The Eye

The eyeball is embedded in orbital fat but is separated from it by the ***fascial sheath*** of the eyeball. The eyeball consists of three coats, which are the fibrous coat, the vascular pigmented coat, and the nervous coat.

1. Fibrous Coat

The fibrous coat is made up of a posterior opaque part, the sclera, and an anterior transparent part, the cornea. The **sclera** is directly continuous in front with the cornea at the corneoscleral junction, or limbus. The transparent **cornea** is largely responsible for the refraction of the light entering the eye. The cornea is avascular and devoid of lymphatic drainage. It is nourished by diffusion from the aqueous humor and from the capillaries at its edge.

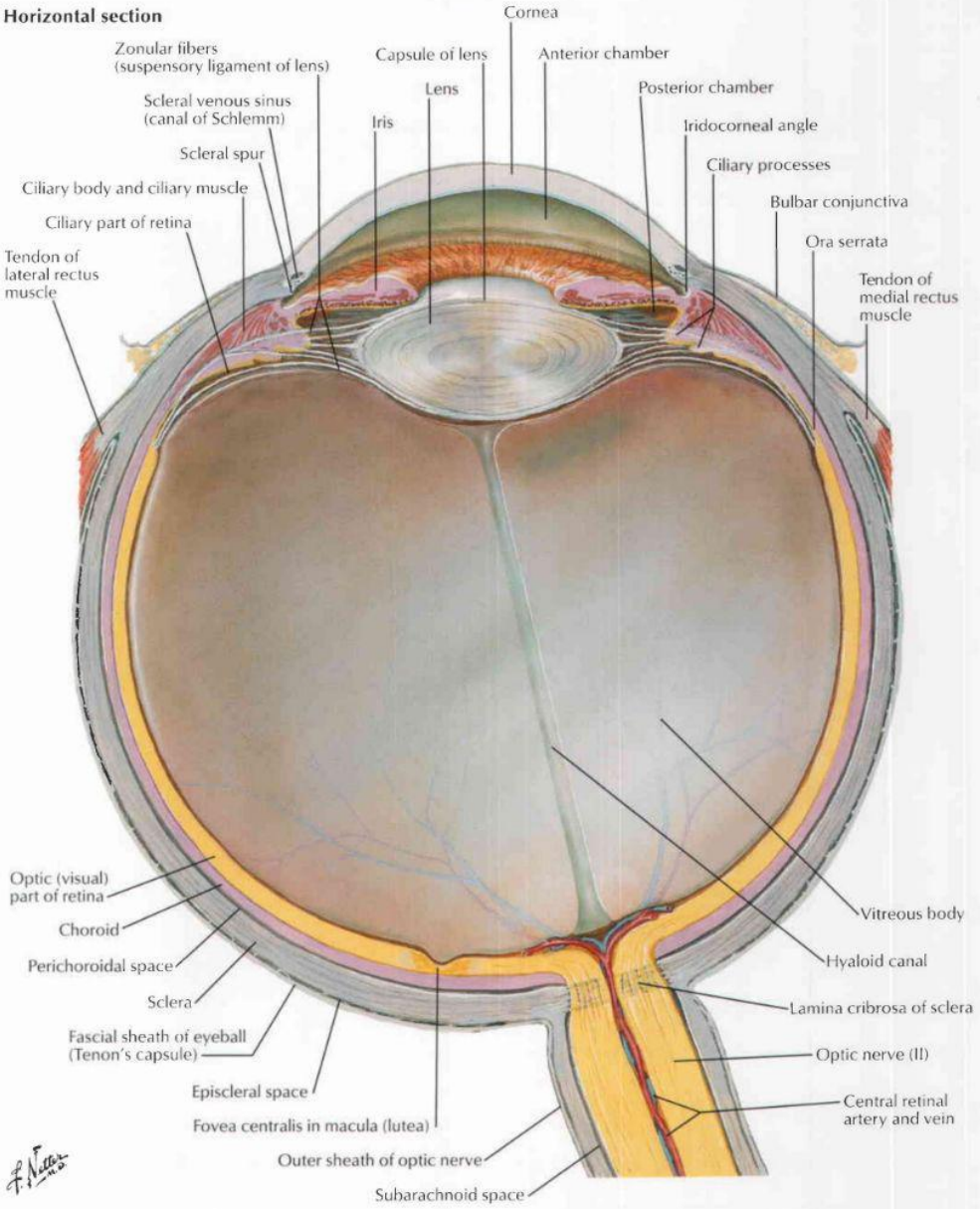
2. Vascular Pigmented Coat

The vascular pigmented coat consists, from behind forward, of the choroid, the ciliary body, and the iris. The **choroid** is composed of an outer pigmented layer and an inner, highly vascular layer. The **ciliary body** is composed of the ciliary ring, the ciliary processes, and the ciliary muscle. Contraction of the ciliary muscle pulls the ciliary body forward. This relieves the tension in the suspensory ligament, and the elastic lens becomes more convex.

