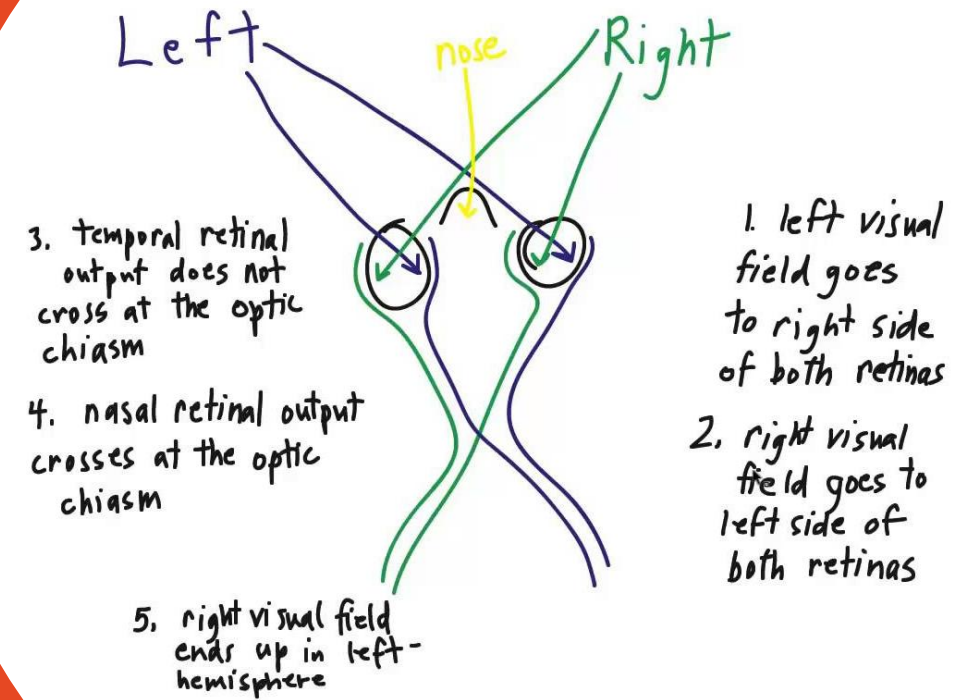



# The Visual Pathways





# Learning Objectives

1. Describe the concept of visual fields
  2. Trace the central visual pathways from the retina to the visual cortex.
  3. Explain the visual deficits produced by damage to the visual fibers at different locations along the visual pathway
  4. Recognize the deficits produced by lesions of the striate and extra striate cortical areas
- 

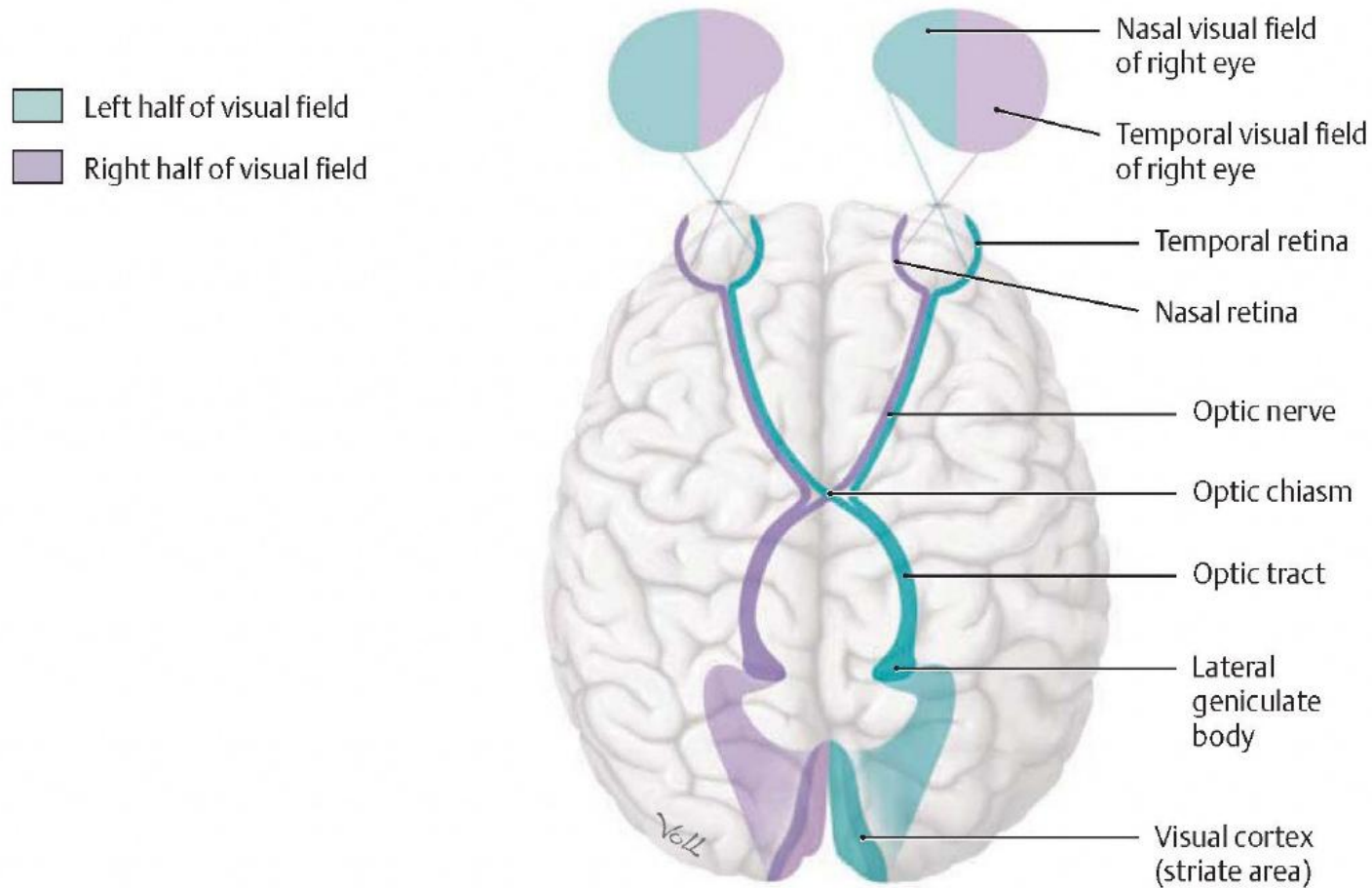
**OBJ. # 1**

# The Visual Fields

Binocular visual field is defined as the space we see with both eyes when the eyes are in primary position

Vf is combined space

## OBJ. # 2



VF are flipped

R half is [processed by L occipital and vice versa  
swap at optic chiasm so VFs line up

crossing fibers - retina: medial/nasal fields cross c  
VF: temporal VFs crossing over

