

The Orbital Region

The orbits are a pair of bony cavities that contain the eyeballs; their associated muscles, nerves, vessels, and fat; and most of the lacrimal apparatus. The orbital opening is guarded by two thin, movable folds, the eyelids.

Eyelids

The eyelids protect the eye from injury and excessive light by their closure. The upper eyelid is larger and more mobile than the lower, and they meet each other at the **medial** and **lateral angles**. The **palpebral fissure** is the elliptical opening between the eyelids and is the entrance into the conjunctival sac. When the eye is closed, the upper eyelid completely covers the cornea of the eye. When the eye is open and looking straight ahead, the upper lid just covers the upper margin of the cornea. The lower lid lies just below the cornea when the eye is open and rises only slightly when the eye is closed.

The superficial surface of the eyelids is covered by skin, and the deep surface is covered by a mucous membrane called the **conjunctiva**. The **eyelashes** are short, curved hairs on the free edges of the eyelids. They are arranged in double or triple rows at the mucocutaneous junction. The sebaceous glands (glands of Zeis) open directly into the eyelash follicles. The **ciliary glands** (glands of Moll) are modified sweat glands that open separately between adjacent lashes. The **tarsal glands** are long, modified sebaceous glands that pour their oily secretion onto the margin of the lid; their openings lie behind the eyelashes. This oily material prevents the overflow of tears and helps make the closed eyelids airtight.

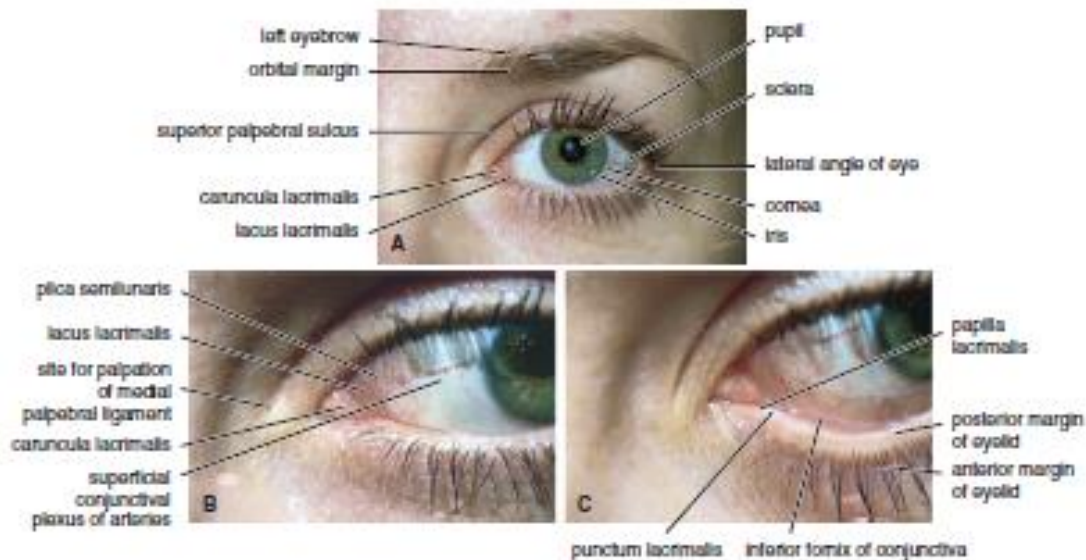
The more rounded medial angle is separated from the eyeball by a small space, the **lacus lacrimalis**, in the center of which is a small, reddish yellow elevation, the **caruncula lacrimalis**. A reddish semilunar fold, called the **plica semilunaris**, lies on the lateral side of the caruncle.