The **iris** is a thin, contractile, pigmented diaphragm with a central aperture, the pupil. It is suspended in the aqueous humor between the cornea and the lens. The muscle fibers of the iris are involuntary and consist of circular and radiating fibers. The circular fibers form the **sphincter pupillae** while the radial fibers form the **dilator pupillae.** The sphincter pupillae constricts the pupil in the presence of bright light and during accommodation. The dilator pupillae dilates the pupil in the presence of low light intensity or in the presence of excessive sympathetic activity such as occurs in fright.

3. Nervous Coat: The Retina

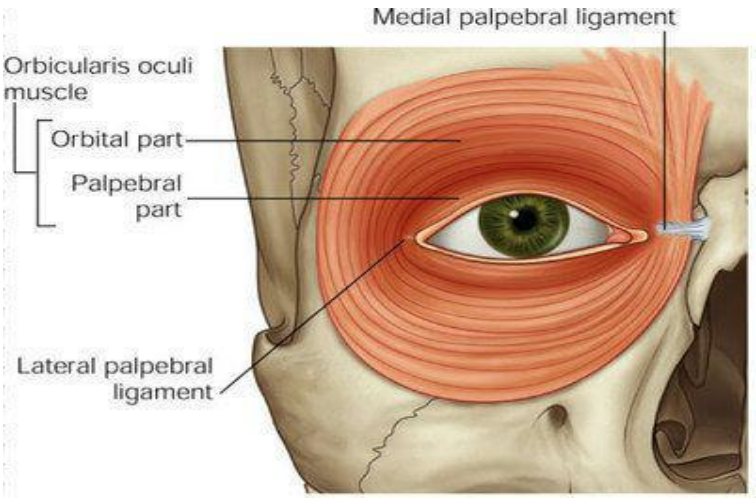
The retina consists of an **outer pigmented layer** and an **inner nervous layer.** Its outer surface is in contact with the choroid, and its inner surface is in contact with the vitreous body. The posterior three quarters of the retina is the receptor organ.


Horizontal section
Cornea
Zonular fibers (suspensory ligament of lens)
Capsule of lens
Anterior chamber
Lens
Posterior chamber
Scleral venous sinus (canal of Schlemm)
Iris
Iridocorneal angle
Scleral spur
Ciliary processes
Ciliary body and ciliary muscle
Bulbar conjunctiva
Ciliary part of retina
Ora serrata
Tendon of lateral rectus muscle
Tendon of medial rectus muscle
Optic (visual) part of retina
Vitreous body
Choroid
Hyaloid canal
Perichoroidal space
Lamina cribrosa of sclera
Sclera
Optic nerve (II)
Fascial sheath of eyeball (Tenon's capsule)
Episcleral space
Central retinal artery and vein
Fovea centralis in macula (lutea)
Outer sheath of optic nerve
Subarachnoid space

