CLINICAL ATLAS OF
CANINE AND FELINE
OPHTHALMIC DISEASE
CLINICAL ATLAS OF CANINE AND FELINE OPHTHALMIC DISEASE

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It is some years since I made the conscious decision to further my postgraduate knowledge of the complex and fascinating world of veterinary ophthalmology. With the passing of the intervening years, I have had the immense good fortune to interact with a number of clinician-scientists, all of whom have generously shared their time, experience, and knowledge with me. In particular, I am indebted in this regard to Drs. Peter Bedford, Randy Scaglotti, Kirk Gelatt, Paul Miller, Dick Dubielzig, Bill Dawson, and Mark Sherwood. I am frequently asked to give lectures about various ophthalmic topics to audiences ranging from students to experienced ophthalmologists, and it is most commonly through photographic images that I am able to share my own thoughts and experience. The field of veterinary ophthalmology, detailed ophthalmic texts, and the peer-reviewed ophthalmic literature represent a sometimes challenging and potentially confusing arena and, as a consequence, I have sought here to provide the busy general practitioner with a clear, systematic, repeatable clinical picture of the most frequently encountered ophthalmic conditions in small animal practice. Images are intentionally presented in the same way as cases would be encountered in practice. In order to expand this project beyond that of simply an image atlas, I have also tried to provide clear, concise, updated, and clinically relevant information as it pertains to each of these conditions. This information has been supported with a small number of relevant references for those who wish to read further.

Any potential drug side effects are identified by this shaded colored box.
ACKNOWLEDGMENTS

Many individuals have contributed to the development of this book. The project, from its inception, has been shaped by my editors and publishers at Wiley, with special thanks to Erica Judisch, Nancy Turner, and Catriona Cooper. The images within this volume have mostly been sourced from my own collection; however, I have relied on friends and colleagues to discuss clinical presentations, help source cases (and in some instances provide images) in order to achieve completeness. In this regard, I acknowledge Drs. Dustin Dees, Anne-Michelle Armour, Nicole McClaren, Randy Scagliotti, Al MacMillan, Christin Chapman, David Wilkie, Matthew Fife, Nancy Park, Anastasia Komenou, Jennifer Urbanz, Peter Bedford, David Williams, David Donaldson, Julius Brinkis, Dilip Bhalerao, Emily Moeller, Francesca Venturi, Neal Wasserman, Joanna Norman, Keith Collins, Steve Sissler, Melanie Church. Ashley Stich, Laura Wilson, Rudayna Gubash, Allison Kirby, Nick Millichamp, Mark Haskins, Gwen Lynch, and Kristina Narfstrom. I am additionally grateful to a number of the affiliated specialists with whom I work, for their willingness to source and discuss cases commonly presented to the services of internal medicine, dermatology, and oncology. In this regard, I particularly acknowledge Drs. Wayne Rosenkrantz, Colleen Mendelsohn, Melissa Hall, Julie Bulman-Fleming, and David Bommarito. The time taken to collate and describe these conditions was allocated by Karen Webster and sponsored by Eye Care for Animals as part of its ongoing commitment to advancing the field of veterinary ophthalmology. Finally but most importantly I am endlessly grateful to my wife Sara, herself a gifted and passionate veterinary ophthalmologist. Without her endless assistance, clinical expertise, and patient advice, this book would simply not have been possible.

For Sara and Justin With all my love Doug Esson Tustin, California, 2014
Section 1

Anatomy and Diagnostics
Normal canine and feline orbital anatomy comprises the following:

- The orbit, made up of bones, connective tissue, lacrimal and salivary glandular tissue, adipose tissue, blood vessels, and nerves.
- The eyelids, comprising skin, orbicularis oculi muscles, deep tarsal, and superficial conjunctival tissue. These tissues also contain mucus-producing goblet cells, lipid-producing meibomian glands, and the openings of the nasolacrimal drainage system.
- The third eyelid, comprising a T-shaped cartilaginous structure, which surrounds the lacrimal gland of the third eyelid and is covered with conjunctival tissue.
- The external shell of the eye, comprising the cornea anteriorly and the episcleral and scleral tissues posteriorly. The cornea is composed of an outer epithelium (with its basement membrane), central stroma, and underlying endothelial layer (with its basement or “Descemet’s” membrane).
- The uveal tract, composed of the anterior iris and ciliary body and the posterior choroid, which is the vascular supply to the retina.
- The lens, which is suspended from the ciliary body by zonular ligaments and surrounded by the lens capsule.

