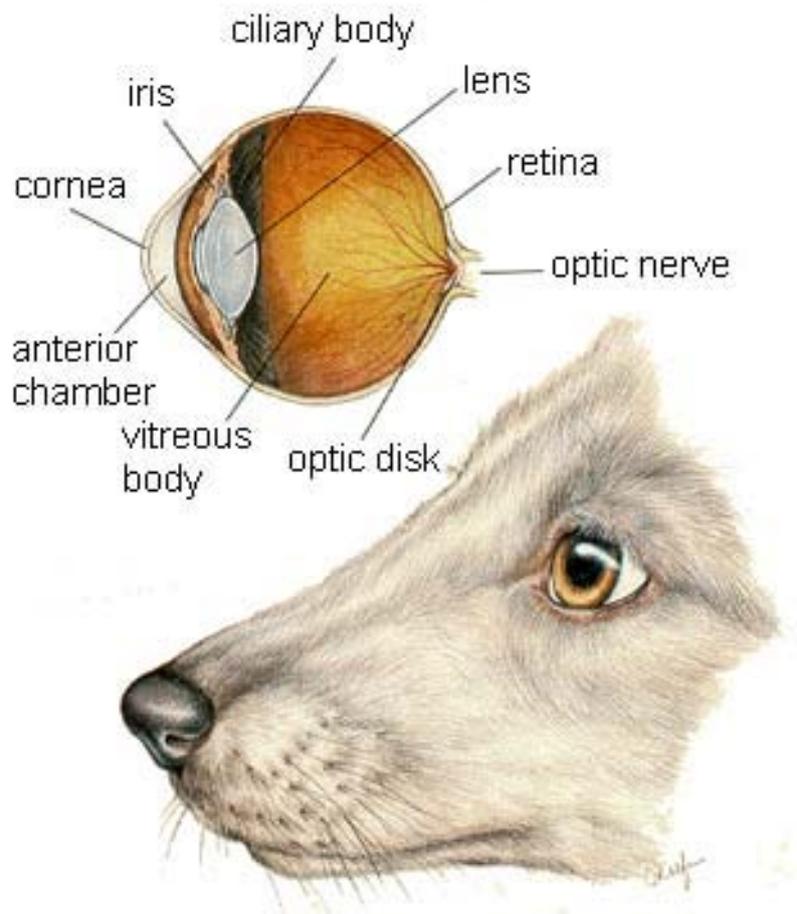


Examination of the eye

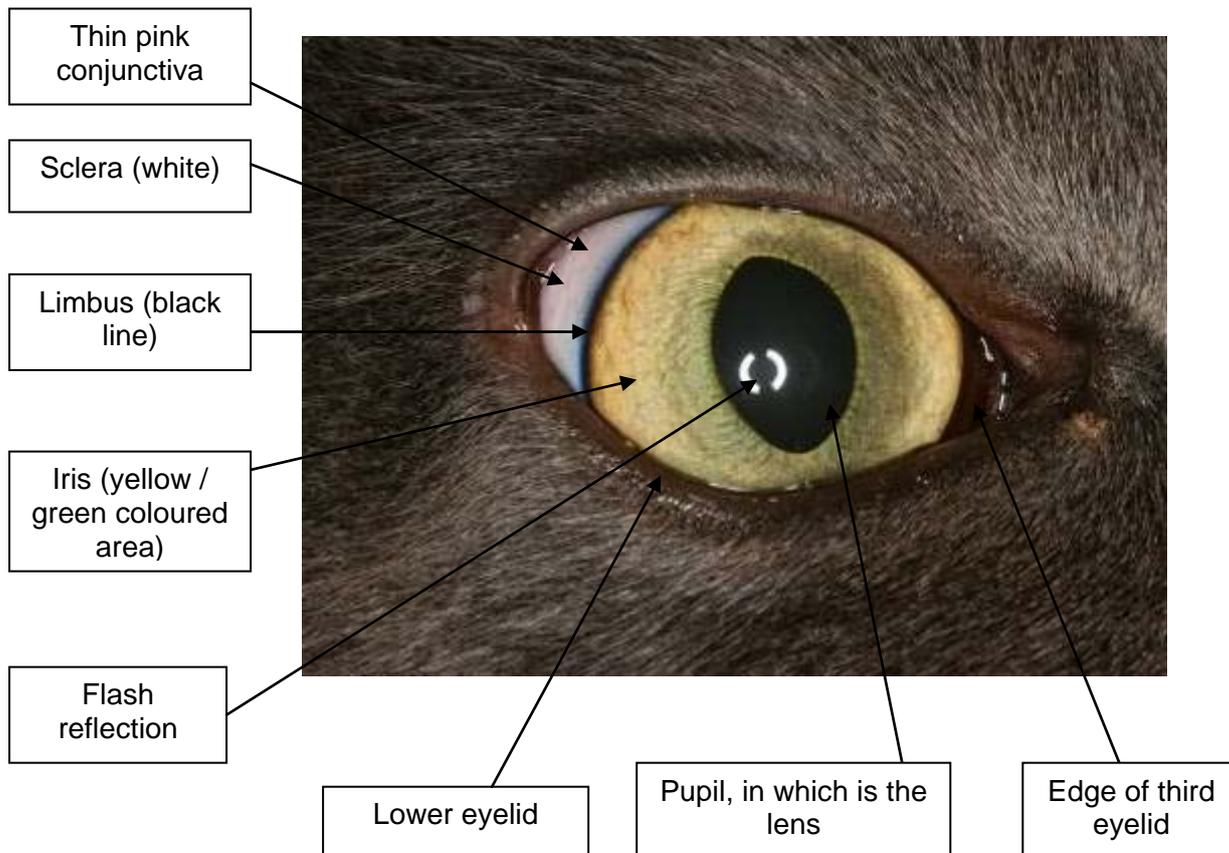
Initial requirements:

- Know your basic anatomy
- Examination room capable of being darkened
- Basic equipment
- Pharmacy

Anatomy:



This picture is property of Dechra



Functions of the parts of the eye, explained simply:

Eyelids – these protect the eye by blinking, they assist in spreading the tear film evenly across the cornea and they produce part of the tear film (the outer oily layer).

Third eyelid – also called the nictitating membrane or haw, this structure evenly spreads the tear film and removes debris, and it contains the nictitans gland which makes part of the tear film (middle aqueous layer).

Conjunctiva – this pink-coloured thin mucous membrane lines the inside of the upper and lower eyelids and the periphery of the globe. It protects the cornea from drying out, and allows the eyelids to be mobile. It contains blood vessels which provide nutrition to, and remove waste products from the eye. It also contains lymph tissue for defence against micro-organisms and foreign substances, nerves, and cells which contribute to the tear film.

Tear film – a moist layer present on the surface of the cornea and conjunctiva which is essential to the health to the front of the eye. It smoothes out any irregularities on the cornea allowing for sharp vision, it provides nutrition and oxygen to the cornea and thus helps it to stay transparent; it removes debris and foreign material from the front of the eye and contains immunoglobulins which protect against infection.

Cornea – this is the clear transparent tough outer part of the eye (the outer 'window') which together with the sclera maintains the shape of the eye and

provides support for the structures contained within it, and transmits light into the eye.

Sclera – this is a continuation of the cornea and is the white of the eye. This tough outer layer protects the contents of the eye and provides its shape.

Limbus – this appears as a black line and is the junction between the cornea and the sclera.

Anterior chamber – this is the space within the eye between the cornea at the front and the iris at the back, and it contains clear aqueous humour.

Aqueous humour – this transparent fluid fills the anterior and posterior chamber. It is made by the ciliary body and drained through the iridocorneal (drainage) angle. It is responsible for providing essential nutrition and oxygen to the delicate internal structures of the eye and it absorbs waste products.

Iris – the coloured part of the eye. This structure provides control over the amount of light entering the eye with iris movement by constriction (getting smaller) or dilation (getting larger). In bright light, the pupil constricts to allow less light to enter which protects the sensitive retina, and in low light the pupil dilates to allow more light to enter the eye.

Pupil – this is not a structure but is actually a space in the iris. In the cat, a constricted pupil is slit-shaped, but a dilated pupil is round.

Ciliary body – this structure is part of the uvea and is located behind the iris. It makes the aqueous humour, provides a barrier from the body's blood supply to protect the eye and provides ciliary zonules which attach to the lens and hold it in place.

Choroid – the posterior part of the uvea, this is a layer of blood vessels between the sclera and retina, which also contains the tapetum. This structure serves the retina by providing nutrition and removing waste products.