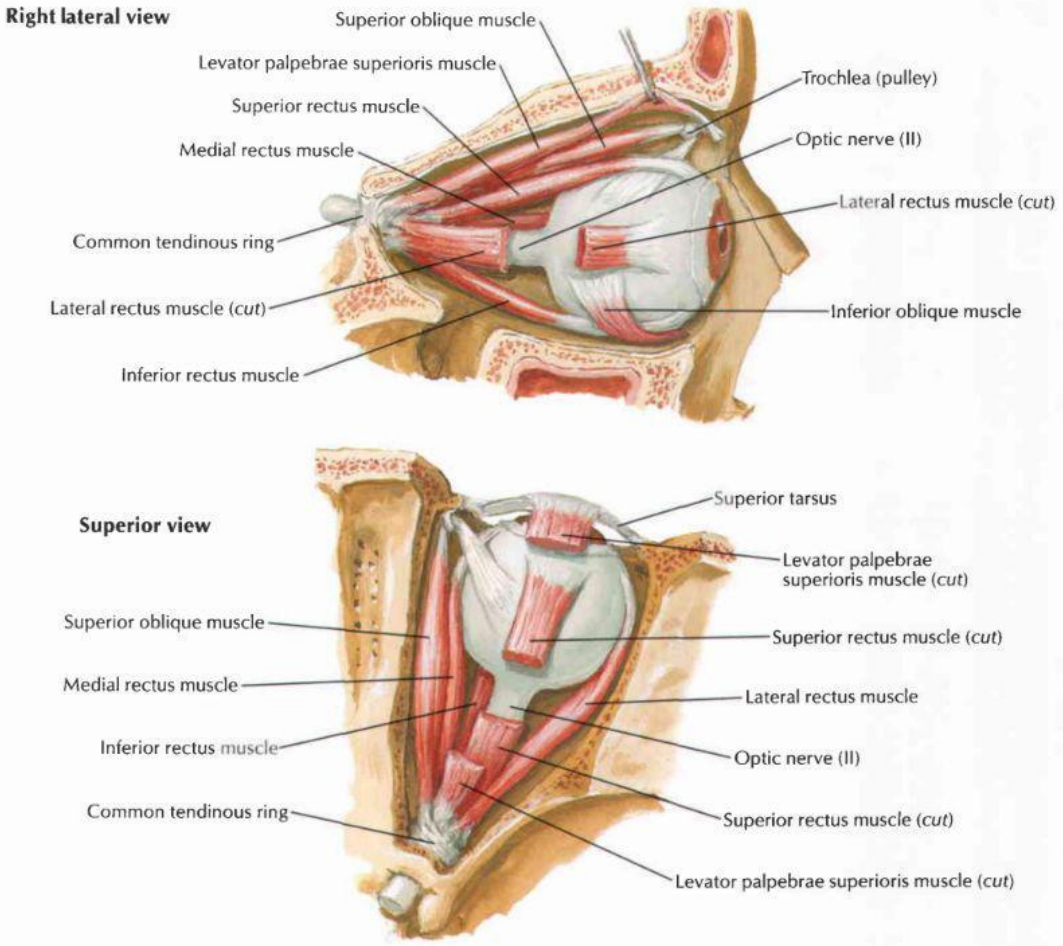
Muscle	Origin	Insertion	Nerve Supply	Action
Extrinsic Muscles of Eyeball (Striated Skeletal Muscle)				
Superior rectus	Tendinous ring on posterior wall of orbital cavity	Superior surface of eyeball just posterior to corneoscleral junction	Oculomotor nerve (3rd cranial nerve)	Raises cornea upward and medially
Inferior rectus	Tendinous ring on posterior wall of orbital cavity	Inferior surface of eyeball just posterior to corneoscleral junction	Oculomotor nerve (3rd cranial nerve)	Depresses cornea downward and medially
Medial rectus	Tendinous ring on posterior wall of orbital cavity	Medial surface of eyeball just posterior to corneoscleral junction	Oculomotor nerve (3rd cranial nerve)	Rotates eyeball so that cornea looks medially
Lateral rectus	Tendinous ring on posterior wall of orbital cavity	Lateral surface of eyeball just posterior to corneoscleral junction	Abducent nerve (6th cranial nerve)	Rotates eyeball so that cornea looks laterally
Superior oblique	Posterior wall of orbital cavity	Passes through pulley and is attached to superior surface of eyeball beneath superior rectus	Trochlear nerve (4th cranial nerve)	Rotates eyeball so that cornea looks downward and laterally
Inferior oblique	Floor of orbital cavity	Lateral surface of eyeball deep to lateral rectus	Oculomotor nerve (3rd cranial nerve)	Rotates eyeball so that cornea looks upward and laterally
Intrinsic Muscles of Eyeball (Smooth Muscle)				
Sphincter pupillae of iris			Parasympathetic via oculomotor nerve	Constricts pupil
Dilator pupillae of iris			Sympathetic	Dilates pupil
Ciliary muscle			Parasympathetic via oculomotor nerve	Controls shape of lens; in accommodation, makes lens more globular
Muscles of Eyelids				
Orbicularis oculi (see Table 11.4)				
Levator palpebrae superioris	Back of orbital cavity	Anterior surface and upper margin of superior tarsal plate	Striated muscle oculomotor nerve, smooth muscle sympathetic	Raises upper lid

