Peripheral Nervous System Module

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Eye and Optic Nerve

Optic Nerve

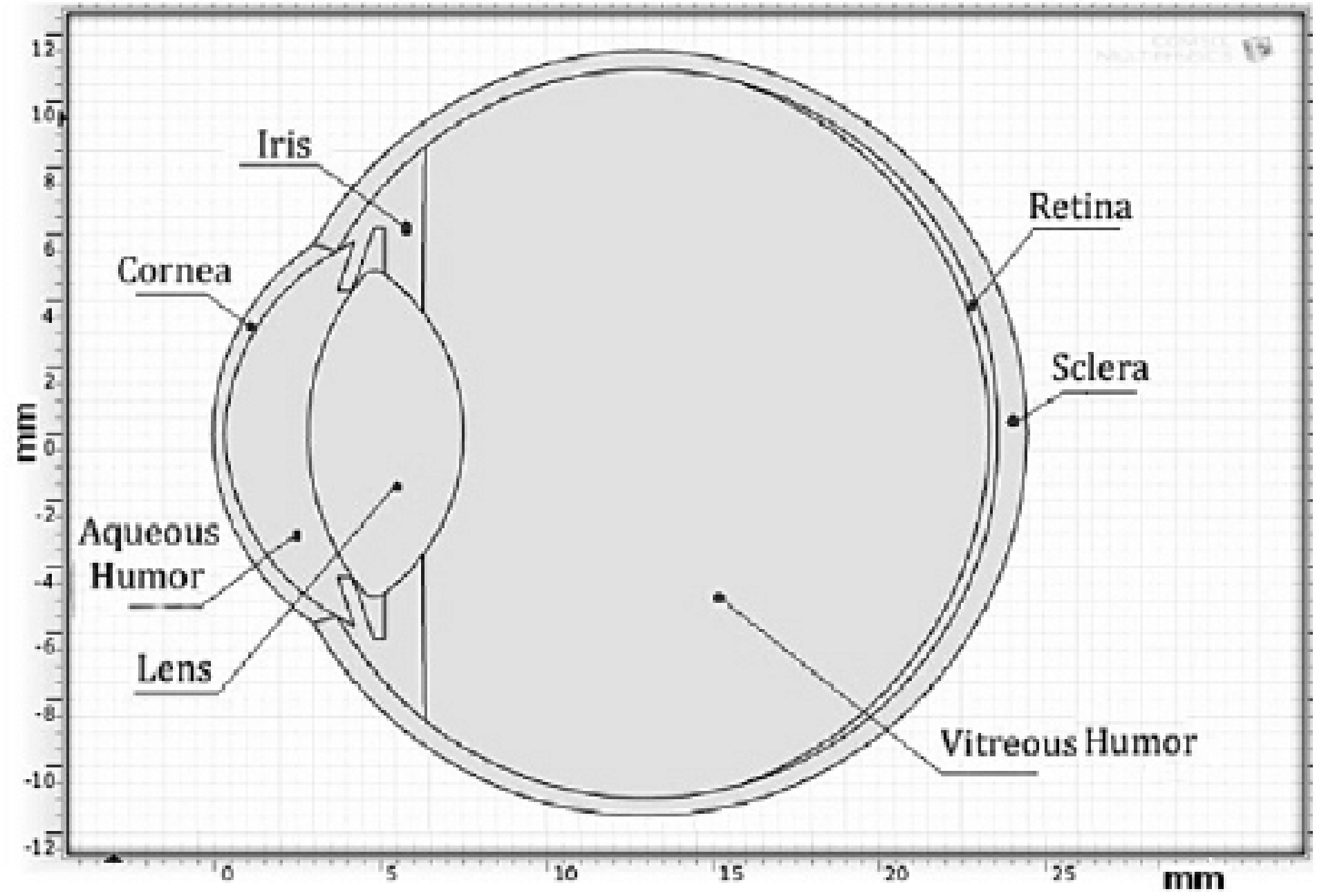
- ***By the end of this session you should be able to:***

1. Different parts of the eye

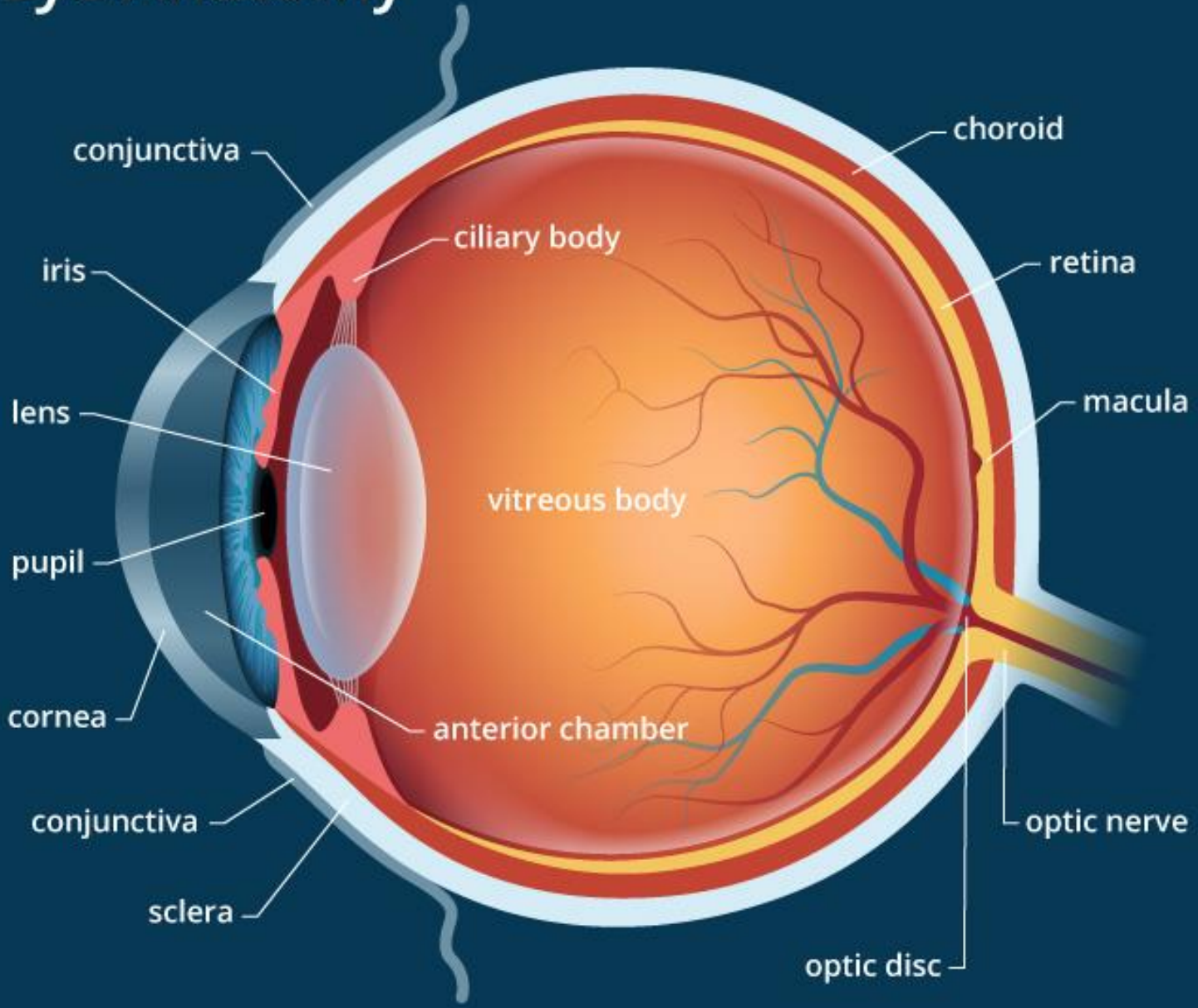
2. Identify and recognize the different parts, course and destination of the optic nerve.

The Eye

- **Size-average AP diameter is 21-26mm**
- **Circumference 72mm**
- **At birth is approx. 16mm**
- **At age of 3yrs 23mm**


Iris
Retina
Cornea
Sclera
Aqueous
Humor
Lens
Vitreous Humor
mm
mm
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
0
5
10
15
20
25

Eye Anatomy


conjunctiva
iris
lens
pupil
cornea
conjunctiva
sclera
ciliary body
vitreous body
anterior chamber
choroid
retina
macula
optic nerve
optic disc

The Eye

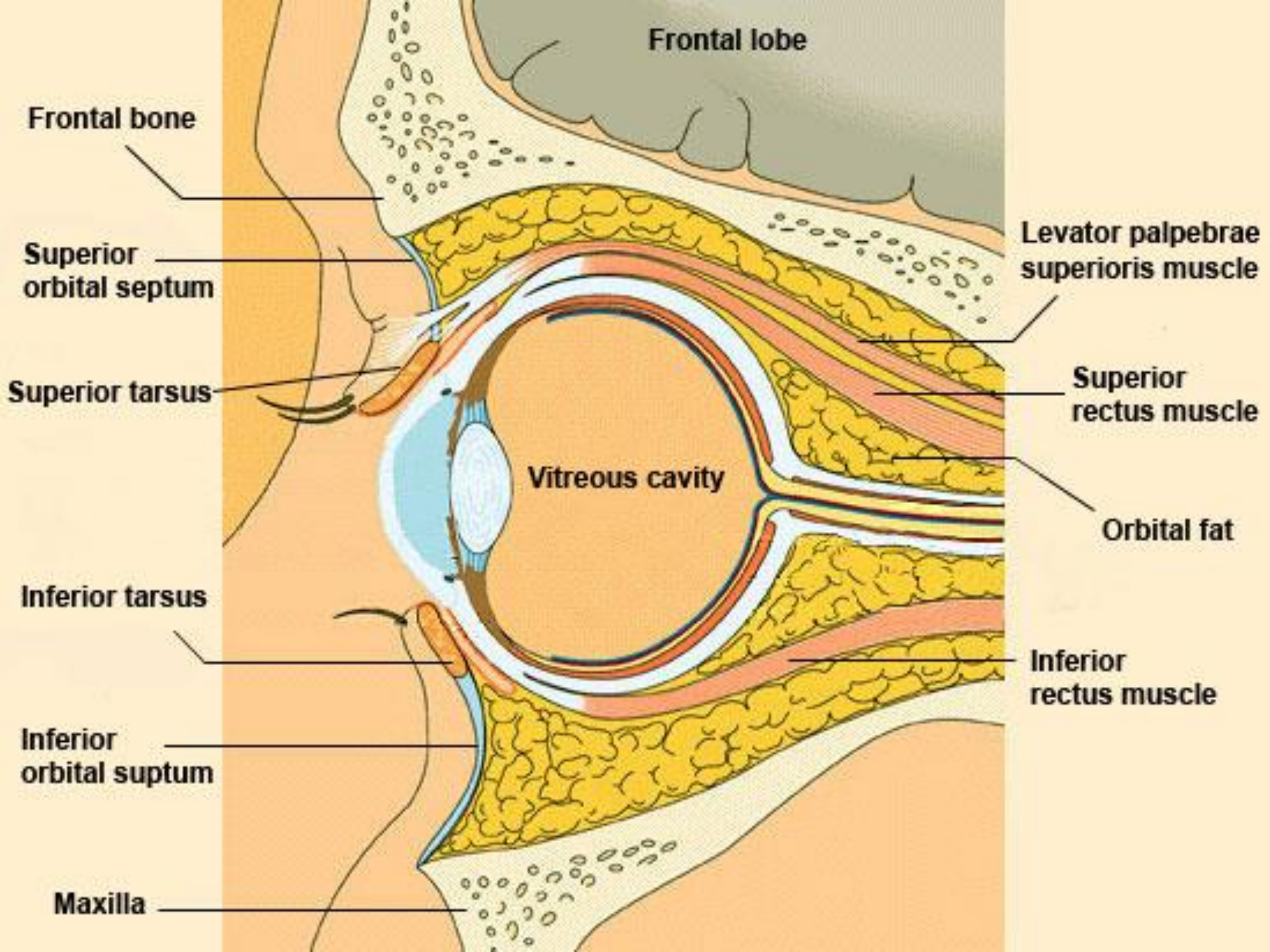
- Has 3 concentric layers connected to the brain by optic nerve
- Protected by bony orbit and eyelids
- It reaches its maximum size at 2 years with very little growth there after

Structure of Eyeball

- The globe-shaped eyeball occupies the anterior part of the orbital cavity, and is embedded in orbital fat, but separated from it by the fascial sheath of the eyeball

- Its ***rounded shape*** is ***disrupted anteriorly***, where it bulges outward.

- This outward projection which forms about one-sixth of the total area of eyeball represents the ***transparent cornea***


Frontal lobe
Frontal bone
Superior orbital septum
Levator palpebrae superioris muscle
Superior tarsus
Superior rectus muscle
Vitreous cavity
Orbital fat
Inferior tarsus
Inferior rectus muscle
Inferior orbital suptum
Maxilla

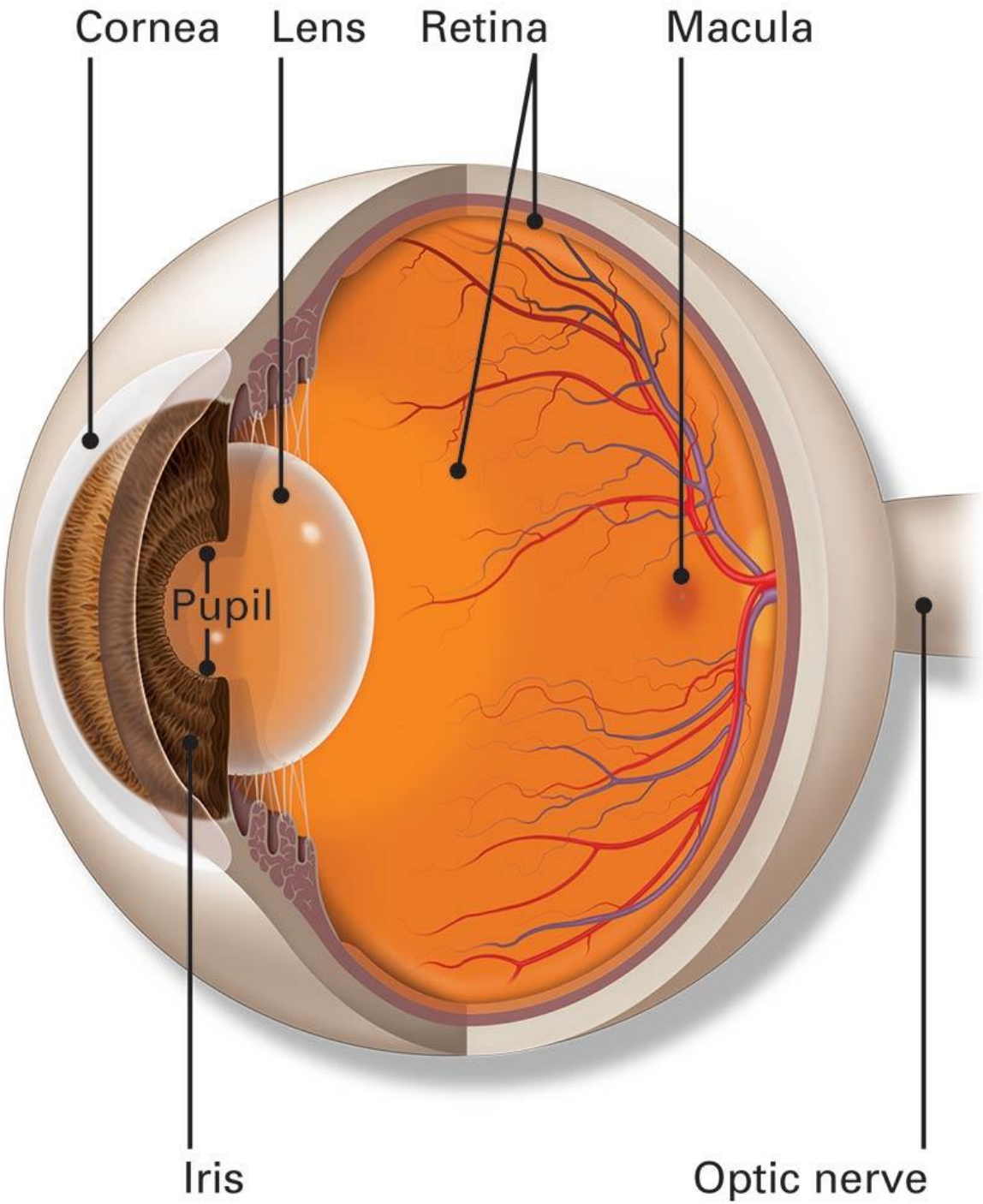
Structure of Eyeball

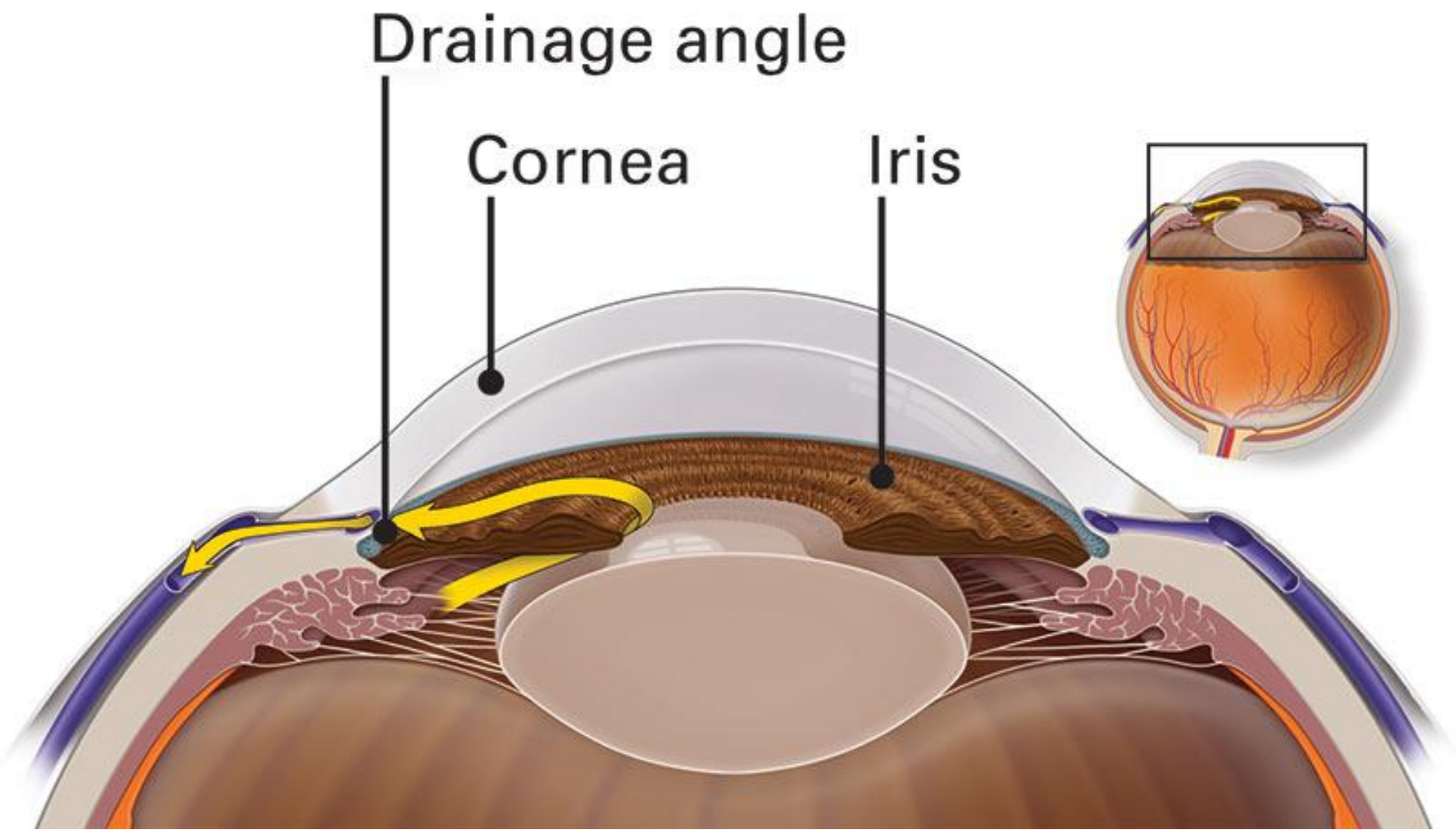
- Posterior to cornea and in order from front to back are the ***anterior chamber, the iris and pupil, posterior chamber, lens, vitreous chamber and retina***

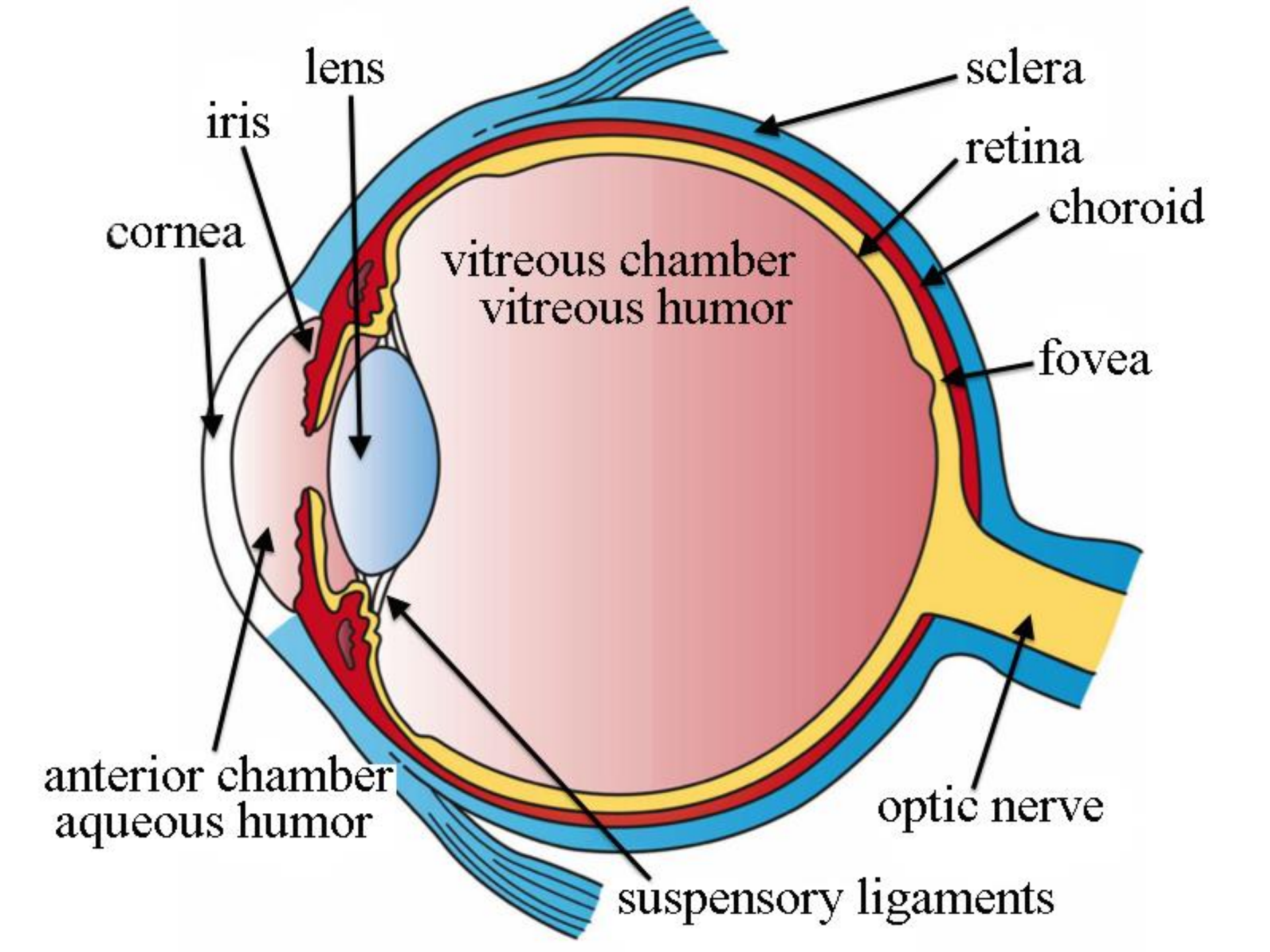
- The eyeball consists of three coats, which, from without inward, are ***fibrous coat***, ***vascular pigmented coat***, and ***nervous coat***

Parts of the Eye

1. **Sclera**
2. **The Cornea**
3. **Lens**
4. **Iris/Pupil**
5. **Anterior & Posterior Chambers**
6. **Vitreous Humor**
7. **Retina**


Cornea
Lens
Retina
Macula
Pupil
Iris
Optic nerve


Drainage angle
Cornea
Iris


lens
iris
cornea
sclera
retina
choroid
vitreous chamber
vitreous humor
fovea
anterior chamber
aqueous humor
optic nerve
suspensory ligaments

Cornea

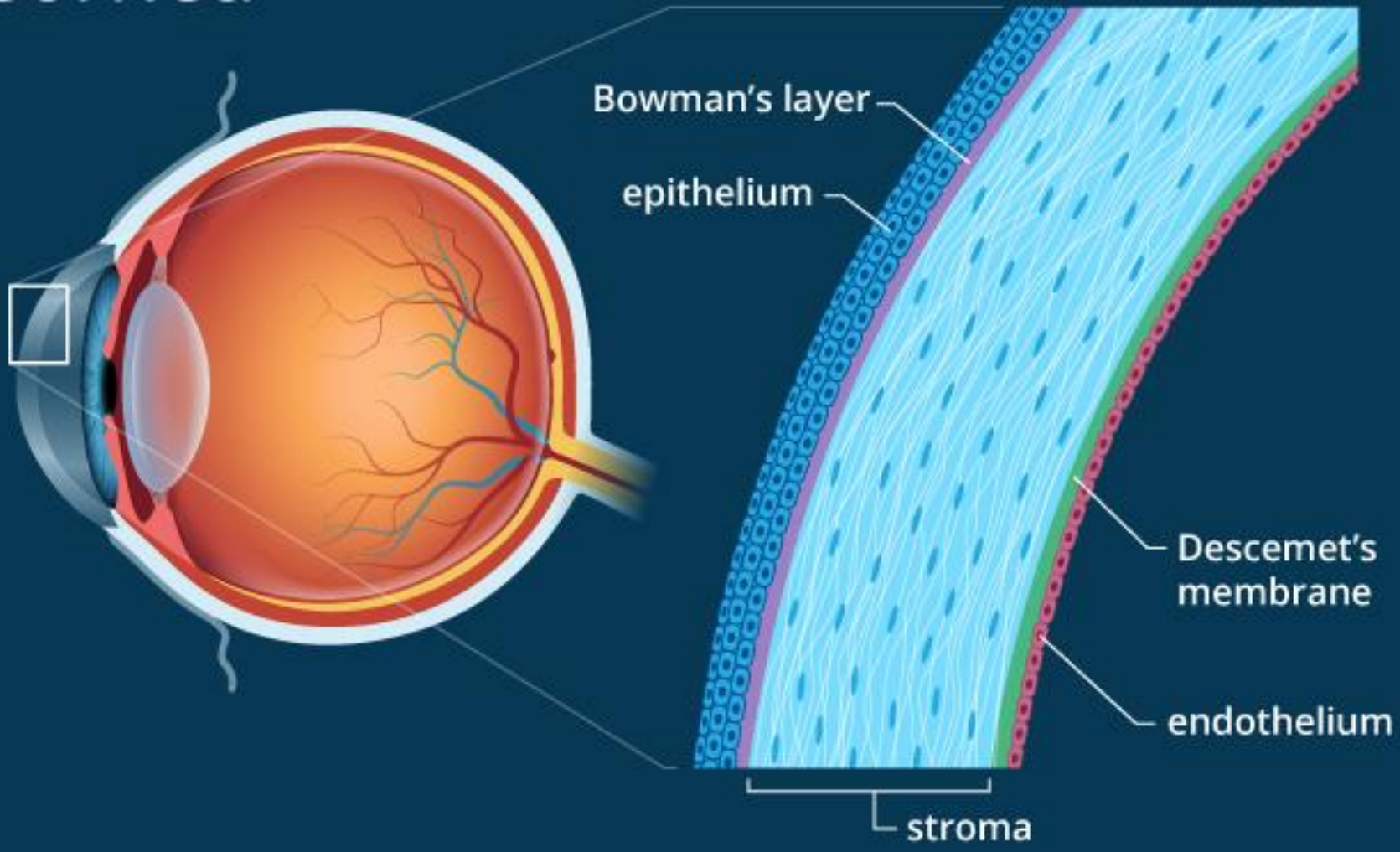
- Occupies the center of the ***anterior pole of the globe***

1. Size 12mm horizontal meridian
2. 11 mm vertical meridian
3. Thickness - 1 mm

- Bordered anteriorly by ***precorneal tear film***, posteriorly by anterior chamber

- ***Transparent and Avascular***

Cornea


Bowman's layer
epithelium
Descemet's membrane
endothelium
stroma

Cornea

- **Rich nerve supply through unmyelinated nerves, from the long ciliary nerve (branch of the nasociliary nerve)**

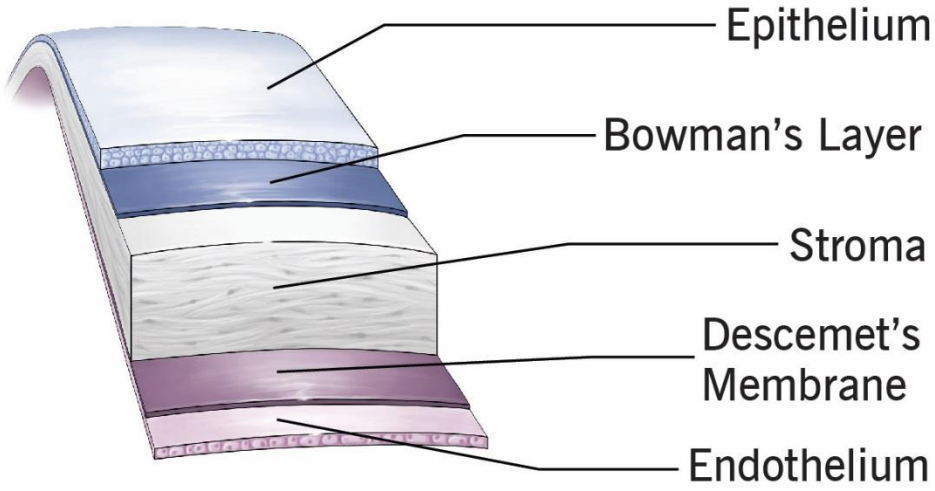
- ***Consists of layers***

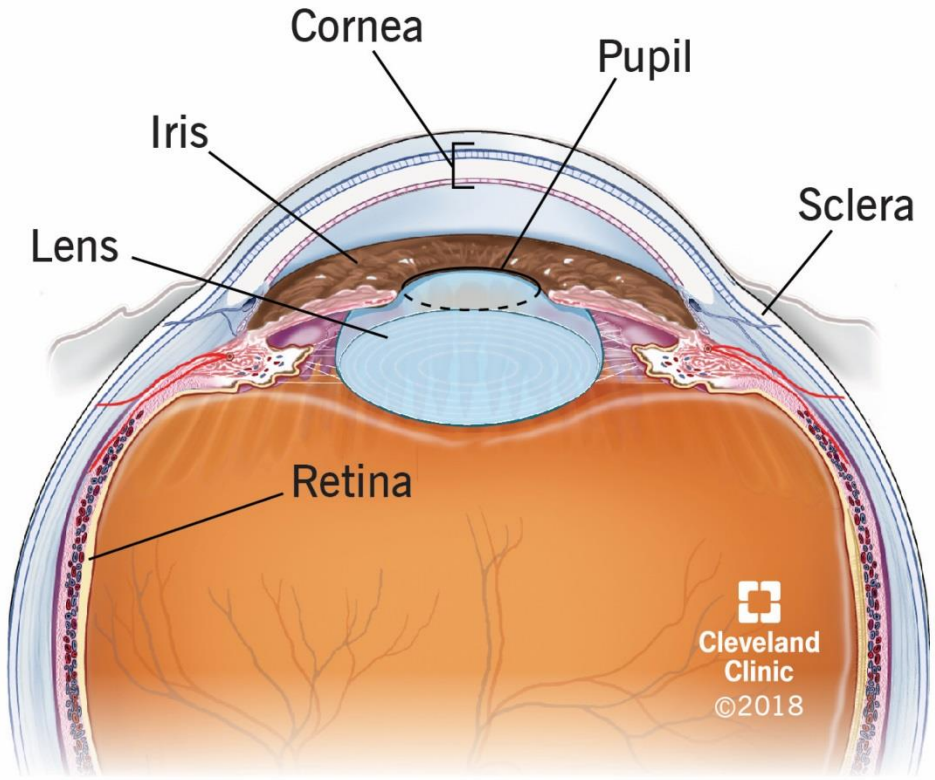
1. Epithelium
2. Bowman's membrane
3. Stroma
4. Descemet's membrane
5. Endothelium

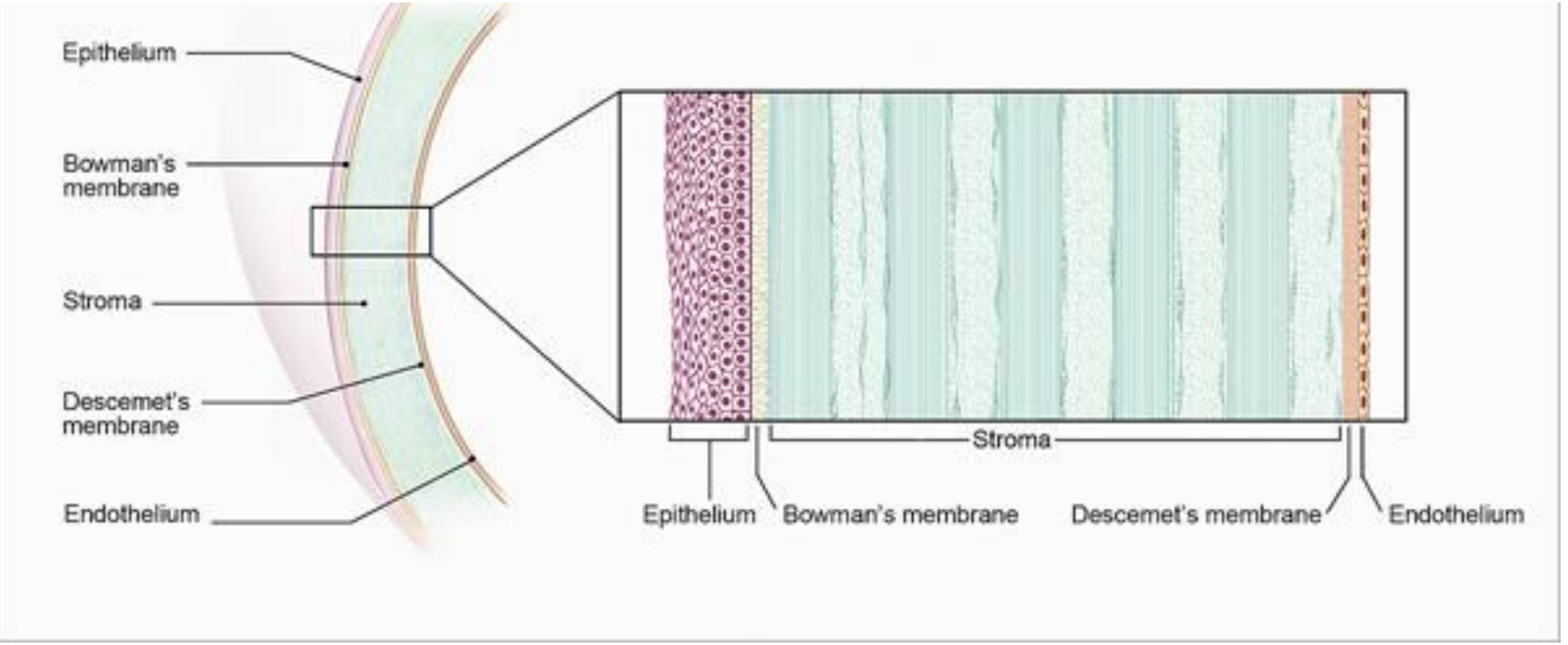
- Receives most of its nutrient from the aqueous humor and the tear film (***Avascular***) and **has no lymphatic drainage**