### B Representation of each visual field in the contralateral visual cortex Superior view.

Illustrator: Markus Voll

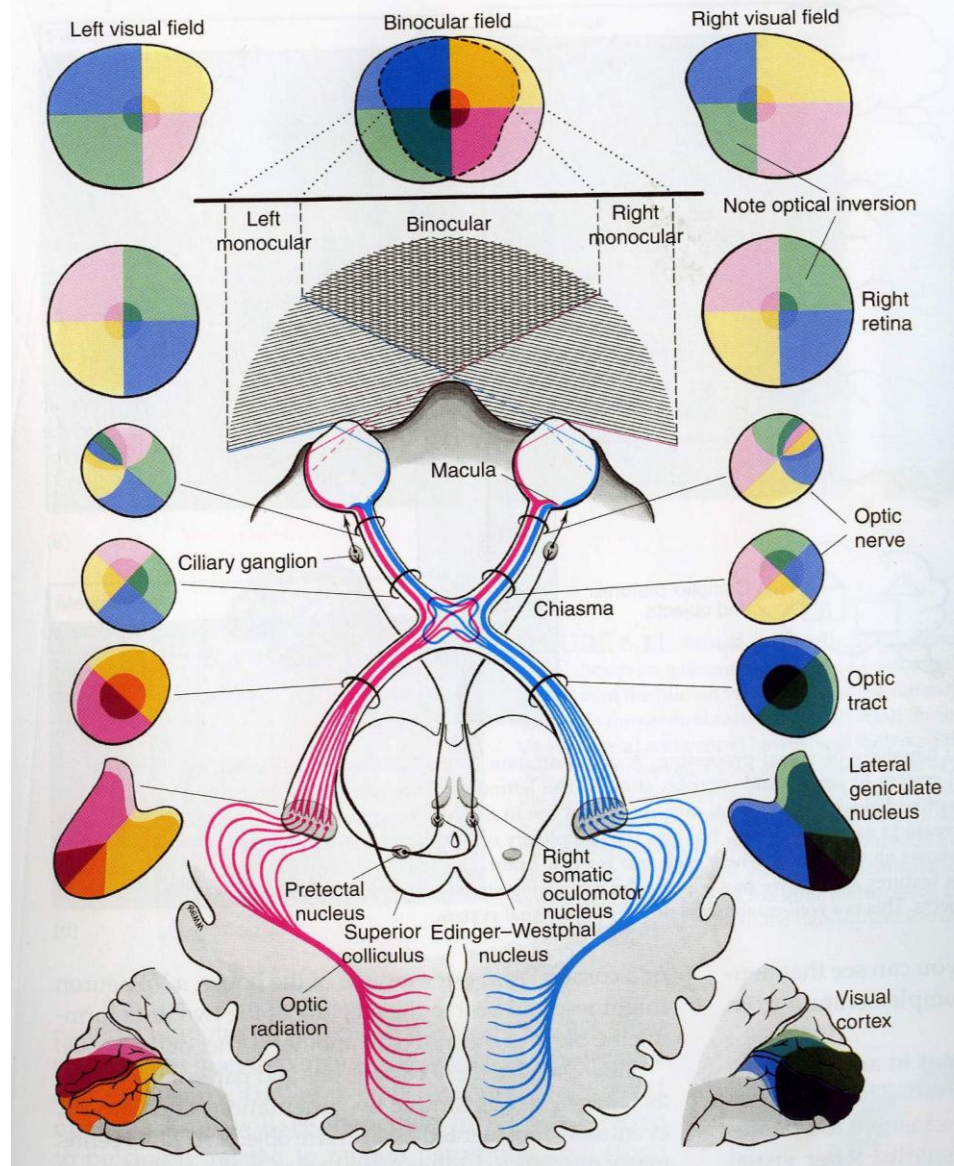
pp. 358-359

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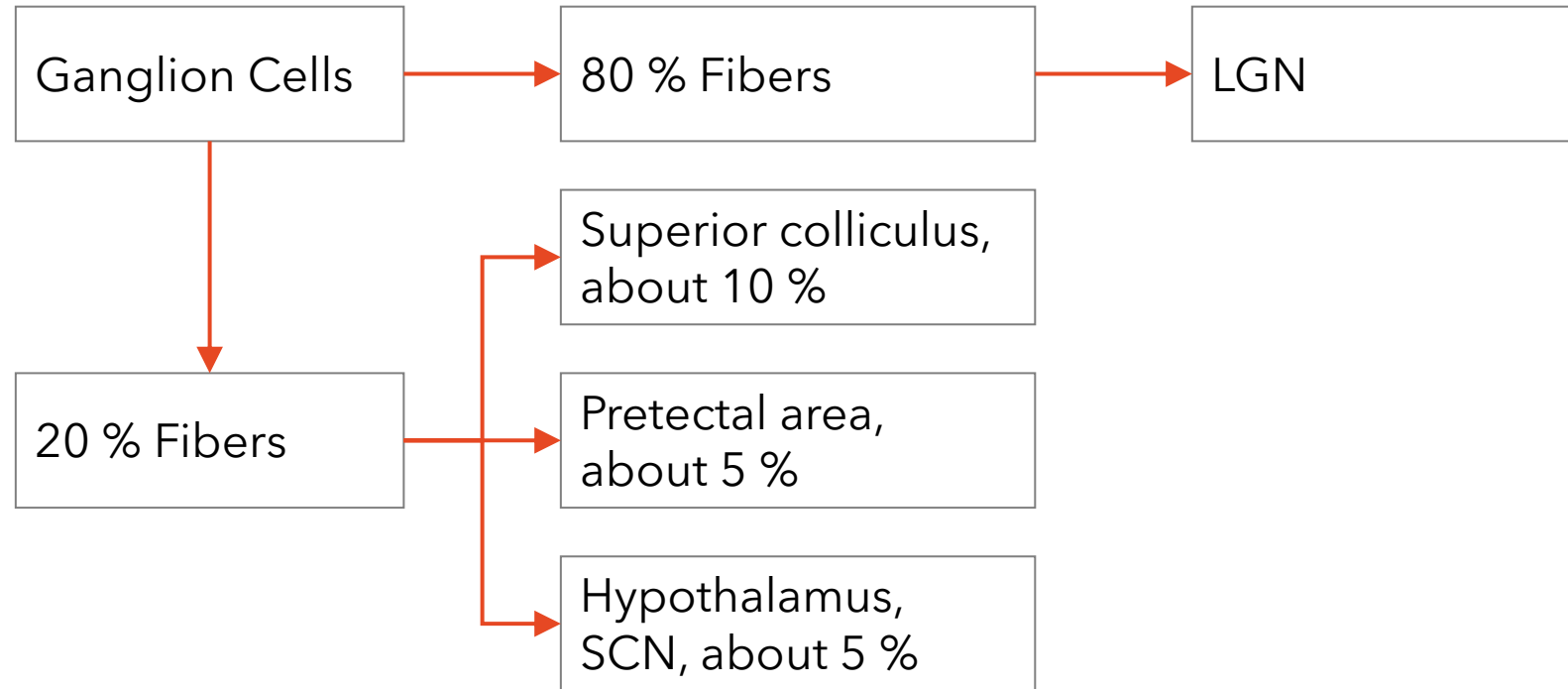
## 2.0 FUNCTIONAL ORGANIZATION OF THE VISUAL SYSTEM