The neuroretina which comprises:

- Nerve fiber layer and inner limiting membrane
- Ganglion cell layer
- Inner nuclear and inner plexiform layers
- Outer nuclear and outer plexiform layers
- Photoreceptors (rods & cones) and outer limiting membrane
- Retinal pigment epithelium.

Retinal ganglion cells coalesce to form the optic nerve which exits the globe posteriorly, through the porous lamina cribrosa.
Figure 1.1 Normal ocular anatomy.
Both canine and feline irides may demonstrate a range of pigmentary variations. True ocular albinism (the complete lack of pigment) is rare. The term subalbinism describes pigment dilution resulting in variably grey to bluish colored iridial tissue, a finding common in animals with light hair coat colors. The term heterochromia iridis describes variable combinations of pigment within either one or both irides.
Figure 2.1 Normal variation in pigmentation between left and right eyes.

Figure 2.2 Normal heterochromic variation in pigmentation within a light colored iris.

Figure 2.3 Normal heterochromic variation in pigmentation within a dark colored iris.

Figure 2.4 Normal blue iris (the “red reflex” of the subalbinotic fundus being visible through the pupil).
CHAPTER 3
THE NORMAL CANINE FUNDUS

The canine fundus exhibits a wide variation in normal appearance, comprising a tapetal as well as a non-tapetal region, the optic nerve head, associated vasculature, and multilayered neuroretina, all of which overlie the choroidal vascular bed. The juvenile canine fundus typically appears bluish in color until maturation within the first 3–4 months of life.

The specialized cells of the tapetal region contain reflective material comprising zinc/cysteine as well as a poorly to non-pigmented retinal pigment epithelial (RPE) layer, which facilitates low-light vision. This region is typically bright yellow to green in coloration.

The non-tapetal fundus is usually dark in color because of the presence of pigment within the RPE.

The optic nerve (“optic disc,” “optic papilla”) appears as a variably shaped and variably myelinated white to pink structure within the fundus, representing the accumulation of ganglion cells and displaying an incomplete vascular circle surrounding a central physiologic pit.

Radiating from the ONH are 3–4 large veins and 15–20 smaller arterioles.
**Figure 3.1** Normal pigmented canine fundus. The bluish color indicates immaturity.

**Figure 3.2** Normal pigmented canine fundus (predominantly green).

**Figure 3.3** Normal pigmented canine fundus (predominantly yellow).

**Figure 3.4** Normal pigmented canine fundus (speckled).
CHAPTER 4
THE NORMAL FELINE FUNDUS

The feline fundus exhibits a wide variation in normal appearance, comprising a relatively large tapetal as well as non-tapetal region, the optic nerve head, associated vasculature, and multilayered neuroretina, all of which overly the choroidal vascular bed.

The specialized cells of the tapetal region contain reflective material comprising zinc/riboflavin as well as a poorly to non-pigmented retinal pigment epithelial (RPE) layer, which facilitates low-light vision. This region is typically bright yellow to green in coloration.

The non-tapetal fundus is usually dark in color due to the presence of pigment within the RPE.

The optic nerve (“optic disc,” “optic papilla”) appears as a small, circular, unmyelinated white to grey structure within the fundus, representing the accumulation of ganglion cells.

Three major pairs of arterioles as well as larger venules radiate from the ONH.
**Figure 4.1** Normal pigmented feline fundus (predominantly green), note the poorly myelinated optic nerve head.

**Figure 4.2** Normal pigmented feline fundus (predominantly green), note the poorly myelinated optic nerve head.

**Figure 4.3** Normal pigmented feline fundus (predominantly yellow), note the poorly myelinated optic nerve head.

**Figure 4.4** Normal pigmented feline fundus (predominantly yellow), note the poorly myelinated optic nerve head.
Dogs or cats displaying blue irides, heterochromic irides, and/or merled coat coloration, typically display “subalbinotic” fundi. In these animals, the tapetal region may be variably reduced to absent in association with a variable to complete lack of pigment within the non-tapetal fundus. As a result, underlying choroidal vasculature is visible against the white scleral background. The subalbinotic fundus represents a normal variation in coloration.
Figure 5.1 Normal (canine) subalbinotic fundus. Choroidal vessels are clearly visible against the white scleral background.

Figure 5.2 Normal (canine) subalbinotic fundus. Choroidal vessels are clearly visible against the white scleral background.

Figure 5.3 Normal (canine) subalbinotic fundus. Choroidal vessels are clearly visible against the white scleral background.