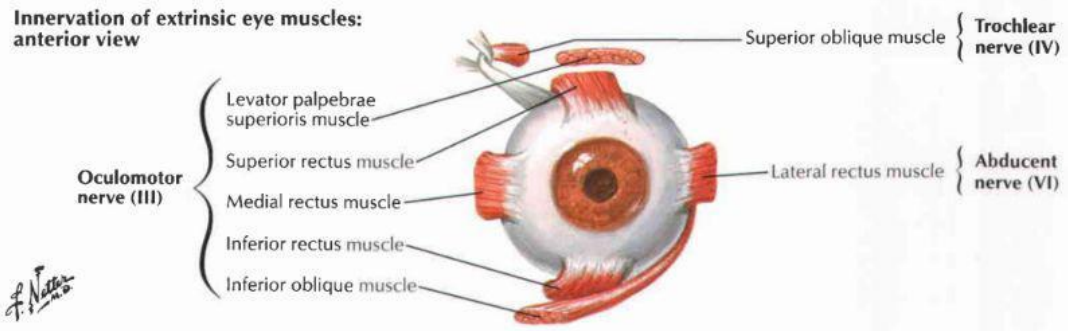
Orbicularis oculi				
Palpebral part	Medial palpebral ligament	Lateral palpebral raphe	Facial nerve	Closes eyelids and dilates lacrimal sac
Orbital part	Medial palpebral ligament and adjoining bone	Loops return to origin	Facial nerve	Throws skin around orbit into folds to protect eyeball

Muscles of the eyeball and eyelid



1 Extrinsic Eye Muscles





Blood and Lymph Vessels of the Orbit

➢ Ophthalmic Artery

The ophthalmic artery is a branch of the internal carotid artery. It enters the orbit through the optic canal with the optic nerve. It has the following branches:

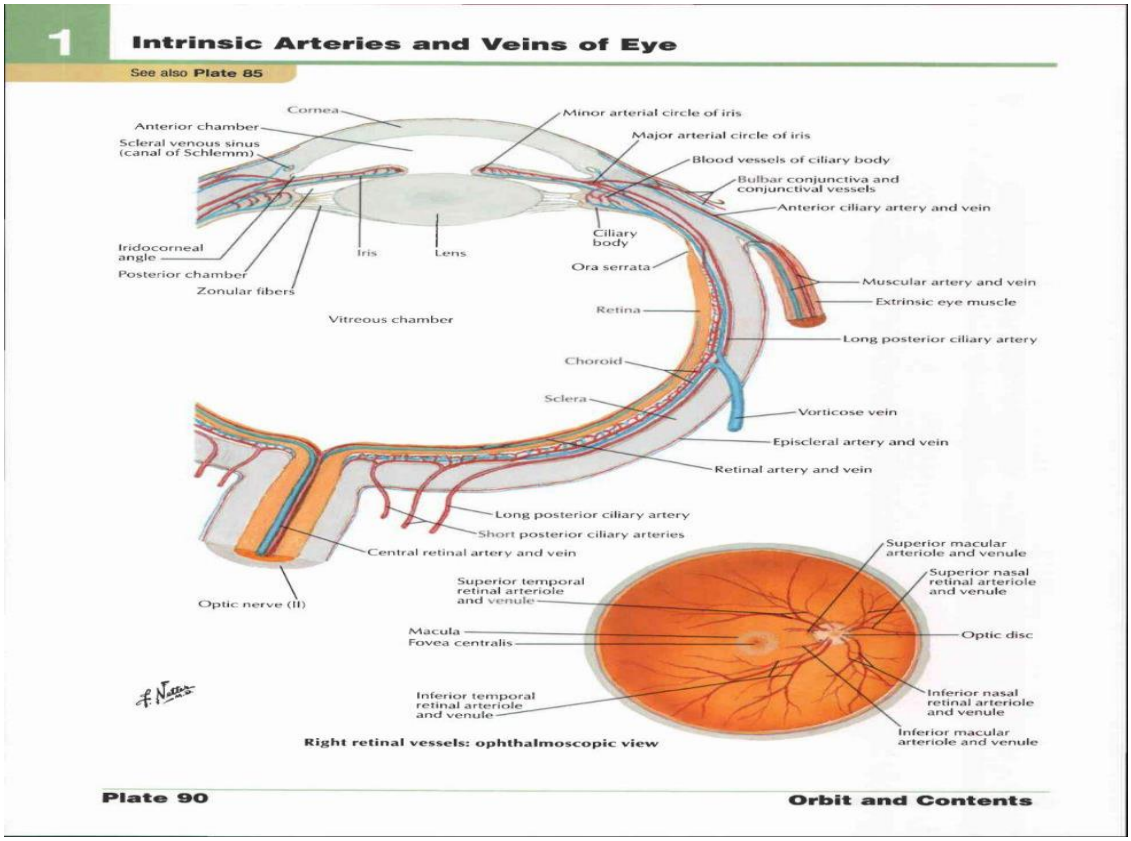
- ✓ The **central artery of the retina** enters the eyeball at the center of the **optic disc.** Here, it divides into branches, which may be studied in a patient through an ophthalmoscope. The branches are end arteries.
- ✓ The **muscular branches.**
- ✓ The **ciliary arteries** can be divided into anterior and posterior groups.
- ✓ The **lacrimal artery** to the lacrimal gland.
- ✓ The **supratrochlear** and **supraorbital arteries** are distributed to the skin of the forehead.