**OBJ. # 2**

# Retinal Output

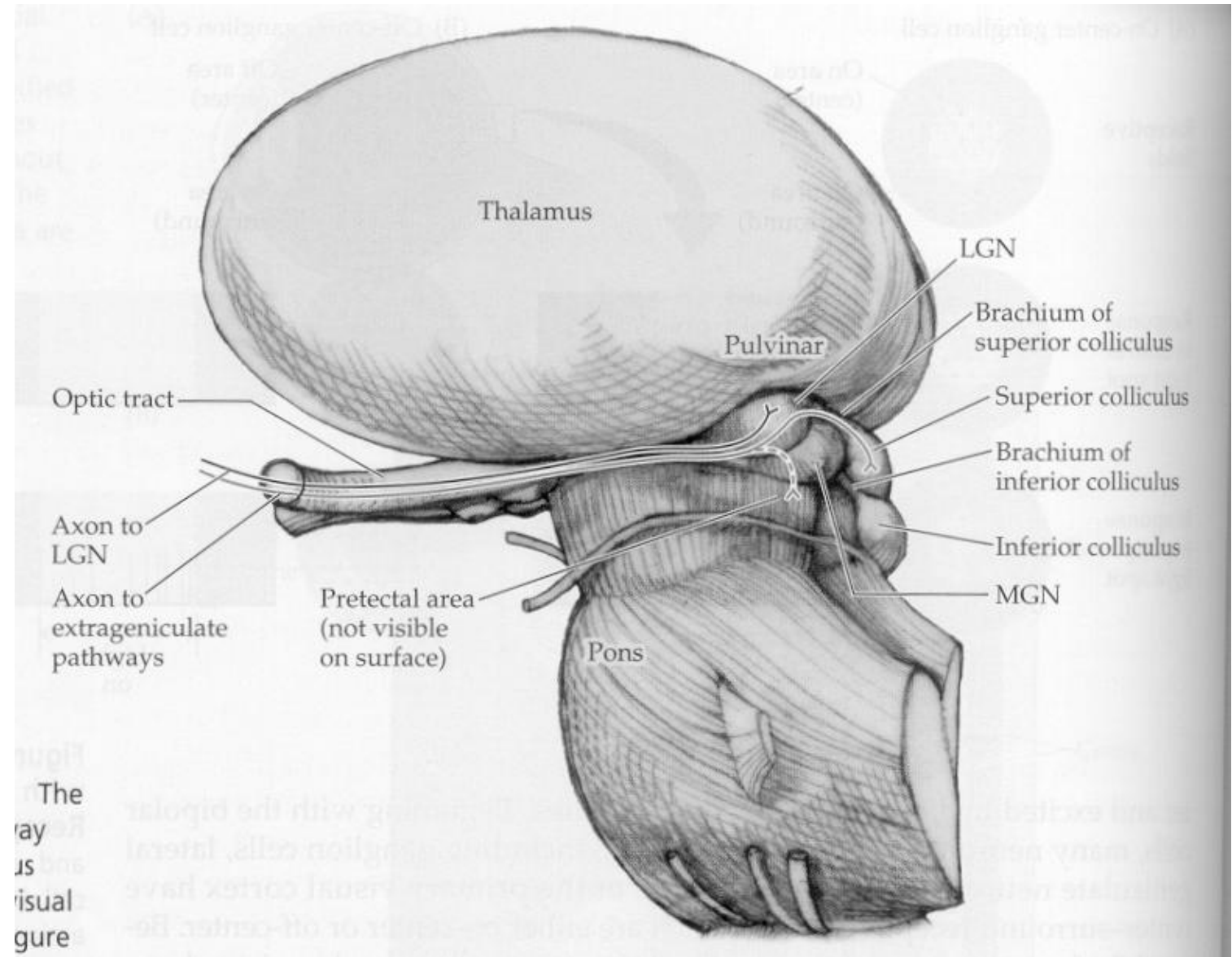
OBJ. # 2





OBJ. # 2

# Trajectory Of The Visual Pathway



OBJ. # 2

# Lateral Geniculate Nucleus

main relay station for vision

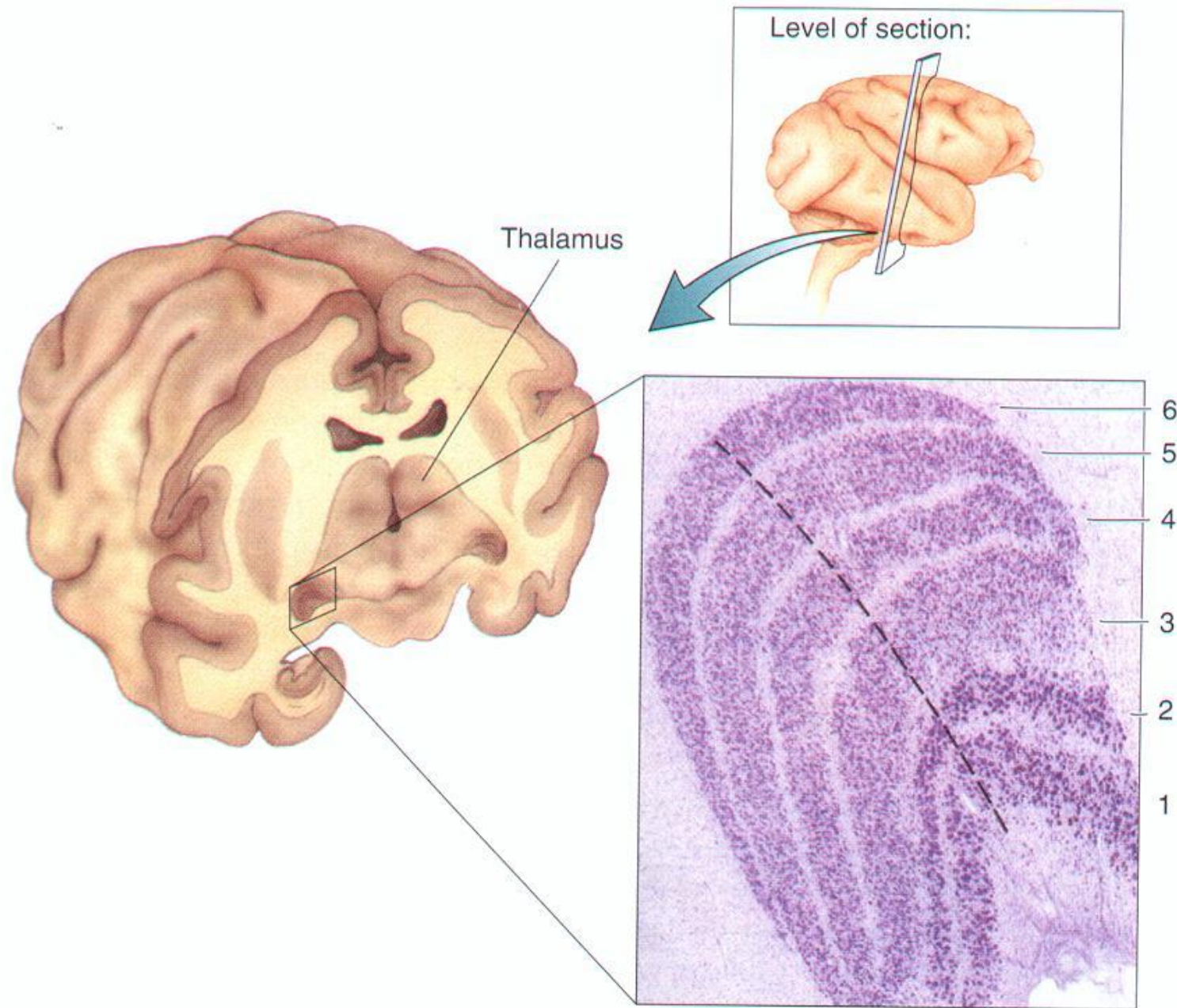
## Retinotopy

- Each layer has a complete retinotopic map
- Each point in space is represented 6 times
- Fovea is over-represented in the LGN bc more visual acuity



