients are unable to process visual information, but still have **normal circadian rhythms** (the supra-chiasmatic hypothalamic connection is spared) and, oddly they **will avoid projectiles** because the superior colliculus is still processing and transmitting "threat-identification" movement and attention-focussing information.

**SECONDARY VISUAL ASSOCIATION AREA: V2 to V5**  
**LESIONS HERE = NO LOSS OF VISUAL FIELD: Much Worse!**  
**Loss of processing:**  
**V2 OR V3 INFARCT:** (posteriormost, next to the calcarine sulcus (V1)= **LOSS OF ORIENTATION + Mental Rotation**  
**V4 INFARCT:** = Loss of **COLOUR** in vision, → monochrome  
**V5 INFARCT:** = Loss of **MOVEMENT** detection, "photographic" vision where only still frames are perceived