



Antaomy of the eye

## ORBIT

The orbit contains and protects the globe, extraocular muscles, third eyelid, retrobulbar fat pad, lacrimal gland, zygomatic salivary gland, and assorted nerves and blood vessels. Abnormalities of the orbital contents or adjacent structures, e.g. frontal or maxillary sinuses, will alter the normal globe-orbit relationship.

The orbital rim is incomplete in the dog and cat, with the dorsolateral portion completed by dense collagenous orbital ligament (lacrimal gland lies deep to orbital ligament). It is completely bony in the horse, cow, sheep and pig. Space-occupying orbital lesions usually produce exophthalmos and lateral strabismus in companion animals, while exophthalmos alone occurs in large animals.

## EYELIDS

The eyelids are the major protection for the eye. The lids are covered externally by epidermis and internally by the palpebral conjunctiva. In between are fibres of the orbicularis muscle which overlie a poorly developed layer of loose connective tissue called the tarsal plate.

The facial nerve innervates the orbicularis muscle which closes the eyelid. The oculomotor n. (CN3) controls the levator muscle which raises the upper eyelid. Eyelid sensation is provided by the trigeminal n..

The point at which the upper and lower eyelids meet is called the canthus, i.e. the nasal/medial or temporal/lateral canthus.

Eyelashes (cilia) are present on the upper lid of the dog and both upper and lower eyelids of the horse and cow. The cat has no true eyelashes.

Openings of the meibomian glands are found along the upper and lower eyelid margins. These glands produce an oily component of the tearfilm which slows evaporation.

### THIRD EYELID

Also referred to as the nictitans or nictitating membrane, the third eyelid is composed of a T-shaped hyaline cartilage with a tear secreting gland at its base (gland of third eyelid), responsible for 40% of the aqueous component of tears. The third eyelid is covered on both sides by conjunctiva, its inner surface contains numerous lymphoid follicles.

Protrusion of the third eyelid is a passive phenomenon which occurs when the eye is retracted posteriorly, displacing the orbital fat pad and third eyelid forward. This is common in painful ocular conditions or as a protective mechanism to menacing gestures. Only the cat has a muscle to the third eyelid which is sympathetic and acts as a retractor.

### CONJUNCTIVA

The conjunctiva is the semitransparent, thin, variably pigmented mucous membrane lining the eyelids (palpebral conjunctiva) and the anterior sclera (bulbar conjunctiva). The region where the palpebral conjunctiva reflects forward onto the sclera is referred to as the fornix or cul-de-sac. The palpebral conjunctiva appears red because it overlies the connective tissue and muscles of the eyelid. The small vessels of the colourless bulbar conjunctiva are easily seen against the white scleral background.

The conjunctiva normally contains goblet cells which contribute mucin to the tearfilm. This innermost layer of the tearfilm aids in adherence of the tears to the corneal surface. Accumulations of lymphoid cells are scattered throughout the conjunctiva, especially near the fornix.

### LACRIMAL APPARATUS

The tearfilm is produced by the meibomian glands (oily layer), lacrimal and third eyelid glands (aqueous layer), and the goblet cells of the conjunctiva (mucin component). A normal tearfilm produces a glistening appearance to the cornea and conjunctiva. If the tearfilm is inadequate, a tenacious discharge is produced by the conjunctiva as a compensatory mechanism by the goblet cells.

The only visible parts of the excretory system in companion animals are the lacrimal puncta, located on the inner surface of the eyelids near the opening of the most medial meibomian glands. In larger animals, the nasal punctum can be seen opening inside the nostril near the floor of the nasal cavity.

## **CORNEA AND SCLERA**

The cornea and sclera make up the fibrous tunic of the eye, determining its shape and protecting the delicate intraocular structures. The transparent portion, the cornea, allows light to enter the eye and in animals is the globe's major refracting structure.