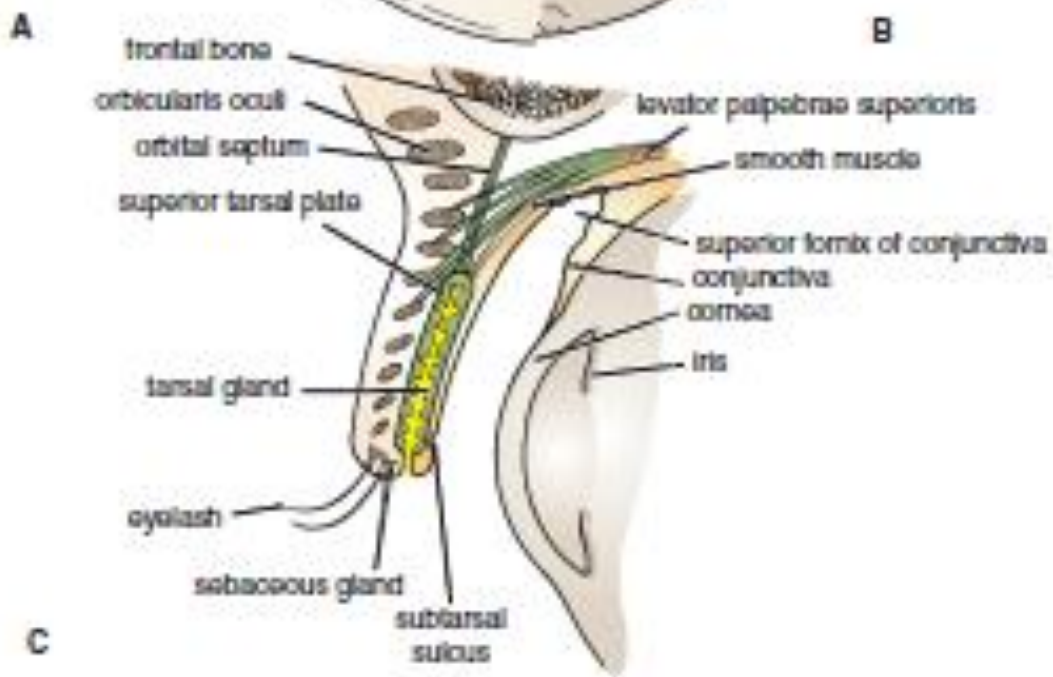
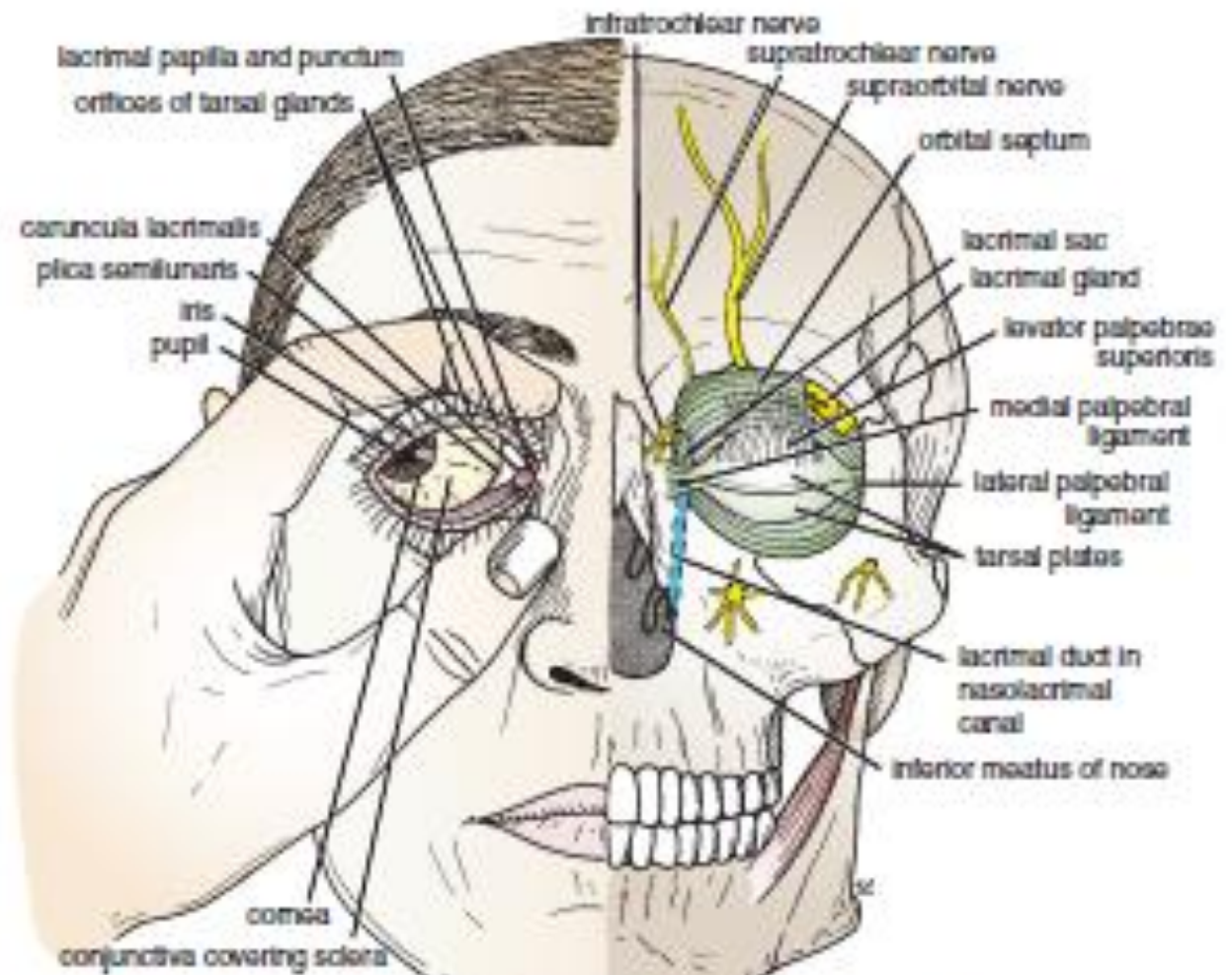
Near the medial angle of the eye a small elevation, the **papilla lacrimalis**, is present. On the summit of the papilla is a small hole, the **punctum lacrimale**,