Tapetum – a layer within the choroid and underneath the retina which acts like a mirror, affording animals better night vision. Light which is not absorbed by the retina passes through to the tapetum, where it is reflected back onto the retina for a second chance at being absorbed by the rods and cones.

Iridocorneal angle (drainage angle) – this is the space at the base of the iris through which aqueous fluid exits the eye. It contains pectinate ligaments with spaces in-between them.

Lens – the lens is a transparent spherical structure. In cats, the shape of the lens in order to accommodate (focus) does not alter as much as it does in people, but it still has a very important function in focusing light rays onto the retina.

Zonules – these fine hair-like structures arise from the ciliary body and attach to the lens, keeping it in place.

Retina – this important layer lies at the back of the eye. It contains the rods and cones essential for vision, and changes light energy into chemical energy and then into electrical energy which can be transmitted through the optic nerve of to the brain where it is interpreted as vision and light perception.

Vitreous – transparent gel which fills the main part of the eye, where it transmits light, supports the retina and helps maintain the shape of the eye.

Optic nerve – the nerve endings of the retina converge at the back of the eye to make the optic nerve, and the impulses generated by light and vision are transmitted through the optic nerve to the brain.

The **aims** of the ocular examination are

- To determine what is wrong with the eye
- To compare with the other eye
- To deduce whether the problem is an eye problem or an ocular manifestation of a systemic disease
- To formulate a treatment plan
- To give the owners a prognosis

History taking:

As with any aspect of veterinary medicine, accurate history taking is crucial to provide useful information. It is important not to rush this step and not to put words into the owners' mouth.

Breed – certain pedigree breeds suffer from hereditary eye disorders. For example, Bassett hounds suffer from glaucoma, and terriers suffer from anterior lens luxation. There are also some breed predispositions, where a certain condition arises with greater frequency in some breeds – for example corneal ulcers in Pugs.

Age – some conditions such as entropion, ectopic cilia and protrusion of the nictitans gland (cherry eye) occur much more frequently in younger animals, whereas neoplasia occurs much more commonly in older animals.

General health – some eye conditions are an ocular manifestation of a systemic disease. Therefore in a dog which has suddenly developed cataracts, systemic signs of diabetes mellitus should be investigated. Similarly in older cats which are presented suddenly blind and with blood in the eyes, systemic hypertension should be considered.

Concurrent medications – medications can influence the eye. People sometimes give their pets old eye medications initially prescribed for other pets or for themselves. This can cause problems such as bacterial contamination of a corneal ulcer, or may cause changes such as atropine dilating the pupil

In-contact animals and people – some ophthalmic conditions in cats are infectious (such as feline herpesvirus and *Chlamydomphila felis* infection, and therefore all cats in the household may have to be treated. A suddenly painful eye in a new puppy to the household which contains a resident cat is likely to be suffering from a scratch to the eye.

Travel history – As pet passports and travelling with pets abroad becomes more common-place, illnesses with which we are not previously used to seeing in Ireland may start to be seen.

Vision – ask the owner if they think that vision is present or not, if there have been any changes, and if there has been any deterioration in night vision

Pain – ask the owners if the animal has been exhibiting signs of ocular pain such as blepharospasm (squinting), epiphora (increased tearing) or photophobia.

Change in appearance – ask about the progression of the condition

Duration of the problem – this is important to ascertain the initial cause

Basic Instrumentation:

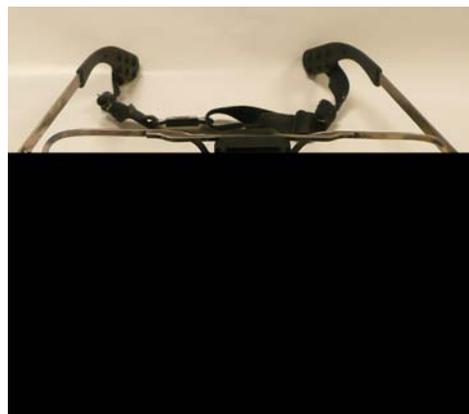
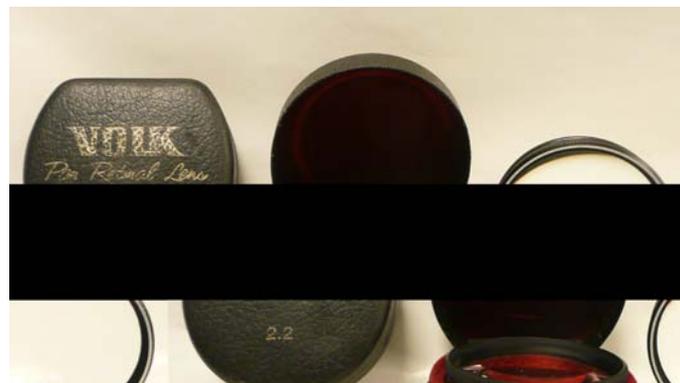
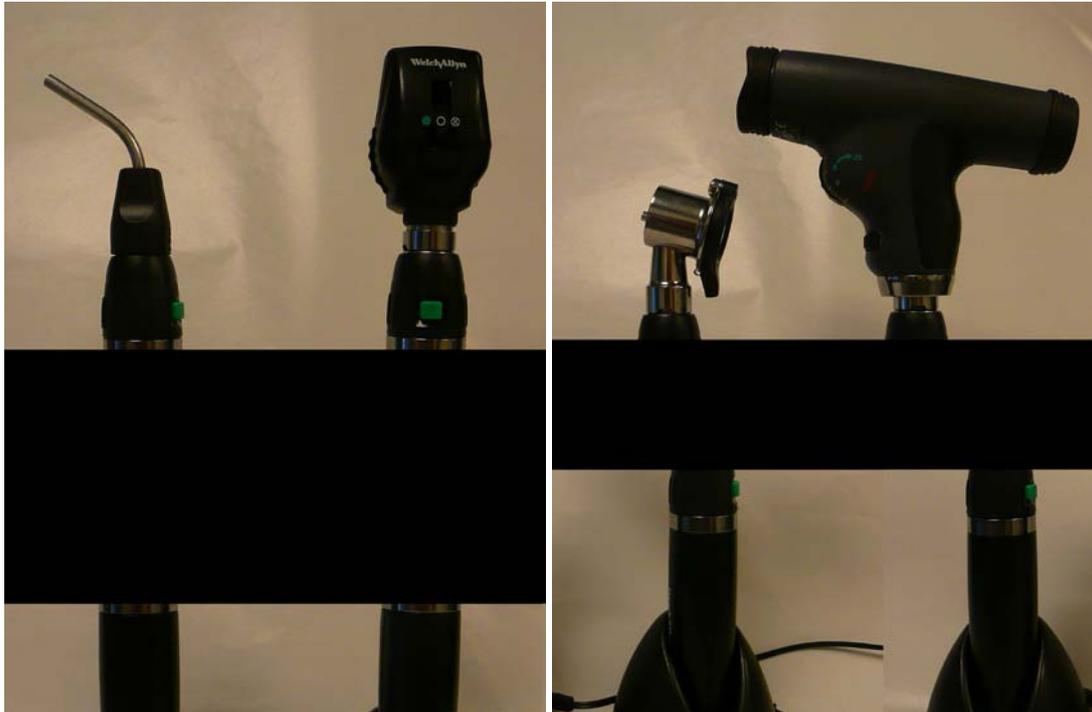
Focal light source (pen-light / Finhoff transilluminator / otoscope / direct ophthalmoscope)

Direct ophthalmoscope (e.g. Welch Allyn, Heine, Keeler)

Magnification – otoscope / direct ophthalmoscope / slit-lamp

Condensing lens (e.g. Volk, Heine, Nikon)

Magnifying loupe (e.g. Heine or Keeler)



Additional instruments (available at referral centres)

Binocular indirect ophthalmoscope (e.g. Keeler, Heine, Neitz)

Monocular indirect ophthalmoscope (pan-optic ophthalmoscope, Welch Allyn)

Slit-lamp biomicroscope (e.g. Kowa SL-15)

Tonometer (e.g. Tono-vet applanation tonometer)

Disposables for ancillary tests:

Cotton wool

Saline

Mydriatic (tropicamide 1% - available as Mydracyl or in Minims vials, Smith & Nephew)

Fluorescein dye (available as sterile strips or in Minims vials – sodium fluorescein 1%, Smith & Nephew)

Local anaesthetic – Proxymetacaine 1% Minims vials are most frequently used as they are less irritating than amethocaine 1%. They do not contain a preservative and therefore are single use only.