Figure 5.4 Normal (feline) subalbinotic fundus. Choroidal vessels are clearly visible against the white scleral background.
The optic nerve head (ONH) comprises coalescing ganglion cells as they converge before exiting the globe caudally through the porous lamina cribrosa. This region is variably myelinated; poorly in the cat and variably in the dog. Variations in the amount of myelin present may result in range of normal appearances when this region is visualized.
Figure 6.1  Normal moderately to heavily myelinated canine optic nerve head.

Figure 6.2  Normal moderately to heavily myelinated canine optic nerve head.

Figure 6.3  Normal moderately to heavily myelinated canine optic nerve head.

Figure 6.4  Normal moderately to heavily myelinated canine optic nerve head.
CHAPTER 7
THE OCULAR EXAMINATION

The ophthalmic examination should comprise the following components.

**HISTORY**
Signalment, pre-existing medical/surgical history (including travel history), and/or current medications.

**PRESENTING COMPLAINT**
Identification of the presenting ophthalmic complaint.

**DISTANT “HANDS-OFF” EXAMINATION**
Patient is allowed to move around freely—demonstrating mentation, neurological status, and visual ability.

**BRIEF GENERAL PHYSICAL EXAMINATION**
Includes assessment of mucous membranes, oral cavity, external ear canals, thoracic auscultation, palpation of lymph nodes and abdomen and body temperature.

**CLOSE UP “HANDS-ON” EXAMINATION**
Includes careful palpation of the skull and orbits, noting any deformity, asymmetry, crepitus, or discomfort.

**NEURO-OPHTHALMIC EXAMINATION**
- Palpebral reflex (closure of eyelids upon tactile stimulus)
- Menace response (eyelid closure and/or head withdrawal in response to menacing hand gesture)
- Dazzle reflex (closure of eyelids in response to bright focal light source being shined into eye)
- Pupillary light reflex (PLR) (direct and consensual reflex pupillary miosis in response to a focal light source).

**SEGMENTAL ANTERIOR EXAMINATION**
A focal light source is used to examine the eyelids, conjunctival surfaces, third eyelid, sclera, cornea, anterior chamber (AC), iris, lens, and anterior vitreous face.

**FUNDIC EXAMINATION**
The posterior segment is examined using either a focal light source and handheld lens or an ophthalmoscope.

**ANCILLARY DIAGNOSTICS**
- **Schirmer tear test I (STT1).** Schirmer strip placed into ventral fornix for one minute, normal value = 15–20 mm/ wetting/min
- **Intraocular pressure (IOP) estimation.** Using either an applanation or rebound tonometer, the probe tip is applied to the axial cornea several times in order to generate an average estimation of IOP (normal value = 15–25 mmHg)
- **Vital corneal staining.** Sodium fluorescein dye is applied to the cornea then excess carefully irrigated away to detect retention associated with epithelial defects. Fluorescein dye may also be used to assess nasolacrimal duct patency (“Jones” test) and/or aqueous leakage from the anterior chamber (“Seidel” test).

Where indicated, additional diagnostic aids may include obtaining blood samples for complete blood count (CBC), chemistry, metabolic, endocrine and/or infectious titer testing, the harvesting of microbial samples for culture and sensitivity testing as well as cytological and/or histological examination and/or advanced imaging (including radiography, B-mode ultrasonography, computed tomography, and/or magnetic resonance imaging).
Figure 7.1  Estimation of intraocular pressure (IOP) using a rebound tonometer (“Tonovet”). The probe-tip is gently allowed to contact the axial corneal surface (without the use of local anesthetic) by pressing the measurement button. Several readings are taken, so that aberrant readings may be disregarded.

Figure 7.2  Measurement of lacrimal function using gradated (“Schirmer”) tear strips. The tip of each strip is folded and placed into the lower medial fornix for one minute and the resultant STT1 value recorded. This test should be performed before the installation of any topical agents.

Figure 7.3  Vital staining of the corneal surface using fluorescein-impregnated strips. Strips are moistened using a physiologic solution and gently touched to the scleral limbus. Excess stain is then carefully irrigated away using eyewash to prevent “pooling” of residual stain.

Figure 7.4  Visualization of the fundus using a simple handheld indirect lens, positioned just in front of the eye and parallel to the posterior segment. Where an indirect ophthalmoscope is unavailable, a small flashlight or transilluminator, held adjacent to the examiner’s head, will suffice as a distant focal light source.