which leads into the **canaliculus lacrimalis**. The papilla lacrimalis projects into the lacus, and the punctum and canaliculus carry tears down into the nose.

The **conjunctiva** is a thin mucous membrane that lines the eyelids and is reflected at **the superior and inferior fornices** onto the anterior surface of the eyeball. Its epithelium is continuous with that of the cornea. The upper lateral part of the superior fornix is pierced by the ducts of the lacrimal gland. The conjunctiva thus forms a potential space, the **conjunctival sac**, which is open at the **palpebral fissure**. Beneath the eyelid is a groove, the **subtarsal sulcus**, which runs close to and parallel with the margin of the lid. The sulcus tends to trap small foreign particles introduced into the conjunctival sac and is thus clinically important.

The framework of the eyelids is formed by a fibrous sheet, the **orbital septum**. This is attached to the periosteum at the orbital margins. The orbital septum is thickened at the margins of the lids to form the superior and inferior **tarsal plates**. The lateral ends of the plates are attached by a band, the **lateral palpebral ligament**, to a bony tubercle just within the orbital margin. The medial ends of the plates are attached by a band, the **medial palpebral ligament**, to the crest of the lacrimal bone. The tarsal glands are embedded in the posterior surface of the tarsal plates. The superficial surface of the tarsal plates and the orbital septum are covered by the palpebral fibers of the **orbicularis oculi muscle**. The aponeurosis of insertion of the **levator palpebrae superioris muscle** pierces the orbital septum to reach the anterior surface of the superior tarsal plate and the skin.





Movements of the Eyelids

The position of the eyelids at rest depends on the tone of the **orbicularis oculi** and the **levator palpebrae superioris muscles** and the position of the eyeball. The eyelids are closed by the contraction of the orbicularis oculi and the relaxation of the levator palpebrae superioris muscles. The eye is opened by the levator palpebrae superioris raising the upper lid. On looking upward, the levator palpebrae superioris contracts, and the upper lid moves with the eyeball. On looking downward, both lids move, the upper lid continues to cover the upper part of the cornea, and the lower lid is pulled downward slightly by the conjunctiva, which is attached to the sclera and the lower lid.

TABLE 11.2 Muscles of the Eyeball and Eyelids				
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

Lacrimal Apparatus

Lacrimal Gland

The lacrimal gland consists of a large **orbital part** and a small **palpebral part**, which are continuous with each other around the lateral edge of the aponeurosis of the levator palpebrae superioris. It is situated above the eyeball in the anterior and upper part of the orbit posterior to the orbital septum. The gland opens into the lateral part of the superior fornix of the conjunctiva by 12 ducts.

The **parasympathetic secretomotor nerve supply** is derived from the **lacrimal nucleus** of the facial nerve. The preganglionic fibers reach the pterygopalatine ganglion (sphenopalatine ganglion) via the nervus intermedius and its great petrosal branch and via the nerve of the pterygoid canal. The postganglionic fibers leave the ganglion and join the maxillary nerve. They then pass into its zygomatic branch and the zygomaticotemporal nerve. They reach the lacrimal gland within the lacrimal nerve.