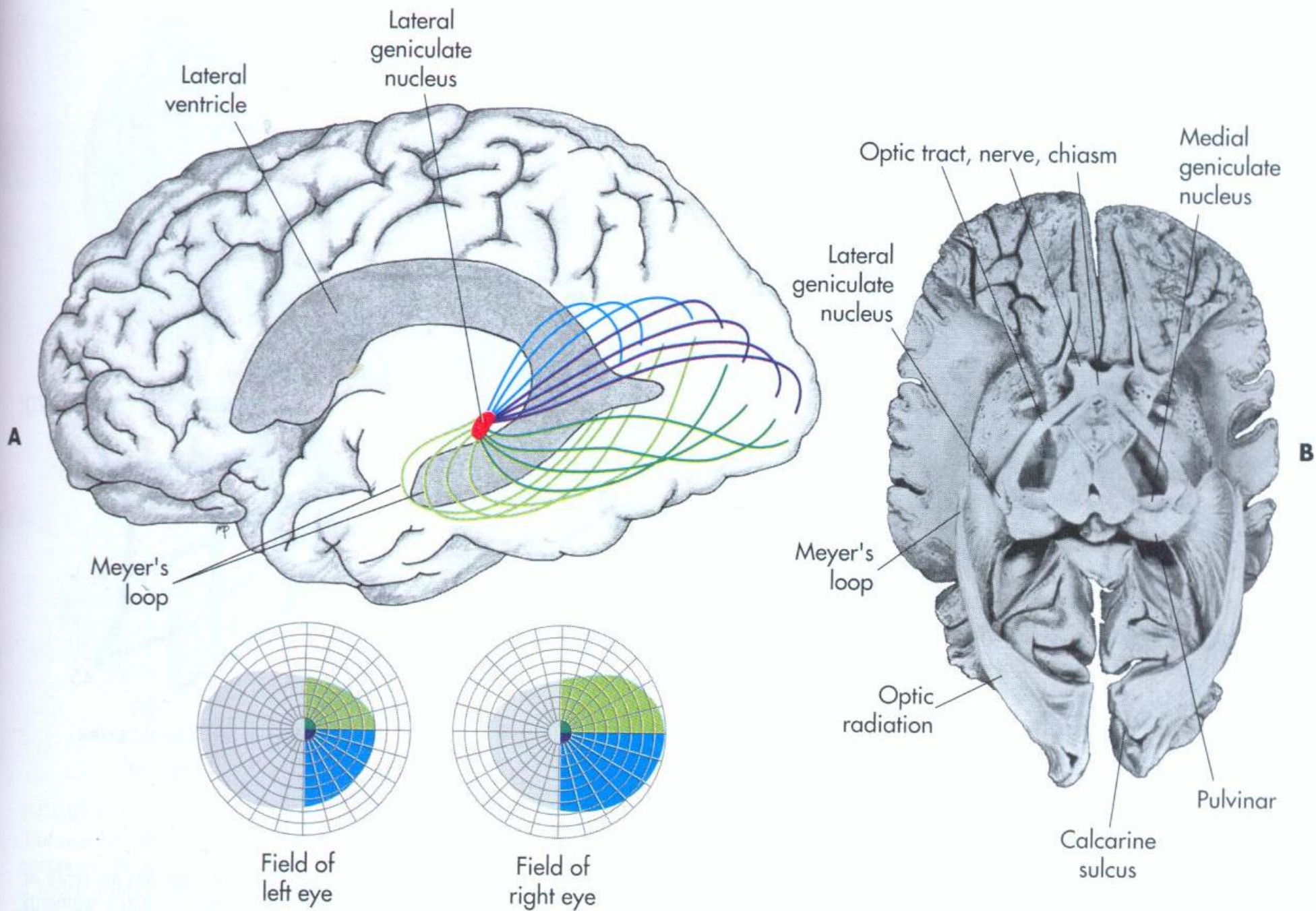


**OBJ. # 2**



## OBJ. # 2

project to striate cortex in 2 paths:  
superior/inferior optic projections



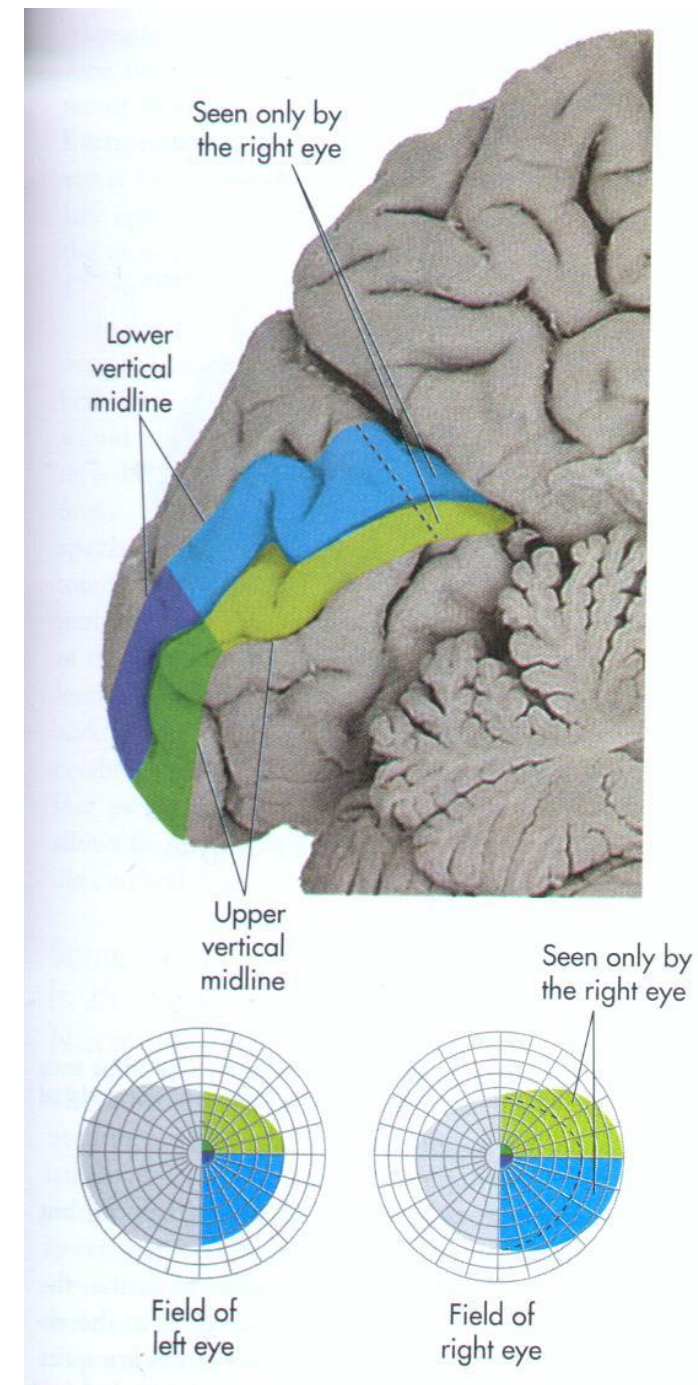


## OBJ. # 2

The occipital lobe - the primary visual cortex: the calcarine Sulcus

The most posterior half of the calcarine sulcus is the representation of the fovea

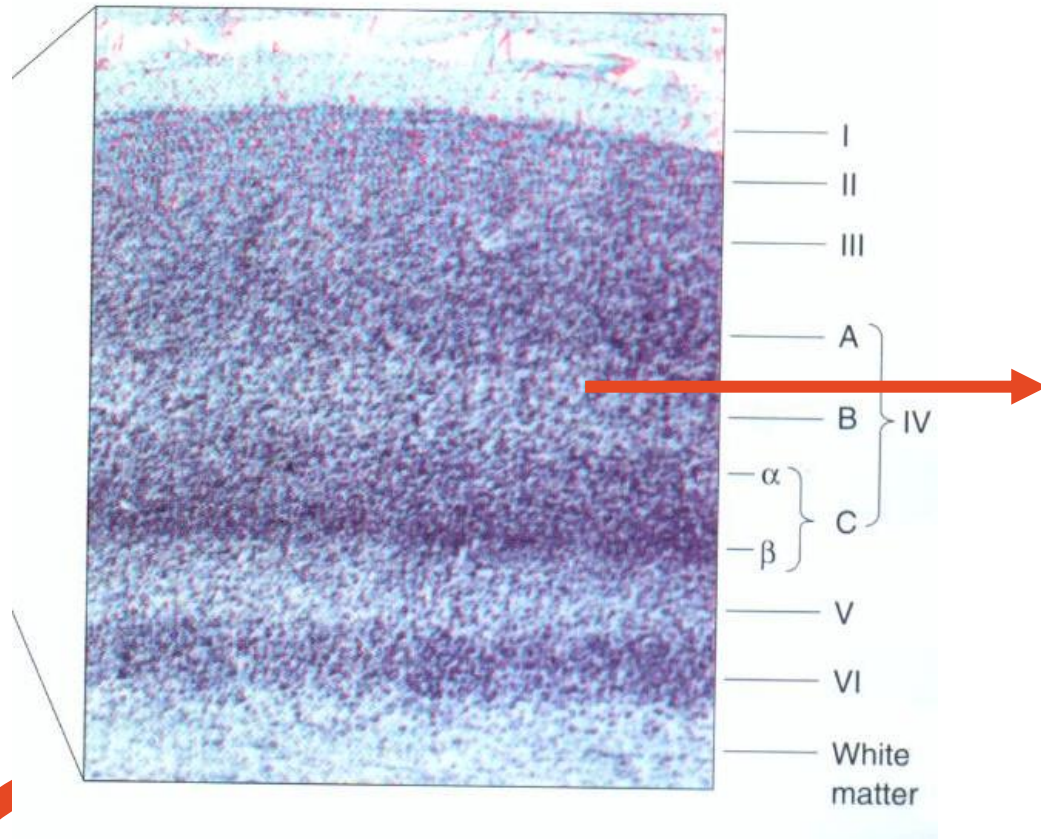
5 degree arc is processed by half the visual cortex