Schirmer tear test paper strips (Schering-Plough)

Swabs for bacterial culture and virus isolation

Lacrimal cannulae (usually plastic preferable, although metal cannulae available)

Examination room:

Ideally the examination room needs to be quiet and it should be able to be darkened. This can be achieved by fitting black-out blinds, or moving the patient to another room such as an x-ray room.

Cats should be allowed a few minutes to acclimatise to the room. They should be gently restrained, using a towel only if necessary.

Dogs are generally best examined on a table, although large dogs are examined on the floor – preferably backed into a corner



Examination techniques:

It is best to adhere to a systematic protocol, examining all parts of the eye in order. By doing this, it is less likely that problems will be missed. Both eyes require examination. Firstly, the animal is examined with the lights on.

Attention should be paid to the following points:

- Facial symmetry
- Palpebral reflex
- Menace response
- Dazzle reflex
- Pupillary light responses (PLR)



To carry out a PLR, the light should be shone into the lateral aspect of the eye for maximal response. Constriction of the pupil being examined is called the indirect response. At the same time, the other pupil should constrict, and this is called the indirect or consensual response. PLR may be normal, partial, sluggish or absent. Animals with no vision can have normal PLRs (e.g. cases with cataracts) and normally visual animals can have absent PLRs (e.g. older animals with iris atrophy, an age-related condition).

Lights-off examination.

The suggested order is as follows:

1. Distant direct ophthalmoscopy
2. Focal light source examination
3. Examination with magnification

4. Indirect ophthalmoscopy
5. Close direct ophthalmoscopy

1. Distant direct ophthalmoscopy

This technique is quick and simple to perform and can provide very valuable information.

- It is performed in a darkened room.
- The lens of the direct ophthalmoscope is set to zero.
- One arms length distance from the patient
- Holding the ophthalmoscope up to your eye, look at the tapetal reflection



Much information can be gained

- Anisocoria (difference between the size of the pupils)
- Lack of tapetal reflection (something in the way – e.g. cataract)
- Distinguish nuclear sclerosis from cataract (a cataract is opaque and it is not possible to see through it, whereas with nuclear sclerosis a normal tapetal reflection with a ring is obtained)
- Focal opacities, e.g. corneal pigmentation
- Aphakic crescent – with lens luxation, a moon-shaped crescent of tapetal hyperreflectivity can be seen
- The retina with its blood vessels can be seen if it is detached

2. Focal light source examination

Using a penlight, Finhoff transilluminator, or the light provided by a direct ophthalmoscope, a general examination of the eyelids and the eye is made, usually starting with the outside and working in. Examination should include:

- eyelids
- lacrimal punctae
- conjunctiva, episcleral, sclera and limbus
- cornea
- anterior chamber
- iris
- lens
- vitreous

The PLRs are repeated as they can be different in light and dark environments.

3. Examination with magnification

Using an otoscope, a direct ophthalmoscope changing the lens dial setting, or a slit-lamp, a more careful examination of the anterior is carried out. Attention is paid to finer details, such as distichia or ectopic cilia on the eyelids, opacities on the cornea, turbidity in the anterior chamber etc.



4. Examination of the fundus

The **fundus** should always be examined. This includes the retina and the optic nerve. It is important to familiarise yourself with the normal fundus, as there are lots of normal variants with different appearances. This is best achieved by examining many animals – for example, make a quick fundus exam part of a normal general health check for vaccination until you are more familiar with the normal. This way, you will be much better able to appreciate the abnormal.

The **optic nerve** should be assessed for colour (red, pale) size (smaller or enlarged) or appearance (raised, depressed).

The **retina** of course cannot be directly seen in the normal animal as it is transparent, but it can be seen as a grey/ white veil when it is detached. The retinal blood vessels can be examined for calibre (attenuated or not), colour and tortuosity.

The **tapetum** is a reflective structure sitting underneath one area of the retina and is present in most animals. It should be examined for hyper-reflectivity, hypo-reflectivity or haemorrhages.

The non-tapetal fundus is the grey / brown area of the fundus excluding the tapetum and optic nerve. This area is often forgotten in examination as it is less obvious. It should be examined for elevations, pigmentation or depigmentation.