➢ Ophthalmic Veins

The **superior ophthalmic vein** communicates in front with the facial vein. The **inferior ophthalmic vein** communicates through the inferior orbital fissure with the pterygoid venous plexus. Both veins pass backward through the superior orbital fissure and drain into the cavernous sinus.

➢ Lymph Vessels

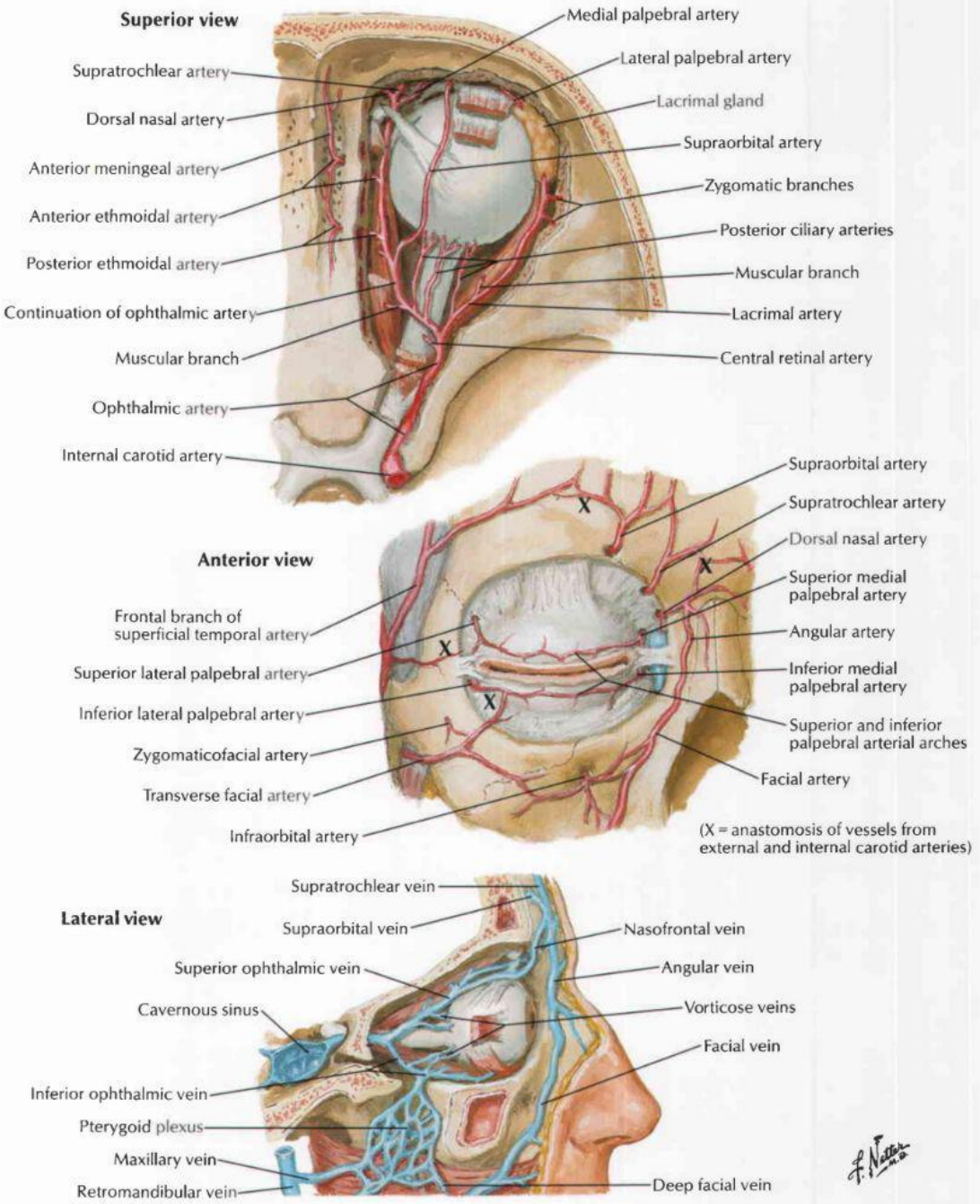
No lymph vessels or nodes are present in the orbital cavity.



