Microscopic Anatomy of the eye

Dog
Cat
Horse
Rabbit
Monkey

Richard R Dubielzig
Mammalian globes
General Anatomy

Arterial Blood Vessels of the Orbit
General Anatomy

Dog

Blood Supply

Horizontal section
Long Posterior Ciliary a.

Blood enters the globe
Short Post. Ciliary a
Anterior Ciliary a.

https://veterinkey.com/vitreoretinal-surgery/

http://rodsneones.blogspot.com/2014/05/anatomy-blood-supply-to-eye.html
General Anatomy

Dog

Major arterial circle of the iris

https://www.slideshare.net/drddhir2014/blood-supply-n-nerve-supply-of-eye
Orbital Anatomy

Dog

Brain

Levator

Dorsal rectus

Ventral rectus

Zygomatic

Lymph node
Orbital Anatomy

Dog

Innervation

Oculomotor n.
- All the rectus mm except lateral
  - Levator palpebrae m.
  - Part of retractor bulbi m.
  - Ventral oblique m.
  - Sphinctor pupillae m.
  - Ciliaris m.

Trochlear n
- Trochlear m.

Abducens nerve
- Lateral rectus m.
  - Part of retractor bulbi m.
- Orbicularis oculi m.
  - Facial n.
  - Lacrimal gland and sensory
    - Trigeminal n.

http://rodsncones.blogspot.com/2014/05/anatomy-muscles-of-eye.html
Cartilaginous trochlea and the tendon of the dorsal oblique m.
Orbital Anatomy

Dog

Rabbit

http://www.allthingscanid.org/canineanatomy.html
Orbital Anatomy

Dog

Zygomatic salivary gland

mucinous gland
Orbital Anatomy

Dog

Gland of the Third Eyelid
Eye lids (dog)

Gland of Zeiss

Glands of Moll

Meibomian Gland
Eye lids (dog)

Meibomian glands at the lid margin

Holocrine secretion
Eye lids (primate)

Upper tarsal plate

Lower tarsal plate

Upper Lid

Lower Lid
Eye lids (rabbit)
The Globe
The Globe

Dog

Cat

Orangutan

Diurnal

Diurnal

Horse

Diurnal

os
Cornea

Epithelium

Stromal lamellae

Bowman’s layer

Descemet’s membrane

Dolphin

Endothelium

TEM of surface epithelium
Cornea

Doubling of Descemet’s

Vimentin + endothelium
Iris

Fig. 85—Diagrams of mammalian iris musculatures.

a, round pupil of diurnal and strictly nocturnal forms, showing simple sphincter (solid lines) and symmetrical dilatator (broken lines).

b, vertical slit (of cat), characteristic of nocturnal forms which bask. Part of the sphincter surrounds the pupil, but two bundles which cross above and below and continue to the periphery have a scissor-action upon the pupil, compressing it laterally. The dilatator (broken lines) is quite symmetrical—contrast Figure 88, page 223. Redrawn from Raselli.

c, horizontal pupil (of horse), characteristic of ungulates, some whales, and other species. Some sphincter fibers are oriented radially and are anchored in connective-tissue sectors (stippled) which are devoid of dilatator fibers (broken lines). The pupil can expand to a circle; but when the sphincter fibers contract, the terminal ones force the pupil to become a horizontal rectangle, indented by the corpora nigra (white). Based upon drawings and descriptions of Eversbusch.

Walls: The vertebrate eye
Iris

Dilator m.

Sphincter m.

Blue-eye, GFAP stain

Iris Collagen
Iris
Cat
Sphinctor m.
Dilator m.
Iris
Cat
Phyomelanocytes
Iris

Equine Corpora nigra (Granula iridica)
seen in ungulates living without shade
Ciliary body

Pars plicata

Ciliary muscle

Pars plana
Ciliary body

Zonular ligaments
Ciliary body

Primarily made of fibrillin
*A major component of elastin*
Ciliary body

Alcian Blue staining acid mucopolysaccharides: Hyaluronic acid
In accommodation and in IOP
Filtration apparatus