Dilation

The best view of the fundus is viewed after pharmacological dilation of the pupils. This is achieved with 1% tropicamide drops, available as Mydracyl drops or Minims vials. One drop is applied to both eyes. Dilation takes 20-30 minutes to achieve full effect, and therefore it is important to be patient. Many owners are familiar with this requirement if they have had their own eyes examined.



The fundus may be examined using in-direct or direct ophthalmoscopy. Using **indirect ophthalmoscopy**, the picture obtained is much larger than that obtained on close direct ophthalmoscopy, and therefore much easier to interpret. The technique takes a little longer to learn, but is very rewarding as the view obtained is so clear due to the wide field of view.

Technique for indirect ophthalmoscopy

The light from the pen-torch or Finhoff transilluminator is shone into the eye from one arms distance away, until the tapetal reflection is obtained.

The condensing lens is placed approximately 2-3 cm in front of the animals eye.

The lens or the observers head can be moved slightly to alter the image seen fill up the entire condensing lens.

The image is upside-down and inside out, therefore practice is required to be able to navigate around the fundus – the lens needs to move in the opposite direction to what it seems.



At referral centres, a **head-mounted indirect ophthalmoscope** is used as the view is again improved, and two hands are available to use.



A **monocular indirect ophthalmoscope** such as the Welch Allyn ophthalmoscope is useful small and large animals. The advantages are that a better view can be obtained through a small pupil, and that the image is the right way up.



Technique for direct ophthalmoscopy

The traditional way to examine the fundus is with the **direct ophthalmoscopy**.

- Set the lens dial wheel to zero
- Use your right eye to examine the animals right eye, and your left eye to examine the patients left eye
- Hold the ophthalmoscope close to your eye
- Obtain the tapetal reflection from a short distance away
- Move forward as close to the animals eye as possible as a better view will be gained, similar to looking through a key-hole
- The optic nerve head is identified and examined
- The rest of the tapetal and non-tapetal fundus is examined in quadrants

The image obtained is the correct way up. It is highly magnified, and this can make interpretation of lesions difficult.



In an ideal world, in-direct ophthalmoscopy (for example with a pen-torch and condensing lens) is performed first. If lesions are seen or suspected, these can then be examined more closely with direct ophthalmoscopy.

Schirmer tear test technique

Tear test strips are available from Schering-Plough, Sno tears and Dioptrix. The Schering-Plough strips are useful as they have a notch for easy placement, are calibrated with a millimeter scale and are impregnated with a blue dye for easy visualisation of the result.

The test should be carried out in every case of ocular discharge, conjunctivitis and keratitis. It should be carried out *before* placement of other topical drops such as local anaesthetic.

To perform the test, first bend the notched area over 90° *before* opening the packet. Then open the packet from the end with L and R for left and right. Try to handle the strip only at this end, as oils on your fingers can absorb onto the strip and prevent the passage of tears down the strip. Gently pull out the lower eyelid slightly. Place the notched section of the strip onto the conjunctival position of the eyelid laterally, so that it may contact the cornea. This is left in place for sixty seconds. If possible, quickly place the strip in the second eye also – the test is then over in one minute instead of two. During these sixty seconds, it is useful to place a hand on the animals' neck area to prevent them from raising their paws to rub out the strips. The distance travelled by the tears on the test strip in sixty seconds is recorded. The following chart provides the normal values for dogs and cats.



Schirmer tear test – before application of any topical eye drops

Reading in mm/minute	Interpretation	Action required
0-10	Insufficient tear production	Treatment is required
10-15	Lower than normal	Treatment may be required, monitoring is very important
15-25	Normal	
>25	Normal or excessive	Occasionally needs investigation

Note – **cats** have variable results and a value of <10mm wetting per minute is considered significant in the presence of ocular surface disease.

Fluorescein stain:

Using fluorescein stain is straight-forward, but it is possible to get it wrong. Fluorescein is a water-soluble ophthalmic dye available as sterile single-use vials (Minims Fluorescein 1% or 2%, Chauvin) or as impregnated paper strips (Fluorets, Chauvin) which need to be moistened by a drop of saline or topical anaesthetic. One drop is applied and excess dye must be then flushed from the eye – otherwise it pools in any irregularities on the corneal surface and appears like uptake of dye. The dye is highly lipophobic and hydrophilic, and therefore does not remain in contact with an intact corneal epithelium with its lipid cell membranes. However with corneal ulceration, there is a breach in the corneal epithelium, leaving the stroma exposed which absorbs and retains fluorescein. Descemet's membrane does not uptake fluorescein; therefore a clear area at the base of a deep defect in the cornea is a bad sign, as the ulcer is very deep and in danger of rupturing. Observing fluorescein stain uptake is greatly enhanced by examining with a blue light – using a Wood's lamp, a blue filter attached to the end of your pen torch or your ophthalmoscope which may contain a blue filter. The stained cornea may be shown to the owners which can help them to understand their pet's problem.