- Most important refractive surface - 43 Diopters

Layers of the Cornea

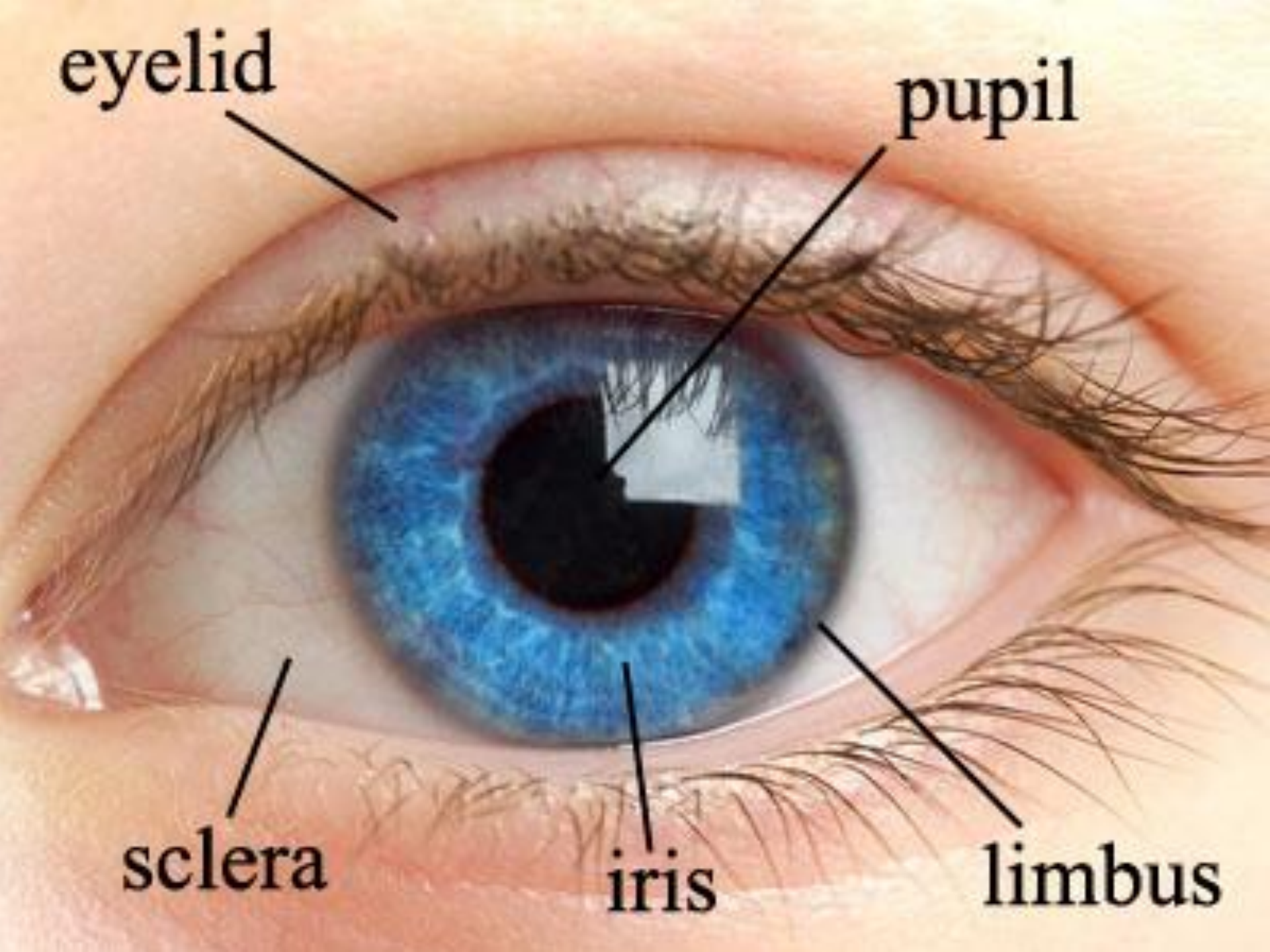





Epithelium
Bowman's membrane
Stroma
Descemet's membrane
Endothelium
Stroma
Epithelium
Bowman's membrane
Descemet's membrane
Endothelium

Sclera

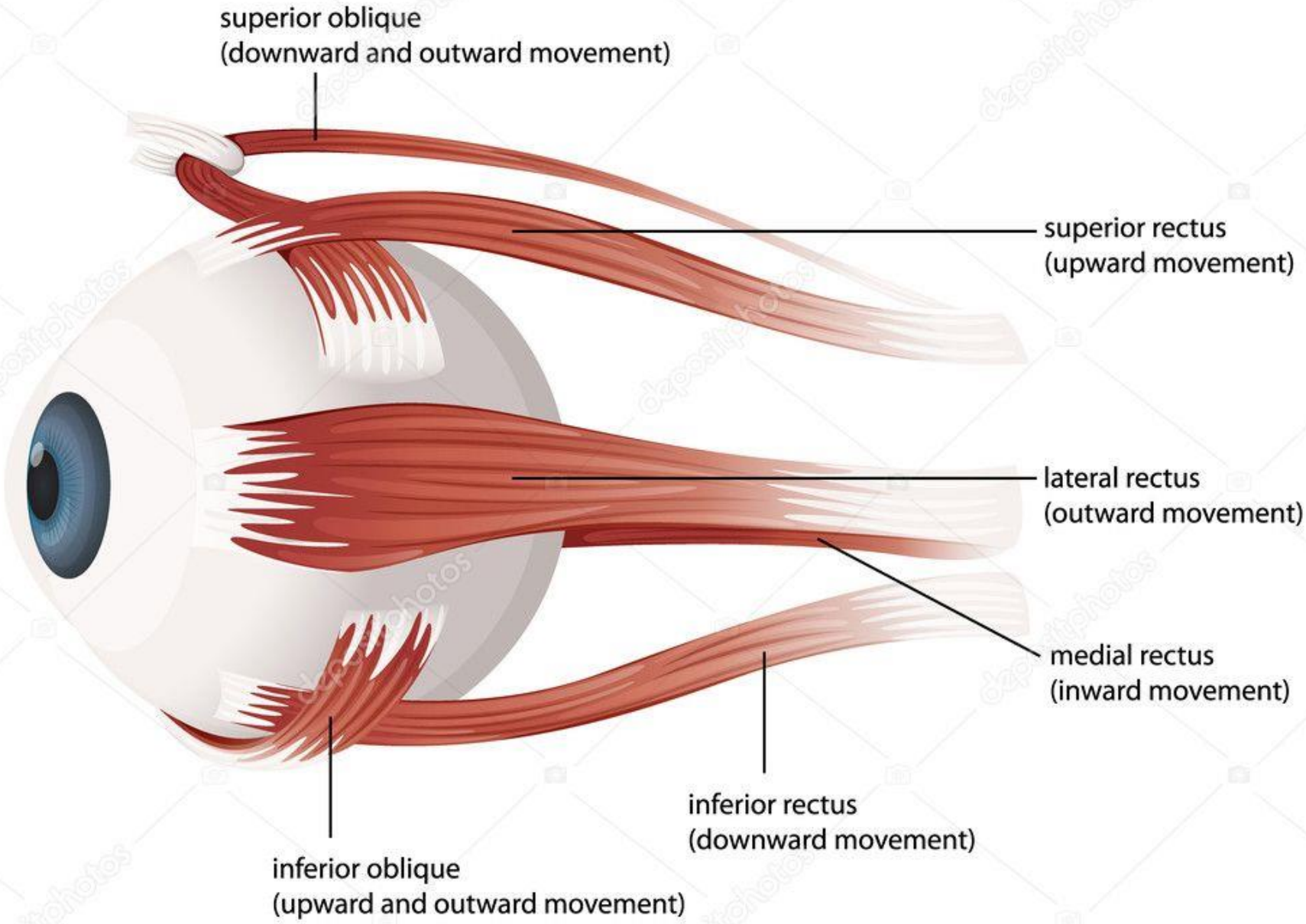
- Covers posterior 4/5 of the surface of the globe forming a protective coat
- Anteriorly ends at the limbus
- Posteriorly - forms lamina cribrosa for optic nerve


eyelid
pupil
sclera
iris
limbus

Sclera

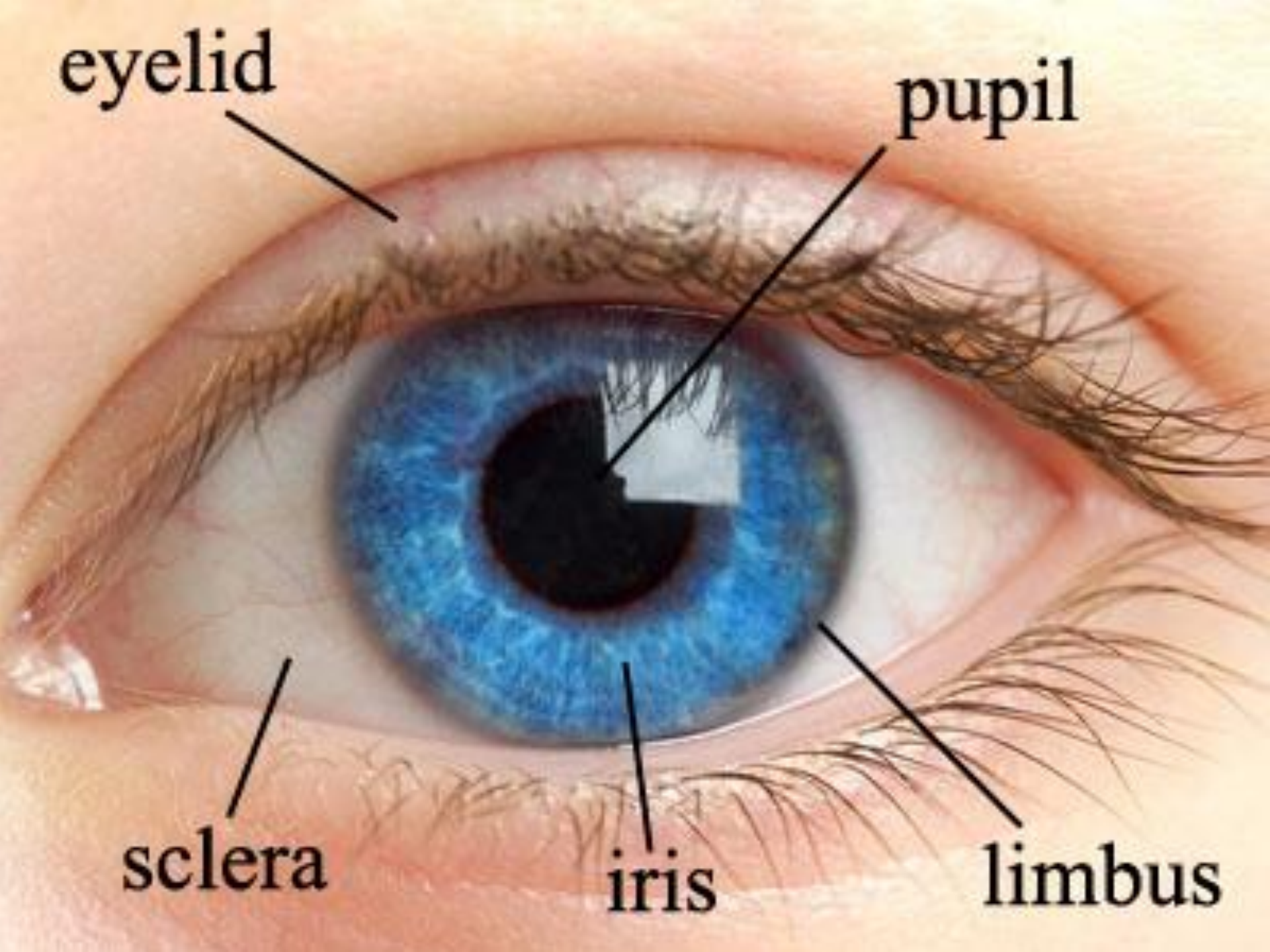
- Opaque
- Provide attachment of the extraocular muscles
- ***Pierced by optic nerve*** and ***ciliary arteries*** (with their accompanied veins.
- Opaque...allows **NO** light to enter

Muscles of the Human Eye



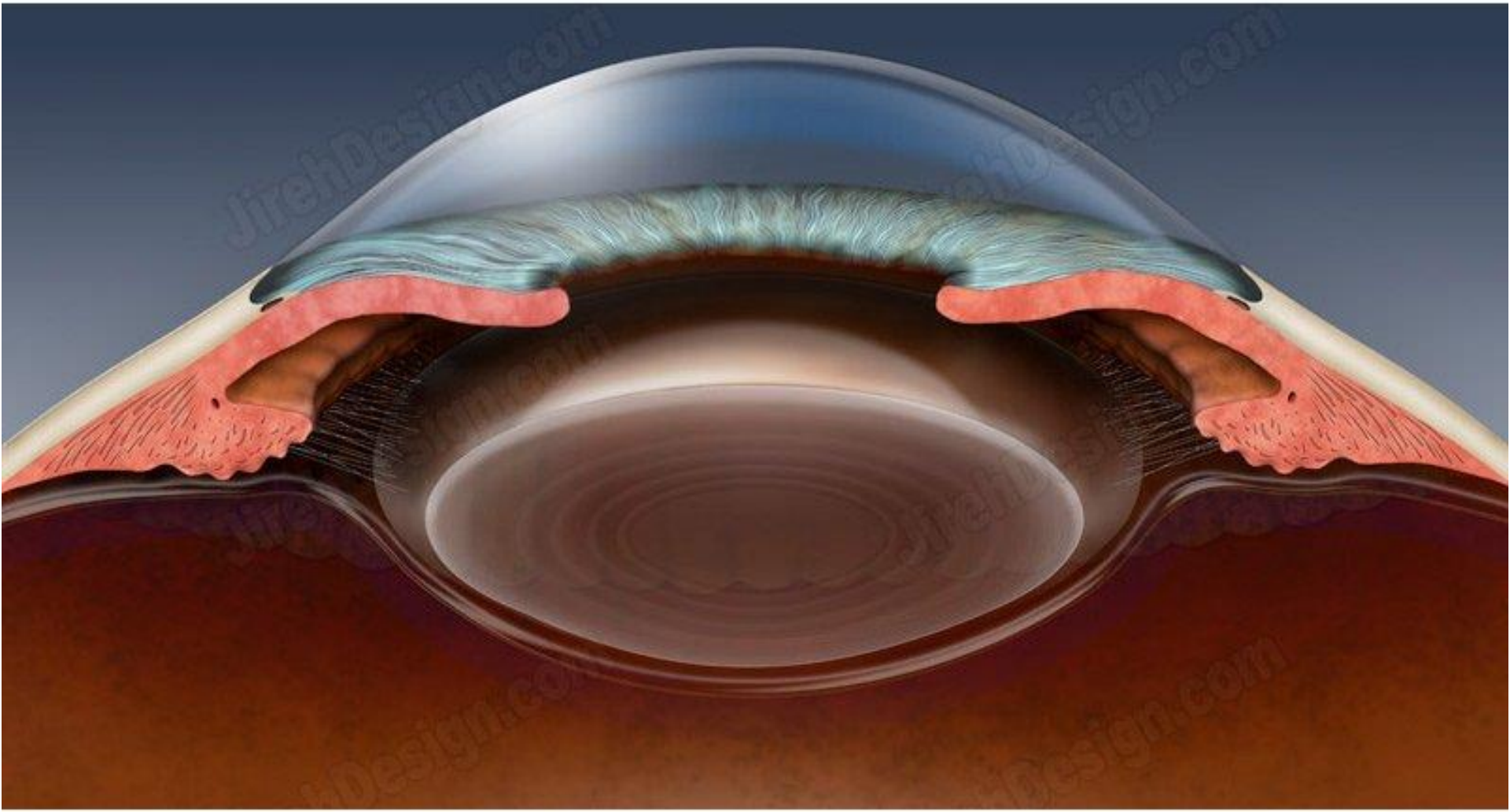
Limbus

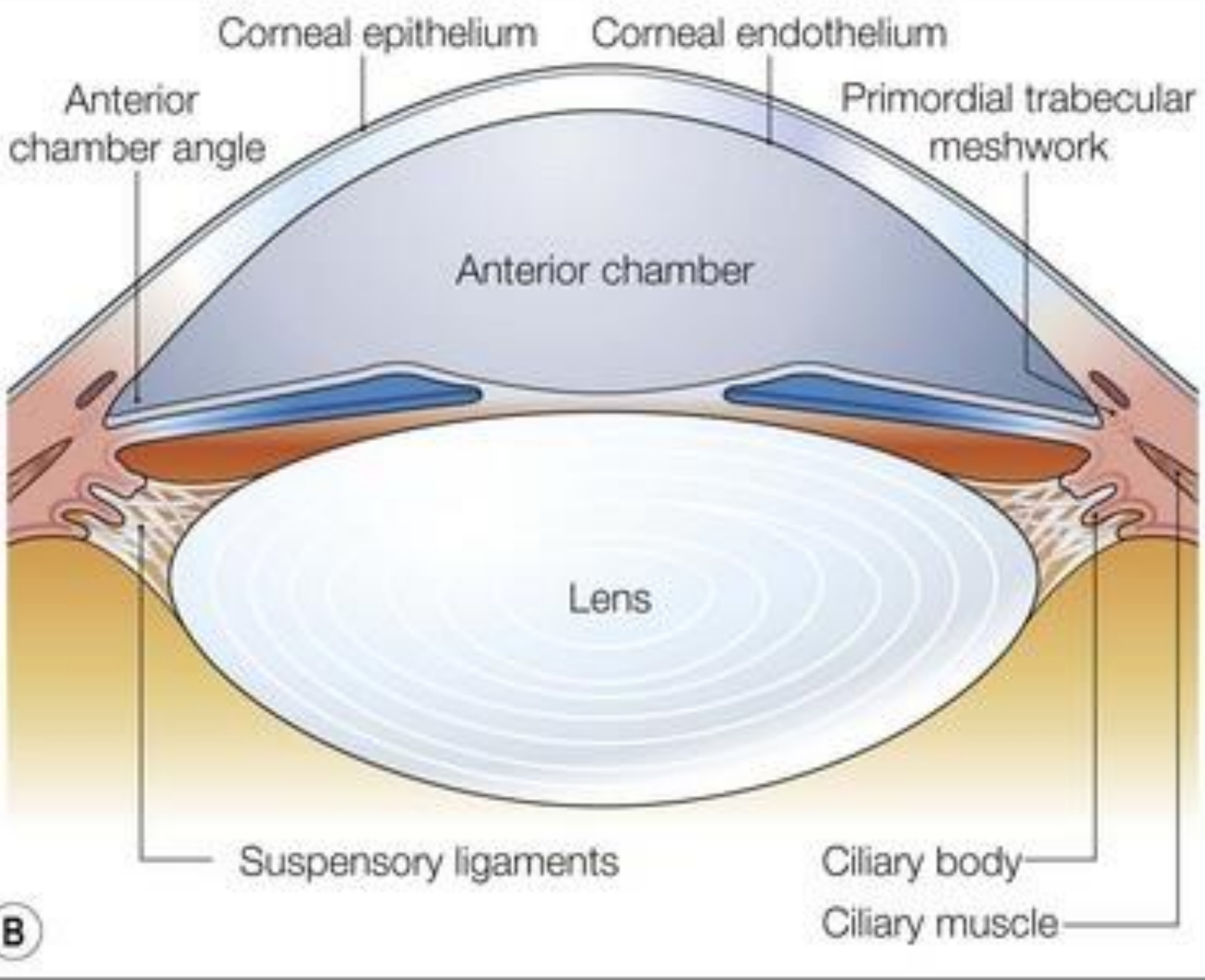
- Junction between cornea and sclera
- It is the transition zone between the peripheral cornea and the anterior sclera
- Surgical landmark for cataract and glaucoma surgeries
- 2mm in width

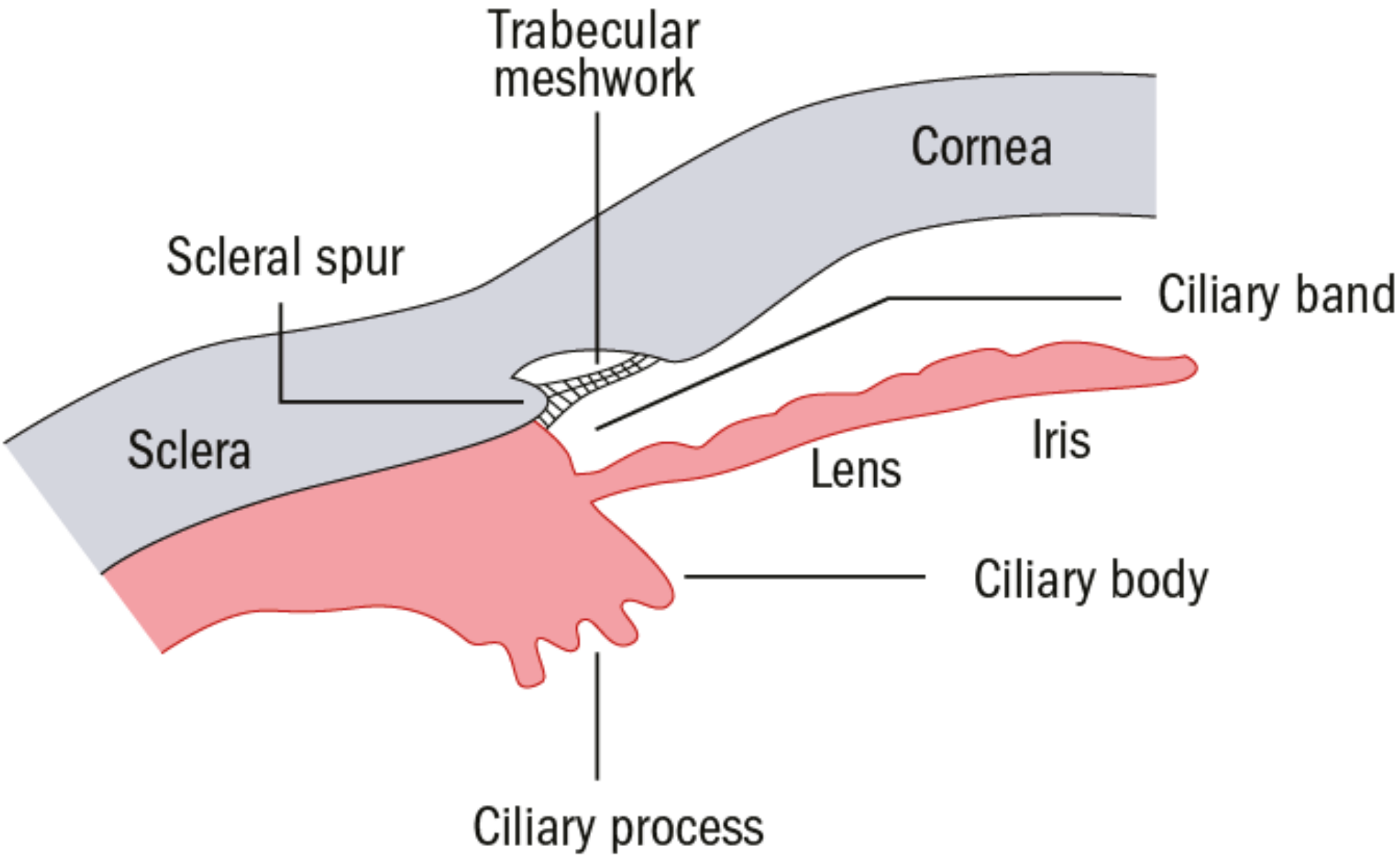

eyelid
pupil
sclera
iris
limbus

Anterior Chamber

- Filled with ***aqueous humor***
- Lies between the cornea and the iris
- **About 3mm in depth**
- Angle of the anterior chamber can be seen during eye examination
- Aqueous drained through the trabecular meshwork ***into canal of Schlemm***




Corneal epithelium
Corneal endothelium
Anterior chamber angle
Primordial trabecular meshwork
Anterior chamber
Lens
Suspensory ligaments
Ciliary body
Ciliary muscle
B


Trabecular meshwork
Cornea
Scleral spur
Ciliary band
Sclera
Iris
Lens
Ciliary body
Ciliary process

Lens

- **Biconvex**
- Suspended behind iris by zonules (suspensory ligaments, ***transparent, avascular, with no nerves***
- Grows throughout the life, Insoluble deposits of proteins build up over time **= Cataracts: A clouding of the lens and capsule**
- ***Functions:*** Refractive media 15-20 D in accommodation

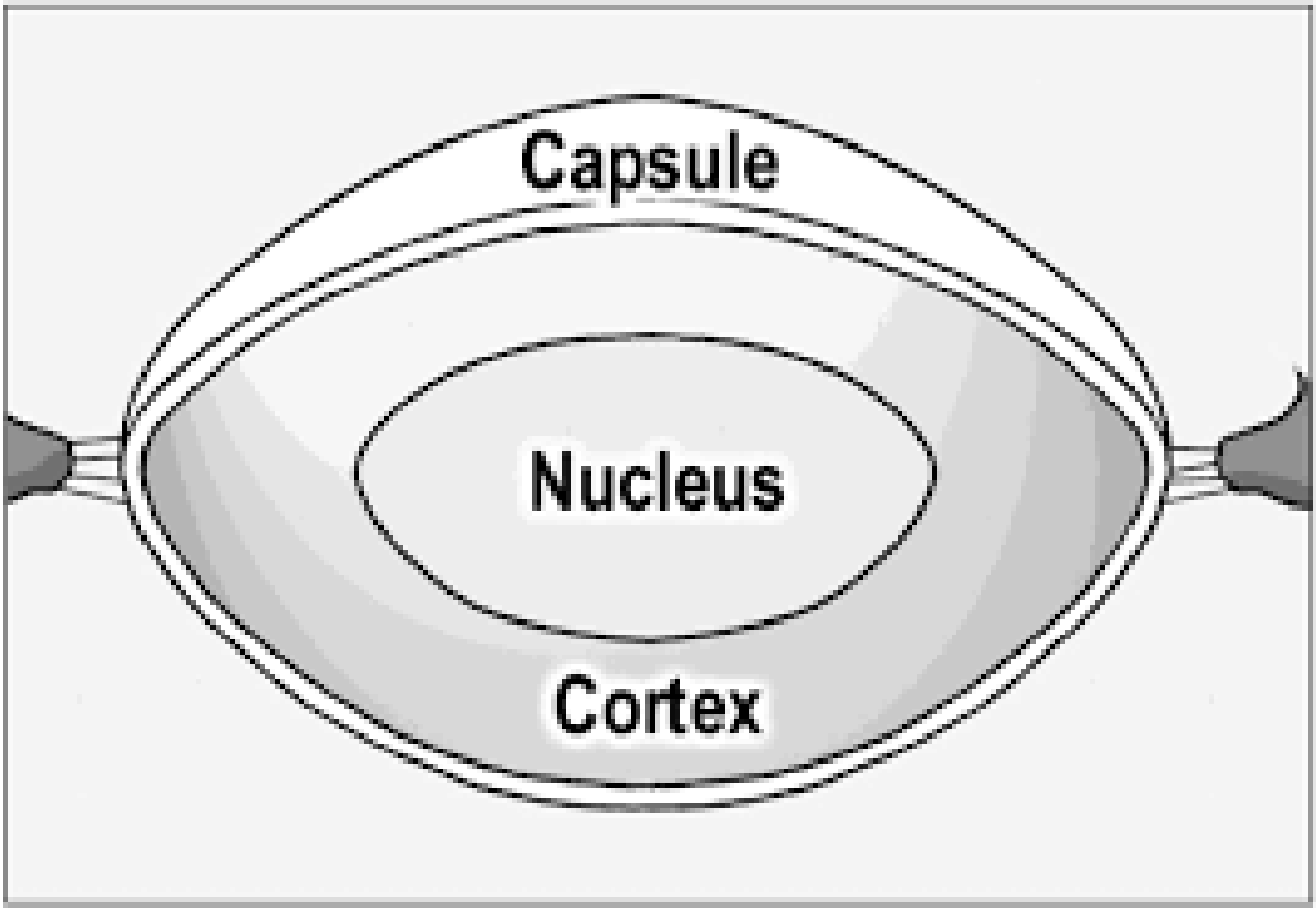
Lens

Structure:

Elastic capsule: It is a clear connective tissue that enclosed the structure.

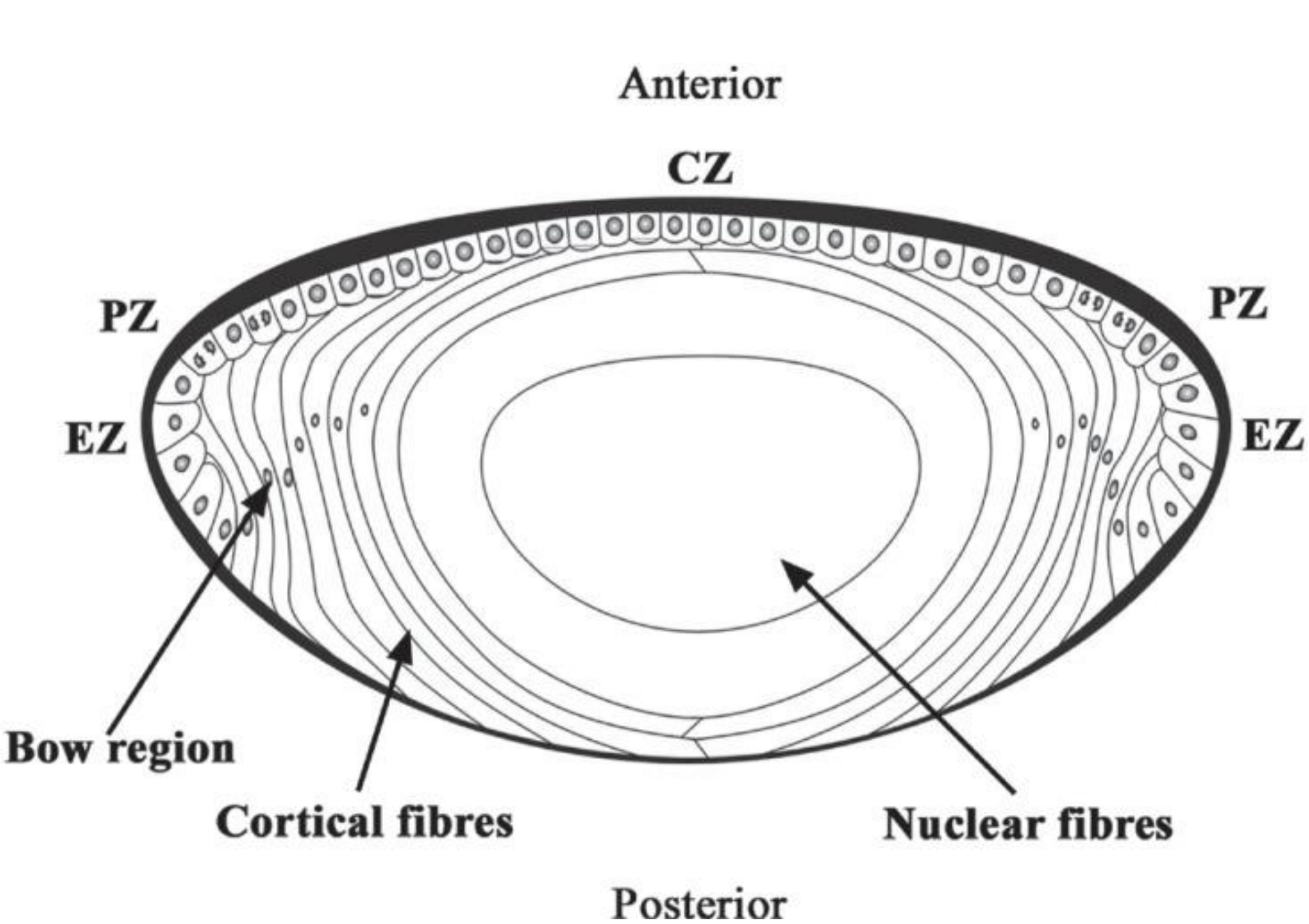
Cuboidal epithelium: It is confined to anterior surface of the lens.

Lens fibers: These fibers make up the bulk of the lens.