The **sympathetic postganglionic nerve supply** is from the internal carotid plexus and travels in the deep petrosal nerve, the nerve of the pterygoid canal, the maxillary nerve, the zygomatic nerve, the zygomaticotemporal nerve, and finally the lacrimal nerve.

Lacrimal Ducts

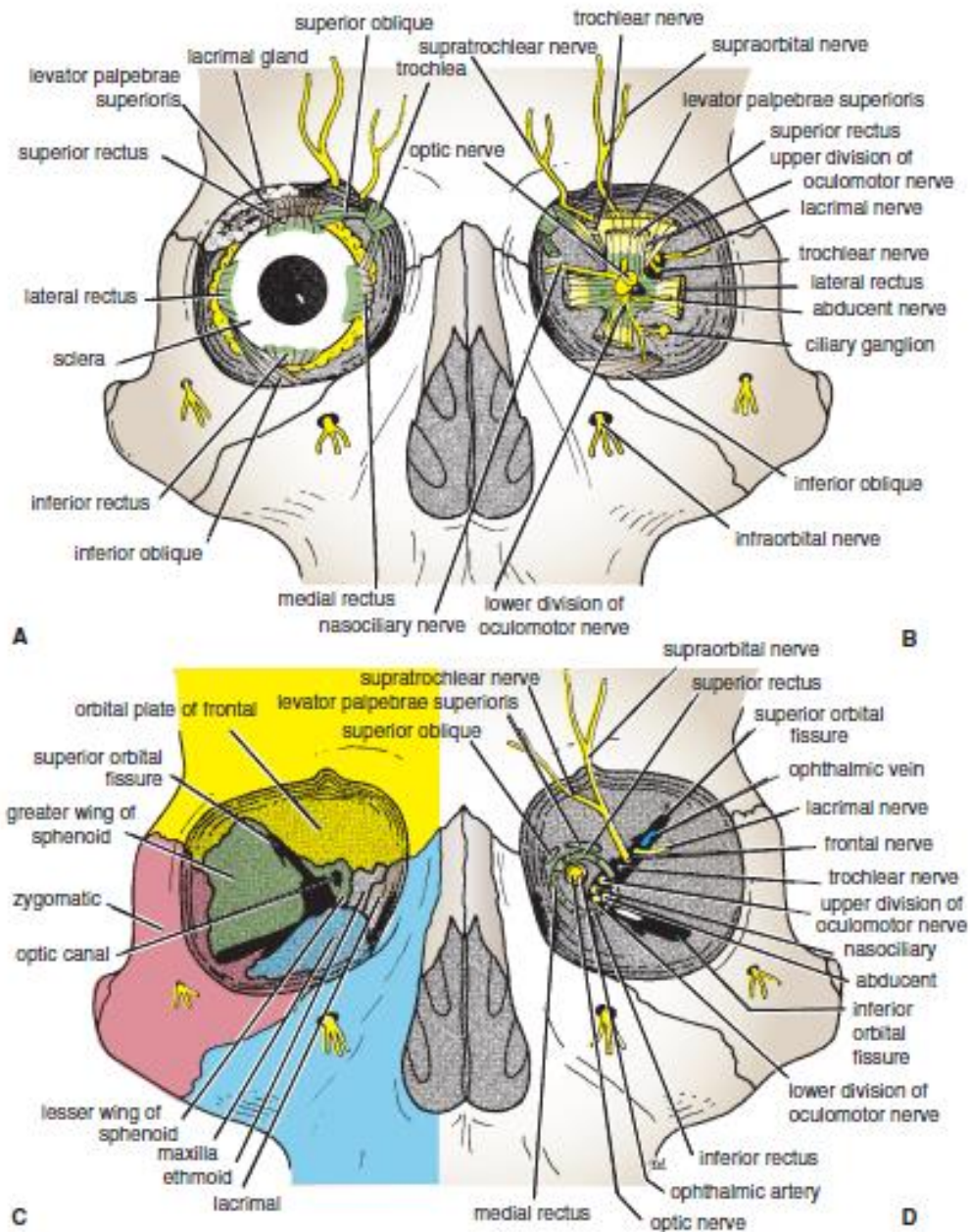
The tears circulate across the cornea and accumulate in the **lacus lacrimalis**. From here, the tears enter the **canaliculi lacrimales** through the **puncta lacrimalis**. The canaliculi lacrimales pass medially and open into the **lacrimal sac** which lies in the lacrimal groove behind the medial palpebral ligament and is the upper blind end of the nasolacrimal duct.