The fluorescein dye may appear at the nares in approximately five minutes. This confirms the patency of the nasolacrimal duct. The absence of fluorescein dye at the nares is not diagnostic for blockage of the nasolacrimal duct, as it may be draining into the pharynx, as it is in the cat photographed below, thus it is appearing in the mouth. However this Jones test is useful to perform.

Every painful, red or inflamed eye should have fluorescein stain to check for corneal ulceration routinely.



Tonometry:

Measurement of intraocular pressure is very useful for the diagnosis of glaucoma (raised intraocular pressure), uveitis (lowered intraocular pressure) and for monitoring response to treatment. Tonometry is done after application of topical anaesthetic. Glaucoma is a very serious condition which can rapidly cause blindness, and it is very painful. Rapid referral is required should glaucoma be suspected. The cause of the glaucoma also needs to be determined. Gonioscopy is carried out, which is the examination of the drainage angle of the eye. This is accomplished by applying a contact lens to the eye to allow for the bending of light, and it is a technique which requires a lot of practice.



Recommended textbooks:

The following books are familiar to the author – there are several excellent text books on this subject and omission from this list does not reflect on the quality of those publications.

BSAVA Manual of small animal ophthalmology. 2002. Second Edition. Edited by Simon Peterson-Jones and Sheila Crispin. ISBN 0 905214 54 4

- this is a comprehensive book containing much useful information

Veterinary ophthalmology: a manual for nurses and technicians. 2005. Sally Turner. Elsevier. ISBN 0-7506-8841-6

- this book contains information aimed at the ophthalmic veterinary nurse but is very comprehensive and written in a manner easy to learn from

Small animal ophthalmology. 2008. Sally Turner. Elsevier. ISBN 978-0-7020-2872-4

- a more comprehensive textbook with a case-based approach, with many useful pictures and illustrations

Ophthalmic disease in veterinary medicine. 2005. Charles L Martin. Manson Publishing Ltd. ISBN 1-84076-016-8

- this book is more suited to practitioners who require a more in-depth knowledge of ophthalmic disease, and is an excellent text book. It also covers ocular problems in large animals.

Canine ophthalmology: an atlas and text. 2002. KC Barnett, J Sansom, C Heinrich. Saunders. ISBN 0-7020-1997-6

- a combination of both atlas and text, this book is a very useful guide to keep in the consulting room

Feline ophthalmology: an atlas and text. 1997. KC Barnett and SM Crispin. Saunders. ISBN 0-7020-1662-4

- a combination of both atlas and text, this book is a very useful guide to keep in the consulting room

Slatter's Fundamentals of veterinary ophthalmology. 2008. Fourth edition. David J Maggs, Paul E Miller and Ron Ofri. Saunders Elsevier. ISBN 978-0-7216-0561-6

Equine textbooks:

Equine Ophthalmology. 2005. Brian C Gilger. Elsevier Saunders. ISBN 0-7216-0522-2

Equine Ophthalmology An Atlas and Text Second Edition. 2004. KC Barnett, SM Crispin, AG Matthews. Saunders. ISBN 0-7020-2748-0

Ophthalmology for the Equine Practitioner. 2002. Dennis E Brooks. Teton NewMedia. ISBN 189344151-2

When to refer:

Urgent referral required –

- Deep or melting corneal ulcers
- Perforating or penetrating corneal foreign bodies
- Deep corneal cat scratch injuries
- Sudden blindness
- Glaucoma
- Uveitis

Cases where referral should be considered –

- Cataracts
- Severe eyelid problems
- Neoplasia of the orbit or globe
- Ocular pain with no apparent cause
- Feline sequestrum
- Superficial corneal ulcers unresponsive to treatment
- Conjunctivitis unresponsive to treatment
- KCS unresponsive to treatment (for alternative treatments or parotid duct transposition)