Capsule
Nucleus
Cortex

Lens

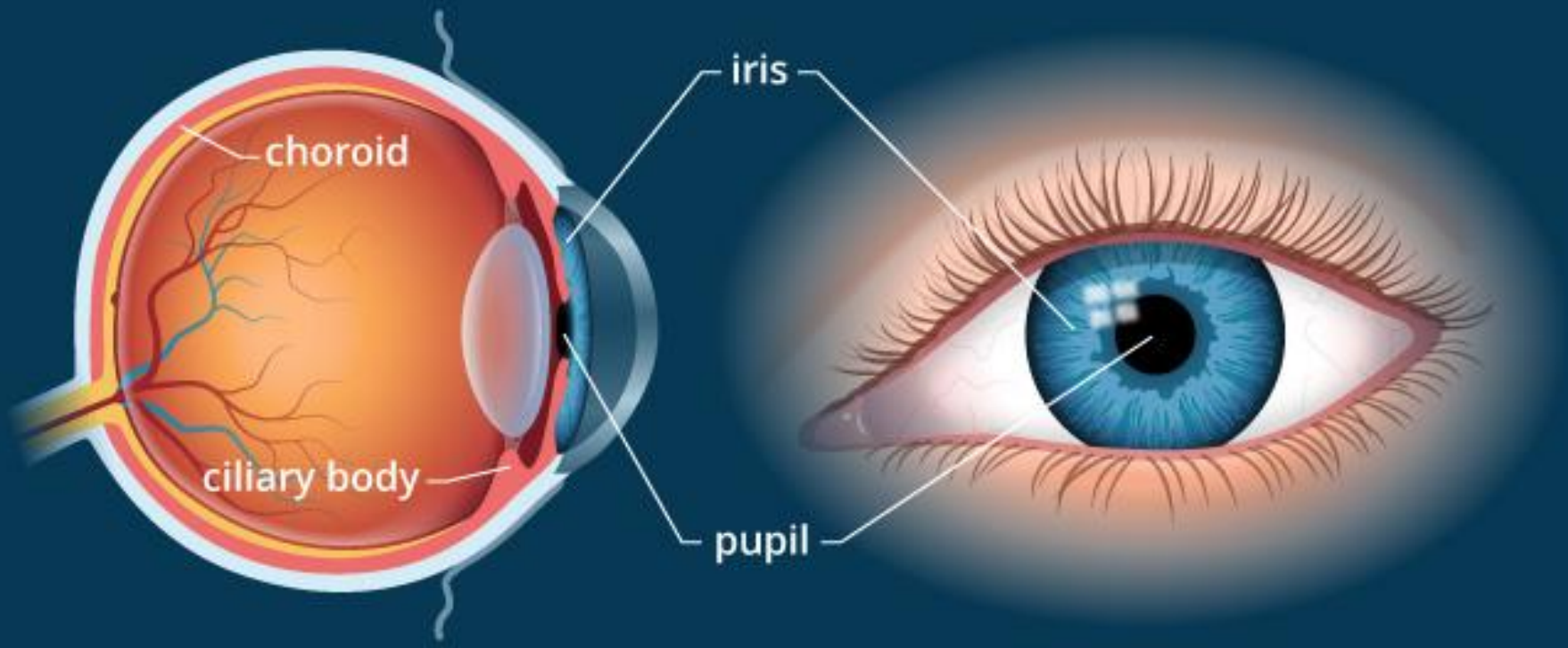
- It is connected on each side to ciliary processes of the ciliary body by the suspensory ligament.
- The ***pull of the radiating fibers*** of the suspensory ligament tend to ***keep the elastic lens flattened*** so that the eye can be **focused** on **distant object**.
- On the contrary **to accommodate** the eye for close objects, the **ciliary muscle contracts** and pulls the ciliary body forward and inward so that the **radiating fibers** of the suspensory ligament are **relaxed**.
- This allows the elastic lens to assume a more globular shape. /convex


Anterior
CZ
PZ
PZ
EZ
EZ
Bow region
Cortical fibres
Nuclear fibres
Posterior

Uvea

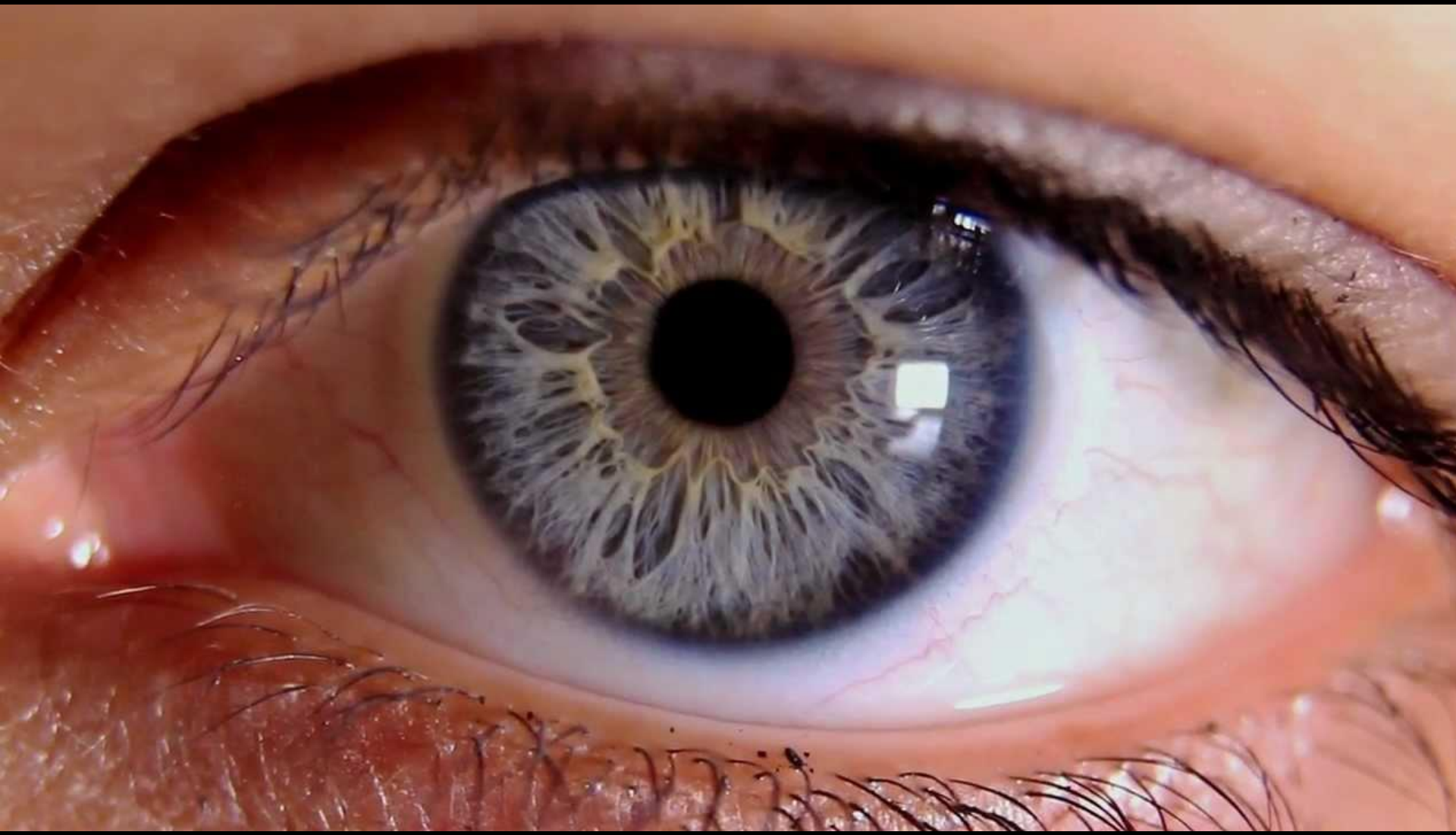
- AKA, **Vascular Pigmented Coat**
- Middle vascular coat of the eye
- Consist of ***iris, ciliary body, choroid Lies between sclera and the retina***
- Main ***vascular tissue*** of the eye

Uvea: Iris, Ciliary Body and Choroid



Iris

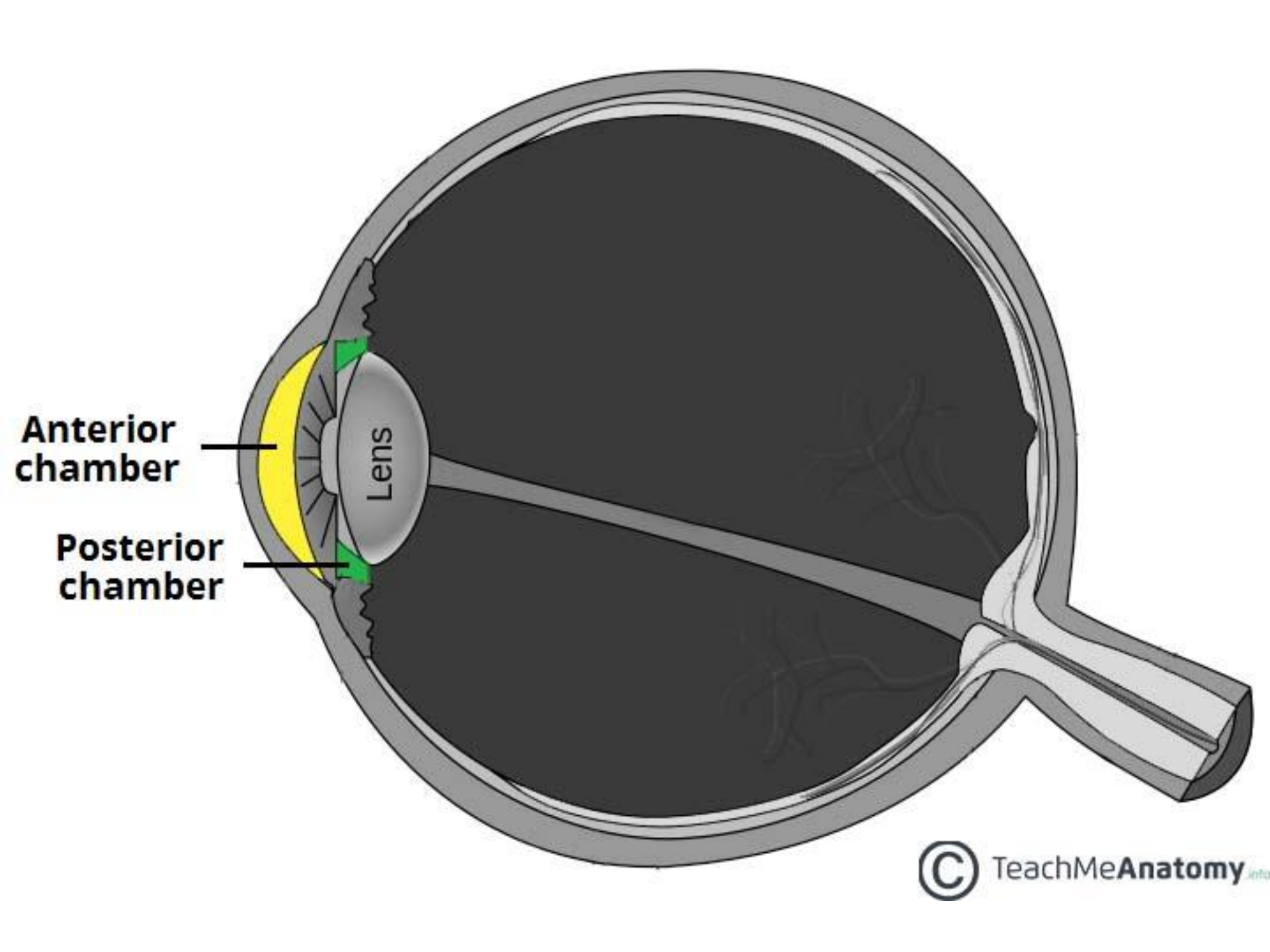
- ***Most anterior part of the uvea***
- Made of ***blood vessels and connective tissue***
- Pigmented according to race, melanocytes + pigment cells



Iris

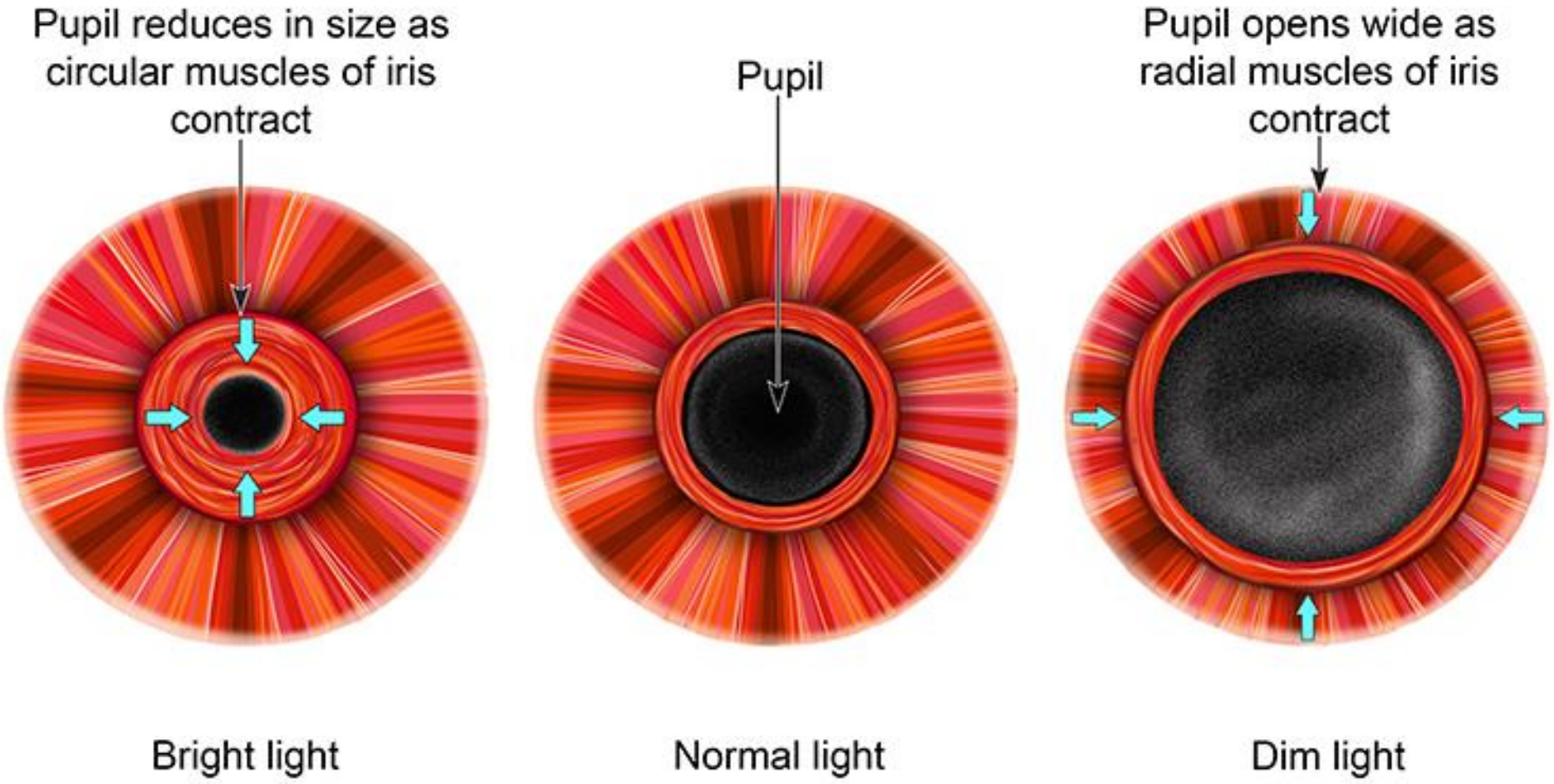
- Projecting outward from ciliary body, and is suspended in the aqueous humor (which is watery & clear) between cornea and lens (thus diaphragm) , dividing the space between them into an anterior and a posterior chamber

- Has 2 layers


Anterior chamber
Posterior chamber
Lens
© TeachMeAnatomy

Iris

- Central perforation - **pupil**
- It has smooth muscles which regulate the pupil
  - Dilator pupillae – dilate – sympathetically enervated - ***derived from long ciliary nerves***
  - Sphincter pupillae - constricts - parasympathetically enervated - ***derived from oculomotor nerve /short ciliary nerve***


Pupil reduces in size as circular muscles of iris contract
Pupil
Pupil opens wide as radial muscles of iris contract
Bright light
Normal light
Dim light

Ciliary Body

- Middle part of the uvea, extends from peripheral margin of iris to anterior end of choroid.

- It forms a complete ring around eyeball triangular-shaped structure, composed of ciliary ring, ciliary processes and ciliary muscle

Ciliary Body

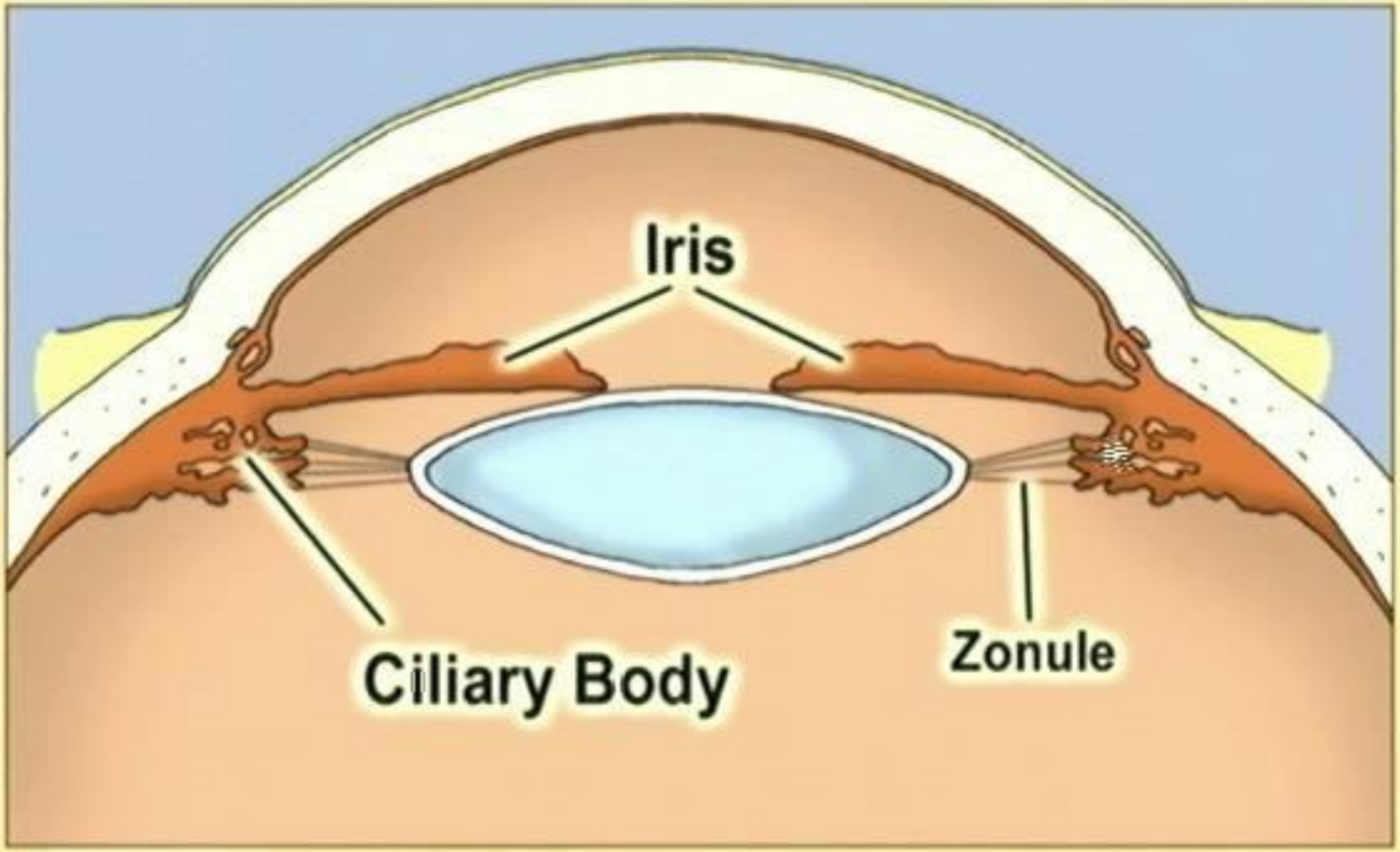
The ciliary processes

1. Are longitudinal ridges projecting from inner surface of ciliary body.

2. On each side, the suspensory ligament of the lens is attached to the posterior aspect of ciliary processes

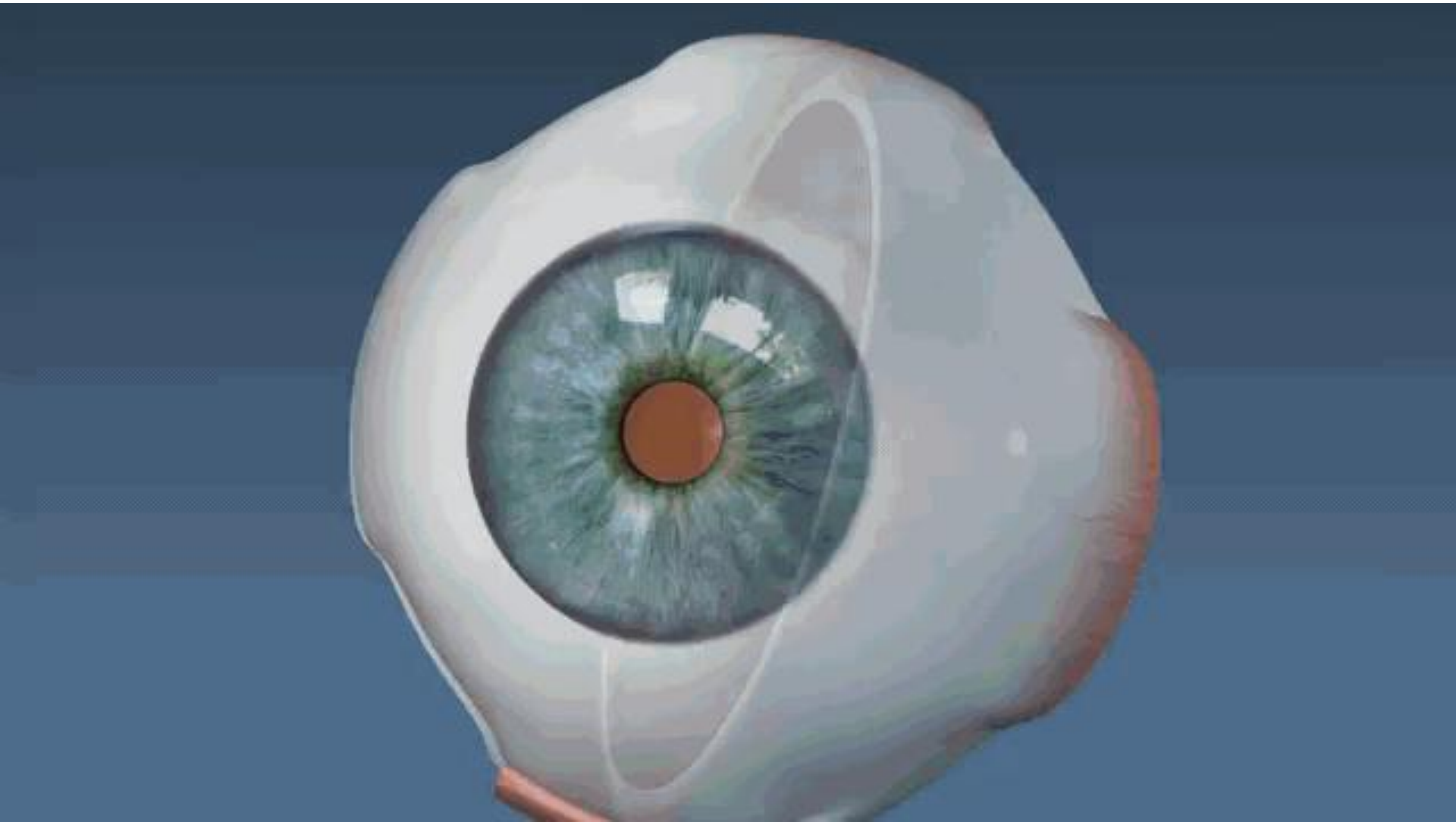
The ciliary Muscle: It changes the shape of the lens within the eye, not the size of the pupil

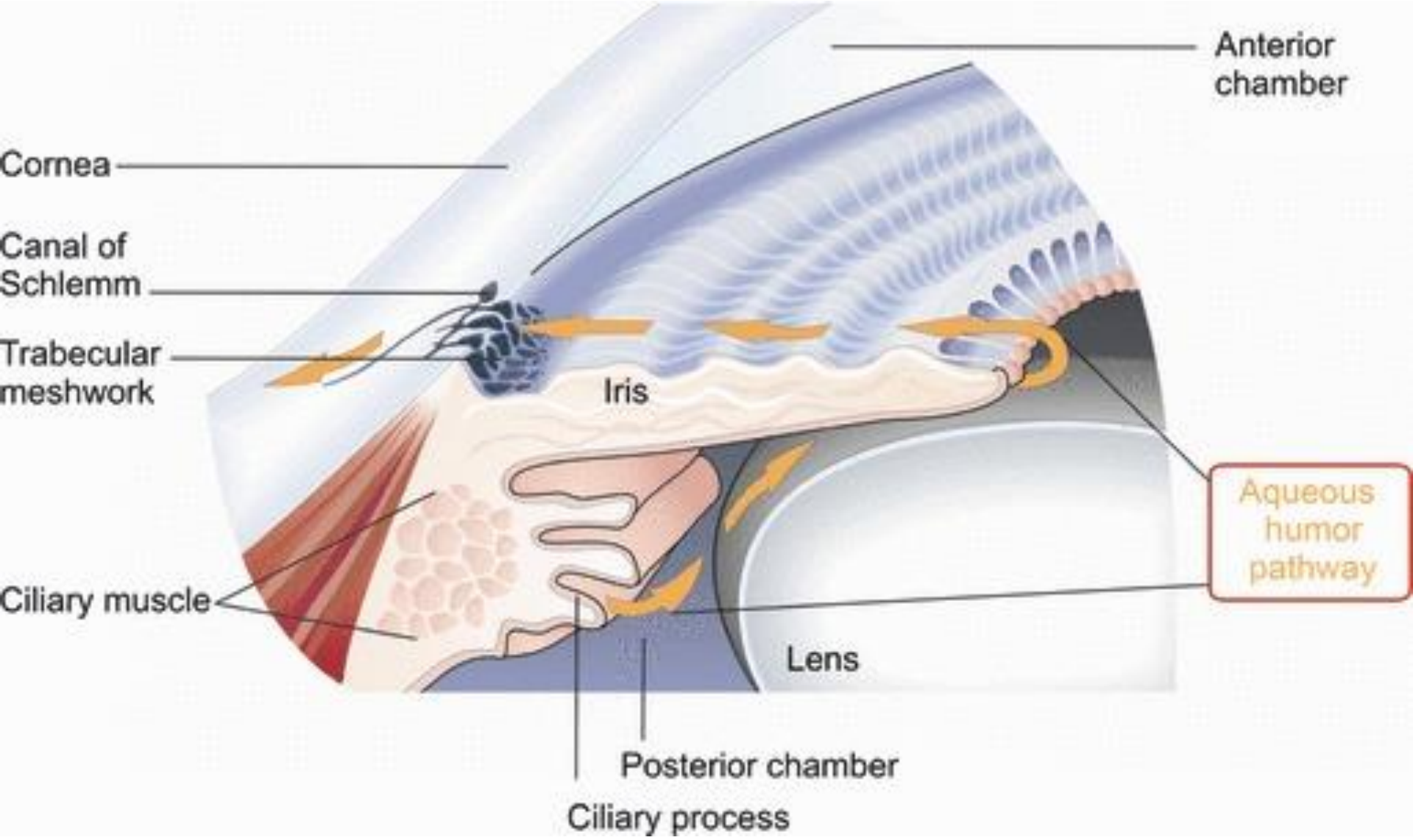
Iris and Ciliary Body



Ciliary Body

- Functions: ***produce aqueous humor from ciliary epithelium***
- Accommodation (***Near vision***)
- The aqueous humor is drained into the canal of Schlemm, which is a venous sinus found near the limbus
- Ciliary muscle is supplied by ***parasympathetic*** innervation derived from the ***oculomotor nerve***



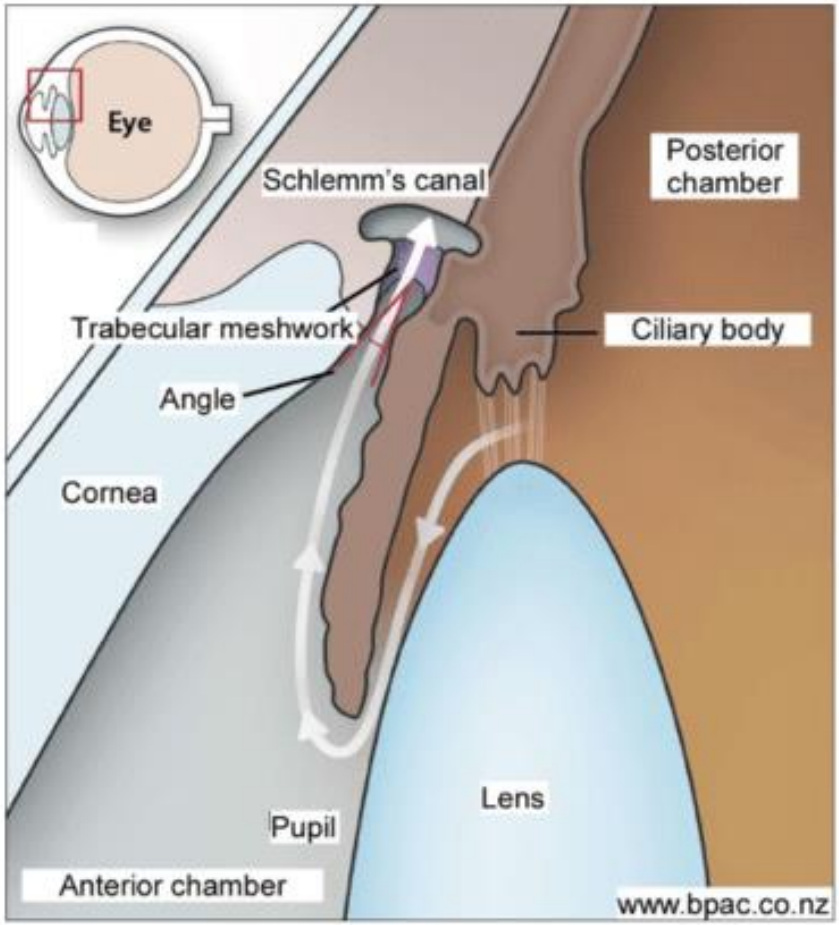

Anterior chamber
Cornea
Canal of Schlemm
Trabecular meshwork
Iris
Aqueous humor pathway
Ciliary muscle
Lens
Posterior chamber
Ciliary process

Aqueous Humor

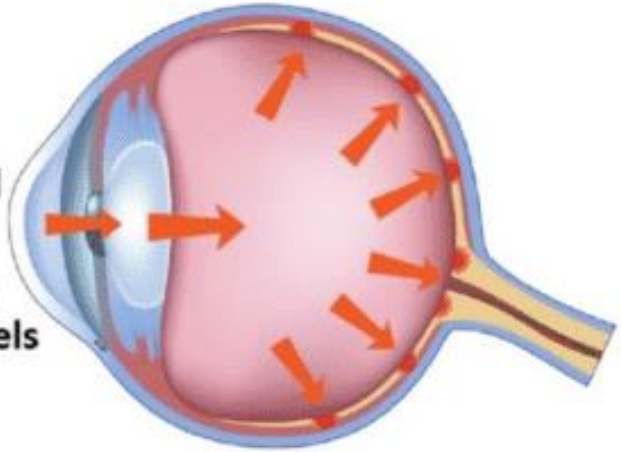
- It is a clear, watery fluid that fills the anterior and posterior chambers of the eyeball.
- It is ***secreted by ciliary processes*** and enters posterior chamber.
- It then flows forward through pupil to enter anterior chamber.
- From anterior chamber, it drains through the scleral venous sinus or canal of Schlemm and then into the blood.

Aqueous Humor

- The opening of this sinus is located at the junction of sclera and cornea.
- Aqueous humor is completely replaced about every 90 min.
- It also nourishes the cornea and lens, and removes the products of metabolism (***since there's no blood supply nor lymphatic drainage***)



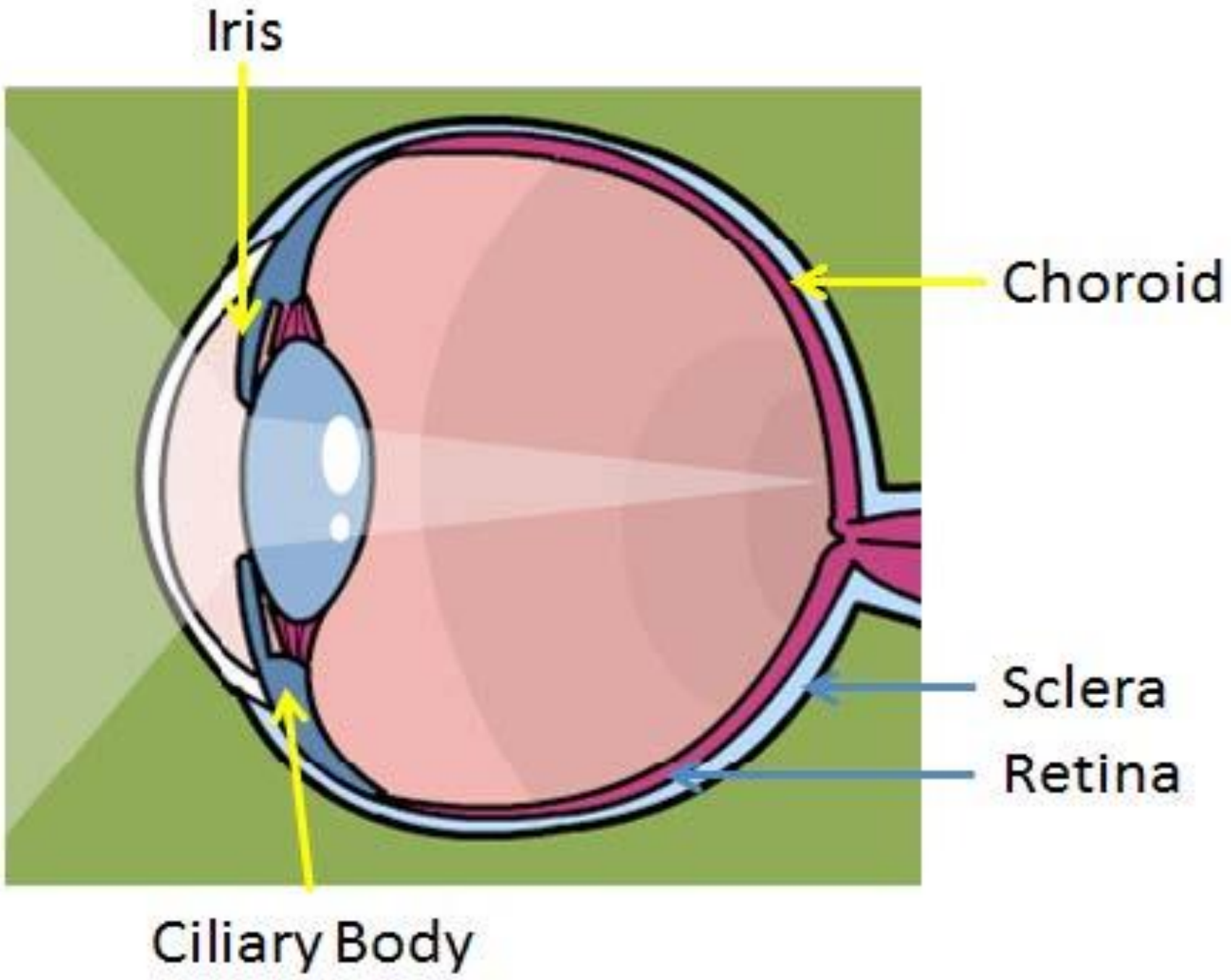
Increased pressure damages blood vessels



www.eyesofyork.com

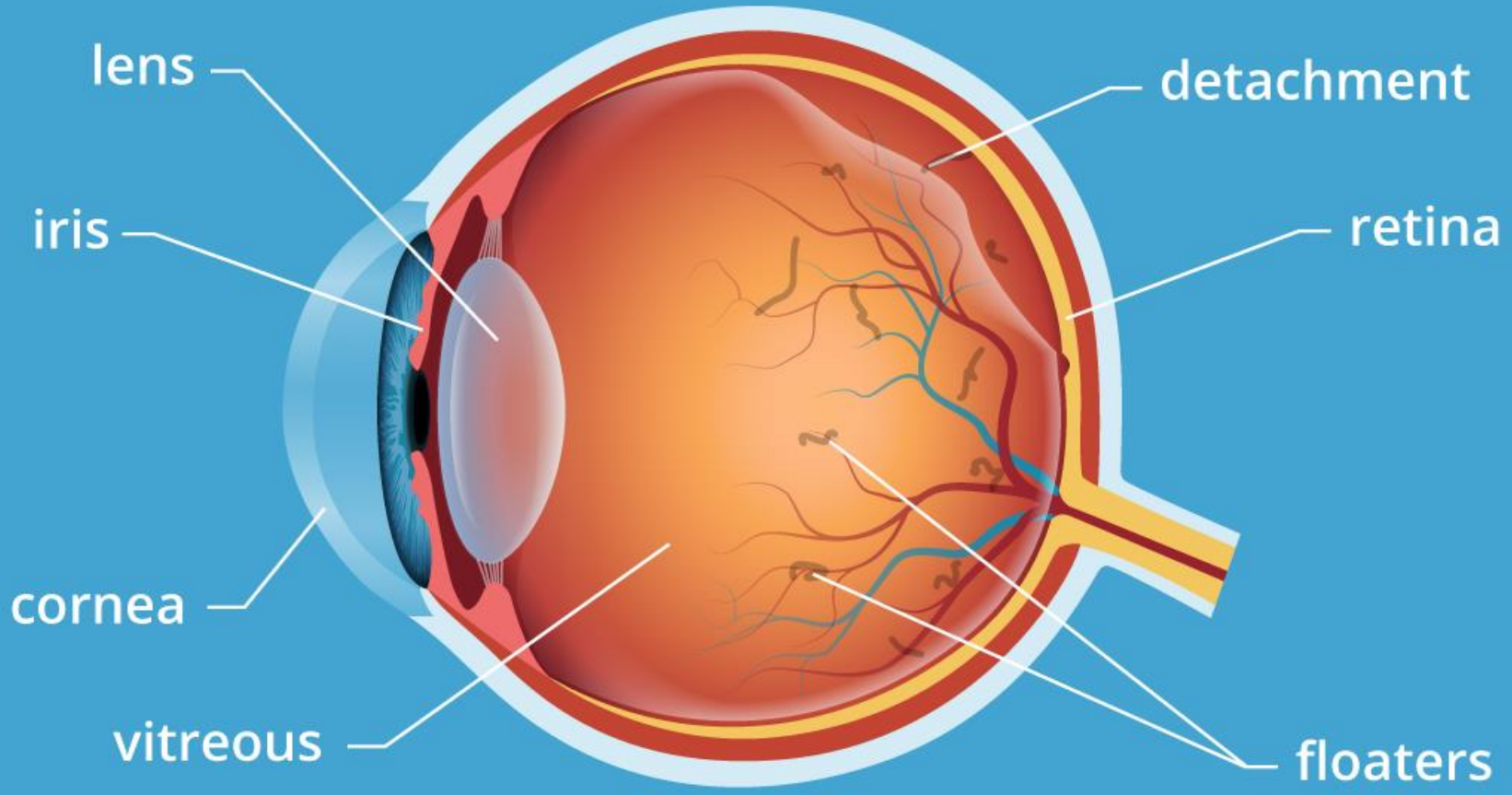
Choroid

- It represents approximately, the ***posterior two-thirds of the vascular layer***.
- It is ***a thin, highly vascular, pigmented layer***.
- It consists of an outer pigmented layer containing larger vessels and an inner layer containing smaller vessels.
- ***It is firmly attached to retina internally and loosely attached to sclera externally***.