Arteries and Veins of Orbit and Eyelids

1

See also **Plates 23, 104**



Nerves of the Orbit

- **Optic Nerve**

  The nerve is surrounded by sheaths of pia mater, arachnoid mater, and dura mater. It pierces the sclera at a point medial to the posterior pole of the eyeball. Here, the meninges fuse with the sclera; a rise in pressure of the cerebrospinal fluid (**CSF**) within the cranial cavity therefore is transmitted to the back of the eyeball.

- **Ophthalmic division of trigeminal nerve** it gives off:

  - **Lacrimal Nerve**

  It is joined by a branch of the zygomaticotemporal nerve, which later leaves it to enter the lacrimal gland (parasympathetic secretomotor fibers). The lacrimal nerve ends by supplying the skin of the lateral part of the upper lid.

  - **Frontal Nerve**

  It divides into the **supratrochlear** and **supraorbital nerves** that supply the skin of the forehead; the supraorbital nerve also supplies the mucous membrane of the frontal air sinus.

  - **Nasociliary Nerve**

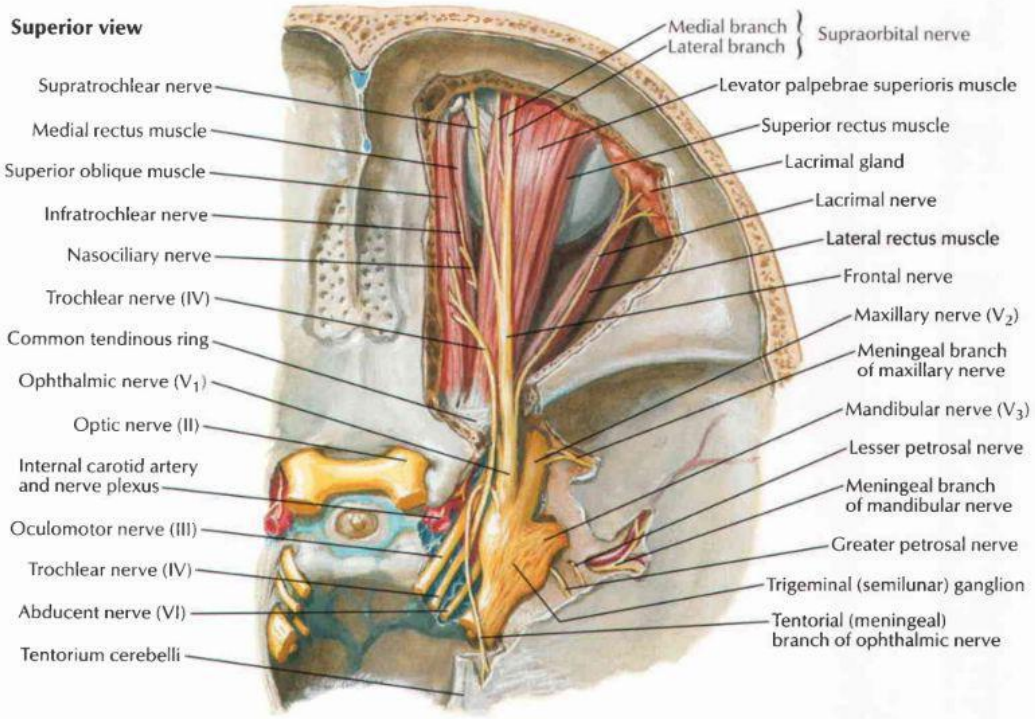
  It has the following branches:

  - ✓ The **communicating branch to the ciliary ganglion** is a sensory nerve. The sensory fibers from the eyeball pass to the ciliary ganglion via the short ciliary nerves and then join the nasociliary nerve by means of the communicating branch.
  - ✓ The **long ciliary nerves,** two or three in number, contain sympathetic fibers for the dilator pupillae muscle.
  - ✓ The **anterior ethmoidal nerve** appears on the face as the **external nasal branch** at the lower border of the nasal bon and supplies the skin of the nose down as far as the tip.
  - ✓ The **posterior ethmoidal nerve** supplies the ethmoidal and sphenoidal air sinuses.