The **nasolacrimal duct** is about 0.5 in. (1.3 cm) long and emerges from the lower end of the lacrimal sac. The duct descends downward, backward, and laterally in a bony canal and opens into the inferior meatus of the nose. The opening is guarded by a fold of mucous membrane known as the **lacrimal fold**. This prevents air from being forced up the duct into the lacrimal sac on blowing the nose.

The Orbit

Description

The orbit is a pyramidal cavity with its base anterior and its apex posterior. The **orbital margin** is formed above by the frontal bone, the lateral margin is formed by the processes of the frontal and zygomatic bones, the inferior margin is formed by the zygomatic bone and the maxilla, and the medial margin is formed by the processes of the maxilla and the frontal bone.



Roof: Formed by the orbital plate of the frontal bone, which separates the orbital cavity from the anterior cranial fossa and the frontal lobe of the cerebral hemisphere. **Lateral wall:** Formed by the zygomatic bone and the greater wing of the sphenoid **Floor:** Formed by the orbital plate of the maxilla, which separates the orbital cavity from the maxillary sinus. **Medial wall:** Formed from before backward by the frontal process of the maxilla, the lacrimal bone, the orbital plate of the ethmoid (which separates the orbital cavity from the ethmoid sinuses), and the body of the sphenoid.

Openings into the Orbital Cavity

The openings into the orbital cavity are:

Orbital opening: Lies anteriorly. About one sixth of the eye is exposed; the remainder is protected by the walls of the orbit.

Supraorbital notch (Foramen): The supraorbital notch is situated on the superior orbital margin. It transmits the supraorbital nerve and blood vessels.

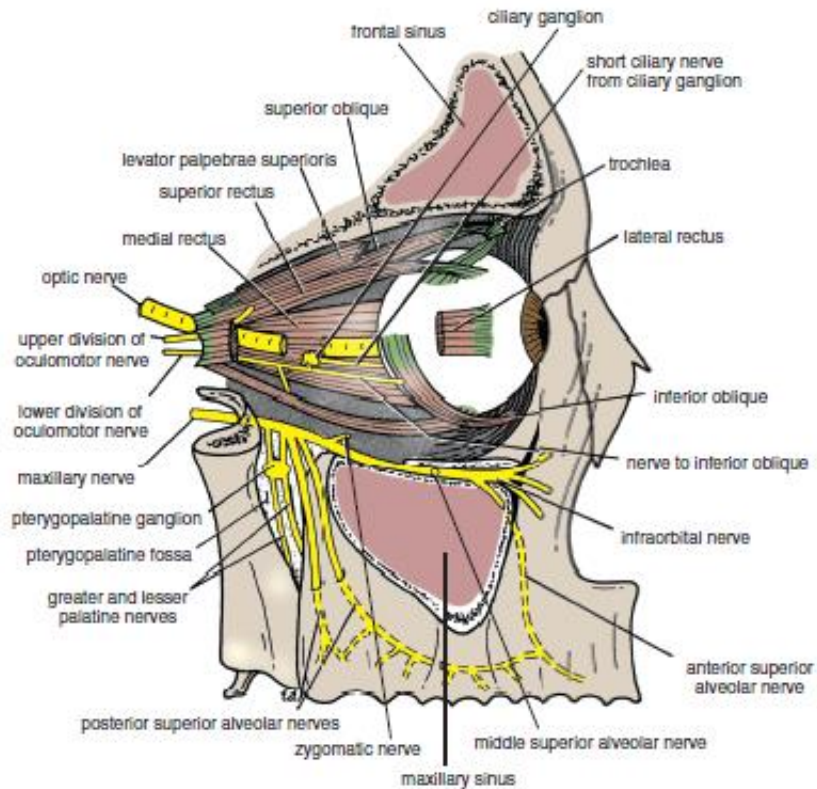
Infraorbital groove and canal: Situated on the floor of the orbit in the orbital plate of the maxilla; they transmit the infraorbital nerve (a continuation of the maxillary nerve) and blood vessels.

Nasolacrimal canal: Located anteriorly on the medial wall; it communicates with the inferior meatus of the nose. It transmits the nasolacrimal duct.