Iris
Choroid
Sclera
Retina
Ciliary Body

Vitreous

- Located ***between lens and retina***
- Is a specialized jelly like connective tissue
- Fills the 4/5 of the globe-largest structure
- Volume: 4 ml


lens
iris
cornea
vitreous
detachment
retina
floaters

Vitreous

- 99% is water
- Transparent, avascular
- Functions

1. Serve as route of nutrient to the lens and inner part of the retina
2. Shock absorber

Vitreous

- Unlike the aqueous humor, the vitreous body is formed during embryonic life and is not replaced thereafter (***doesn't regenerate or recycle***).

- The function of the vitreous body is to contribute slightly to the magnifying power of the eye.

- ***It support the posterior surface of the lens, helps maintain the shape of the eyeball***, and assists in ***holding the neural part of the retina against the pigmented part of the retina***

Retina

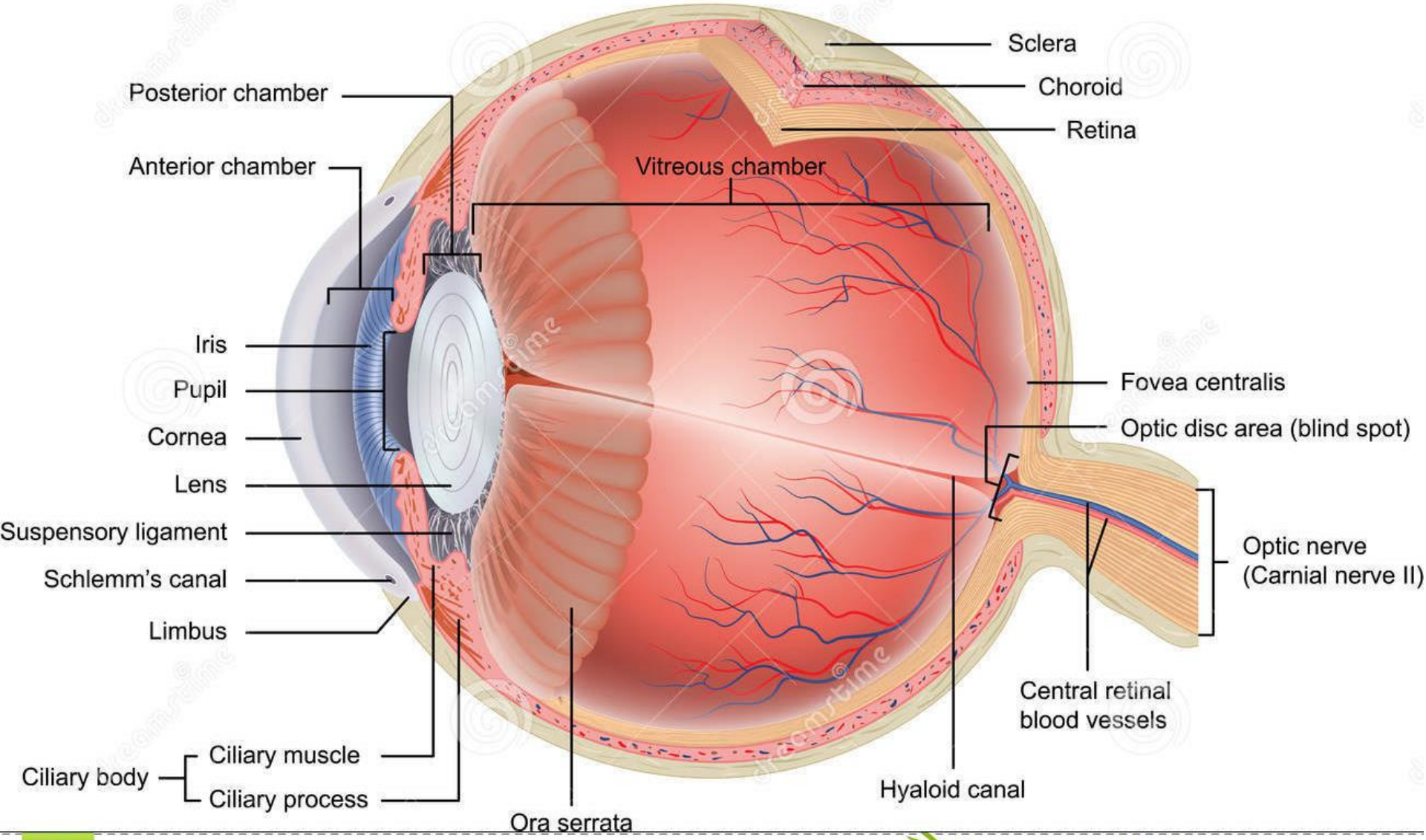
- **Inner coat of the eye**
- **Thin transparent layer which is in contact with choroid**
- ***Has 2 main layers***

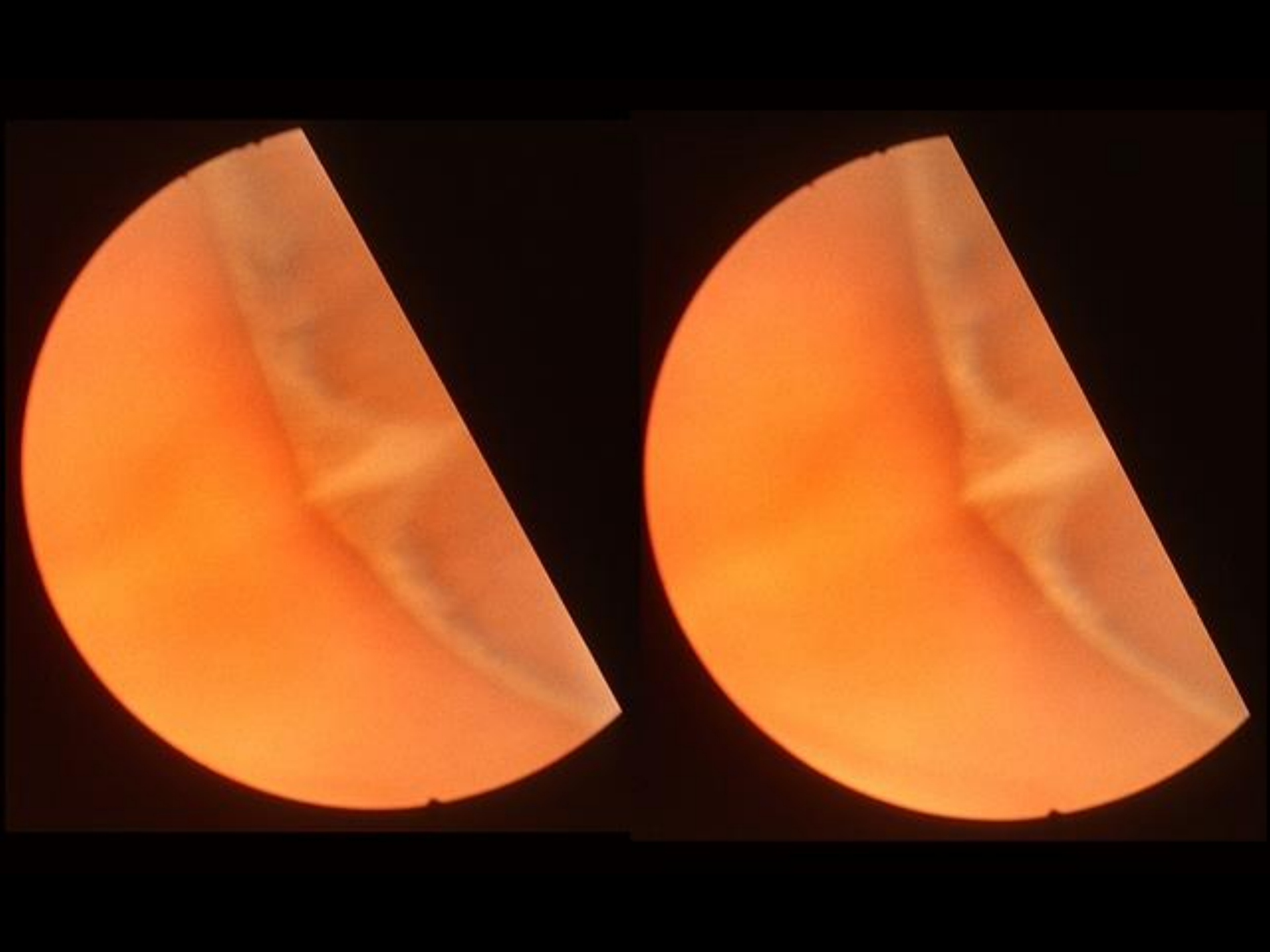
1. Outer retinal pigment epithelium (RPE)
2. Inner neurosensory retina

Retina

- The ***anterior*** part of the ***retina*** is non-receptive, and termed the ***non-visual part***.

- The junction between these two part forms a wavy ring, called ***ora serrata***





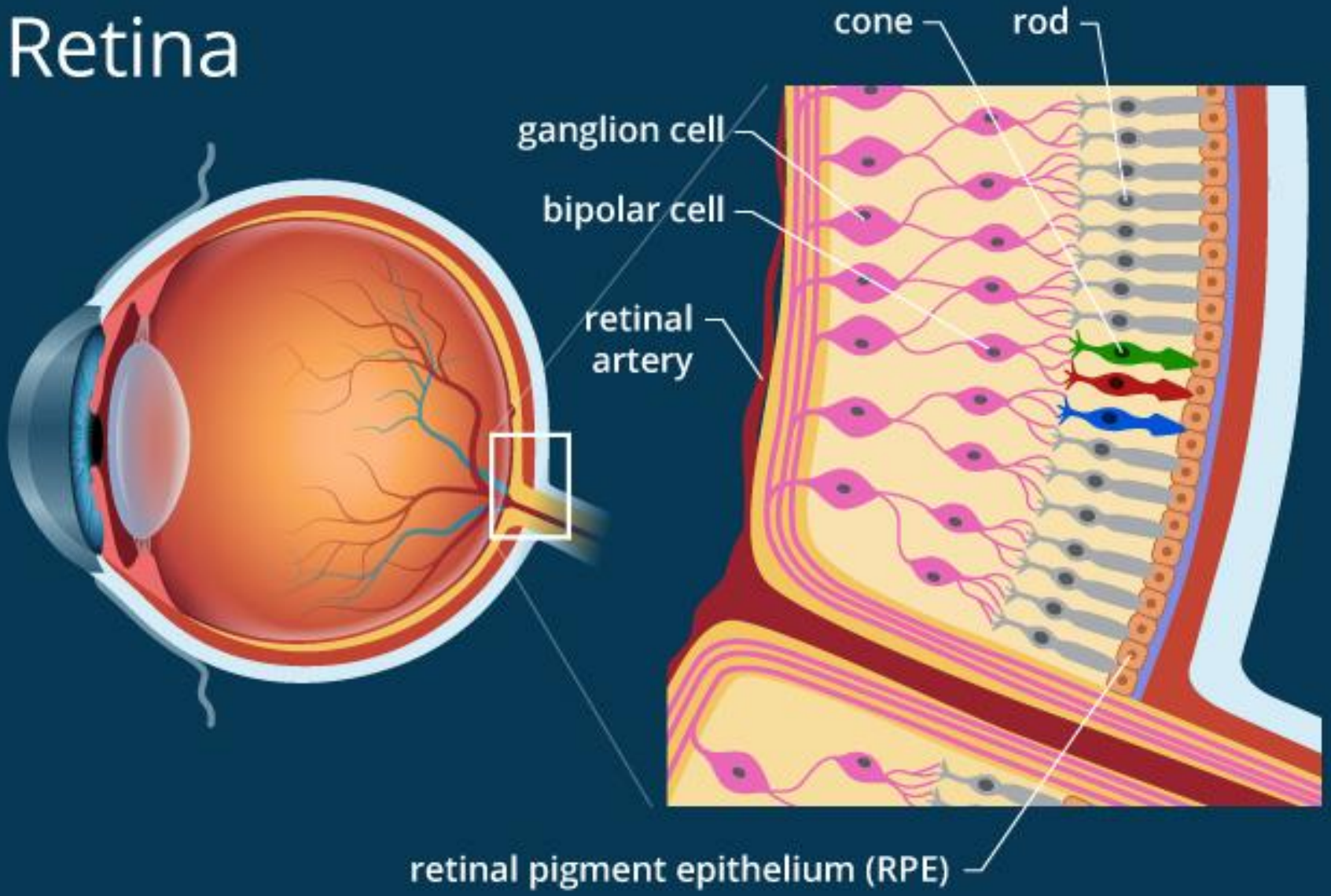
Retina

- The pigmented layer is a sheet of ***melanin-containing epithelial cells located between choroids and neural part of the retina***.

- ***Melanin in the choroids and in the pigmented layer absorbs stray light rays, which prevents reflection and scattering of light within the eyeball.***

- As a result, the ***image cast*** on the retina by the cornea and lens ***remains sharp and clear***.

Retina


cone
rod
ganglion cell
bipolar cell
retinal artery
retinal pigment epithelium (RPE)

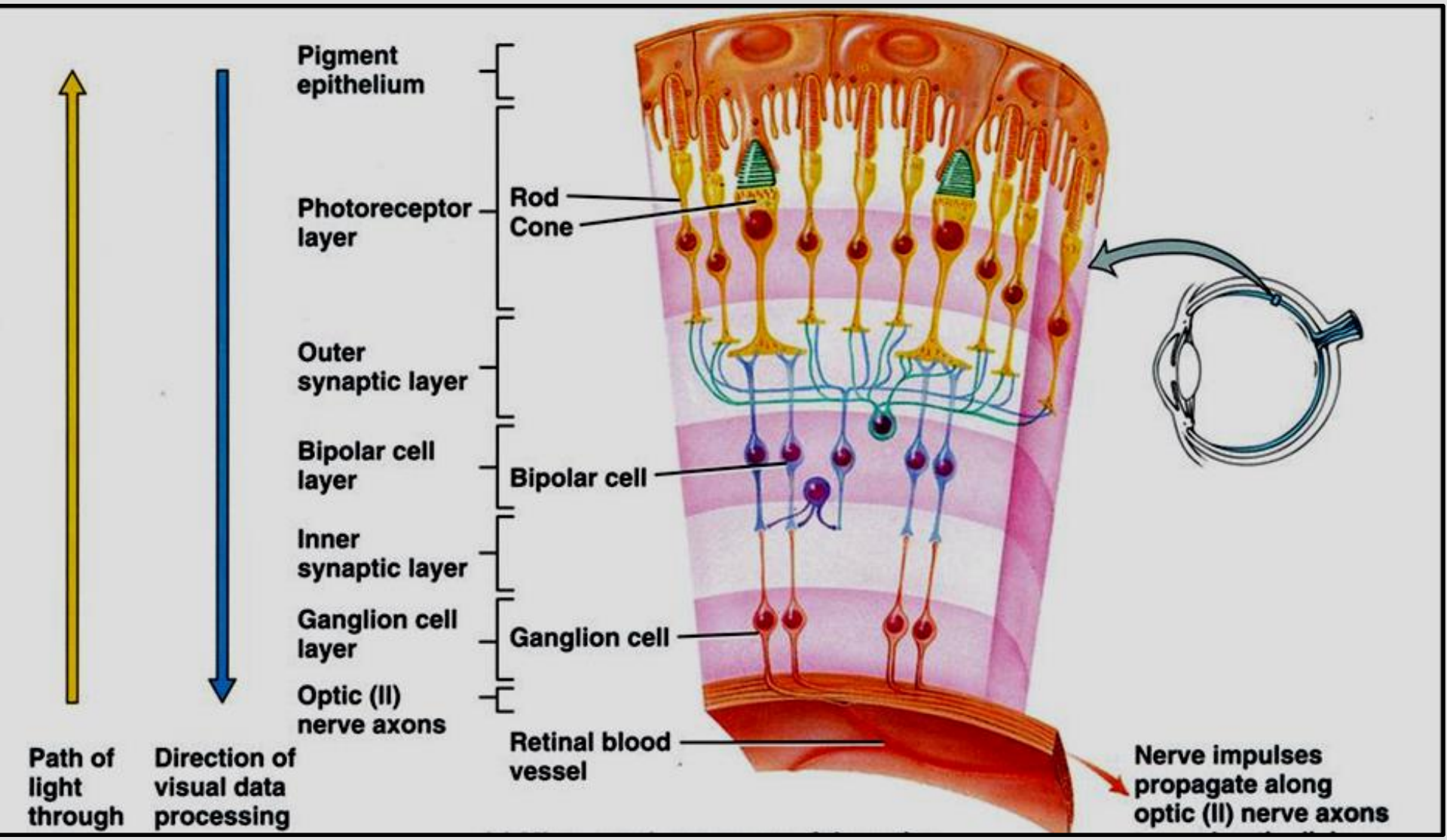
Retina

- ***Divided into 2 parts***

1. **Central, macula (fovea) for day vision (Cones)**
2. **Peripheral, for night and peripheral vision (Rods)**

- ***Nourished by***

1. Choroidal choriocapiliries
2. Central retina artery


Pigment epithelium
Photoreceptor layer
Outer synaptic layer
Bipolar cell layer
Inner synaptic layer
Ganglion cell layer
Optic (II) nerve axons
Rod
Cone
Bipolar cell
Ganglion cell
Retinal blood vessel
Path of light through
Direction of visual data processing
Nerve impulses propagate along optic (II) nerve axons

Retina

- Two types of photoreceptors are present in the retina, rods and cones.
- **Rods** allow as to see in **dim light**, such as **moonlight**.
- Because they do not provide color vision, in dim light we **see only shades of gray**.
- Animals have these only

Rods

- **Rods** see in black, white, and shades of gray and tell us the form or shape that something has.

- Rods can't tell the difference between colors, but they are super-sensitive, allowing us to see when it's very dark.

Cones

- **Cones** sense color and they need more light than rods to work well.

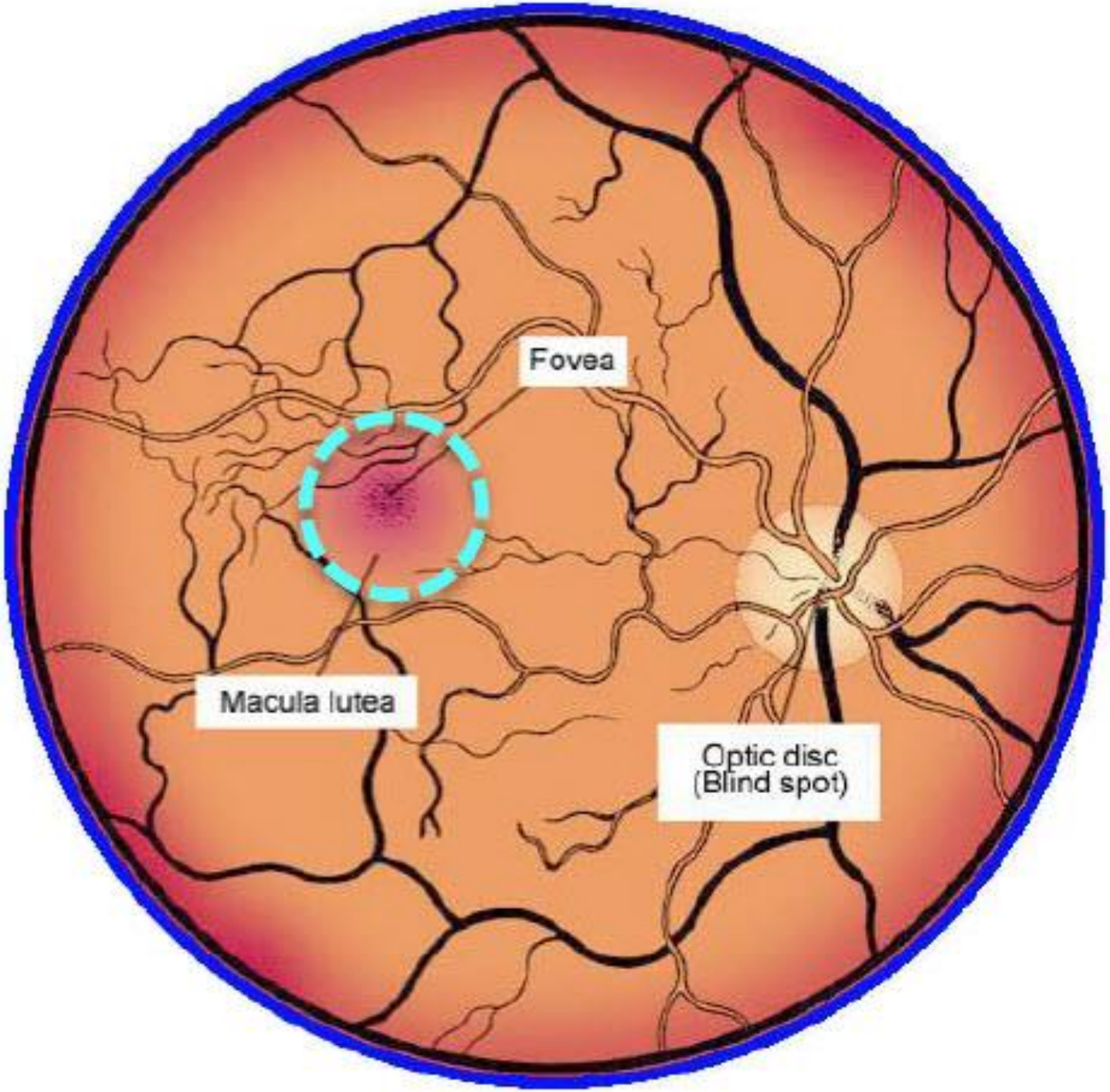
- Cones are most helpful in normal or bright light.

Retina

- ***Bright lights*** stimulate ***cones***, which produce ***color vision***.

- At the center of the posterior part of retina is an oval, yellowish area, called ***macula lutea***.

- The ***fovea centralis*** is a small depression in the center of ***macula lutea***, contains ***only cones***. ------> ***high visual acuity / resolution***


Fovea
Macula lutea
Optic disc
(Blind spot)

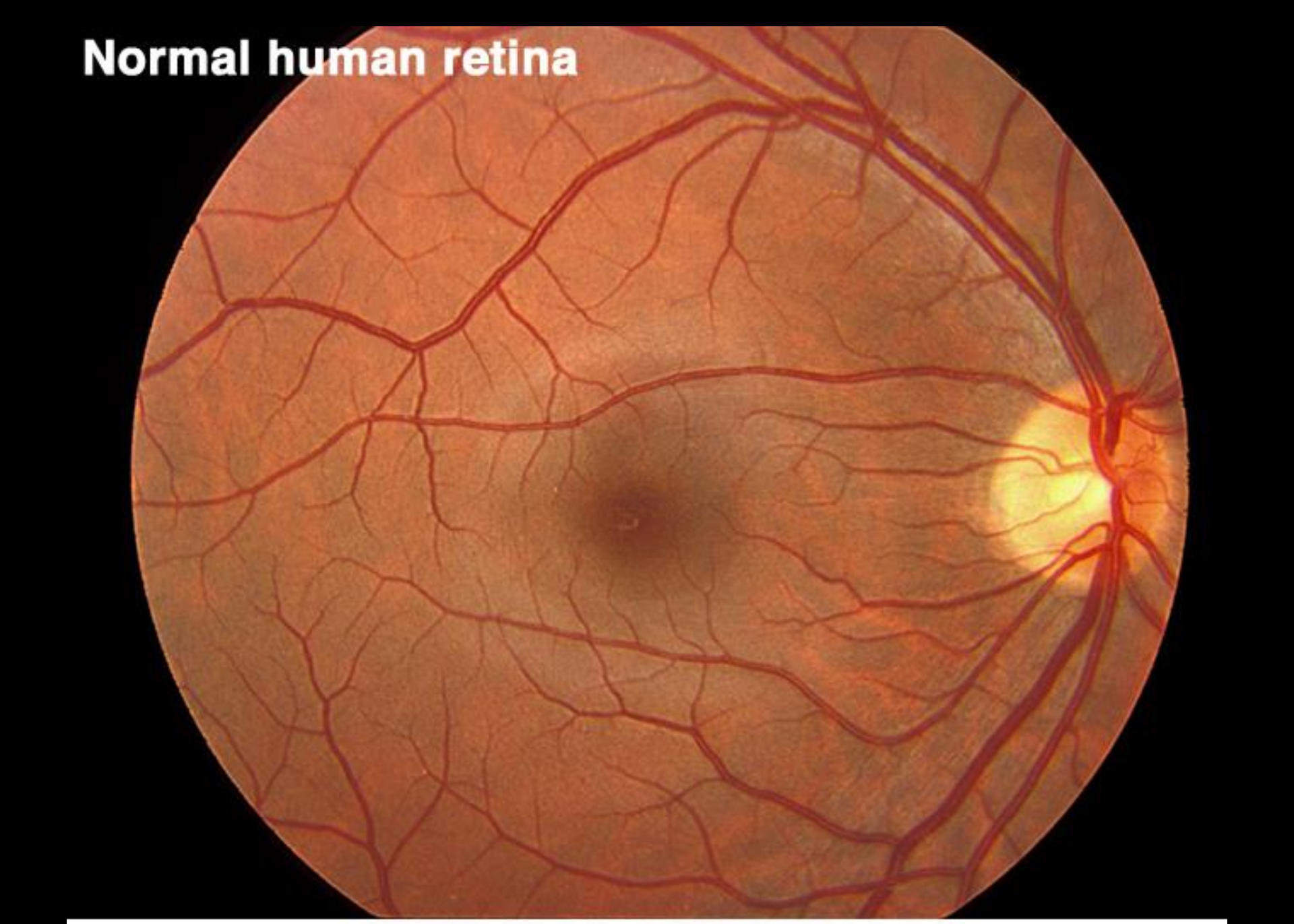


Fig. 12a. Fundus photo of a normal human retina.

The Eye Lid

- They are movable folds
- Acts like curtain
- Protect the eye against injury & excessive light
- Help pupil to regulate amount of light reaching the retina

The Eye Lid

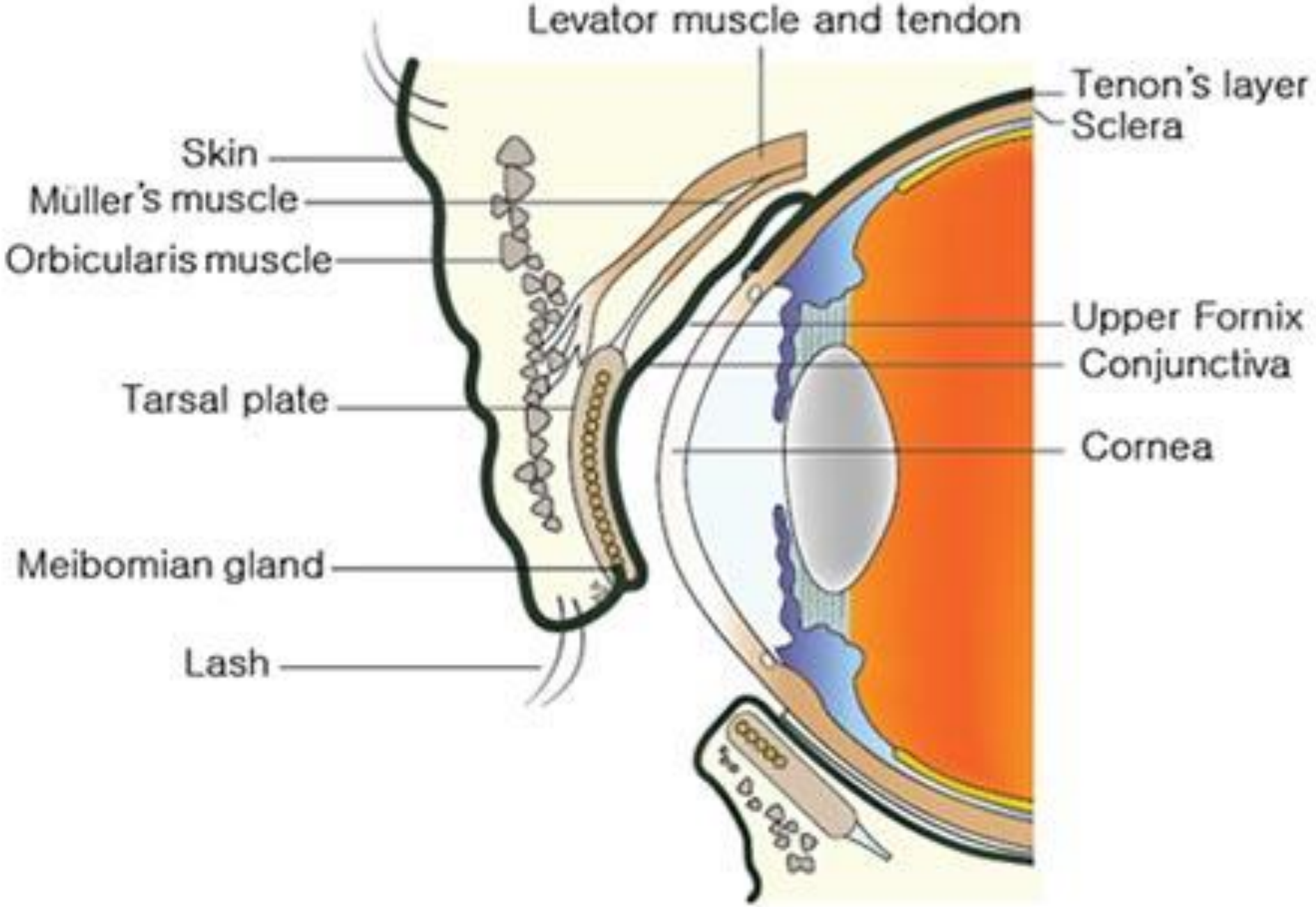
- Spread tears film by blinking
- Pumping effect-tear drainage
- Has tear producing glands-forms basic tear

The Eye Lid

- Skin thinnest-transparent elastic , no hair folds

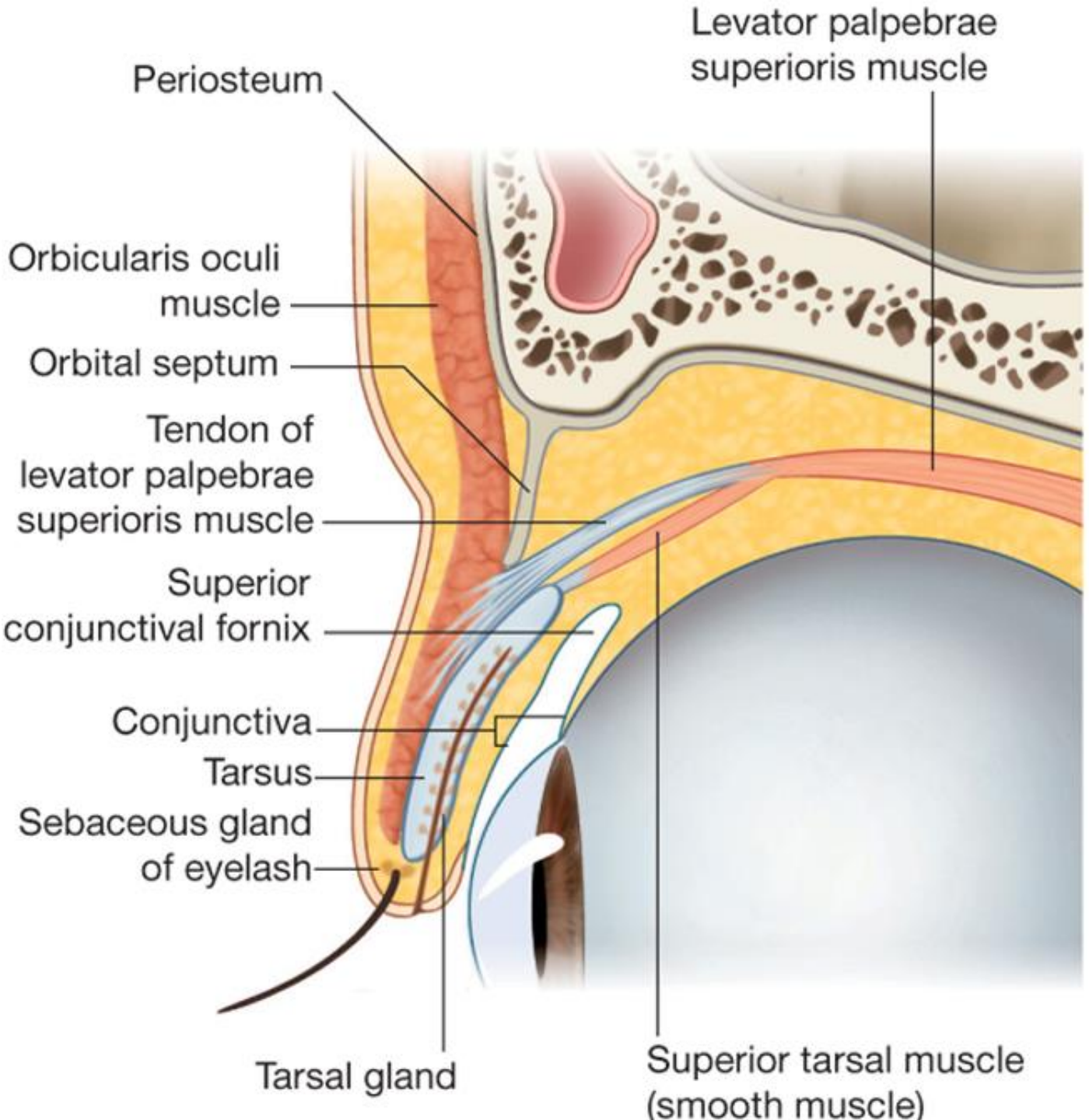
- Orbicularis oculi: roughly circular

1. Closes the lids
2. Its contraction help tear drainage
3. Innervation by facial nerve


Levator muscle and tendon
Tenon's layer
Sclera
Skin
Müller's muscle
Orbicularis muscle
Upper Fornix
Conjunctiva
Tarsal plate
Cornea
Meibomian gland
Lash