# The Layers Of The Primary Visual Cortex Or Striate Cortex

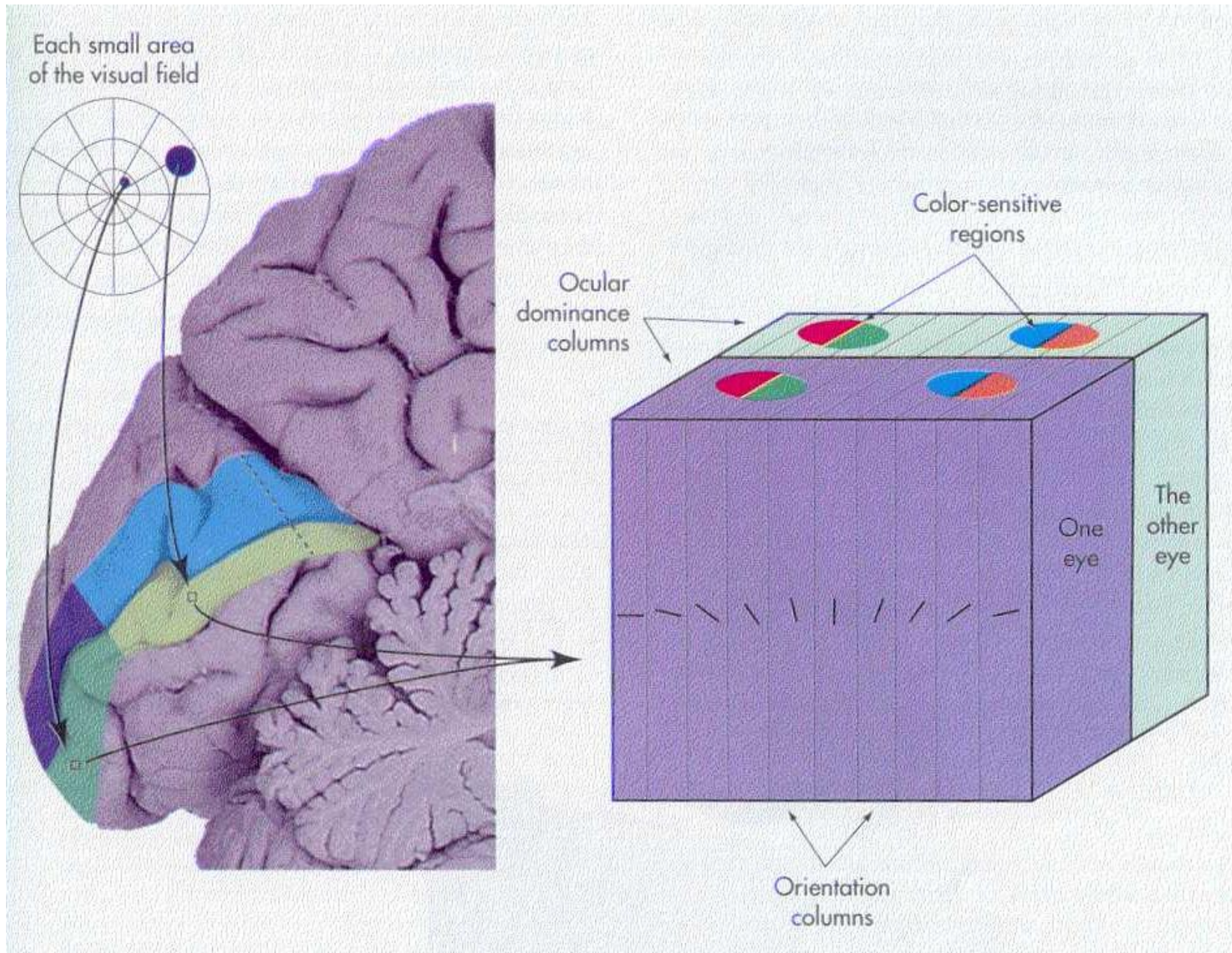
OBJ. # 2

thick layer of myelinated fibers in lamina IV



The myelinated Fibers in lamina IV B of the calcarine cortex named the Stria of Gennari





## OBJ. # 2

visual information being compared between the two eyes to produce a cohesive VF helps with depth perception



# Visual Information Is Processed Through 3 Different Channels

OBJ. # 2

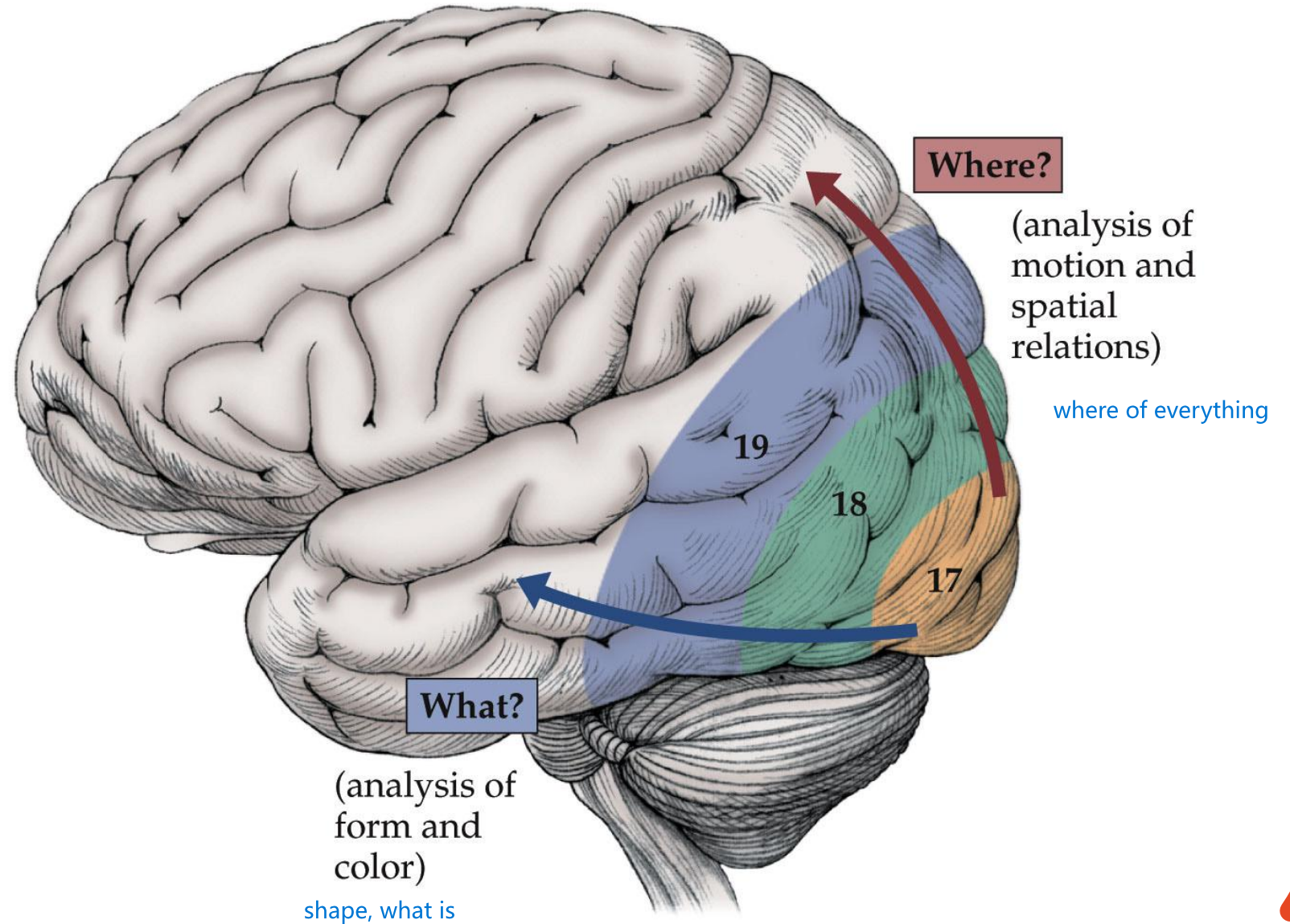
Specialized in object  
motion information