Inferior orbital fissure: Located posteriorly between the maxilla and the greater wing of the sphenoid; it communicates with the pterygopalatine fossa. It transmits the maxillary nerve and its zygomatic branch, the inferior ophthalmic vein, and sympathetic nerves.

Superior orbital fissure: Located posteriorly between the greater and lesser wings of the sphenoid; it communicates with the middle cranial fossa. It transmits the lacrimal nerve, the frontal nerve, the trochlear nerve, the oculomotor nerve (upper and lower divisions), the abducent nerve, the nasociliary nerve, and the superior ophthalmic vein.

Optic canal: Located posteriorly in the lesser wing of the sphenoid; it communicates with the middle cranial fossa. It transmits the optic nerve and the ophthalmic artery.



Orbital Fascia

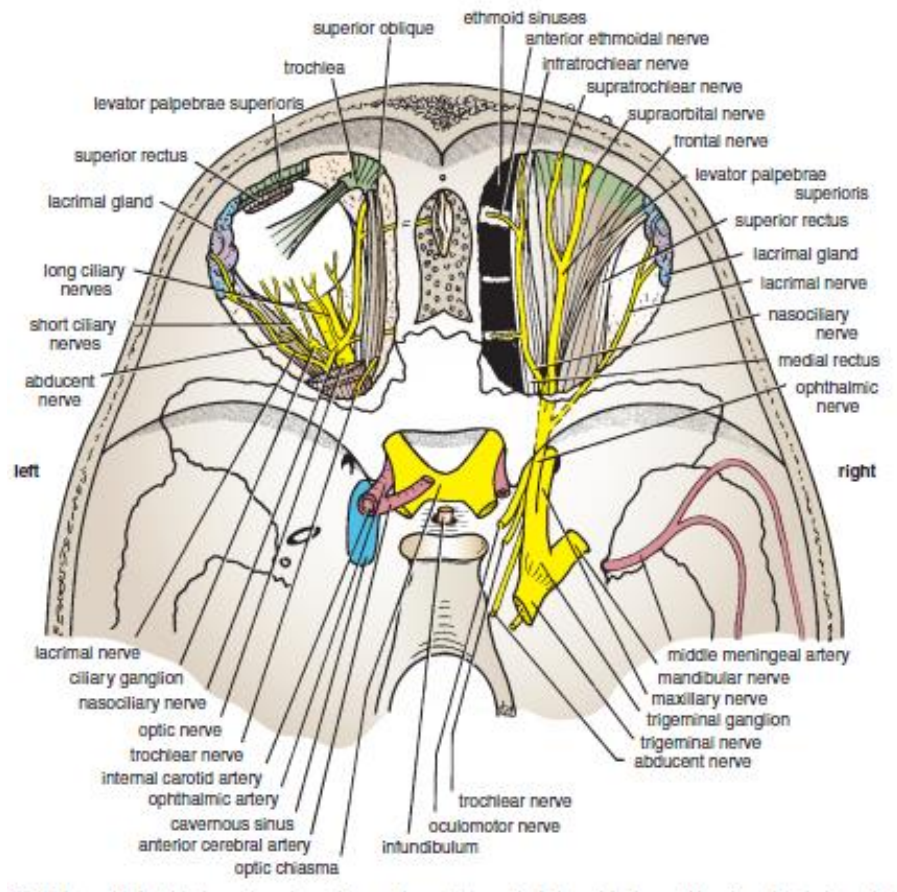
The orbital fascia is the periosteum of the bones that form the walls of the orbit. It is loosely attached to the bones and is continuous through the foramina and fissures with the periosteum covering the outer surfaces of the bones. The **muscle of Müller**, or **orbitalis muscle**, is a thin layer of smooth muscle that bridges the inferior orbital fissure. It is supplied by sympathetic nerves, and its function is unknown.

Nerves of the Orbit

Optic Nerve

The optic nerve enters the orbit from the middle cranial fossa by passing through the optic canal. It is accompanied by the ophthalmic artery, which lies on its lower lateral side. The nerve is surrounded by sheaths of pia mater, arachnoid mater, and

dura mater. It runs forward and laterally within the cone of the recti muscles and pierces the sclera at a point medial to the posterior pole of the eyeball. Here, the meninges fuse with the sclera so that the subarachnoid space with its contained cerebrospinal fluid extends forward from the middle cranial fossa, around the optic nerve, and through the optic canal, as far as the eyeball. A rise in pressure of the cerebrospinal fluid within the cranial cavity therefore is transmitted to the back of the eyeball.