The Eye Lid

- Tarsal plates: dense fibrous tissue, contributes to its formation and support
- Levator palpebral superioris, elevates upper lids
- Innervated by 3rd cranial nerve and ***Mullers muscle - smooth - sympathetic***

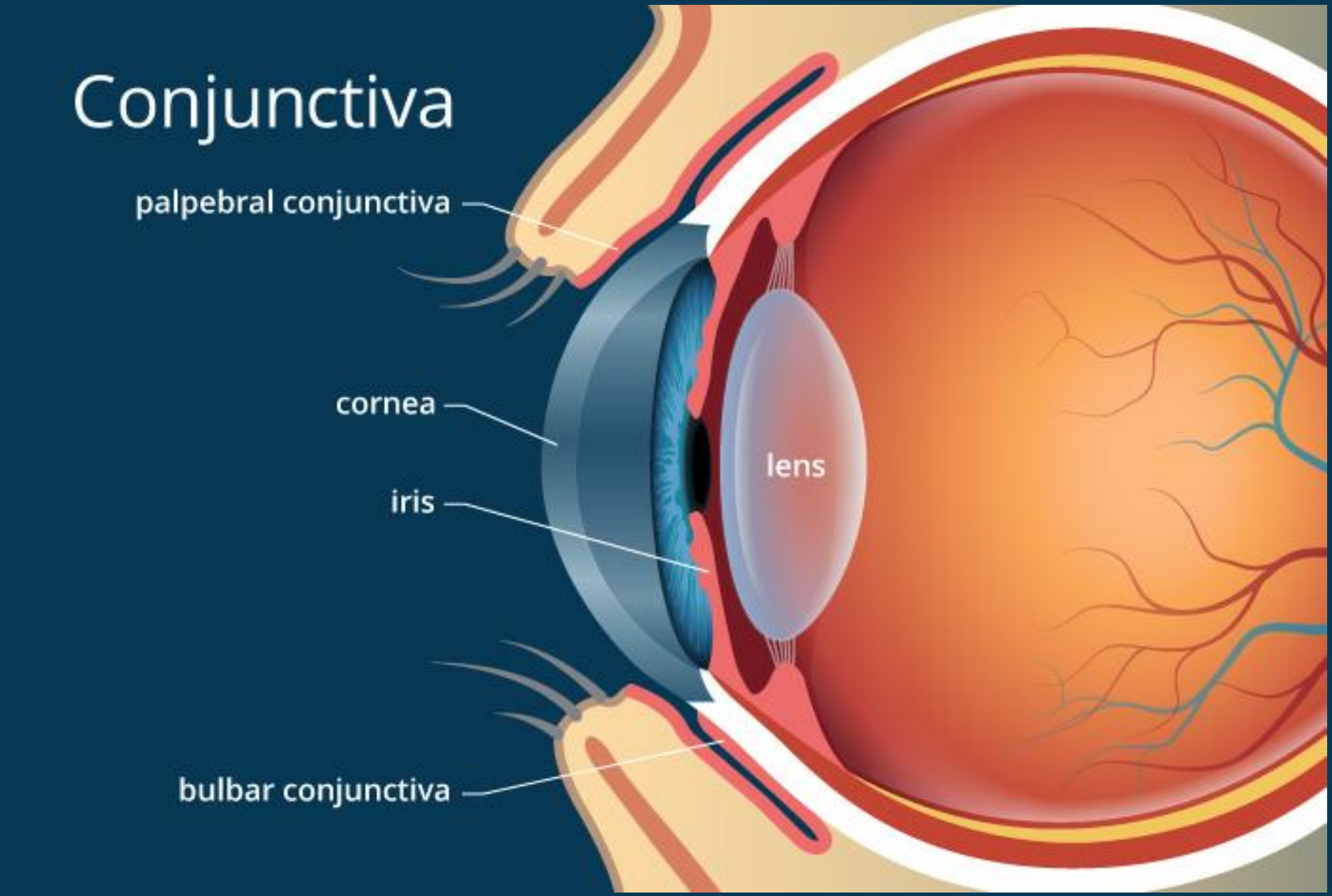

Levator palpebrae superioris muscle
Periosteum
Orbicularis oculi muscle
Orbital septum
Tendon of levator palpebrae superioris muscle
Superior conjunctival fornix
Conjunctiva
Tarsus
Sebaceous gland of eyelash
Tarsal gland
Superior tarsal muscle (smooth muscle)

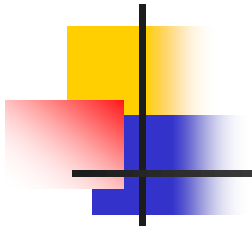
Conjunctiva

- Thin, transparent mucous membrane Non-keratinized squamous epithelium
- ***Has goblet cells***
- Highly ***vascularized***
- ***Parts***

1. ***Palpebral, firm adherent to tarsus (eye lids)***
2. ***Bulbar, loosely attached to underlying sclera, allows eye to move & inserts at the limbus***

Conjunctiva





Optic Nerve

Optic Nerve

- It is a ***2nd cranial nerve***
- Originate in the ganglion layer of the retina
- Consist of about one million axons, fibers within the retina are transparent

Optic Nerve

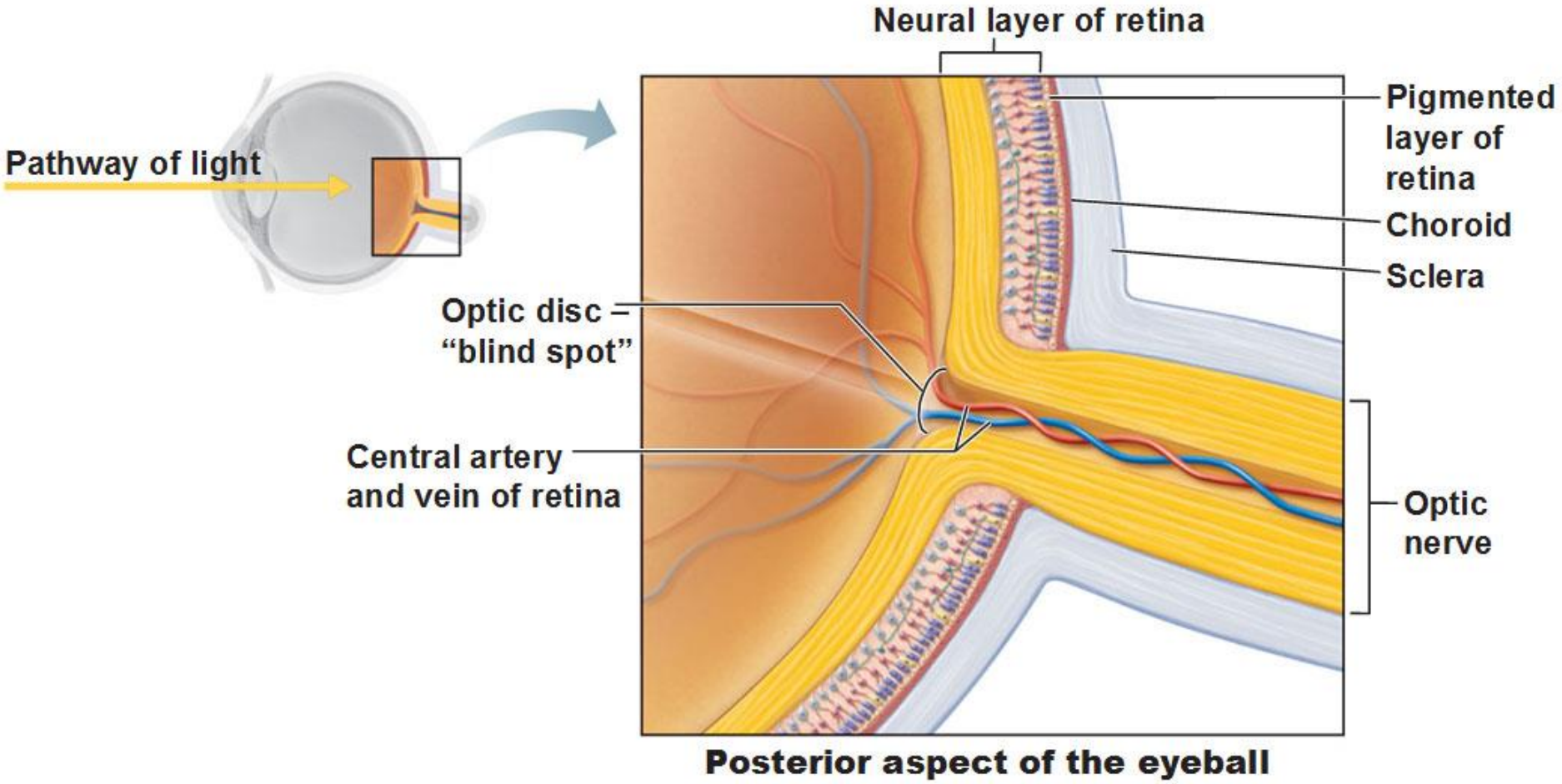
- Its organization structure similar to white matter of the brain, in other words, ***an outgrowth from the brain***

- ***Optic disc:*** is the site where optic nerve leaves the retina and can be visualized with an ophthalmoscope.

- Within the orbit, covered with meningeal sheaths, ***not covered by neurilemma (like peripheral nerves)*** so does not regenerate when cut.

Optic Nerve

- The disc lies about 3 mm to the medial side of the macula lutea.
- At the optic disc ***is a complete absence of rods and cones so that it is insensitive to light*** and is known as the "***blind spot***".
- Blood supply: central retinal artery


Neural layer of retina
Pathway of light
Pigmented layer of retina
Choroid
Sclera
Optic disc – "blind spot"
Central artery and vein of retina
Optic nerve
Posterior aspect of the eyeball

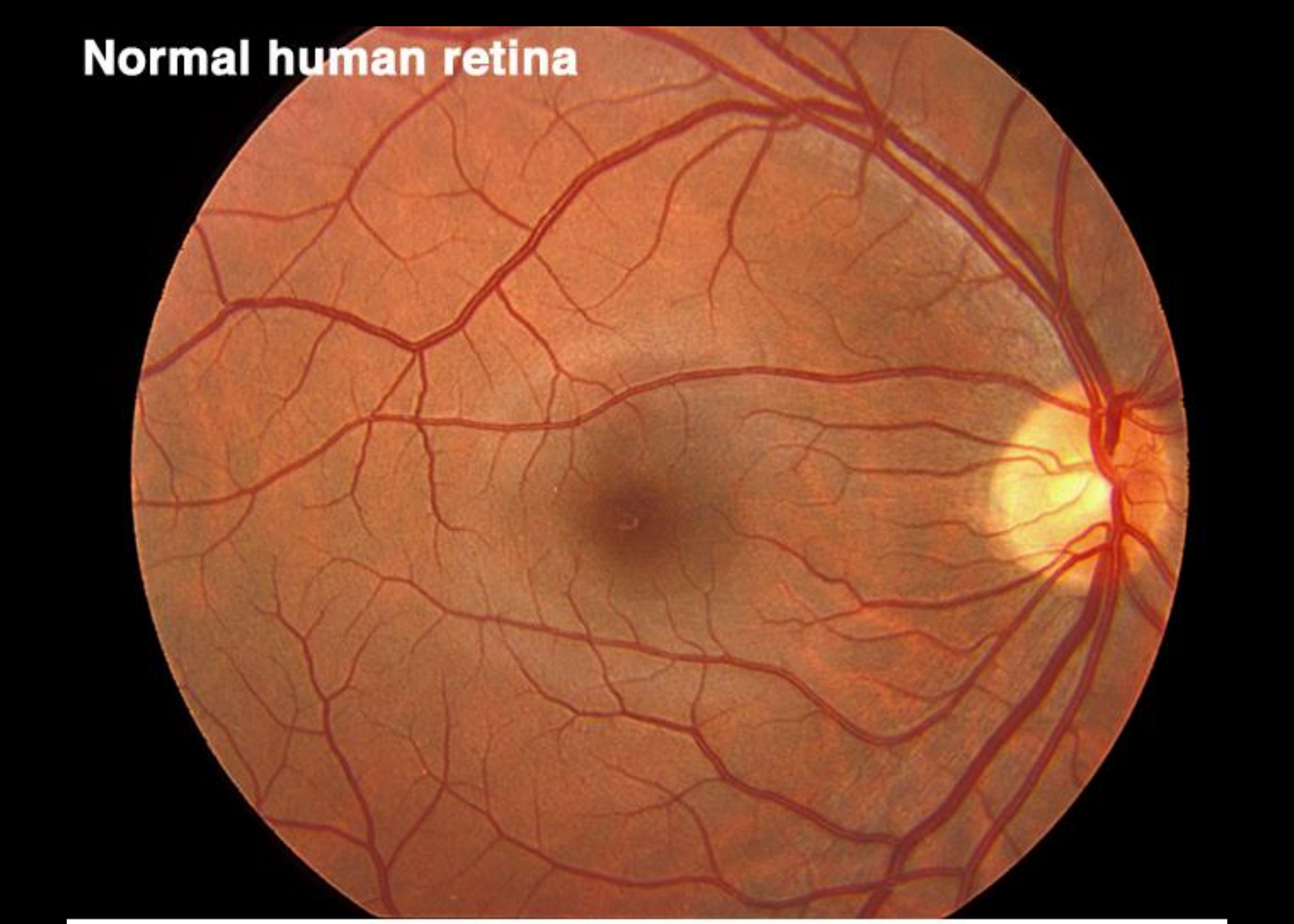
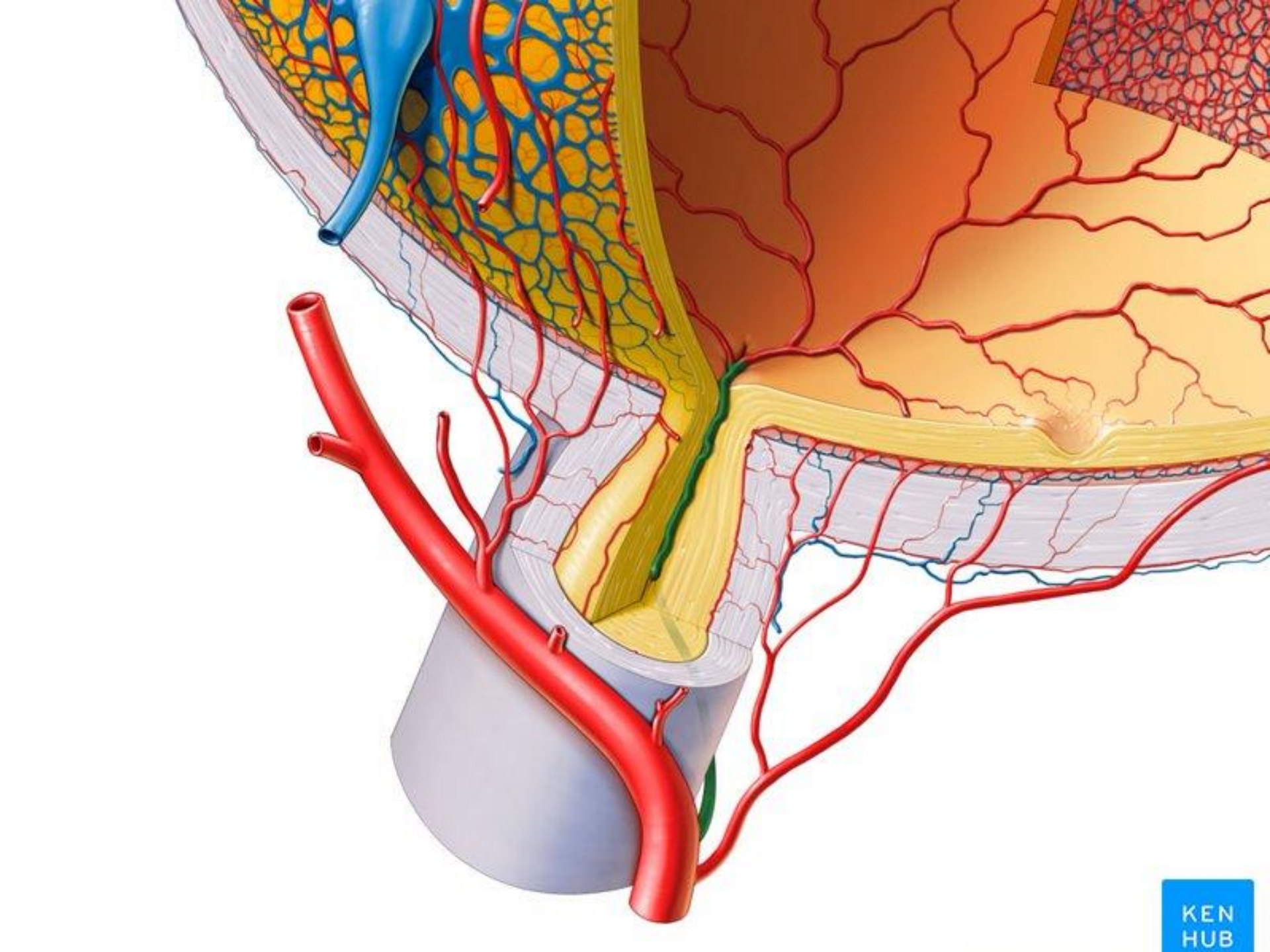


Fig. 12a. Fundus photo of a normal human retina.



Blood Supply of the Eye

Arterial supply

The orbit is supplied by ***the ophthalmic branch of the internal carotid artery,*** through the following branches:

a. ***Central artery of the retina***:
Runs in the substance of the optic nerve and enters eyeball at the center of optic disc, and divides into branches.

b. ***Short posterior ciliary arteries***:
Pierce the sclera around the optic nerve and enter the choroid layer.

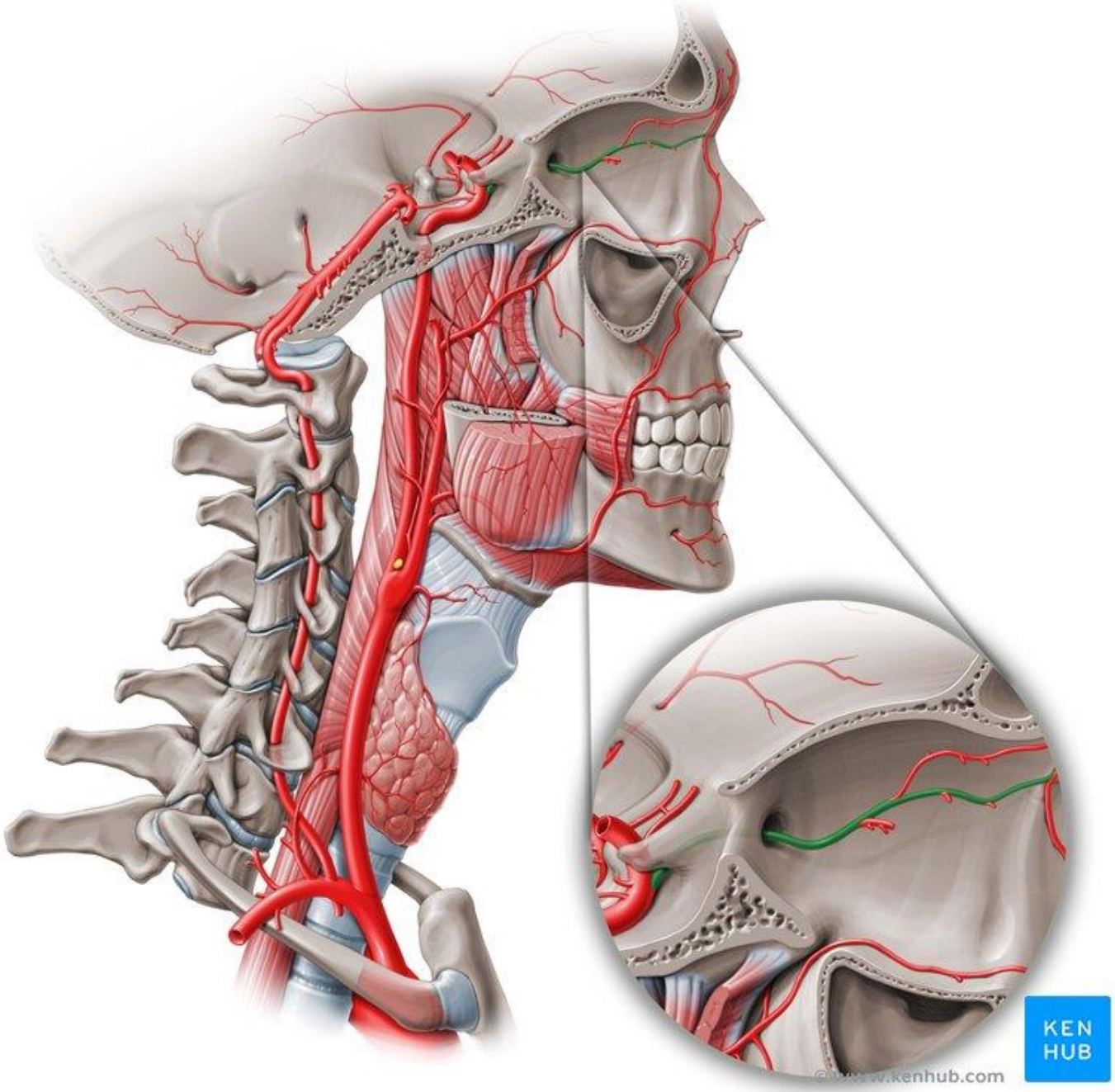
Blood Supply of the Eye

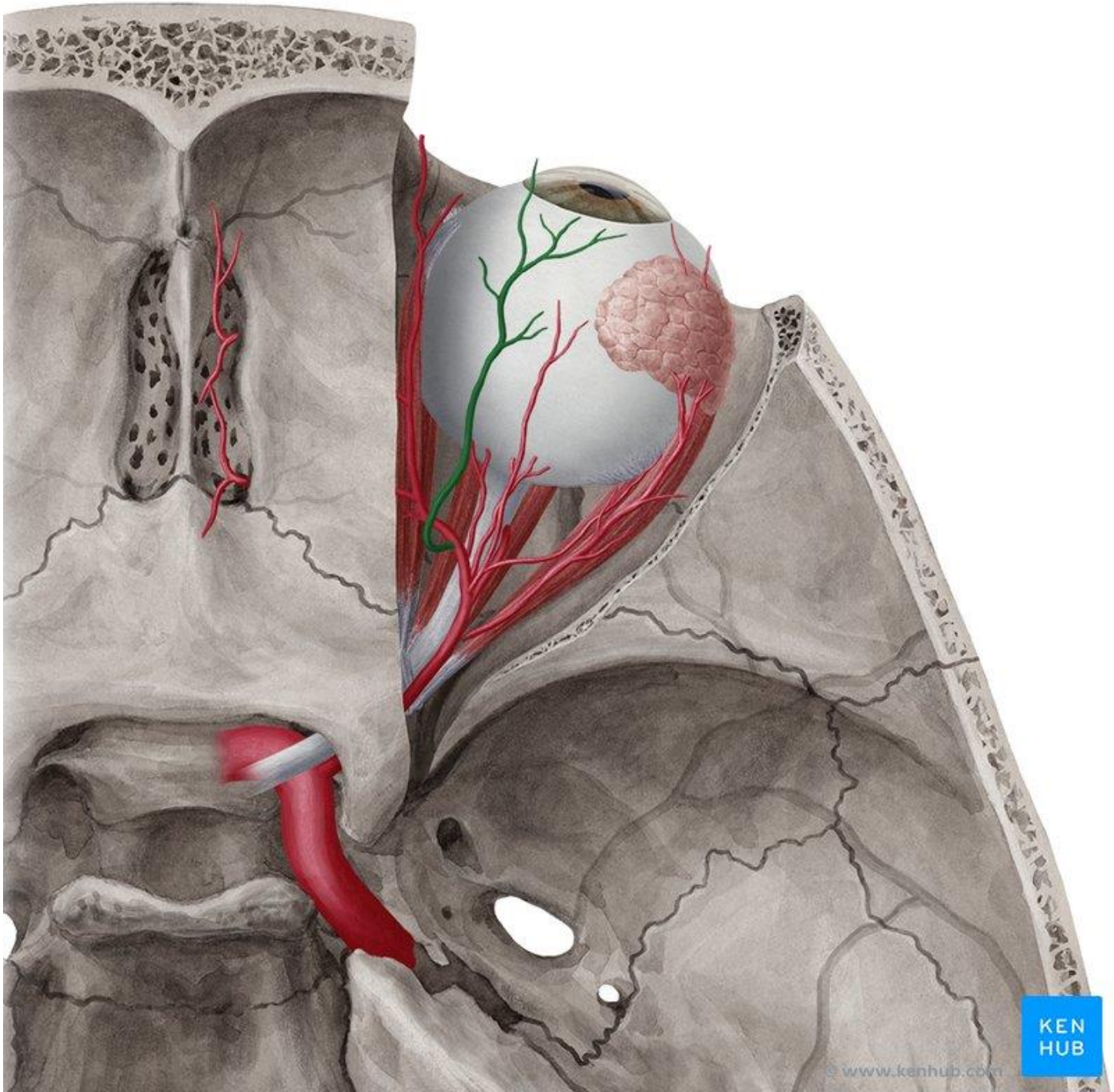
Arterial supply

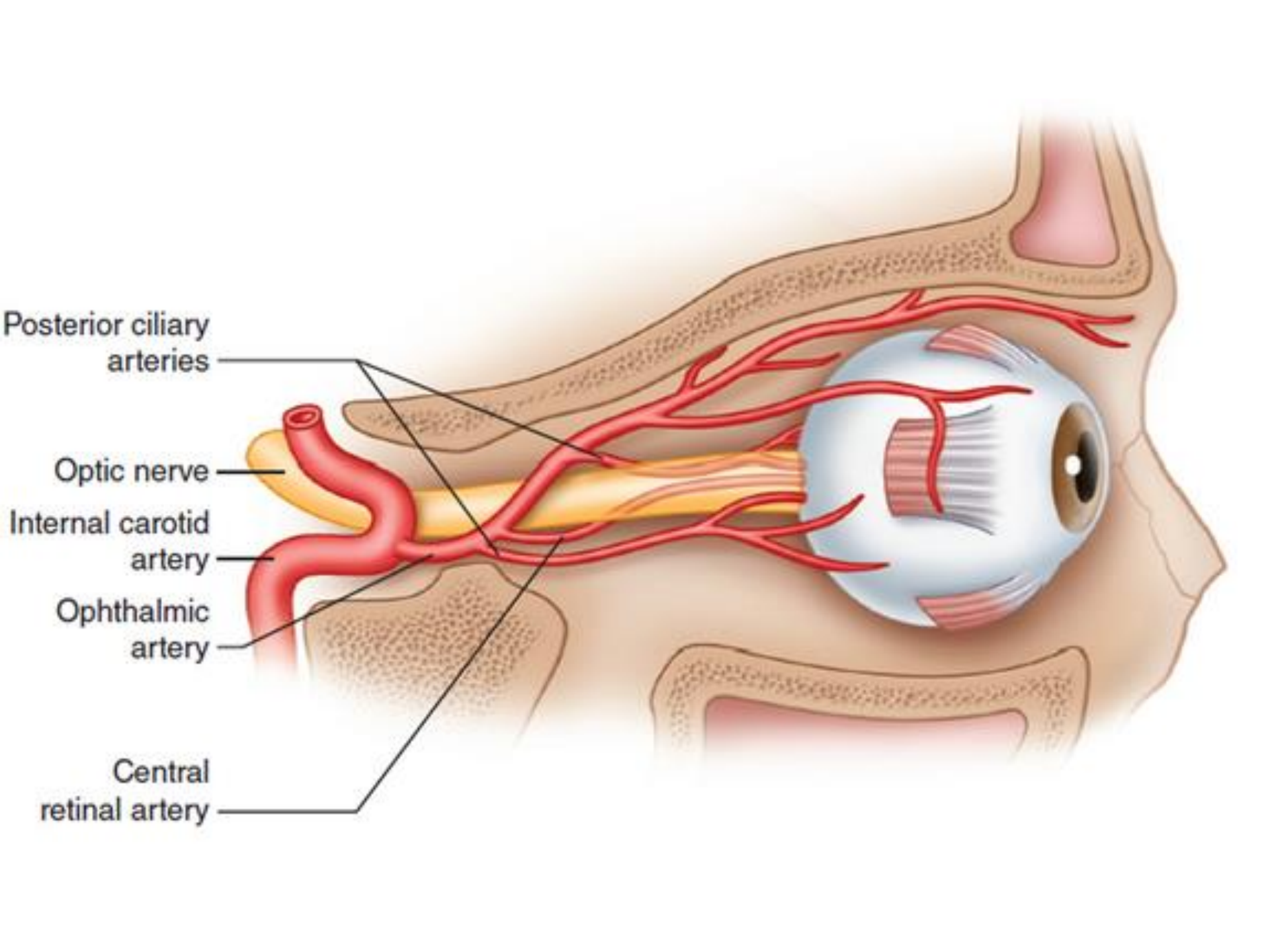
c. ***Long posterior ciliary arteries***: Usually two, enter the sclera on the medial and lateral sides of the optic nerve and continues forward in the choroid layer to anastomose with the anterior ciliary arteries.

d. ***Anterior ciliary arteries***: Spring from the muscular arteries close to the sclera, and pierce the sclera to anastomose with the long posterior ciliary arteries in the choroid layer.

e. ***Muscular arteries***: Supply the extraocular muscles


KEN
HUB


KEN
HUB
© www.kenhub.com


Posterior ciliary arteries
Optic nerve
Internal carotid artery
Ophthalmic artery
Central retinal artery

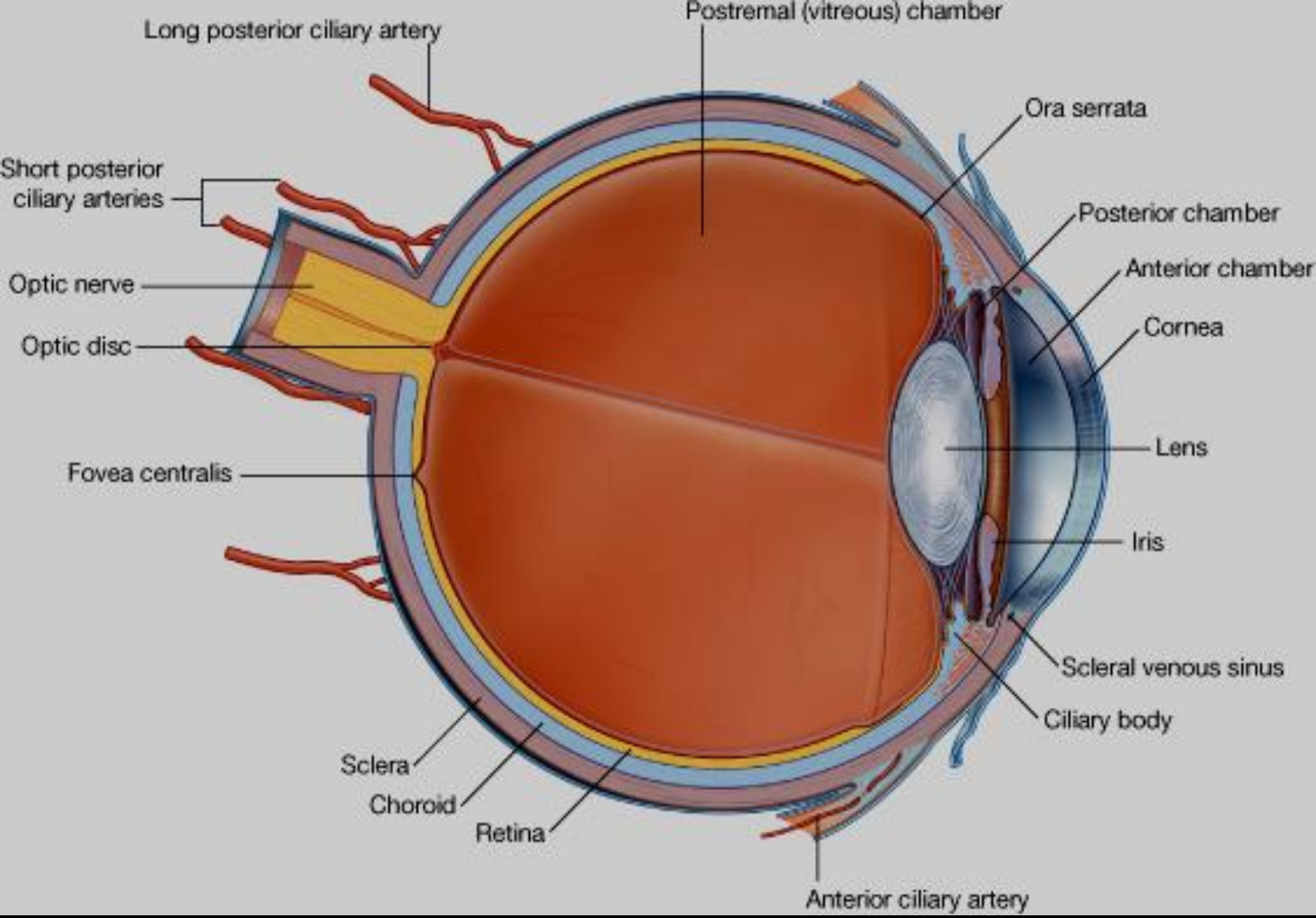


Figure 6. Arterial supply of the eyeball.