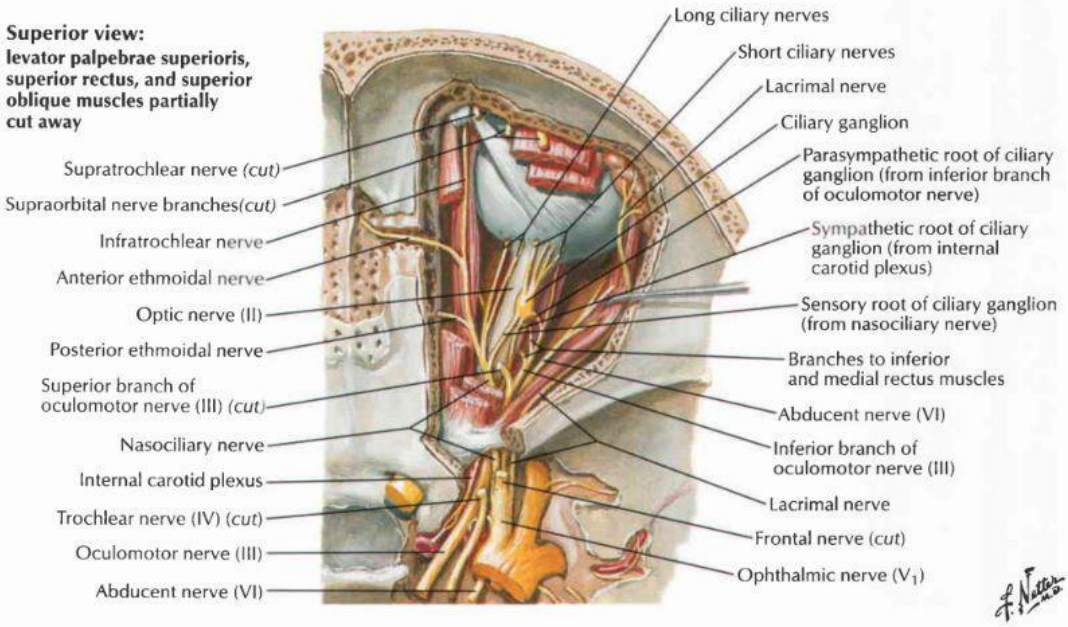
1 Nerves of Orbit

See also **Plates 45, 121, 132**

Superior view



Superior view:
levator palpebrae superioris, superior rectus, and superior oblique muscles partially cut away