Specialized in fine special  
information about object  
shape

Specialized in the analysis  
of object color

OBJ. # 2

# The What And Where Pathways

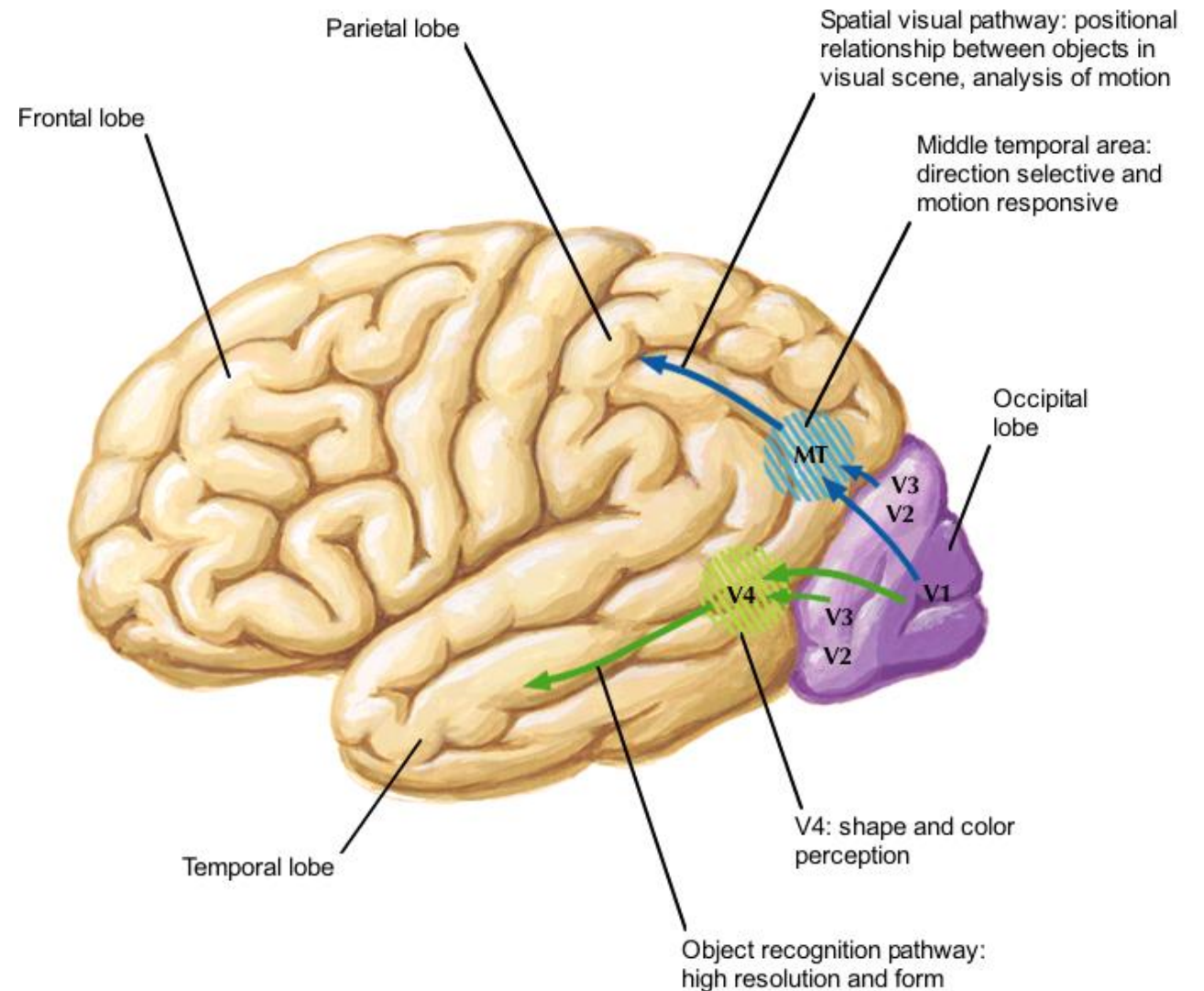


NEUROANATOMY 2e, Figure 19.12

# The Visual Cortex

OBJ. # 2

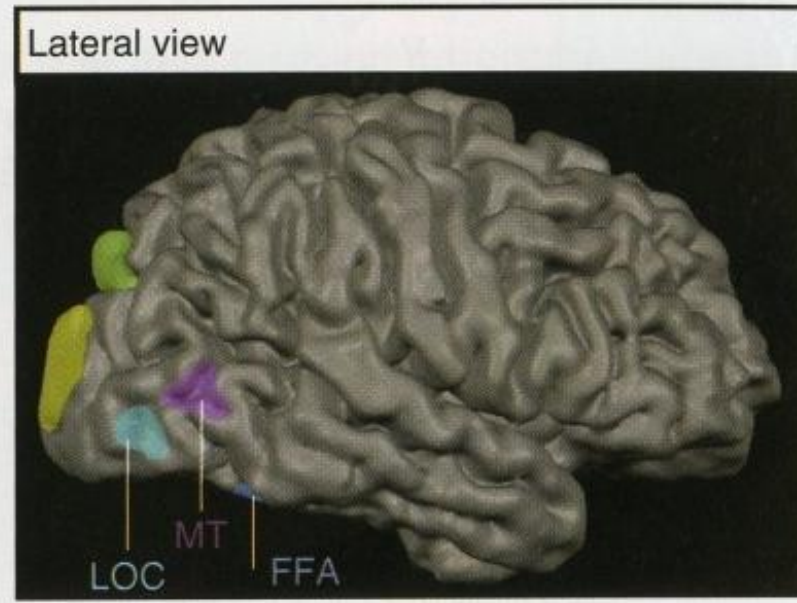
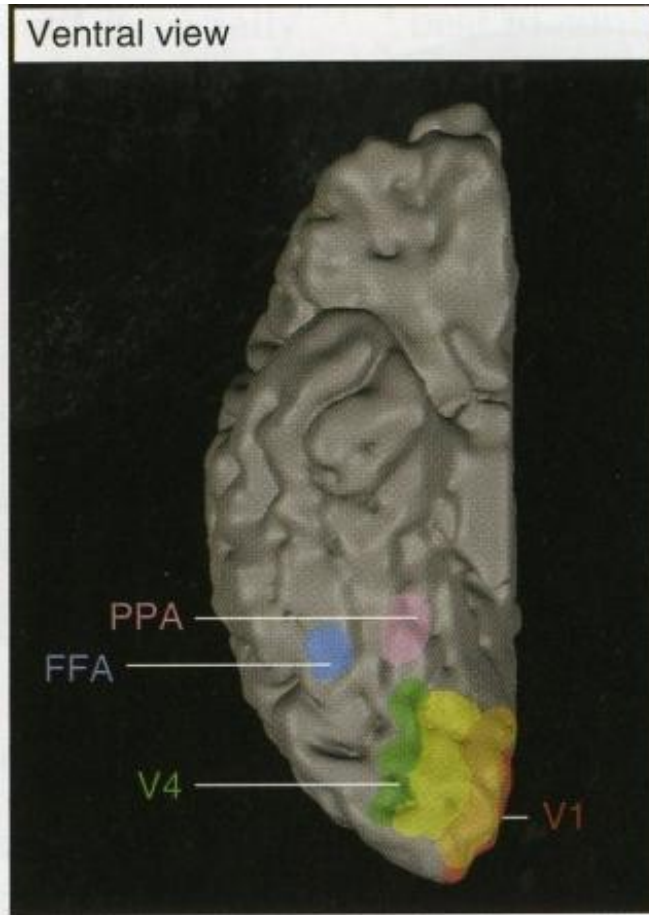
## Visual Pathways in the Parietal and Temporal Lobes