Venous Drainage

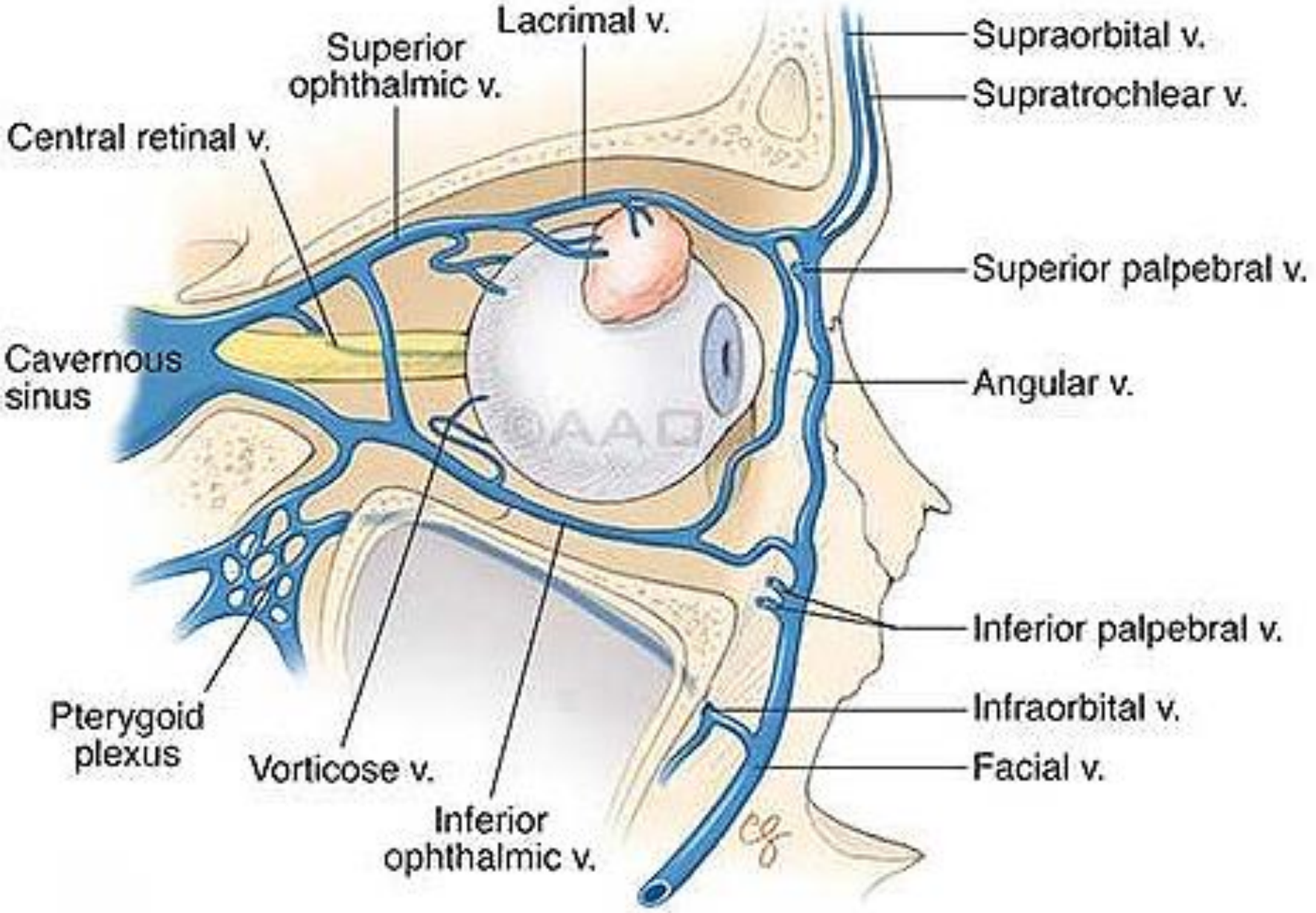
- The orbit is drained by superior and inferior ophthalmic veins.
- Both veins pass backwards through superior orbital fissure and drain into cavernous sinus.

- ***The superior ophthalmic vein*** communicates anteriorly with facial vein.

- The ***inferior ophthalmic vein*** communicates through the inferior orbital fissure with the pterygoid venous plexus (***dangerous area***)

Lymph vessels:

No lymph vessels or nodes are present in the orbit. And the cornea has no blood supply , nourished by acquis humour


Lacrimal v.
Superior ophthalmic v.
Central retinal v.
Supraorbital v.
Supratrochlear v.
Superior palpebral v.
Cavernous sinus
Angular v.
Inferior palpebral v.
Infraorbital v.
Facial v.
Pterygoid plexus
Vorticose v.
Inferior ophthalmic v.

Visual Fields

- **Each eye sees a part of the visual space that defines its visual field.**

- The visual fields of both eyes overlap extensively to create a binocular visual field.

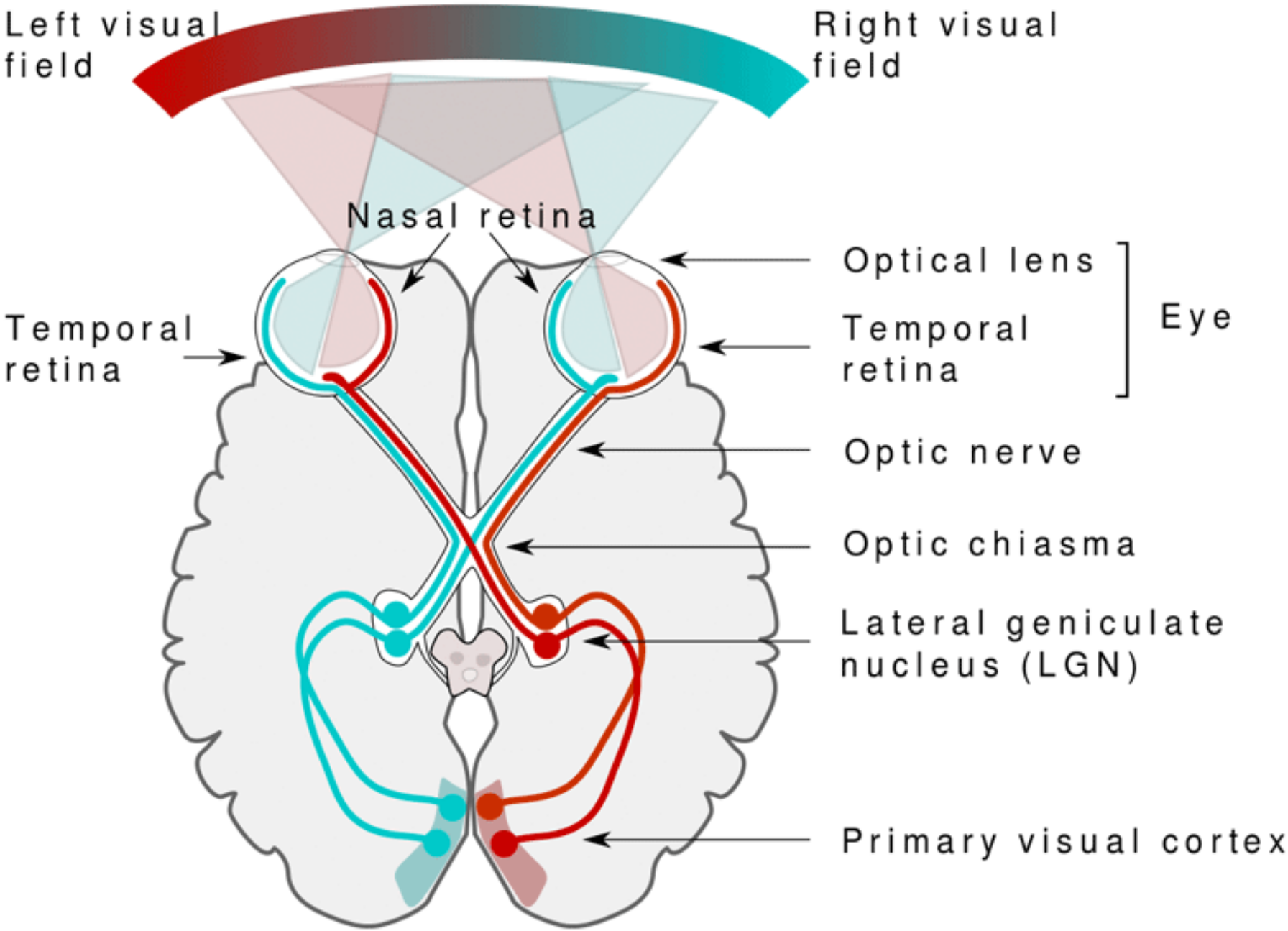
- ***The total visual field is the sum of the right and left hemifields and consists of a binocular zone and two monocular zones.***

Visual Pathway

- Vision is produced by ***photoreceptors*** in the ***retina***, a layer of cells behind the eye. The information ***leaves*** the eye ***by*** manner of the ***optic nerve***.

- The nerves then ***cross to form*** a ***chiasma***, the axons are termed as the ***optic tract***. The optic tract wraps about the midbrain to ***reach*** to the lateral geniculate nucleus (***LGN***), where all axons should synapse.

- From there, the ***LGN*** axons ***fan out*** via the deep white matter of the brain as the ***optic radiations***, that will ultimately travel to ***primary visual cortex***, at behind the brain.


Left visual field
Right visual field
Nasal retina
Temporal retina
Optical lens
Temporal retina
Eye
Optic nerve
Optic chiasma
Lateral geniculate nucleus (LGN)
Primary visual cortex

Visual Pathway

- Each retina divided into nasal and temporal halves

- Light rays travel only in straight lines, through the pupil, and so ***objects*** of ***temporal vision*** are ***perceived*** by the ***nasal half of*** the ***retina*** and those in the ***nasal vision*** are ***perceived*** by the ***temporal half*** of the ***retina***

Optic Nerve

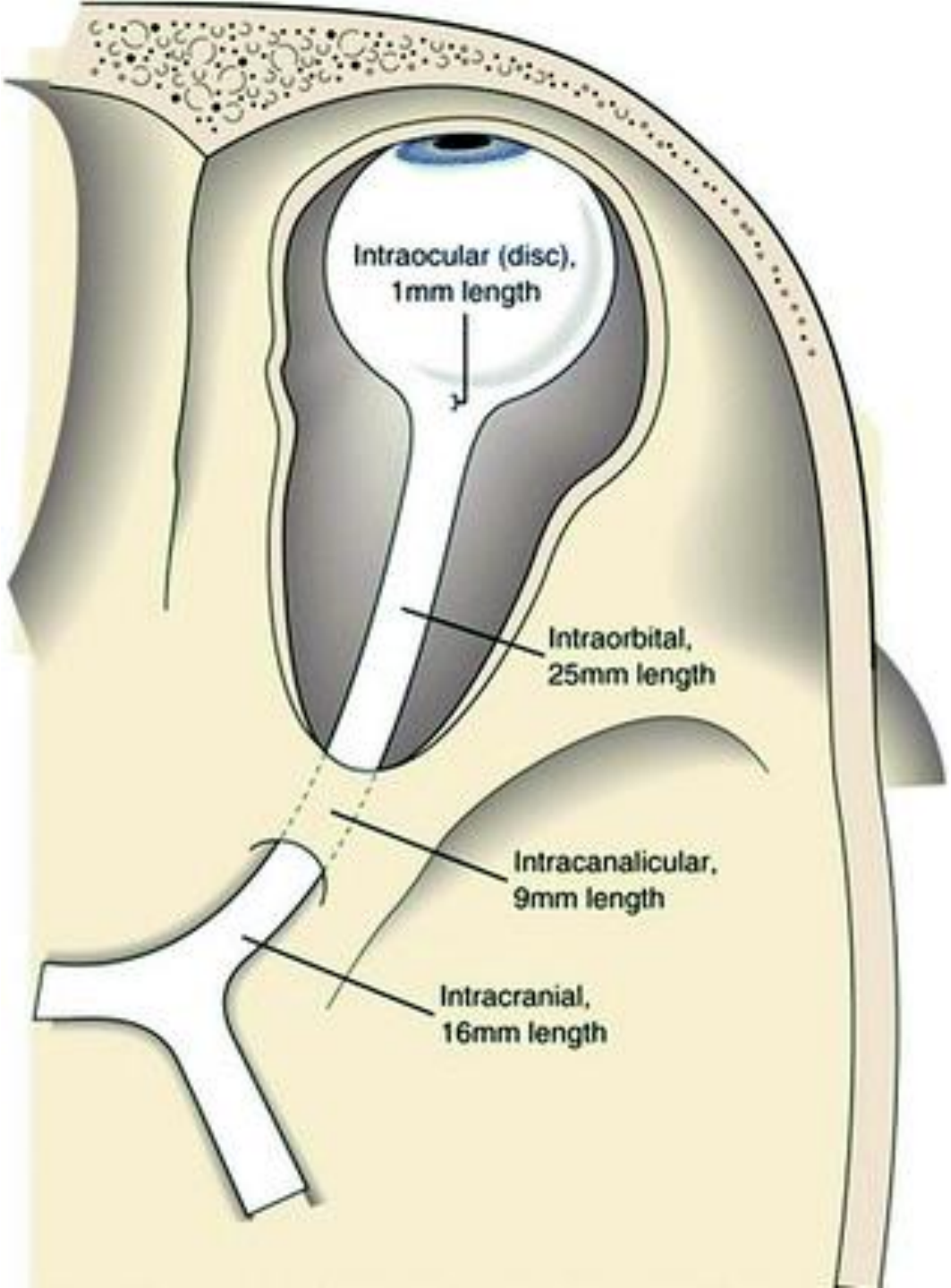
- 2nd cranial nerve, formed of backward continuation of nerve fiber layer of retina which consist of axons originating from ganglion cells.
- 35 - 55 mm in length.
- Starts from optic disc & extends up to optic chiasma where the two nerves meet.

Optic Nerve

- Contains the ***afferent fibers of light reflex***

Has 4 parts :

1. Intraocular (1 mm)
2. Intra orbital (25 – 30 mm)
3. Intra canalicular (6-9 mm)
4. Intracranial (10 – 16 mm)


Intraocular (disc),
1mm length
Intraorbital,
25mm length
Intracanalicular,
9mm length
Intracranial,
16mm length

Optic Nerve

Intra ocular Part :

- About 1mm in size, passes through sclera , choroid & finally appears in eye as optic disc.

Intra orbital part :

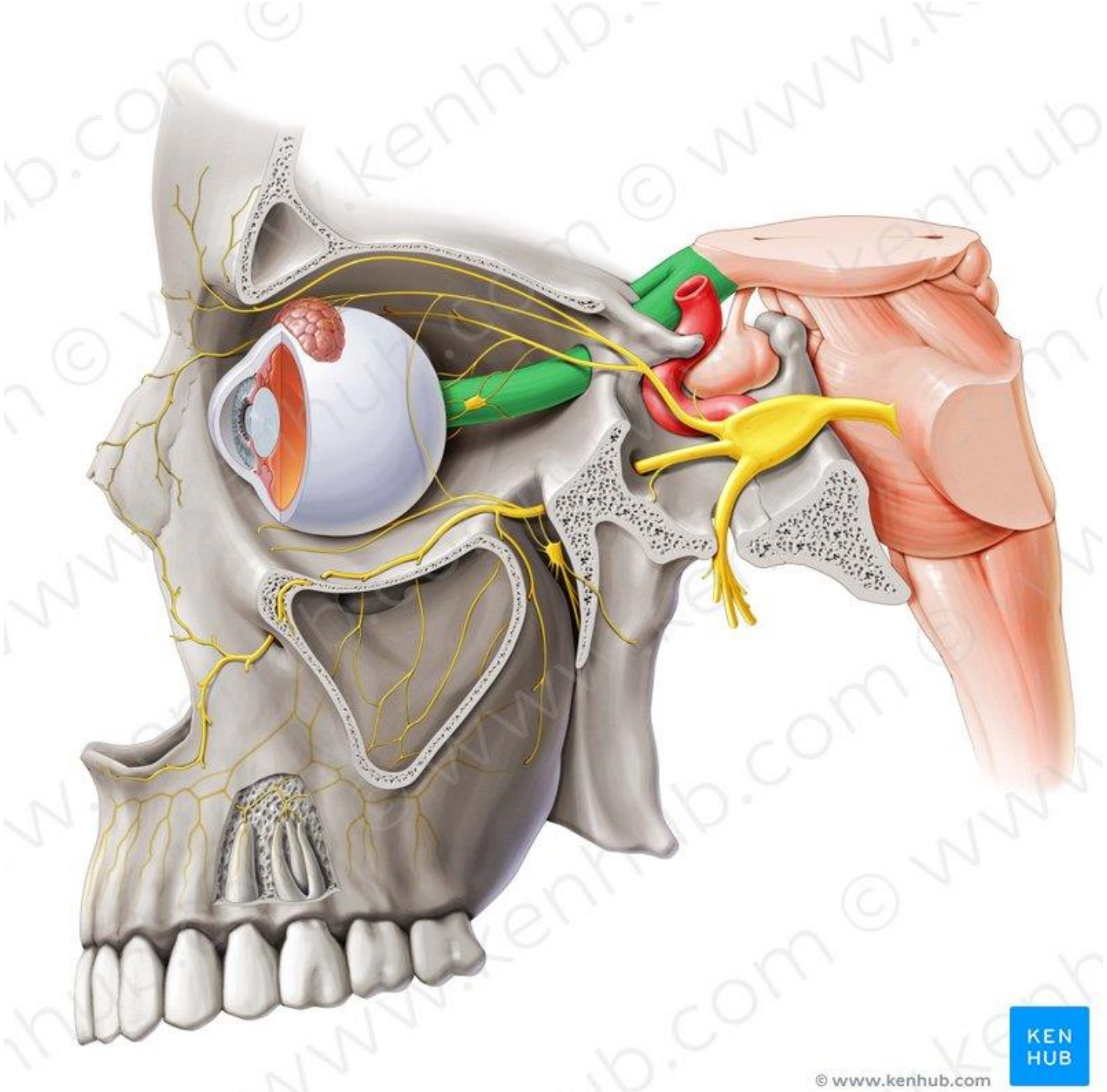
- Extends from back of eyeball to optic foramina.

- This part ***slightly redundant to give play for the eye movements***.

Optic Nerve

Intra orbital part :

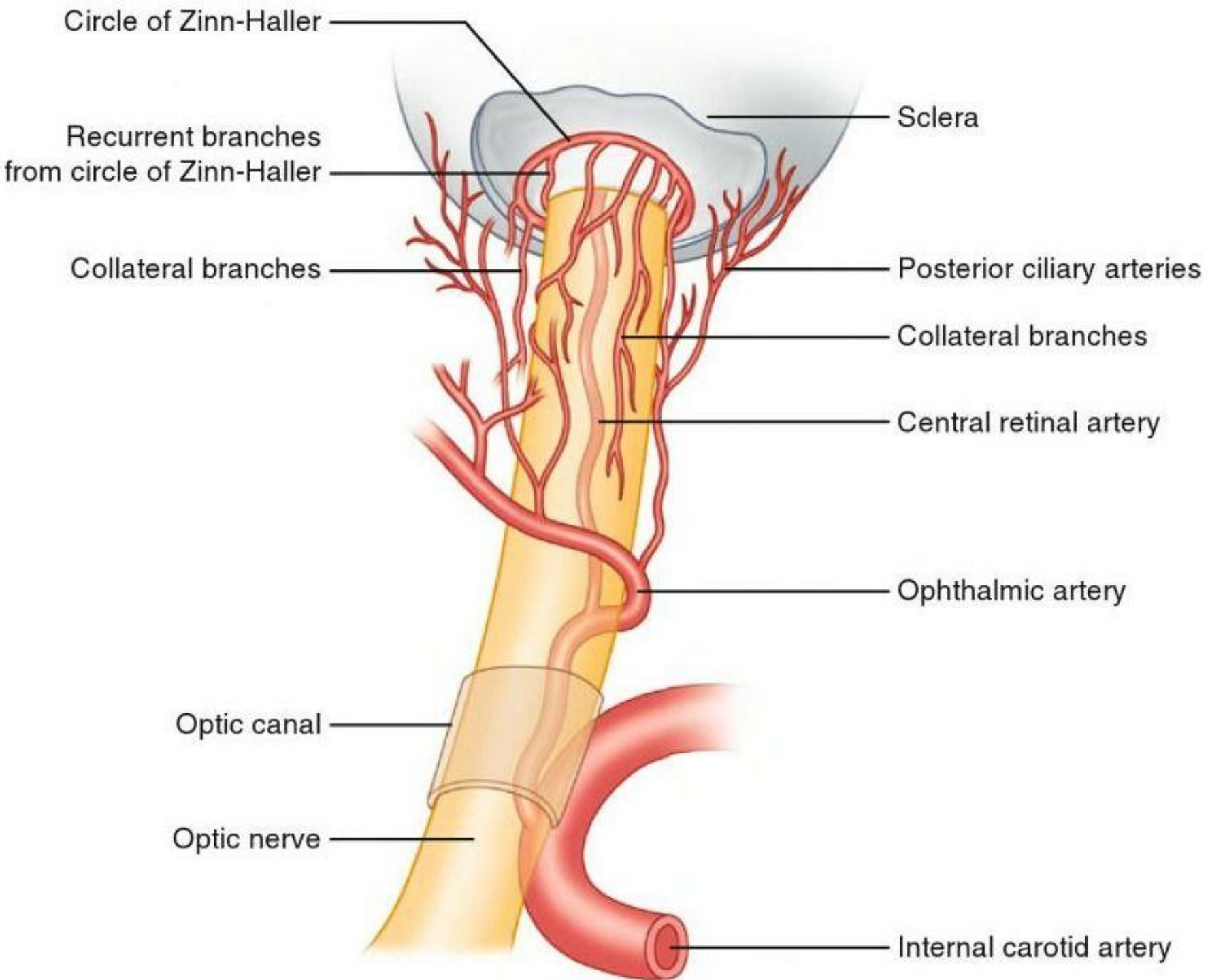
- Here optic nerve is ***surrounded*** by all ***3*** layers of ***meninges*** & subarachnoid space.
- The ***central retinal artery*** enters the subarachnoid space to ***enter*** the ***nerve*** on its ***inferomedial*** aspect.
- ***Near optic foramina***, optic nerve is closely ***surrounded*** by ***annulus*** of ***Zinn*** & the origin of four recti muscles.



Optic Nerve

Intra canalicular Part

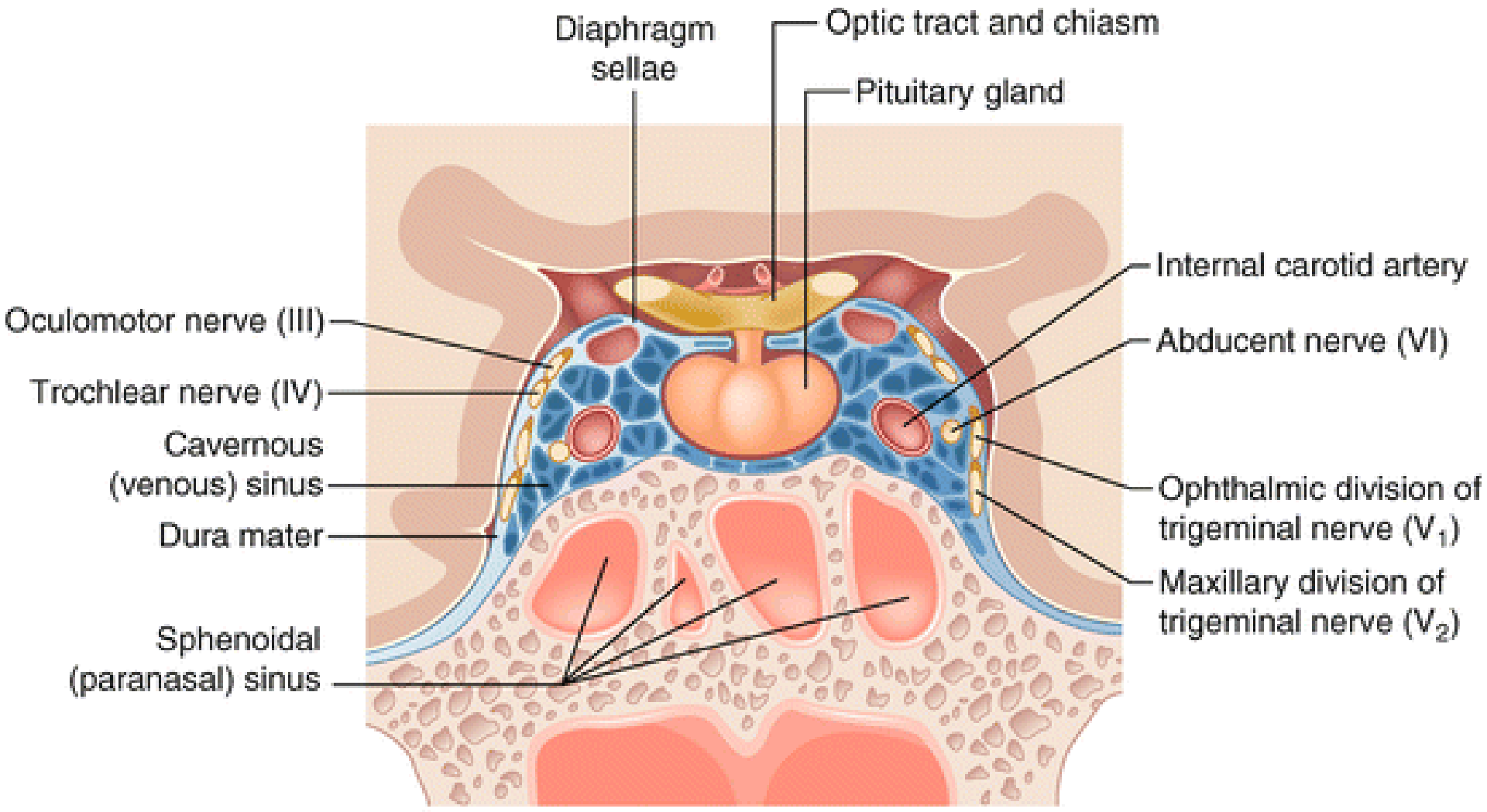
- This part is closely ***related*** to ***ophthalmic artery***.
- It ***crosses*** the nerve ***from medial to lateral*** side in dural sheath.
- **Sphenoid & posterior ethmoidal sinuses** lie medial to it & separated by thin bony lamina, this relation accounts for ***retrobulbar neuritis following infection of sinuses.***

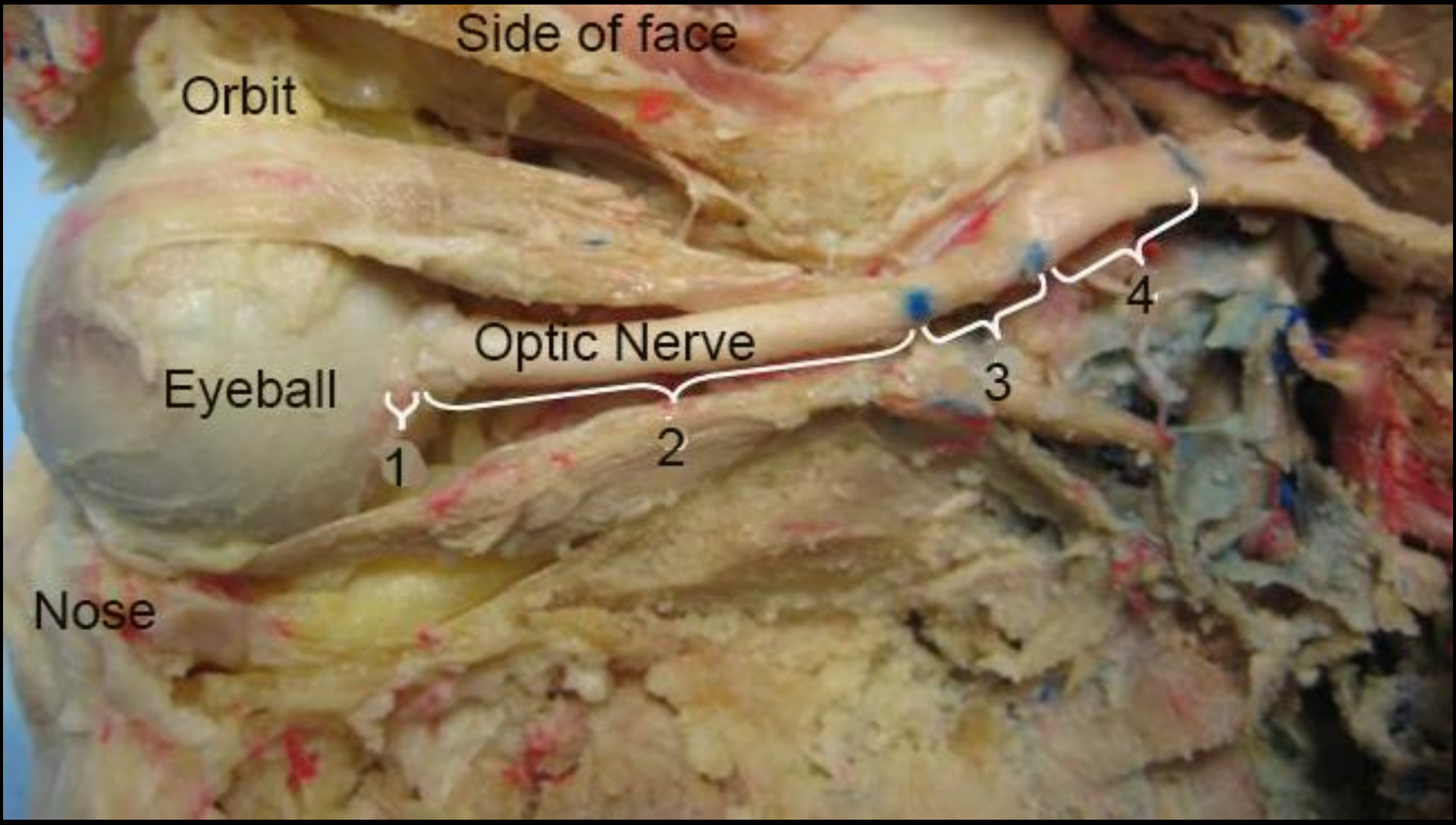

Circle of Zinn-Haller
Sclera
Recurrent branches from circle of Zinn-Haller
Collateral branches
Posterior ciliary arteries
Collateral branches
Central retinal artery
Ophthalmic artery
Optic canal
Optic nerve
Internal carotid artery

Optic Nerve

Intracranial part

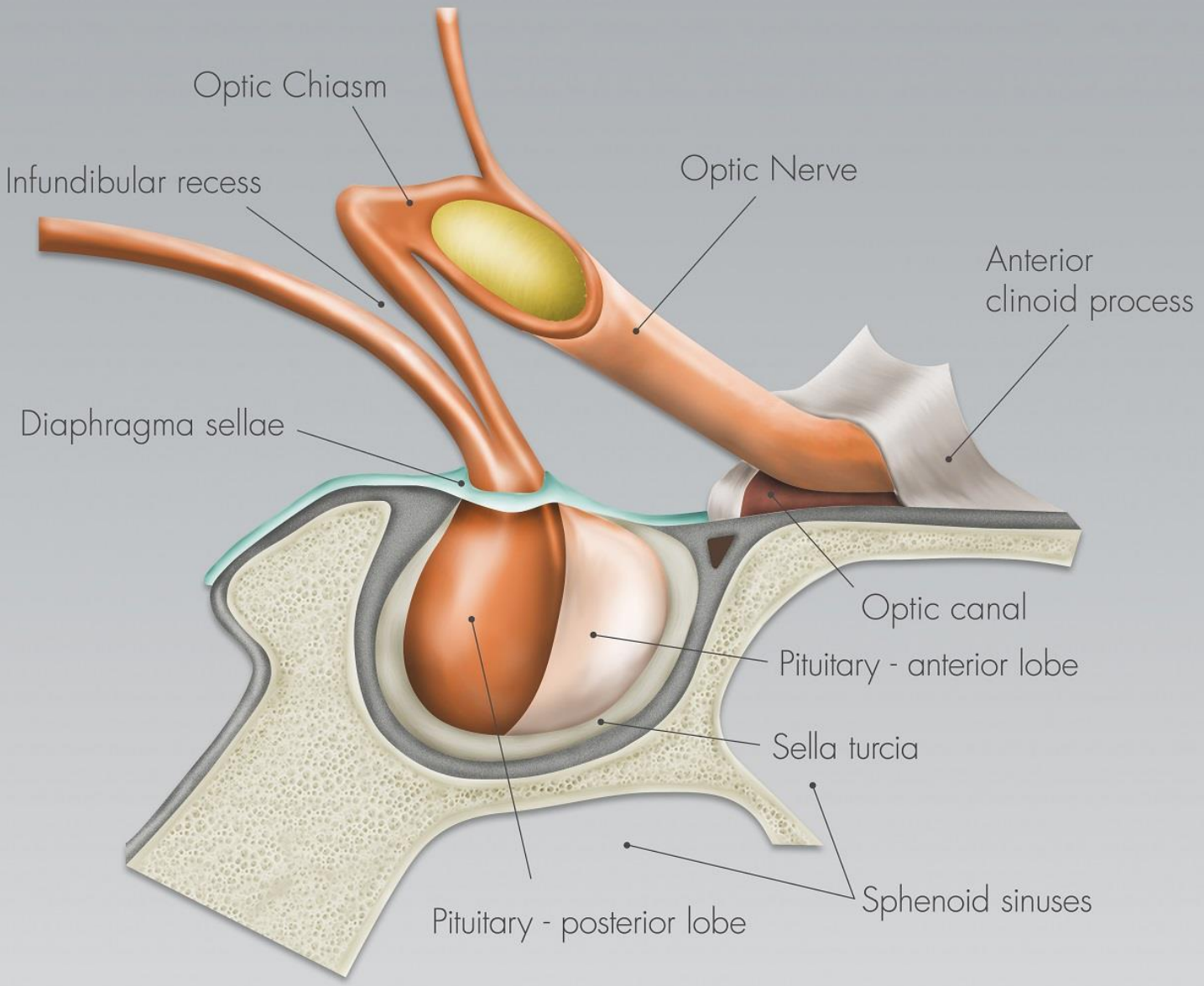
- About 10 – 16 mm
- Lies **above cavernous sinus** & converges with its fellow to form chiasma**.**
- **Ensheathed in pia mater**.
- Internal carotid artery runs below then lateral to it**.**


Diaphragm sellae
Optic tract and chiasm
Pituitary gland
Internal carotid artery
Oculomotor nerve (III)
Abducent nerve (VI)
Trochlear nerve (IV)
Cavernous (venous) sinus
Ophthalmic division of trigeminal nerve (V_1)
Dura mater
Maxillary division of trigeminal nerve (V_2)
Sphenoidal (paranasal) sinus