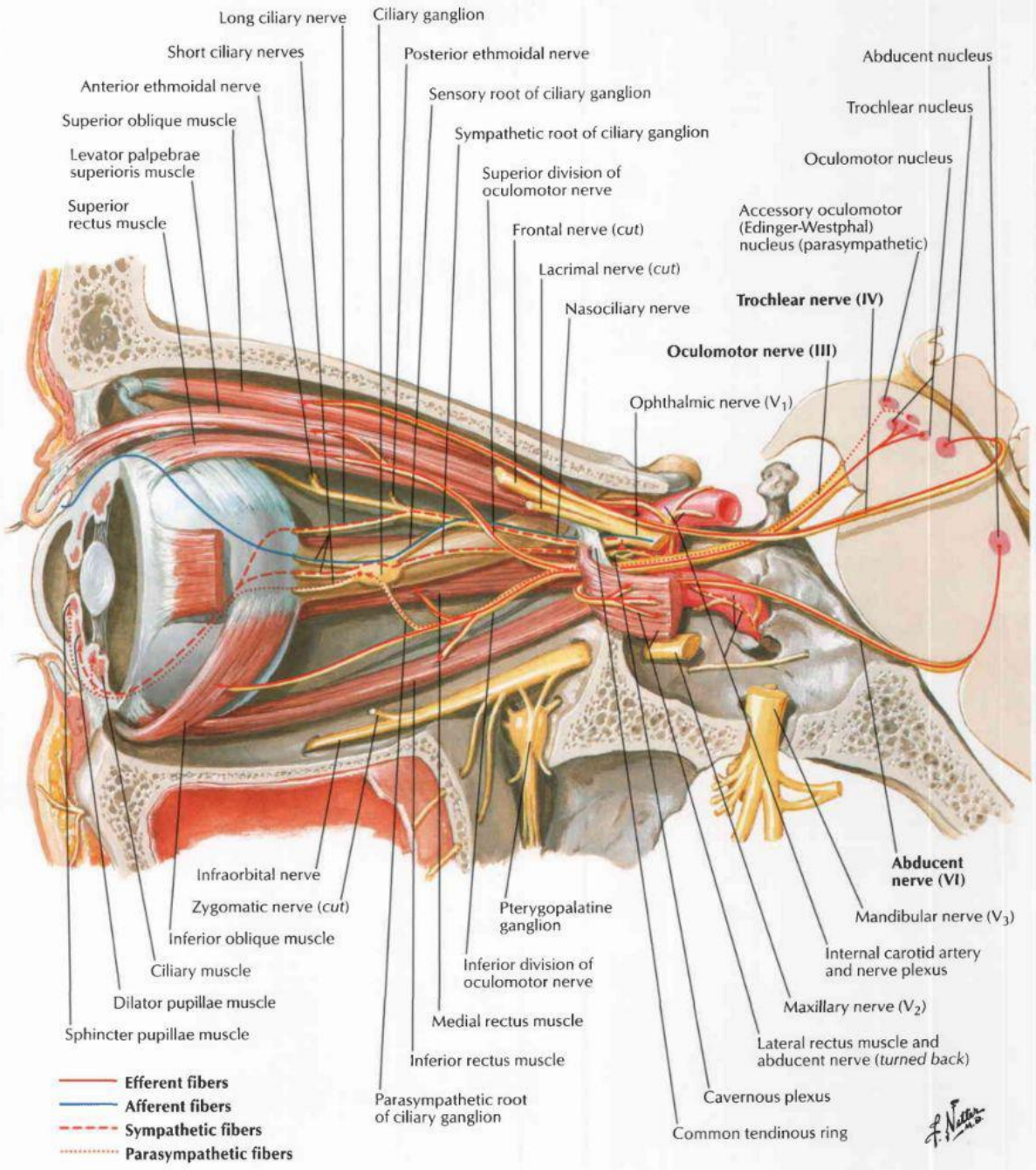
- **Trochlear Nerve**
  It supplies the superior oblique muscle.
- **Oculomotor Nerve**
  The **superior ramus** of the oculomotor nerve supplies the superior rectus muscle, then pierces it, and supplies the levator palpebrae superioris muscle.

  The **inferior ramus** of the oculomotor nerve supplies the inferior rectus, the medial rectus, and the inferior oblique muscles. The nerve to the inferior oblique gives off a branch that passes to the ciliary ganglion and carries parasympathetic fibers to the sphincter pupillae and the ciliary muscle.
- **Abducent Nerve**
  It supplies the lateral rectus muscle.
- The **infratrochlear nerve** a branch of maxillary nerve supplies the skin of the medial part of the upper eyelid and the adjacent part of the nose.

Oculomotor (III), Trochlear (IV), and Abducent (VI) Nerves: Schema

1

See also **Plates 86, 132, 167, 168**



Cranial and Cervical Nerves **Plate 121**

Clinical Notes

➢ Eye Trauma

Blowout fractures of the orbital floor involving the maxillary sinus commonly occur as a result of blunt force to the face. If the force is applied to the eye, the orbital fat explodes inferiorly into the maxillary sinus, fracturing the orbital floor. Not only displacement of the eyeball, blowout fractures can cause symptoms of double vision (diplopia), also can injure the infraorbital nerve, producing loss of sensation of the skin of the cheek and the gum on that side. Entrapment of the inferior rectus muscle in the fracture may limit upward gaze.

➢ Pupillary Reflexes

The pupillary reflexes, that is the reaction of the pupils to light and accommodation, depend on the integrity of nervous pathways. The optic nerve mediate the afferent limb of the reflex, whereas the parasympathetic fibers in the oculomotor nere mediate the efferent limb.

In the **direct light reflex**, the normal pupil reflexly contracts when a light is shone into the patient's eye.

The **consensual light reflex** is tested by shining the light in one eye and noting the contraction of the pupil in the opposite eye. This reflex is possible because the afferent pathway travels to the parasympathetic nuclei of both oculomotor nerves.

The **accommodation reflex** is the contraction of the pupil that occurs when a person suddenly focuses on a near object after having focused on a distant object.

➢ Corneal reflex

It is the blinking reflex when touching the cornea, the ophthalmic nerve mediate the afferent limb of the reflex by the way of the nasociliary branch, whereas the facial nerve mediate the efferent limb by stimulating the contraction of the orbicularis oculi muscle.