## OBJ. # 2

fMRI data

# Object And Face Recognition Areas



### **LOC area**

Lateral occipital complex area

### **FFA**

Fusiform face area

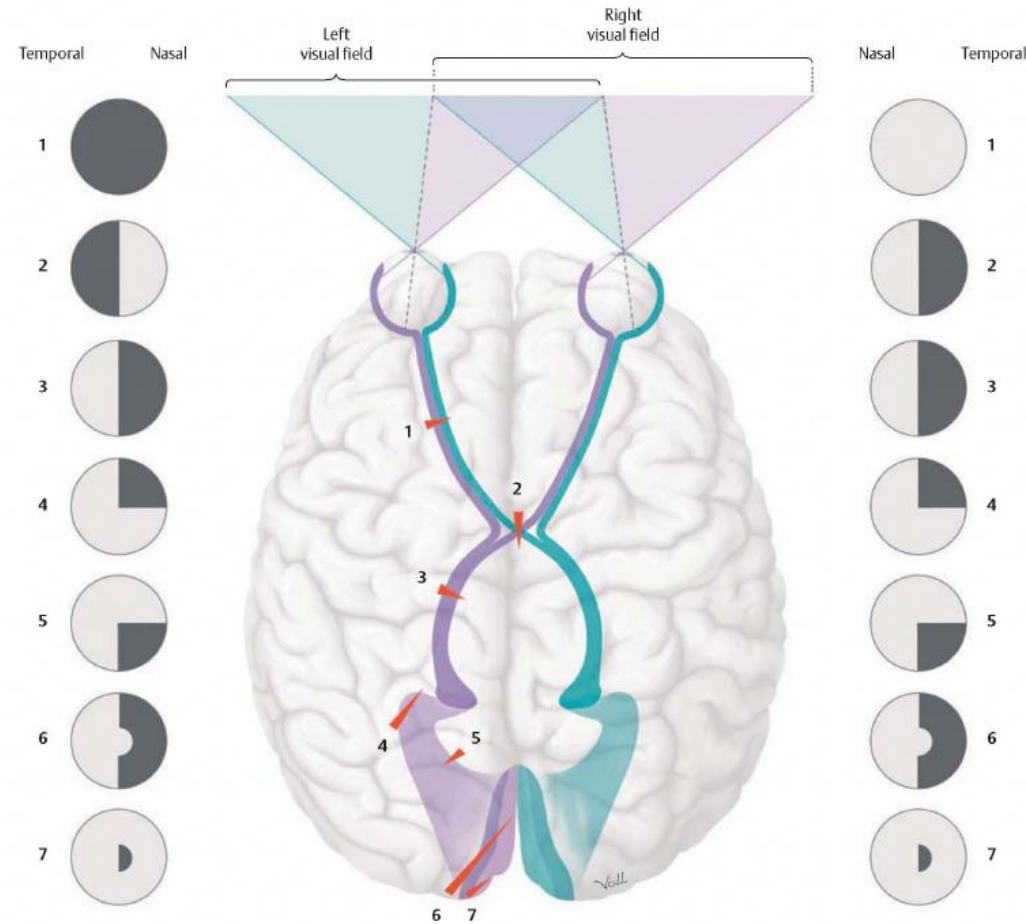
### **PPA**

Parahippocampal place area



OBJ. # 3 & 4

# The Visual Deficits



## A Visual field defects (scotomata) and their location along the visual pathway

- 1 Unilateral optic nerve lesion.
- 2 Lesion of the optic chiasm.
- 3 Unilateral lesion of the optic tract.
- 4 Unilateral lesion of the optic radiation.
- 5 Unilateral lesion in the medial part of the optic radiation.
- 6 Lesion of the occipital lobe.
- 7 Lesion of the cortical areas of the occipital pole.

will come up on exam - only crossing fibers (temporal fields of vision) bitemporal hemianopsia

retrochiasmatic - hemi field loss - deficits on one side of vision

4. superior contralateral quadrantanopsia

5. inferior contralateral quadrantanopsia

inferior  
superior

6. sparing central vision - occipital pole still gets blood supply  
7. central vision

Illustrator: Markus Voll

pp. 360-361

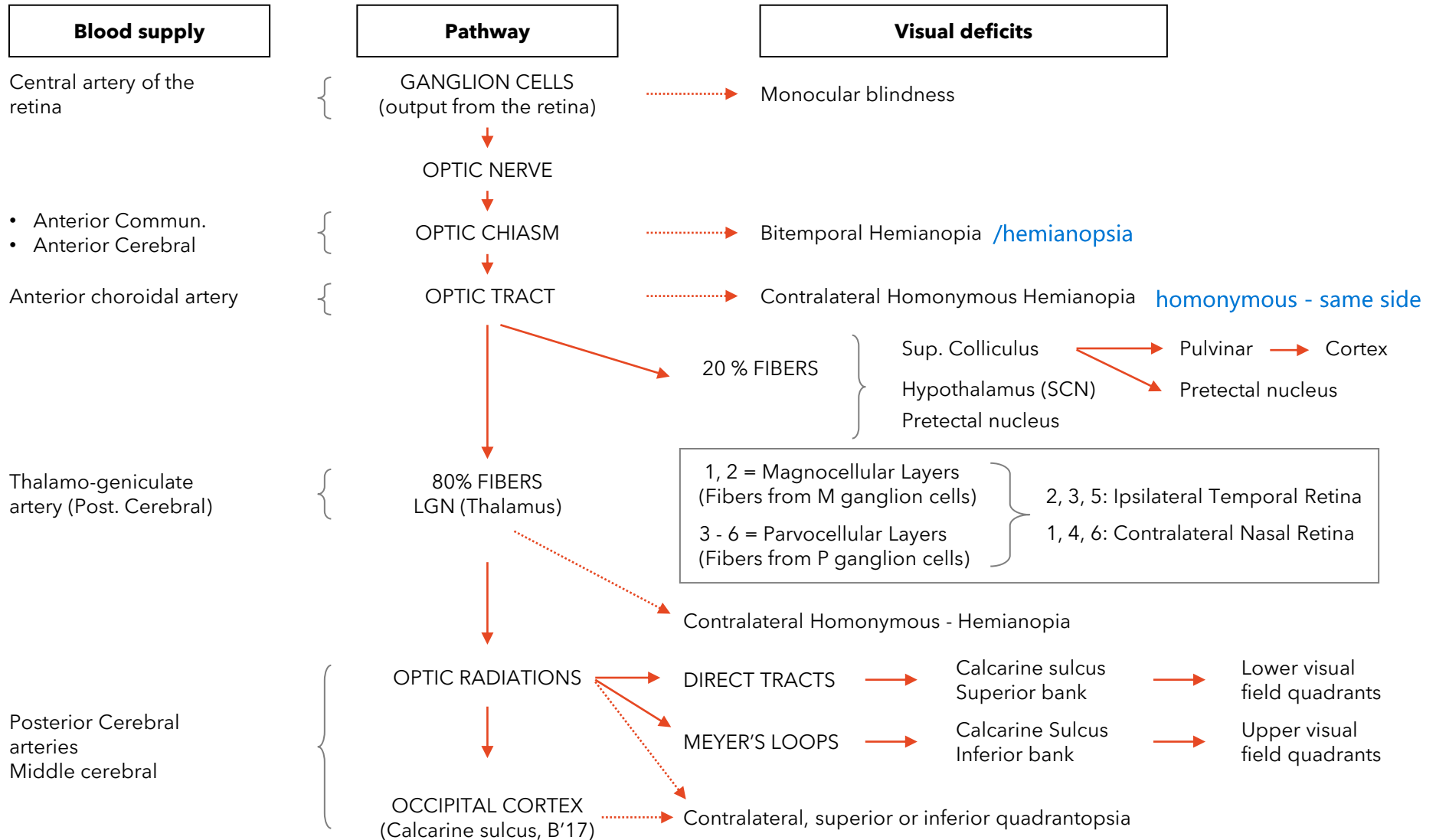
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# Visual Pathways