The sclera is made up of dense connective tissue penetrated by arteries, veins, and nerves at the equator and posterior pole. The lamina cribosa is a fenestrated region of sclera through which optic nerve fibres exit the globe. The sclera is covered by loose connective tissue (Tenon's capsule) and bulbar conjunctiva. The junction of cornea, sclera and bulbar conjunctiva is the limbus.

The cornea is composed of regularly arranged collagen fibres that are maintained in a state of dehydration so as to be transparent. Referred to as the stroma, these hydrophilic collagen fibres are sandwiched between a lipophilic epithelium on the surface and similarly lipophilic layers known as Descemet's membrane and endothelium internally. In addition to its hydrophobic nature, the endothelium also maintains corneal dehydration by means of an active metabolic pump. The cornea is avascular, deriving its metabolic needs through the tearfilm, the perilimbal vessels, and the aqueous humor. Corneal sensation is provided by superficial sensory and deep pressure-sensitive trigeminal nerve endings.

## **ANTERIOR CHAMBER**

The anterior chamber is the space between the cornea and the iris. It is filled with a clear fluid, the aqueous humor, which is produced by the ciliary body epithelium. The aqueous flows from the posterior chamber, through the pupil into the anterior chamber. It passes into the iridocorneal angle and through the trabecular meshwork into the general circulation via the trabecular, anterior ciliary and vortex veins.

The aqueous provides nutrition for the avascular cornea and lens. It also serves as the second refractive medium of the eye; unless it is transparent, vision will be impaired.

## **ANTERIOR UVEA**

The iris and ciliary body comprise the anterior uveal tract. Along with the more posterior choroid, they form the vascular coat of the eye.

The iris is very vascular and contains pigment and smooth muscle controlled by the autonomic nervous system. The main function of the iris is to control the amount of light which enters the eye through the pupil. The iris sphincter causes the pupil to constrict under the influence of parasympathetic stimulation. The iris dilator opens the pupil when stimulated by the sympathetic system.

The parasympathetically innervated ciliary muscle extends into the trabecular meshwork of the iridocorneal angle. Pharmacologic manipulation of these fibres will enhance flow of aqueous through the drainage angle. The iris and ciliary body are the sources of most intraocular haemorrhages. Because of its visibility, the iris is the main indicator of uveal tract inflammation.

## LENS

Because the lens forms the third refractive medium of the eye, it must be transparent, a feature largely dependent on the state of the lens proteins. The layer of epithelial cells beneath the anterior capsule produces new lens fibres throughout life. As with the other refractive media, it is avascular, deriving its metabolic needs from normal aqueous. The lens capsule is permeable to the necessities of anaerobic glycolysis, and energy from the glycolysis drives various pumps against concentration gradients.

The lens is held in place by the iris anteriorly, the vitreous body posteriorly, and the zonules of the ciliary body radially. Since animals have poorly developed ciliary muscles compared to man, it is assumed that their ability to alter lens shape to facilitate near vision (accommodation) is minimal. This explains why their vision following cataract extraction is adequate without the use of artificial lens implants.

Lens protein is organ-specific rather than species-specific. If lens protein breaches the lens capsule, an autoimmune response will ensue.

## THE FUNDUS

The ocular fundus is the portion of the posterior globe viewed with an ophthalmoscope. It includes the vitreous, the neural retina, the retinal pigmented epithelium, the tapetum, the choroid, the sclera, and the optic disc.

The vitreous is a gel made up of almost 99% water, devoid of any cellular activity or regenerative capability. It is firmly attached at the optic disc, the ciliary body, and to the posterior surface of the lens.

The retina is a complex photosensory structure consisting of 10 anatomic layers, which clinically function as 2 layers: the neural retina (containing the innermost 9 anatomic layers) and the outermost pigment epithelium. The tapetum is a modification of the choroid located deep to the retina. It is composed of highly organized crystals which result in its reflective appearance.

The optic disc is the origin of the optic nerve within the globe.