Canine

Primary Pectinate Ligament
Filtration apparatus

Canine

Ciliary Cleft

Corneoscleral Trabecular Meshwork
Filtration apparatus

*Canine*

Collecting vessels
Filtration apparatus

Canine

Angular aqueous plexus: AAP

Corneoscleral trabecular meshwork: CTM

Collecting vessels: CV
Filtration apparatus

Feline
Filtration apparatus

Equine

Angular aqueous plexus
Filtration apparatus

Primate

Schlemm’s canal

SMA
Filtration apparatus

*Rabbit*

Schlemm’s canal
Filtration apparatus

Aqueous vein draining to episcleral veins
Canal of Schlemm
Intrascleral and deep scleral plexus

http://www.eophtha.com/eophtha/Anatomy/anatomyofanteriorchamber.html

Canine
Uveoscleral trabecular meshwork

*the alternative pathway*

Vortex veins
Uveoscleral trabecular meshwork

the alternative pathway

Fluorescein dextran perfusion of alternative pathway
Primate
M. Johnson et al. / Experimental Eye Research 158 (2017) 94-111
Lens

Canine
Lens

Embryo
Lens
Lens

Posterior suture
Fundus

Canine

Normal fundus

Tapetum
Fundus

Canine

Arteriole

Tapetum lucidum

Venule

Nontapetum

Optic disk

Nontapetal fundus

http://medical-dictionary.thefreedictionary.com/

Arteries

Veins
Fundus

Equine

Paurangirotic retina

https://veterankey.com/retina/
Ron Ofri
Fundus *Rabbit*

Merangiotic retina

Myelinated medullary ray
Rabbit Medullary Ray
Retinal vessels come from the central retinal artery in the middle of the optic nerve.
Fundus

Canine

Fluorescein angiography

Arteries come from the short posterior ciliary arteries
Retina

Canine

- Inner Limiting Membrane
- Nerve Fiber Layer
- Ganglion Cell Layer
- Inner Plexiform Layer
- Inner Nuclear Layer
- Outer Plexiform Layer
- Outer Nuclear Layer
- Outer Limiting Membrane
- Inner Segments
- Outer Segments
- Retinal Pigment Epithelium
- Tapetum Lucidum

Feline

- Inner Limiting Membrane
- Nerve Fiber Layer
- Ganglion Cell Layer
- Inner Plexiform Layer
- Inner Nuclear Layer
- Outer Plexiform Layer
- Outer Nuclear Layer
- Outer Limiting Membrane
- Inner Segments
- Outer Segments
- Retinal Pigment Epithelium
- Tapetum Lucidum
Retina

Ganglion cells

Cone “bouquet”

Feline Area Centralis
Retina

Primate fovea
Temporal to the ON
Retina

Nerve fiber layer

Individual axons separated by astrocytes
Retina
Primate Retina
Feline Retina

Rod Arrestin
Labelling rods

Cone Arrestin
Labelling cones

Images from Caroline Zeiss
Primate Retina

This section is across the inner segments of the photoreceptors and cuts across larger cone inner segments and smaller rods.
Retina

Plastic section of the Peripheral primate retina
Showing mostly rod Outer segments and a few cones
RPE

https://www.intechopen.com/books/
Choriocapillaris and Bruch’s Membrane

The choriocapillaris is the most heavily perfused capillary bed in the body.
Choriocapillaris and Bruch’s Membrane

5 layers of Bruch’s membrane
- 2 Basement membranes
- 2 collagen layers
- Central elastic layer
Choriocapillaris

Canine tangential section

RPE
Cellular Tapetum Lucidum

Carnivore

Protein + zinc units

Eye Shine - Canine

Nontapetal   Tapetal   Tapetal
Cellular Tapetum Lucidum
Feline

Melan-A+ & protein & riboflavin

Autofluorescent
Pinniped Cellular Tapetum

Upper

200 µm

Lower

200 µm
Fibrous Tapetum Lucidum

Ungulates & Cetaceans

Equine

Impala

Tapir or Hippo

Dolphin
Fibrous Tapetum Lucidum

Impala tapetum
Picrosirious red
Polarized light

Thick fibrous tapetum
of the tapir
Optic Nerve
Optic Nerve
Optic Nerve
Optic Nerve
Optic Nerve