OBJ. # 3 & 4



# Visual Deficits

OBJ. # 3 & 4

**Lesion to the optic nerve**



Monocular blindness

**Lesion to the central part of the optic chiasm**



Bitemporal hemianopsia

**Lesions to the optic tracts**



Contralateral homonymous hemianopsia

**Lesions to the optic radiations**



Homonymous hemianopsia of a quadrant



Contralateral superior or inferior quadrantsopia

# Cognitive Deficits Produced By Damage To Visual Cortical Areas

OBJ. # 3 & 4

Damage to the primary visual cortex results in loss of vision on the contralateral visual field. In some cases the macula is spared due to collateral blood supply to the occipital pole from the MCA

Some patients show what is known as **blindsight**. These patients report complete loss of visual perception however they can perform some visual tasks such as indicate the direction of movement of an object in their blind visual field

do not perceive conscious movement





# Cognitive Deficits Produced By Damage To Visual Cortical Areas

Damage to the ventral pathway

- **Cortical color blindness or achromatopsia** - Produced by damage to area V4 and/or other color processing areas on the ventral temporal lobe
- **Visual agnosia** - Produced by lesions of the ventral pathway, object area - LOC

## OBJ. # 3 & 4

**Visual neglect** - Produced by damage to the posterior parietal cortex

will ignore one side when presented with both (split attention)

**Motion Blindness** - Produced by lesion of the area MT and surrounding areas

# Cognitive Deficits Produced By Damage To Visual Cortical Areas

Damage to the dorsal pathway



# Cognitive Deficits Produced By Damage To Visual Cortical Areas

OBJ. # 3 & 4

## Damage to the dorsal pathway

Balint's syndrome - Patients have difficulty to scan a complex visual scene or identify moving objects. They are able to perceive small regions of the visual field at a time. Patients have optic ataxia, ocular apraxia, and simultanagnosia

bilateral dorsal pathways  
watershed infarcts

### **OPTIC ATAXIA**

Inability to reach for an object in space under visual guidance or point to a target

in contrast to central ataxia, or cerebellar ataxia

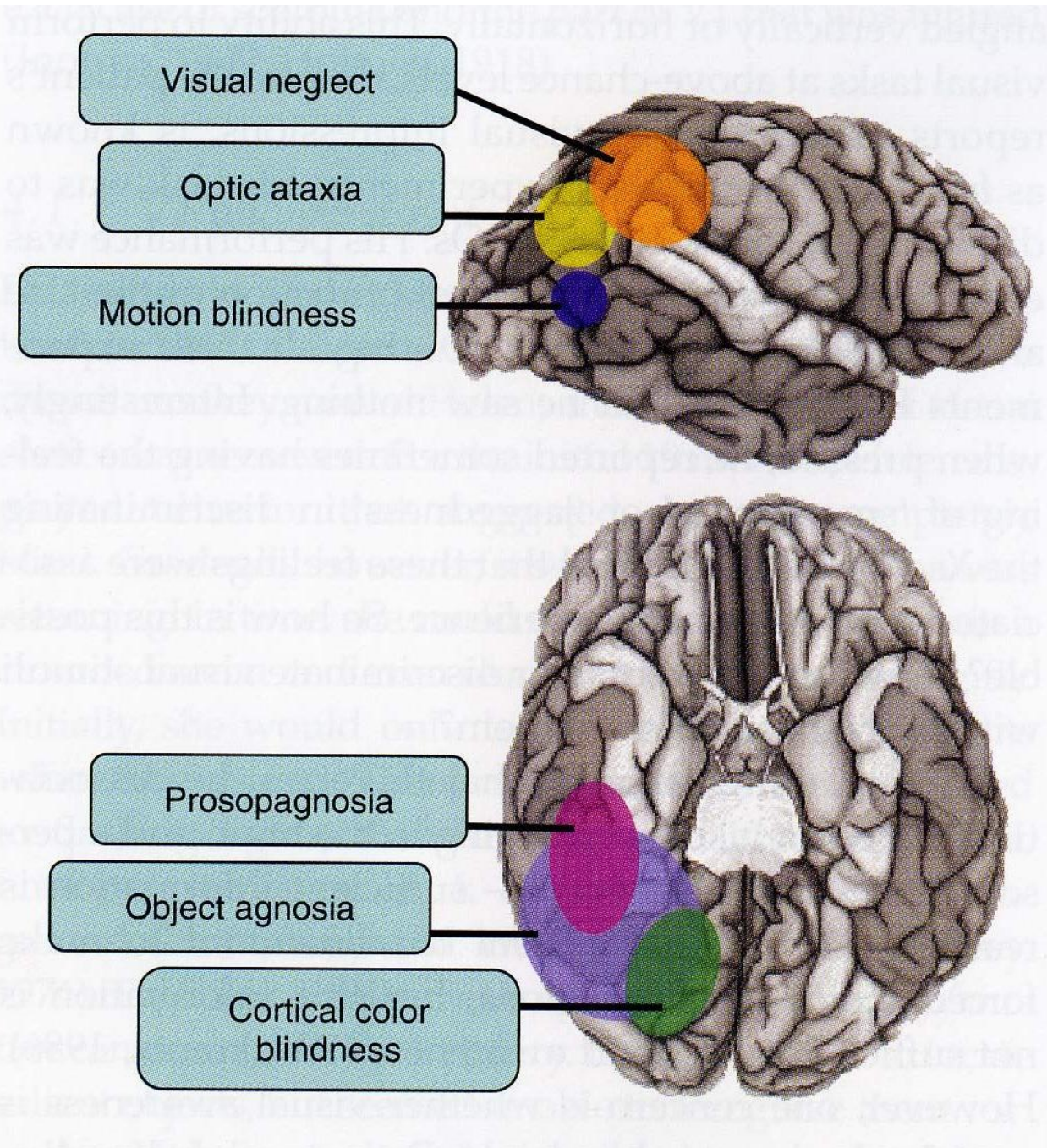
### **OCULAR APRAXIA**

Difficulty in directing the gaze towards an object through saccades

### **SIMULTANAGNOSIA**

Inability to perceive more than one object in the visual field simultaneously

only small features without describing the whole picture (i.e. details of elephant but cannot identify)



# Dorsal and ventral visual areas and cognitive visual deficits

visual paths before cortex most high yield  
monocular, field cut, quadrantopsia, bitemporal hemianopsia

prosopagnosia - cannot recognize faces as a whole/distinct object

**OBJ. # 3 & 4**