Side of face
Orbit
Optic Nerve
Eyeball
1
2
3
4
Nose

Optic Chiasma

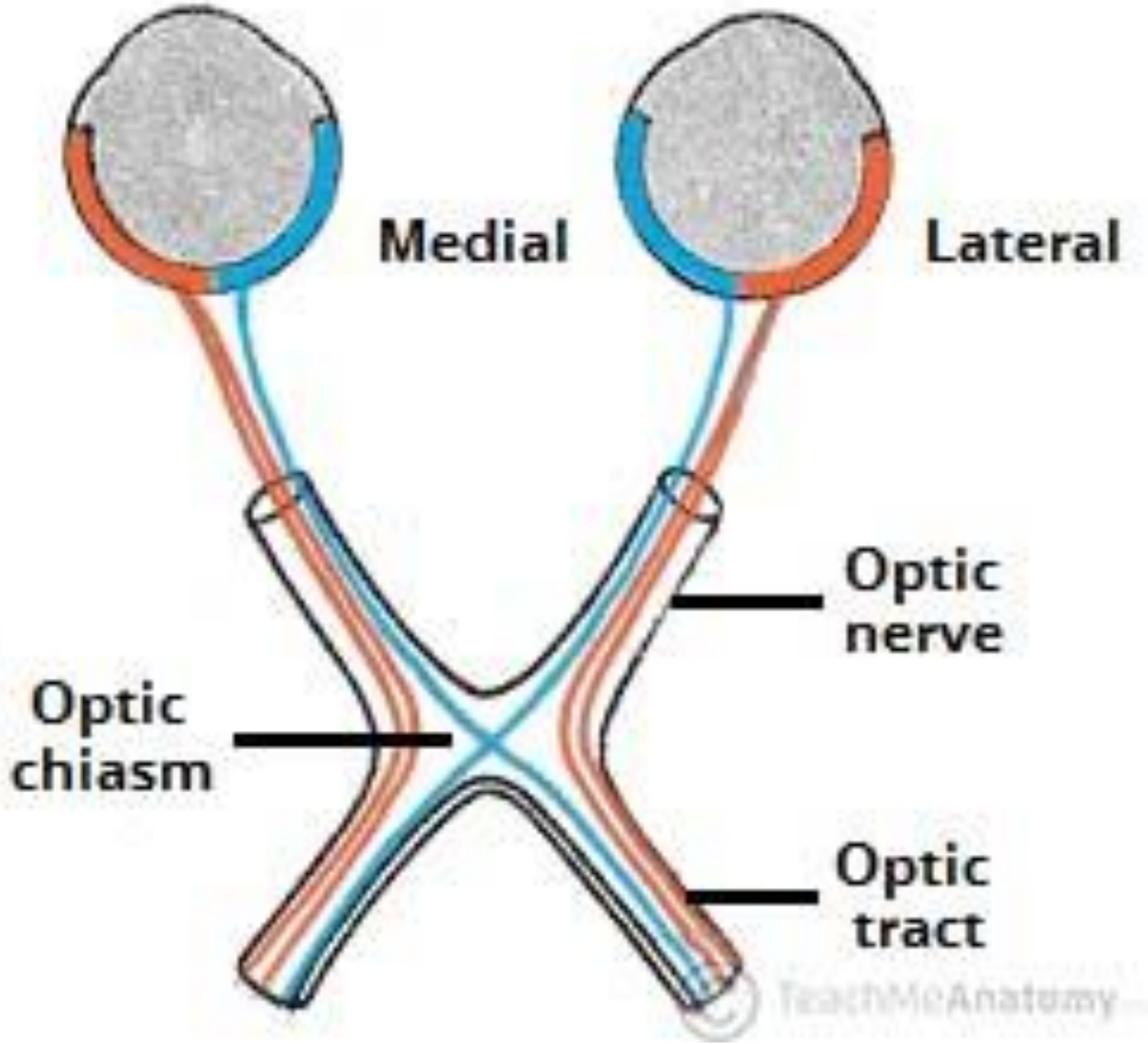
- Flattened structure, 12 mm horizontally & 8 mm anteroposteriorly.
- Ensheathed by pia & surrounded by CSF.
- Lies over diaphragma sellae ***(pituitary tumor may have suprasellar extension affecting it).***

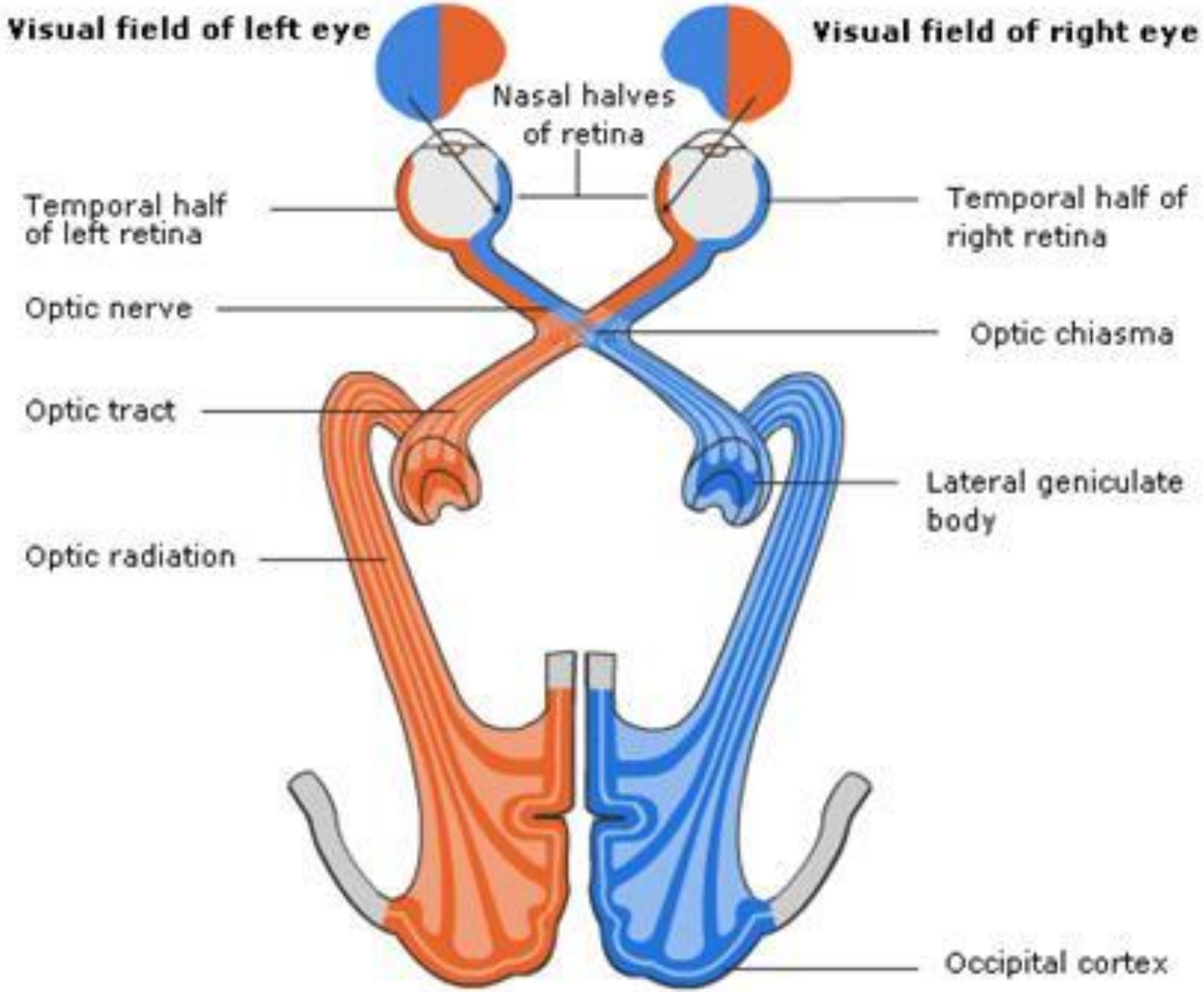

Optic Chiasm
Infundibular recess
Optic Nerve
Anterior
clinoid process
Diaphragma sellae
Optic canal
Pituitary - anterior lobe
Sella turcia
Sphenoid sinuses
Pituitary - posterior lobe

Optic Chiasma

- Posteriorly chiasma continuous with the optic tracts & form the anterior wall of 3rd ventricle.

- ***Nerve fibers arising from nasal half of two retina decussate at the chiasma*.**


Medial
Lateral
Optic nerve
Optic chiasm
Optic tract


Visual field of left eye
Visual field of right eye
Nasal halves of retina
Temporal half of left retina
Temporal half of right retina
Optic nerve
Optic chiasma
Optic tract
Lateral geniculate body
Optic radiation
Occipital cortex

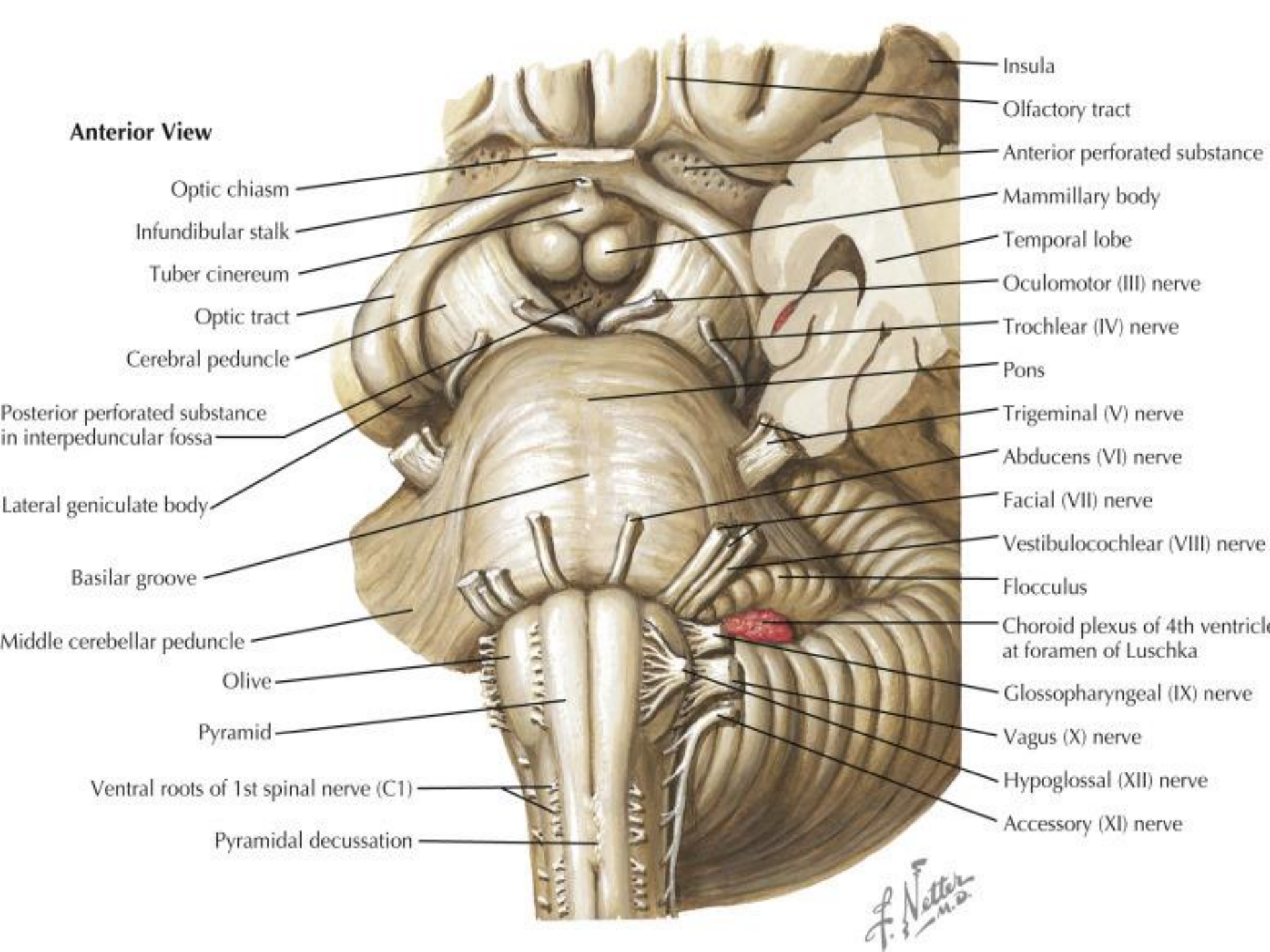
Relations of Chiasma

- ***Anterior*** - anterior cerebral arteries & its communicating arteries.

- ***Posterior*** - tuber cinereum, infundibulum, pituitary body, posterior perforated substance.

Relations of Chiasma

- ***Superior*** - third ventricle.
- ***Inferior*** - pituitary gland
- ***Lateral*** - extra cavernous part of internal carotid artery& anterior perforated substance.


Anterior View
Optic chiasm
Infundibular stalk
Tuber cinereum
Optic tract
Cerebral peduncle
Posterior perforated substance in interpeduncular fossa
Lateral geniculate body
Basilar groove
Middle cerebellar peduncle
Olive
Pyramid
Ventral roots of 1st spinal nerve (C1)
Pyramidal decussation
Insula
Olfactory tract
Anterior perforated substance
Mammillary body
Temporal lobe
Oculomotor (III) nerve
Trochlear (IV) nerve
Pons
Trigeminal (V) nerve
Abducens (VI) nerve
Facial (VII) nerve
Vestibulocochlear (VIII) nerve
Flocculus
Choroid plexus of 4th ventricle at foramen of Luschka
Glossopharyngeal (IX) nerve
Vagus (X) nerve
Hypoglossal (XII) nerve
Accessory (XI) nerve
F. Netter M.D.

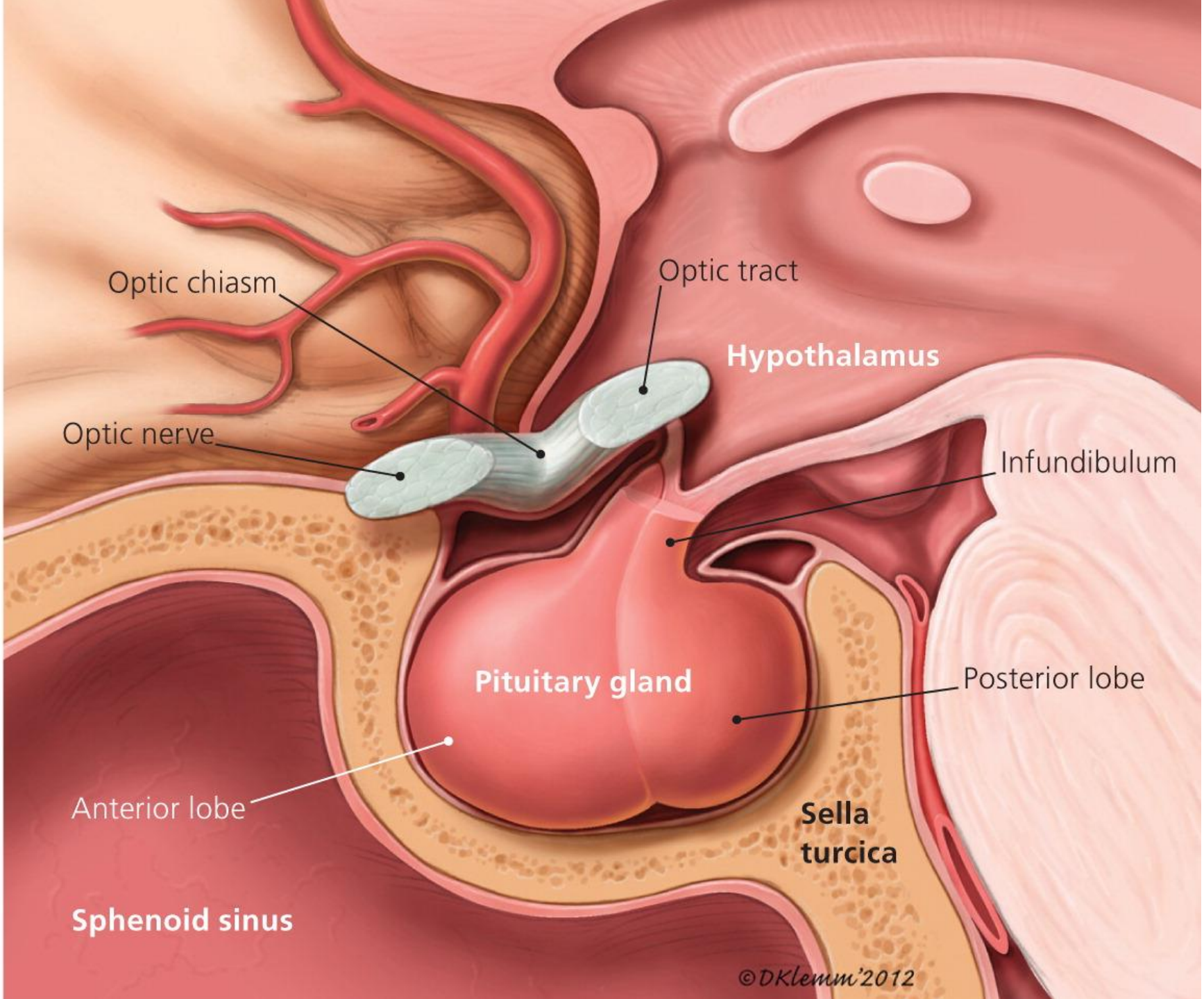
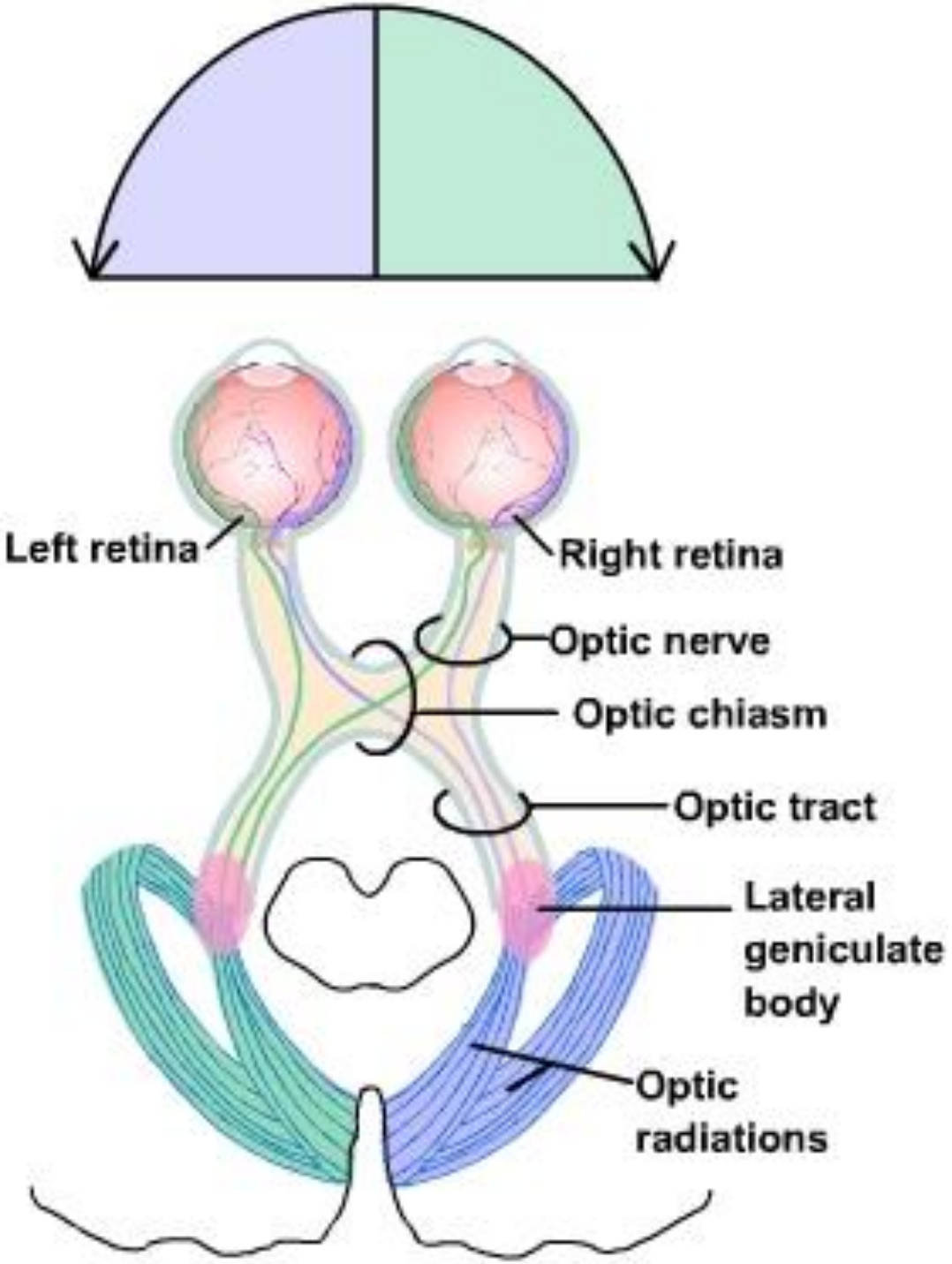


ILLUSTRATION BY DAVID KLEMM

Optic Tracts

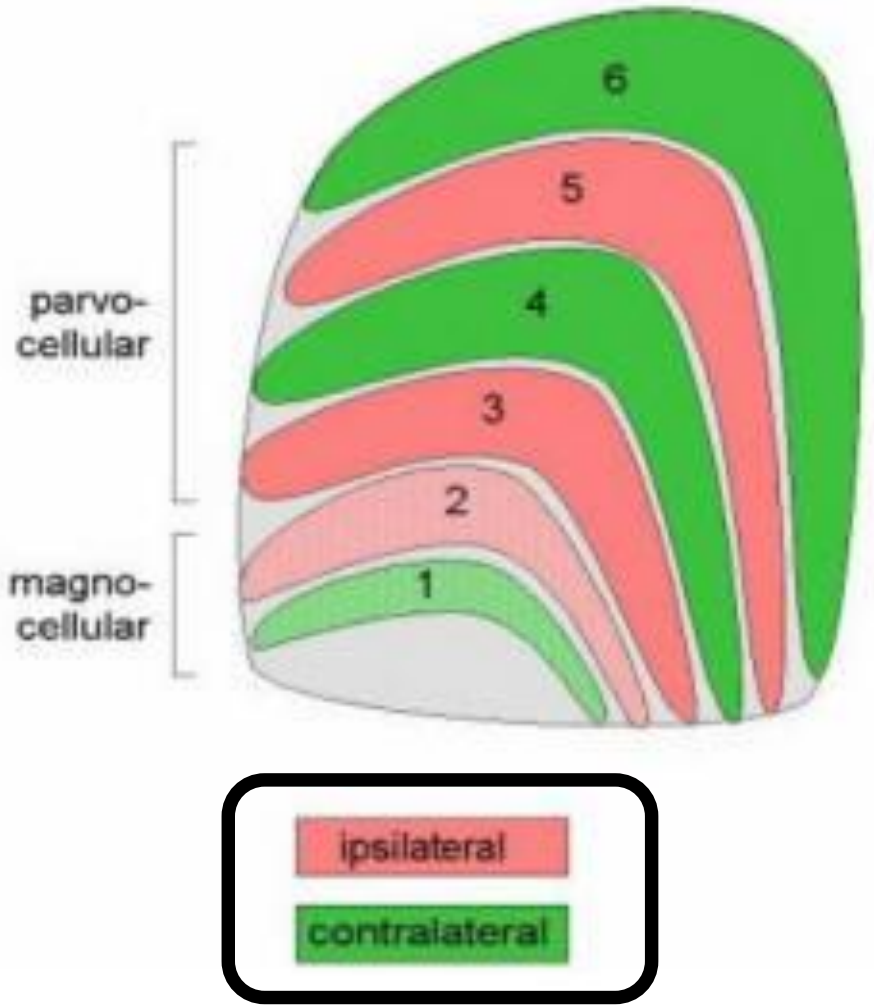
- Cylindrical bundle of nerve fibers.
- Run outwards & backwards from posterolateral aspect of optic chiasma
- Fibers from temporal half of retina of same eye & nasal half of opposite eye.
- Posteriorly each ends in Lateral Geniculate Body.

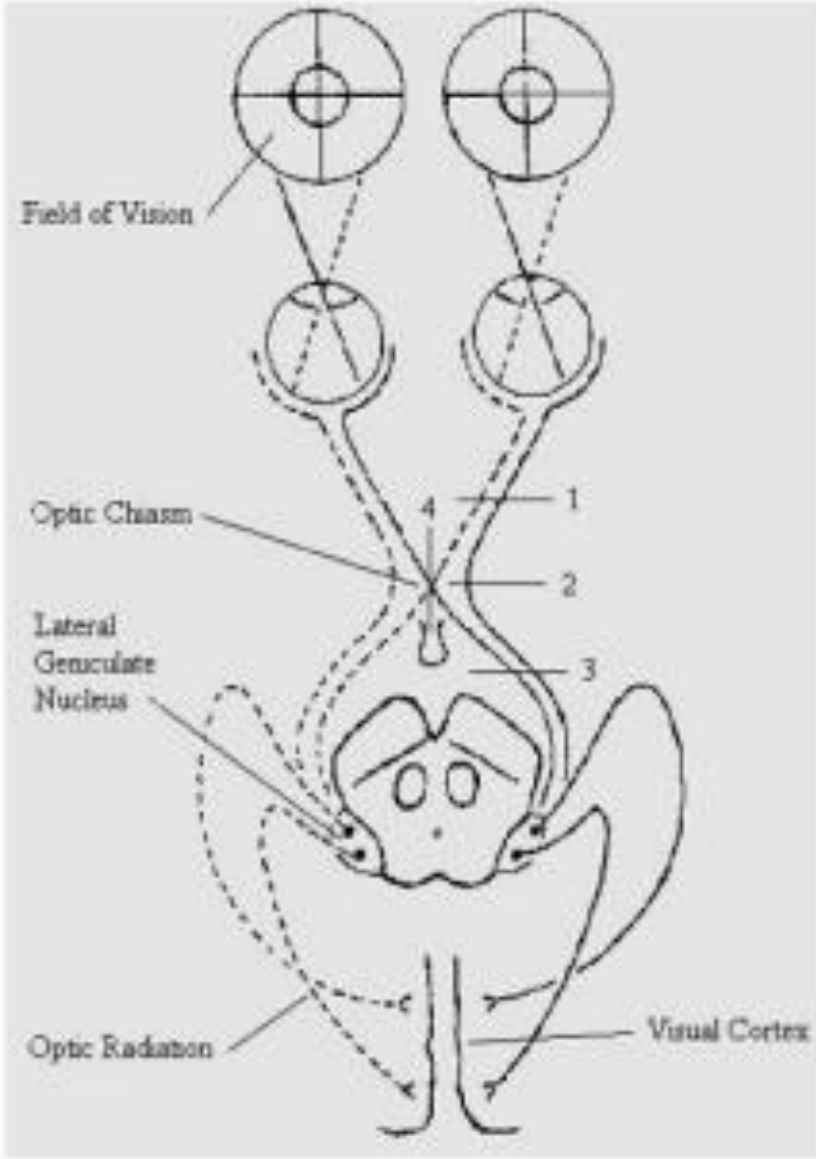

Left retina
Right retina
Optic nerve
Optic chiasm
Optic tract
Lateral geniculate body
Optic radiations

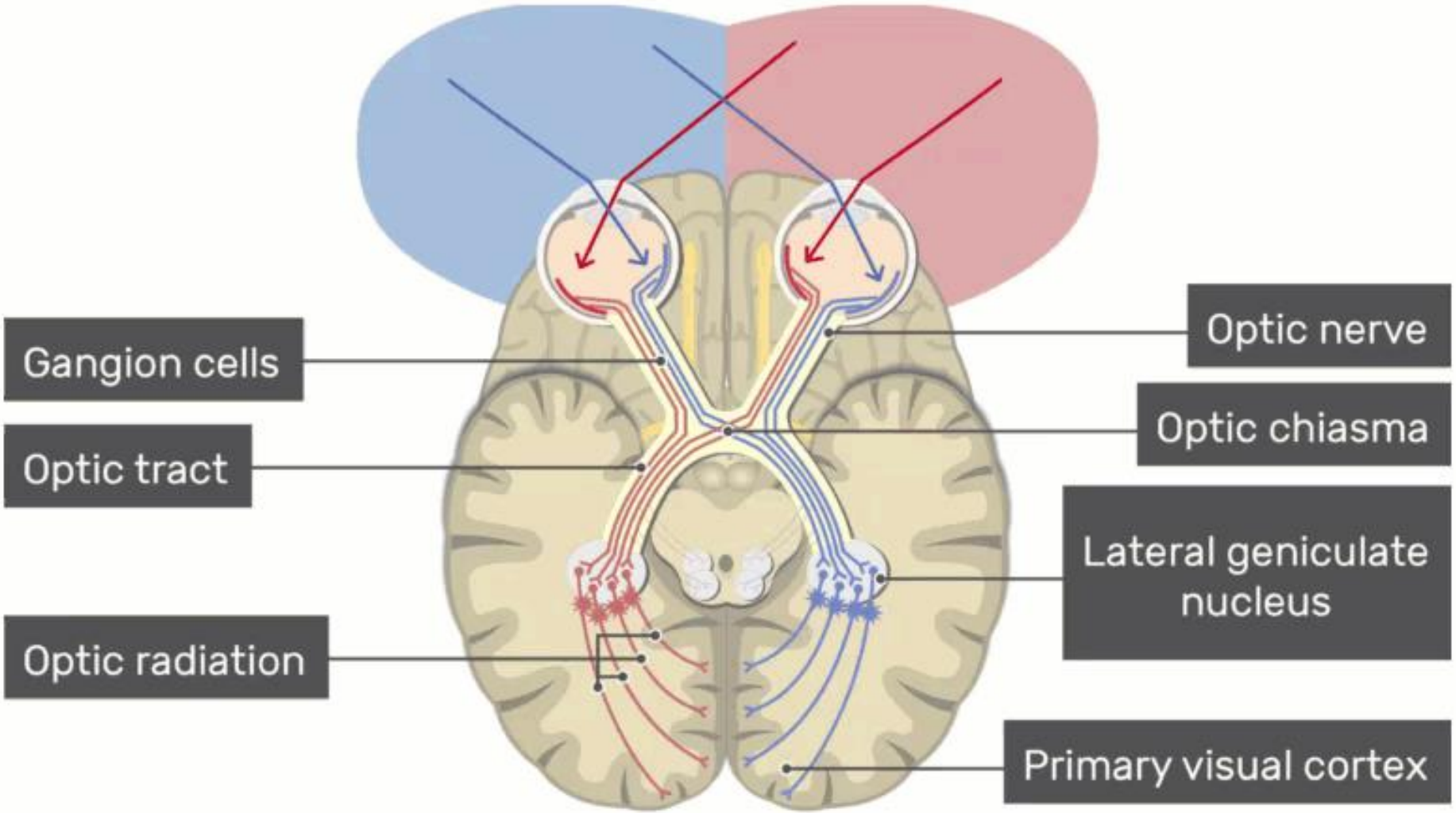
Lateral Geniculate Body (LGB)

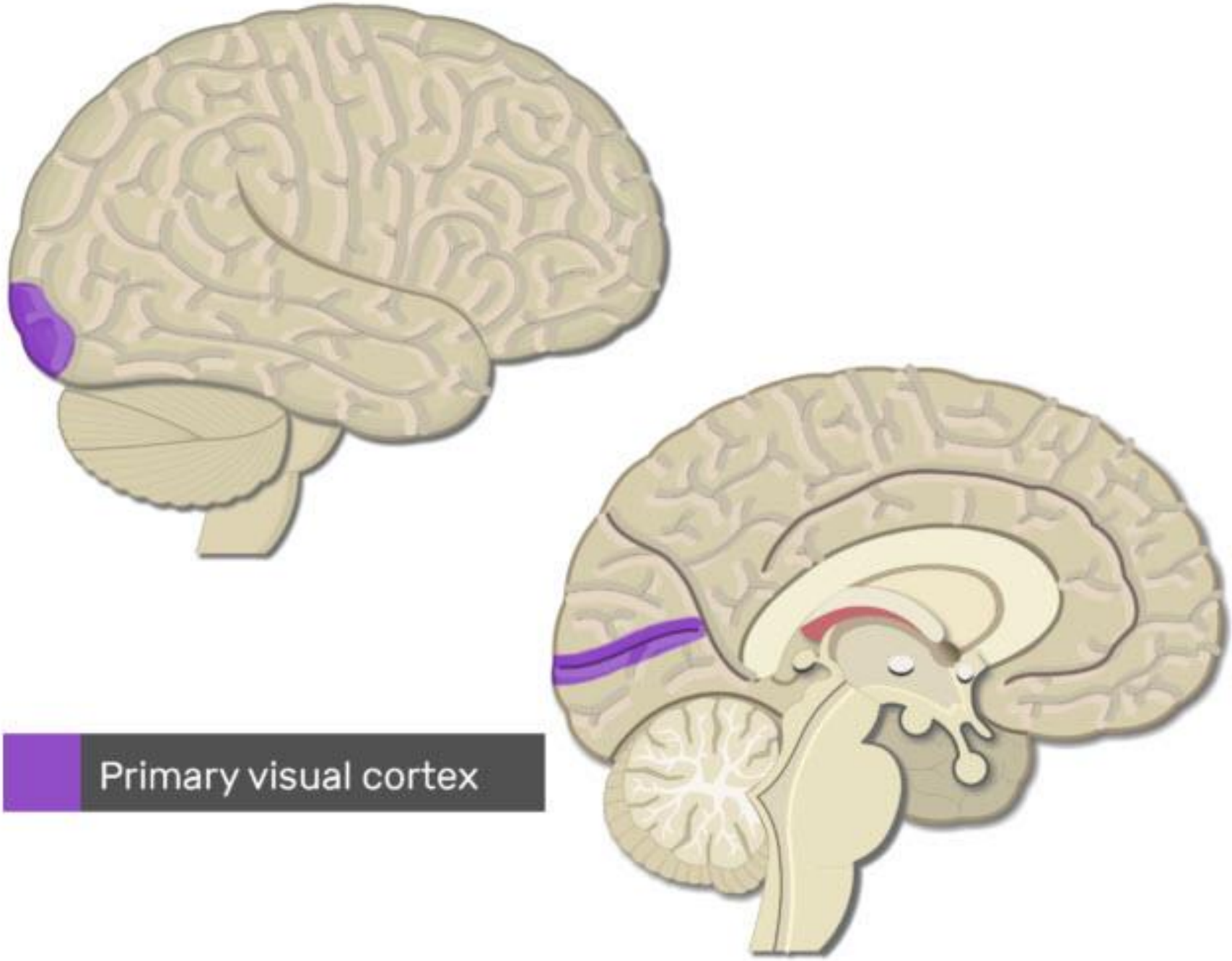
- Oval structures situated at termination of the optic tracts.
- Fibers of 2nd order neuron coming via optic tract relay here.
- Acts as a ***relay station for visual information from optic tract to cortex***. Also acts as gate controls signal transmission to visual cortex, i.e. **control how much signals reach visual cortex**