Lacrimal Nerve

The lacrimal nerve arises from the ophthalmic division of the trigeminal nerve. It enters the orbit through the upper part of the superior orbital fissure and passes forward along the upper border of the lateral rectus muscle. 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

The frontal nerve arises from the ophthalmic division of the trigeminal nerve. It enters the orbit through the upper part of the superior orbital fissure and passes forward on the upper surface of the levator palpebrae superioris beneath the roof of the orbit. It divides into the **supratrochlear** and **supraorbital nerves** that wind around the upper margin of the orbital cavity to supply the skin of the forehead; the supraorbital nerve also supplies the mucous membrane of the frontal air sinus.

Trochlear Nerve

The trochlear nerve enters the orbit through the upper part of the superior orbital fissure. It runs forward and supplies the superior oblique muscle.

Oculomotor Nerve

The **superior ramus** of the oculomotor nerve enters the orbit through the lower part of the superior orbital fissure. It supplies the superior rectus muscle, then pierces it, and supplies the levator palpebrae superioris muscle. The **inferior ramus** of the oculomotor nerve enters the orbit in a similar manner and 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

Nasociliary Nerve

The nasociliary nerve arises from the ophthalmic division of the trigeminal nerve. It enters the orbit through the lower part of the superior orbital fissure. It crosses above the optic nerve, runs forward along the upper margin of the medial rectus muscle, and ends by dividing into the **anterior ethmoidal** and **infratrochlear nerves**.

Branches of the Nasociliary Nerve

■ 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, pass through the ganglion without interruption, and then join the nasociliary nerve by means of the communicating branch.

■ The **long ciliary nerves**, two or three in number, arise from the nasociliary nerve as it crosses the optic nerve. They contain sympathetic fibers for the dilator pupillae muscle. The nerves pass forward with the short ciliary nerves and pierce the sclera of the eyeball. They continue forward between the sclera and the choroid to reach the iris.

■ The **posterior ethmoidal nerve** supplies the ethmoidal and sphenoidal air sinuses

■ The **infratrochlear nerve** passes forward below the pulley of the superior oblique muscle and supplies the skin of the medial part of the upper eyelid and the adjacent part of the nose.

■ The **anterior ethmoidal nerve** passes through the anterior ethmoidal foramen and enters the anterior cranial fossa on the upper surface of the cribriform plate of the ethmoid. It enters the nasal cavity through a slitlike opening alongside the crista galli. After supplying an area of mucous membrane, it appears on the face as the **external nasal branch** at the lower border of the nasal bone, and supplies the skin of the nose down as far as the tip.

Abducent Nerve

The abducent nerve enters the orbit through the lower part of the superior orbital fissure. It supplies the lateral rectus muscle.

Ciliary Ganglion

The ciliary ganglion is a parasympathetic ganglion about the size of a pinhead and situated in the posterior part of the orbit. It receives its preganglionic parasympathetic fibers from the oculomotor nerve via the nerve to the inferior oblique. The postganglionic fibers leave the ganglion in the **short ciliary nerves**, which enter the back of the eyeball and supply the sphincter pupillae and the ciliary muscle. A number of sympathetic fibers pass from the internal carotid plexus into the orbit and run through the ganglion without interruption.

Blood Vessels and Lymph Vessels of the Orbit

Ophthalmic Artery

The ophthalmic artery is a branch of the internal carotid artery after that vessel emerges from the cavernous sinus. It enters the orbit through the optic canal with the optic nerve. It runs forward and crosses the optic nerve to reach the medial wall of the orbit. It gives off numerous branches, which accompany the nerves in the orbital cavity.

Branches of the Ophthalmic Artery

- The **central artery of the retina** is a small branch that pierces the meningeal sheaths of the optic nerve to gain entrance to the nerve. It runs in the substance of the optic nerve and 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 former group enters the eyeball near the corneoscleral junction; the latter group enters near the optic nerve.
- 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.

References :

- 1- Snell, Richard S. Clinical anatomy by regions. Lippincott Williams & Wilkins, 2011.
- 2- Norton, Neil S. Netter's head and neck anatomy for dentistry e-book. Elsevier Health Sciences, 2016.