Lateral Geniculate Nucleus



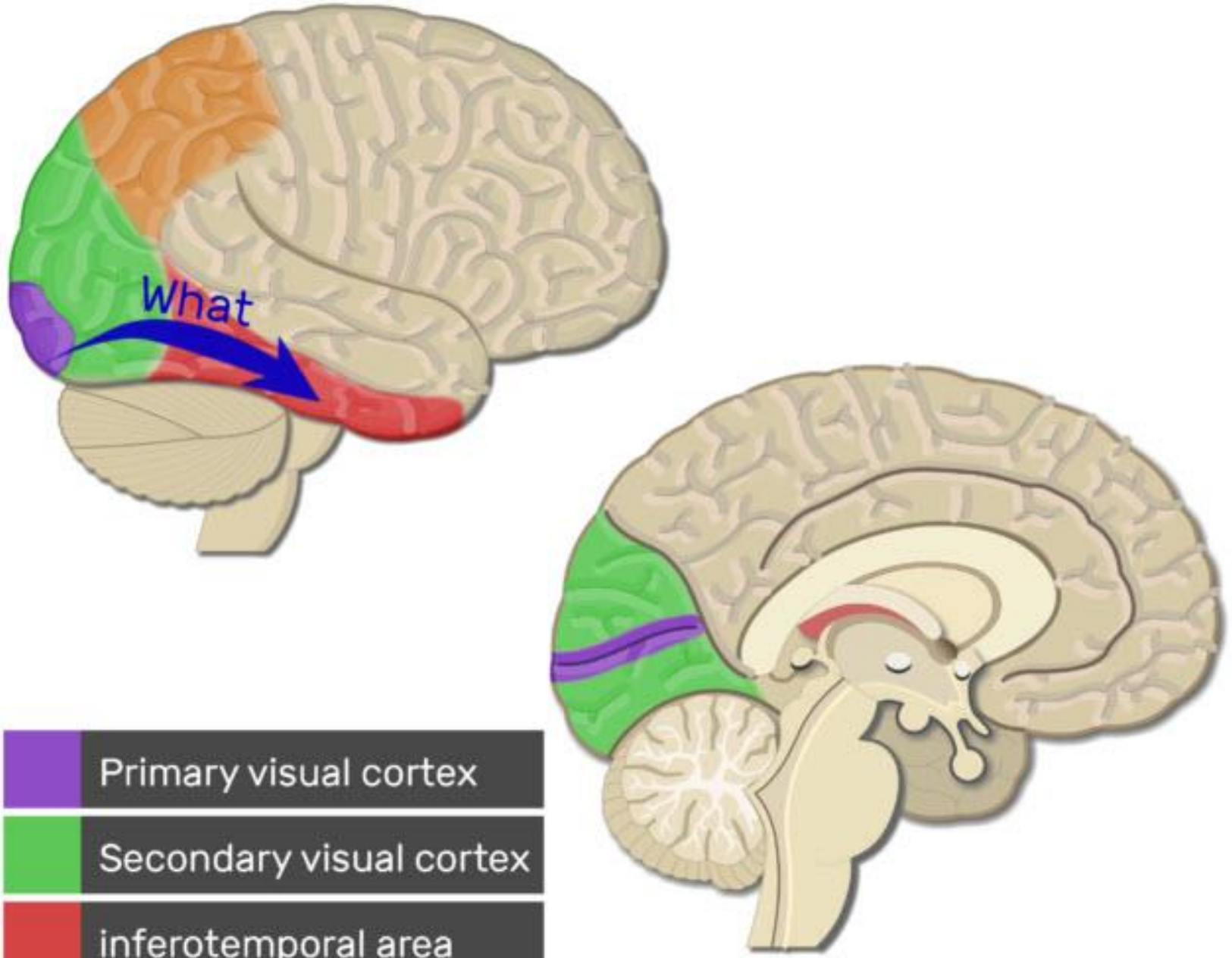



Gangion cells
Optic tract
Optic radiation
Optic nerve
Optic chiasma
Lateral geniculate nucleus
Primary visual cortex


Primary visual cortex

Visual Cortex

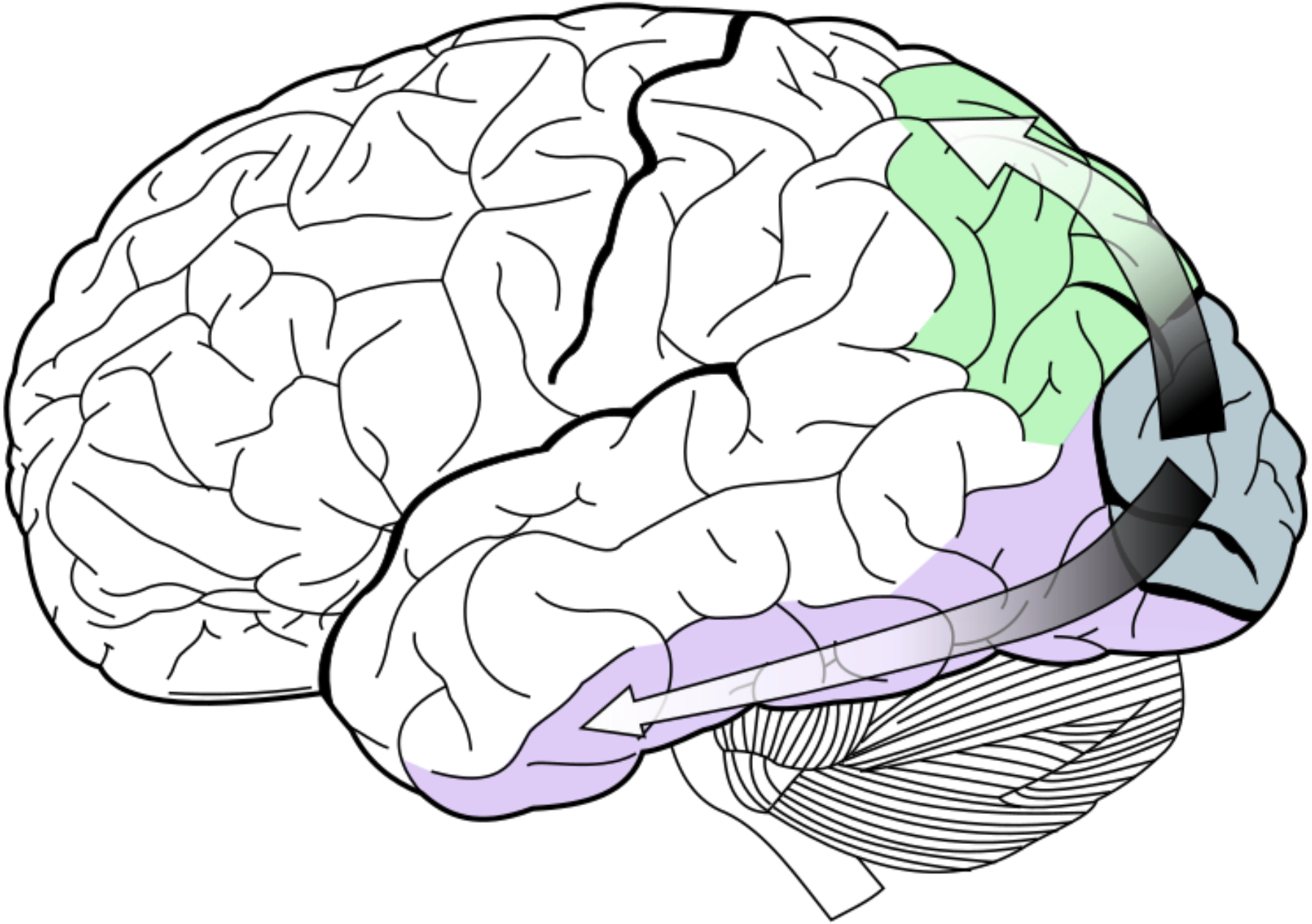
- Primary visual cortical areas are situated around the calcarine sulcus (***Broadman area 17***)
- A ventral stream passes through the secondary visual cortex (extrastriate cortex; Broadmann areas 18 and 19) and extends downward into the inferior temporal gyrus.
- The processing done by neurons in this pathway allows us to ***recognize faces and objects based on their size, shape, and color*** (***what objects are?***)

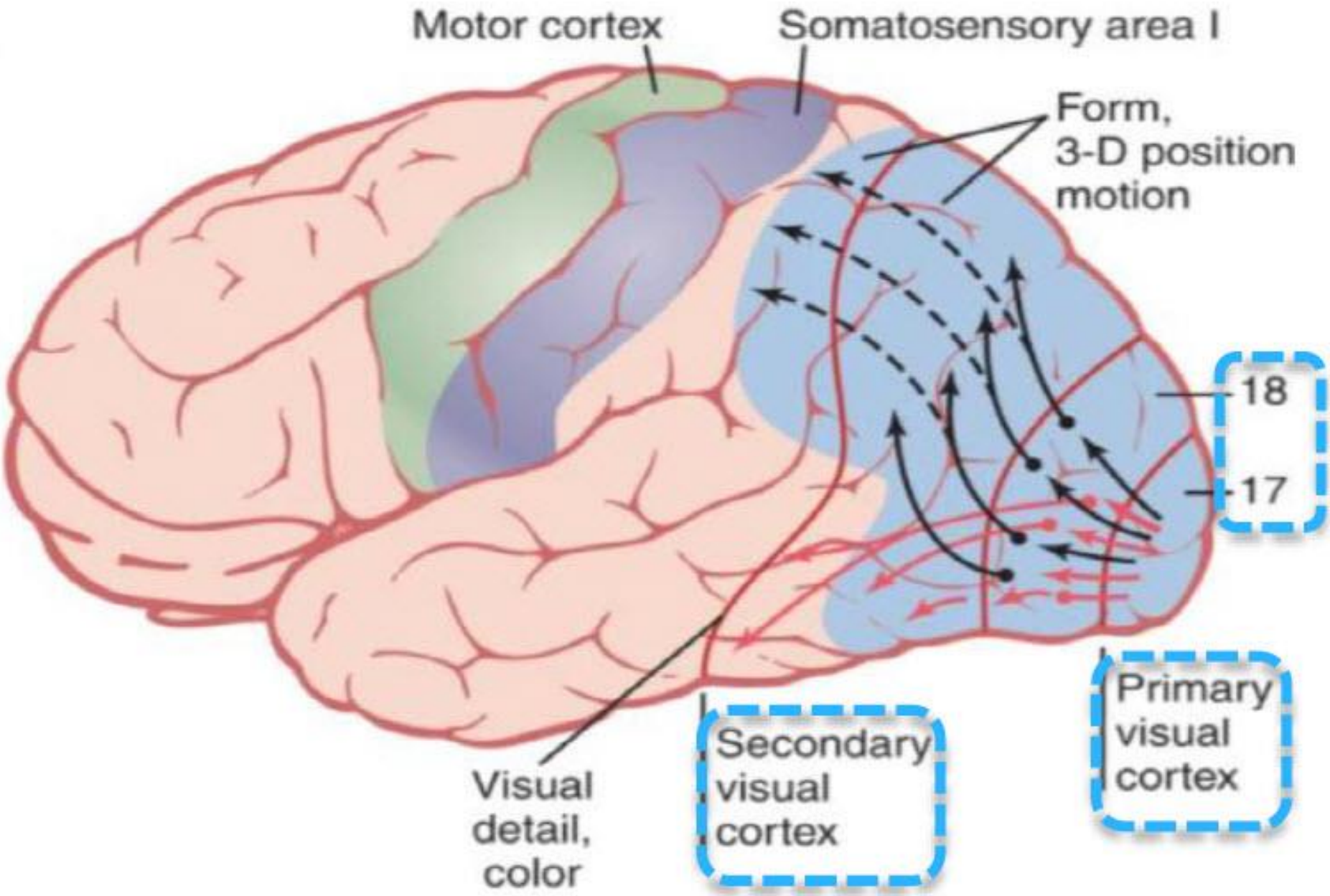

What
Primary visual cortex
Secondary visual cortex
inferotemporal area
Posterior partial area

Visual Cortex

- A dorsal stream passes through the secondary visual cortex and extends upward to the posterior parietal cortex.

- Neurons in this pathway provide ***information about the motion of objects*** (***where object are?***).



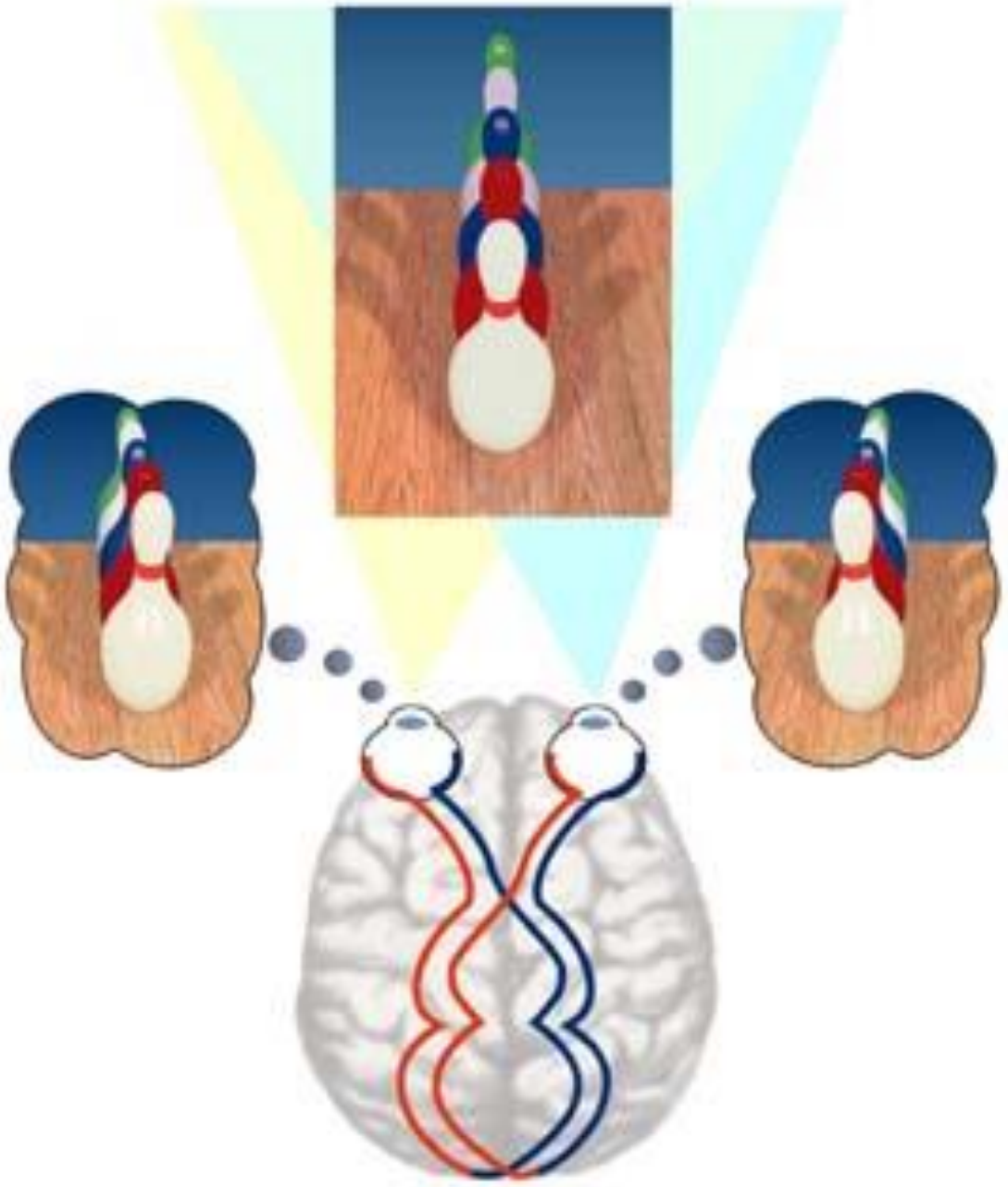

Motor cortex
Somatosensory area I
Form,
3-D position
motion
18
17
Primary
visual
cortex
Secondary
visual
cortex
Visual
detail,
color

Binocular Vision

- Two eyes are used to produce a single image
- This allows for 3D vision and accurate judgement of distance
- Predators (including humans and primates) have eyes positioned at the front of the head.
- This provides a narrow field of vision in which the image from which eye overlaps considerably, providing excellent judgement of distance and 3D vision

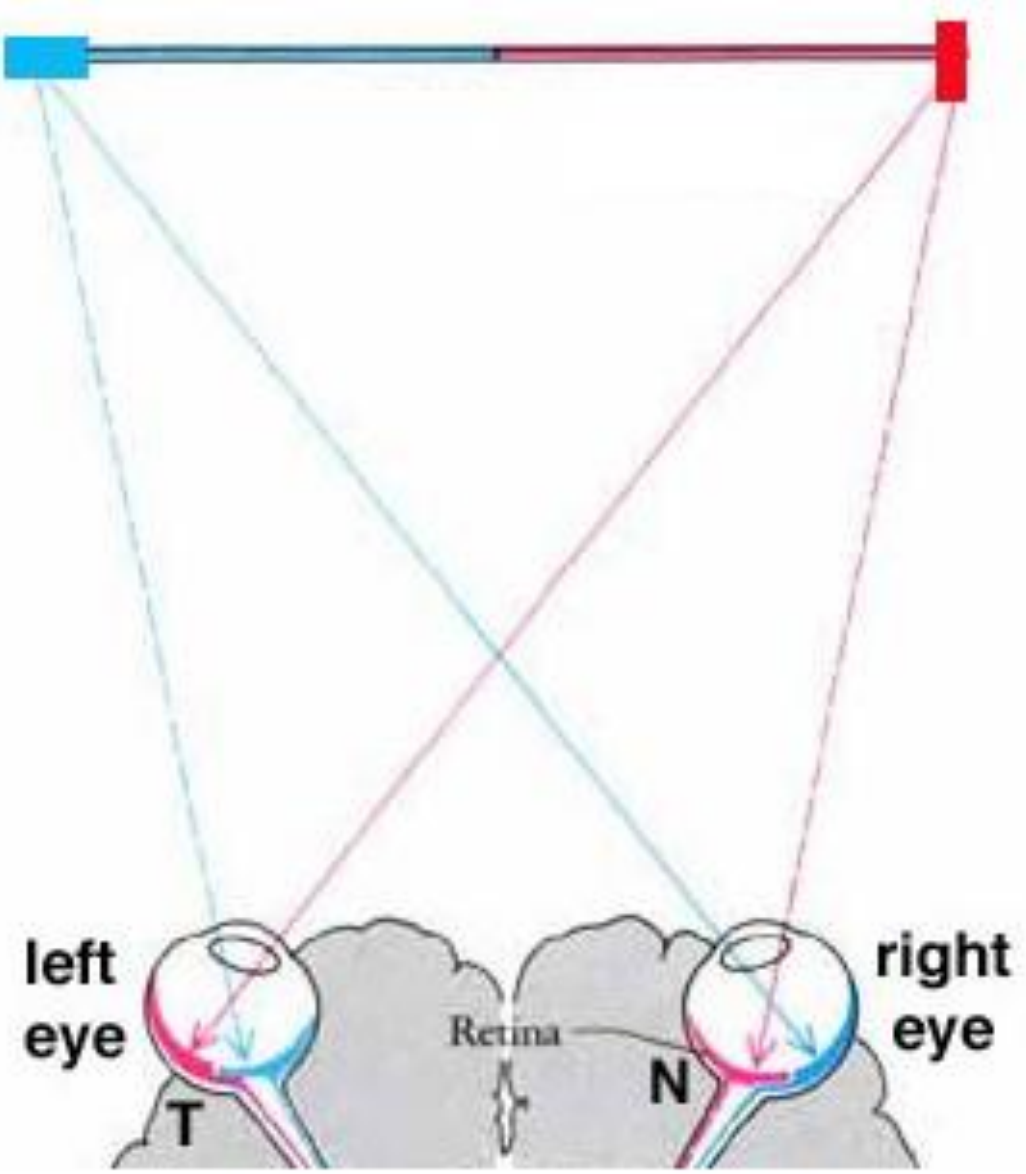
Each eye can see an object from a different position. The brain measures the angle at which each eye is pointing and calculates the object's distance.

By merging the two images the brain produces a 3 dimensional image of the object. This is called stereoscopic/binocu-lar vision



The area which each eye can see is called the field of vision.

The more the areas overlap the better the human/animal is at judging distance.



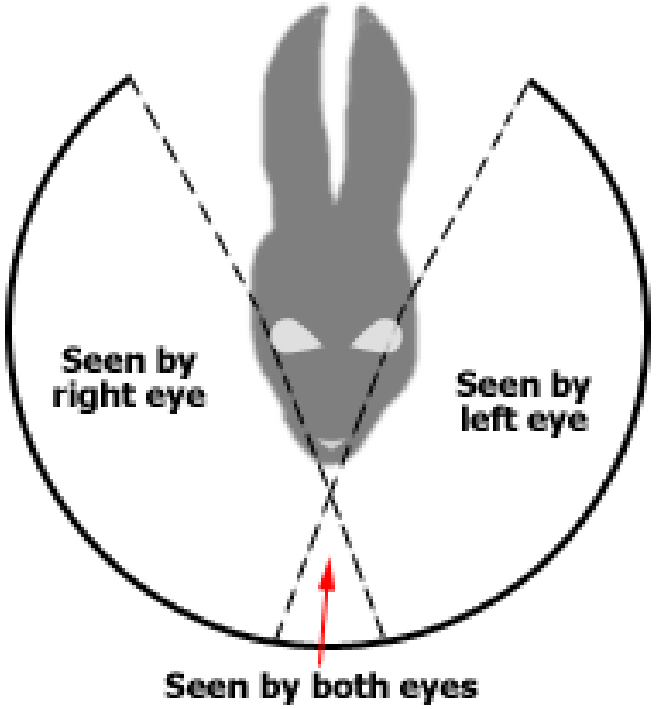
Visual Field

- In prey animals (e.g. rabbits) the eyes are positioned at the side of the head. This gives a very wide field of vision, able to detect movement from all directions.

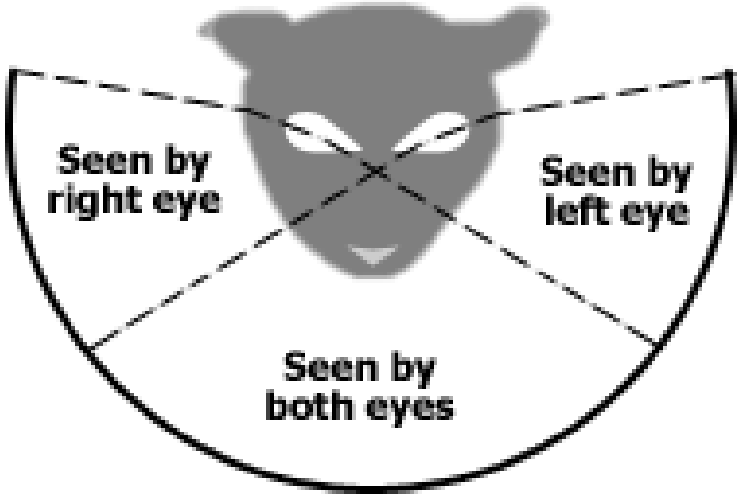
- However as there is little overlap they have poor judgement of distance and 3D vision.

Prey animal

Eyes at side of head
Little overlap of field of vision from each eye



Wide field of view
Poor distance and depth perception



Predator animal

Eyes at front of head

Large overlap of field of vision from each eye

Narrow field of view

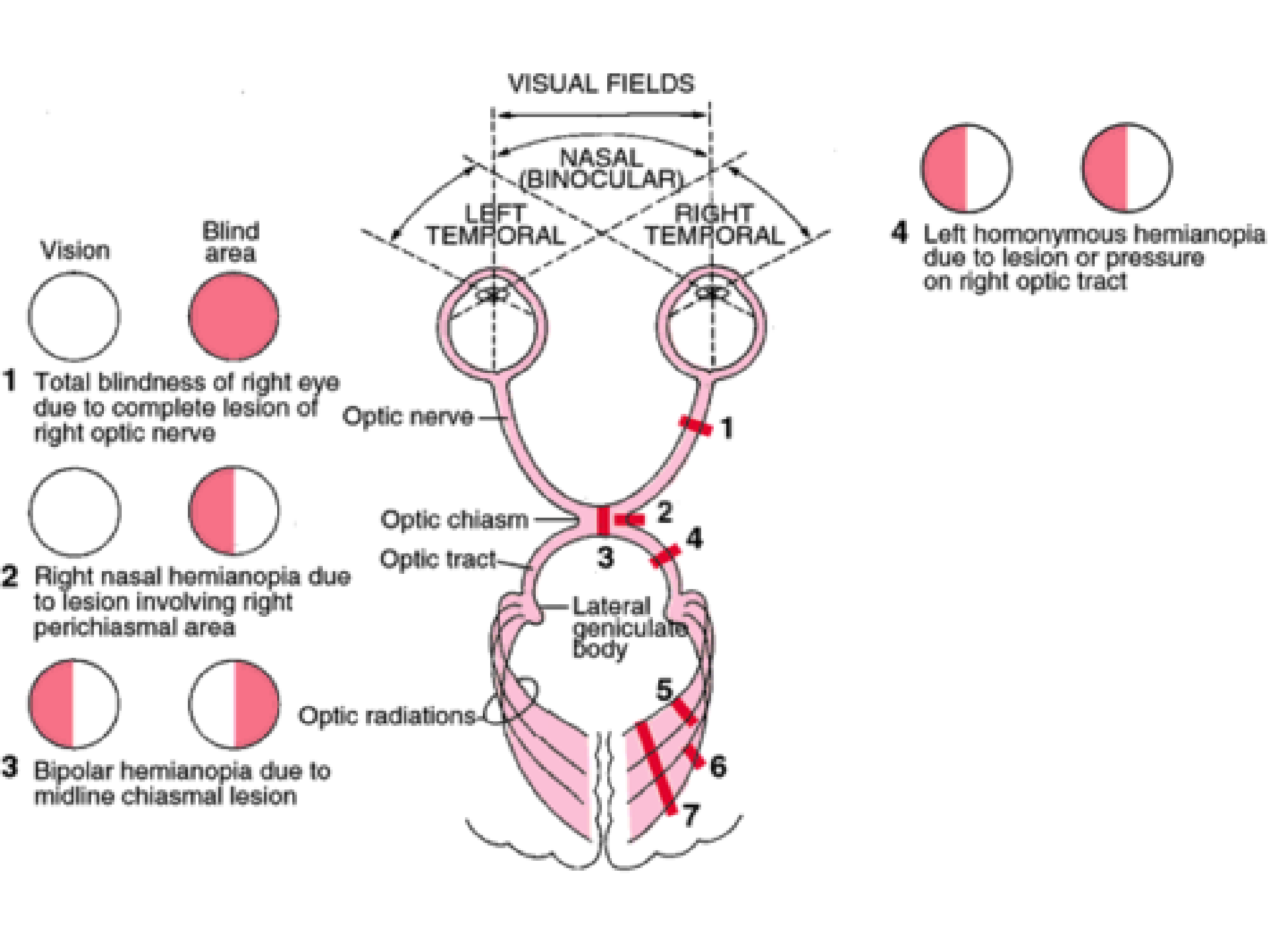
Good distance and depth perception

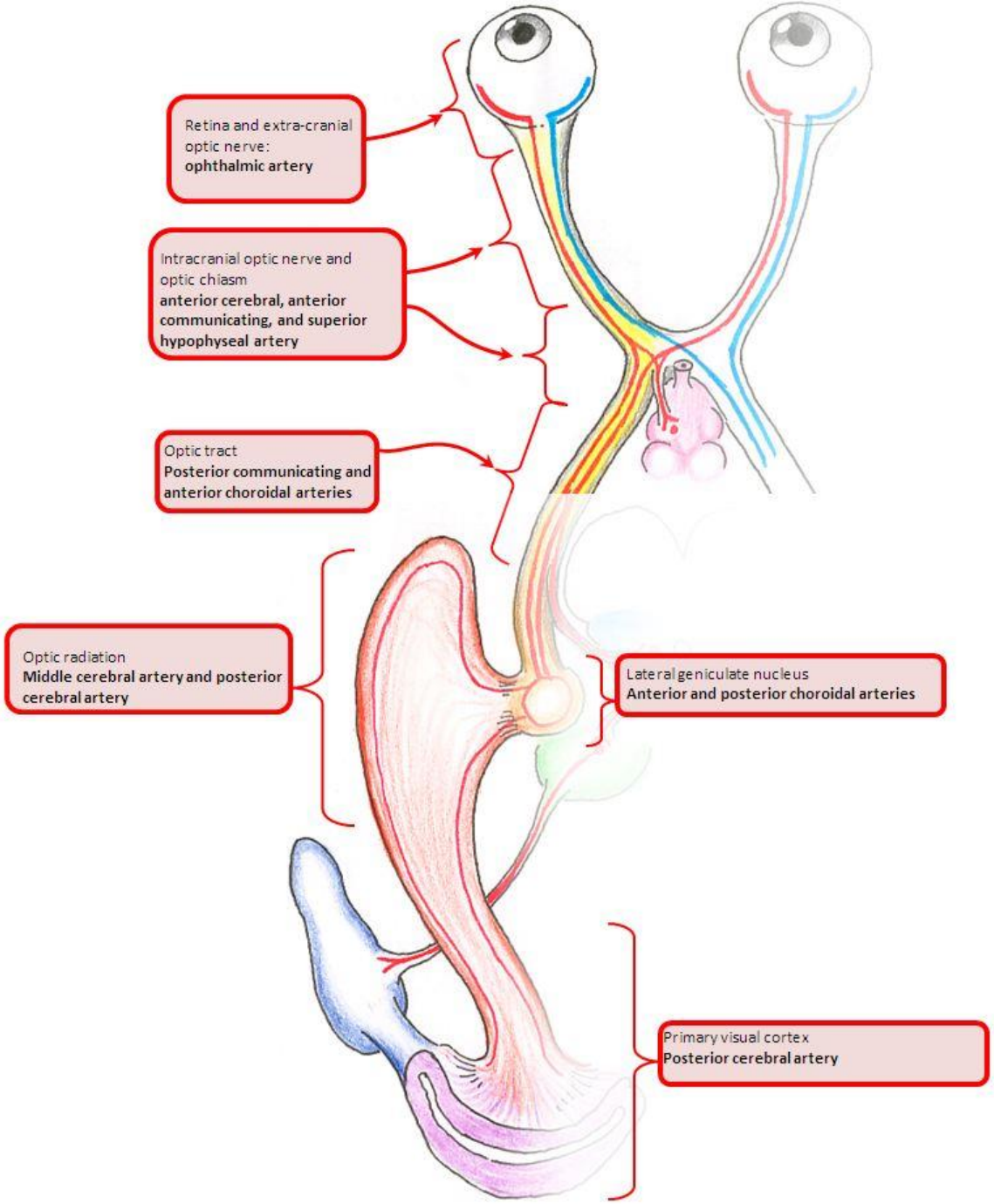
Lesions in Visual Field

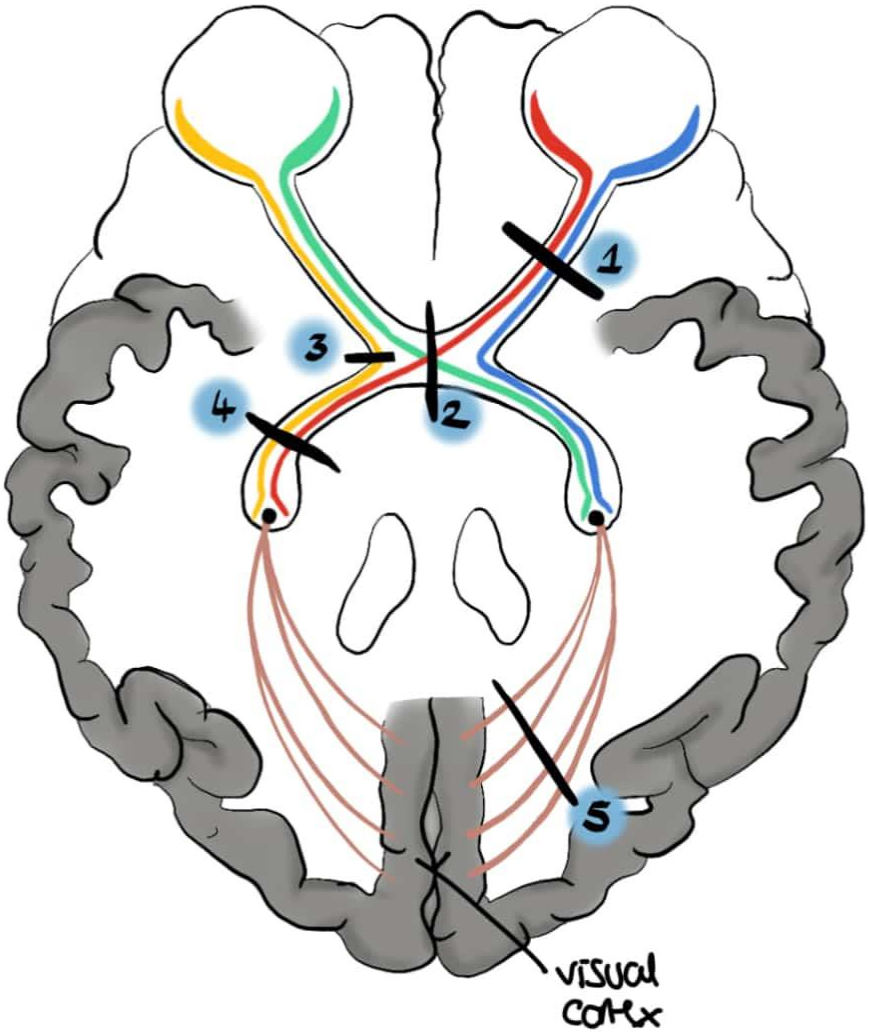
- Loss of vision in one-half of the visual field (right or left) is called ***hemianopia***

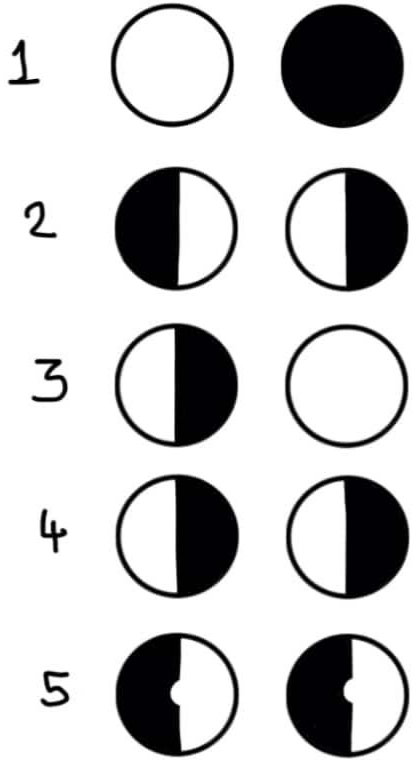
- If the same halves of visual fields are affected in both eyes - ***homonymous hemianopia***

- If different halves of visual fields are affected – ***heteronymous hemianopia***


VISUAL FIELDS
NASAL (BINOCULAR)
LEFT TEMPORAL
RIGHT TEMPORAL
Vision
Blind area
1 Total blindness of right eye due to complete lesion of right optic nerve
2 Right nasal hemianopia due to lesion involving right perichiasmal area
3 Bipolar hemianopia due to midline chiasmal lesion
4 Left homonymous hemianopia due to lesion or pressure on right optic tract
Optic nerve
Optic chiasm
Optic tract
Lateral geniculate body
Optic radiations
1
2
3
4
5
6
7


Retina and extra-cranial optic nerve:
ophthalmic artery
Intracranial optic nerve and optic chiasm
anterior cerebral, anterior communicating, and superior hypophyseal artery
Optic tract
Posterior communicating and anterior choroidal arteries
Optic radiation
Middle cerebral artery and posterior cerebral artery
Lateral geniculate nucleus
Anterior and posterior choroidal arteries
Primary visual cortex
Posterior cerebral artery





1 Total right eye blindness

2 Bipolar hemianopia

3 Left nasal hemianopia

4 Right homonymous hemianopia

5 Left homonymous hemianopia with macular sparing

Lesions in Visual Field

- Removal of the primary visual cortex causes loss of conscious vision, blindness, but ***patient react subconsciously to changes in light intensity***, to movement in the visual scene..

- These reactions include turning the eyes, turning the head, and avoidance. This vision is believed to be subserved by neuronal pathways that pass from the optic tracts mainly into ***the superior colliculi***.

- For further inquiries ***PLZ*** feel free to contact at any time through email

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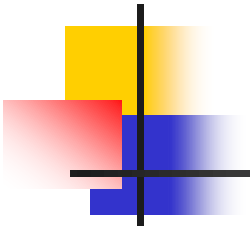

Thank You