Color Atlas of Veterinary Ophthalmology

Second Edition

Kirk N. Gelatt
Distinguished Professor of Comparative Ophthalmology Emeritus,
Department of Small Animal Sciences,
College of Veterinary Medicine, University of Florida,
Gainesville, FL, USA

and

Caryn E. Plummer
Associate Professor of Comparative Ophthalmology and Service Chief,
Veterinary Ophthalmology Service,
Department of Small Animal Clinical Sciences,
College of Veterinary Medicine, University of Florida,
Gainesville, FL, USA

WILEY Blackwell
Contents

Preface xv

1 Ocular Anatomy 1
   Fig. 1.1 Eye anatomy 2
   Fig. 1.2 Eyelid 5

2 The Ophthalmic Examination and Diagnostics 7
   Fig. 2.1 Ophthalmic examination equipment 8
   Fig. 2.2 Ophthalmic examination 10
   Fig. 2.3 Ophthalmic examination in a horse 11
   Fig. 2.4 Nasolacrimal patency 12
   Fig. 2.5 Microbiologic culture and susceptibility testing 13
   Fig. 2.6 Cytology 14
   Fig. 2.7 Ophthalmic stains 15
   Fig. 2.8 Slit lamp biomicroscopy 17
   Fig. 2.9 Intraocular pressure 18
   Fig. 2.10 Gonioscopy 19
   Fig. 2.11 Ophthalmoscopy 20

3 Clinical Signs and Their Interpretations 25
   Fig. 3.1 Blepharospasm 26
   Fig. 3.2 Epiphora 27
   Fig. 3.3 Exophthalmos/enophthalmos/strabismus 27
   Fig. 3.4 Microphthalmia/phthisis bulbus/buphthalmos 29
   Fig. 3.5 Conjunctival hyperemia 30
   Fig. 3.6 Iridocyclitis 32
   Fig. 3.7 Episceral venous congestion 33
   Fig. 3.8 Corneal edema 34
   Fig. 3.9 Corneal ulceration/vascularization 36
   Fig. 3.10 Corneal pigmentation 38
   Fig. 3.11 Corneal cellular infiltrate 38
   Fig. 3.12 Sequestrum 40
   Fig. 3.13 Corneal fibrosis 41
   Fig. 3.14 Corneal lipidosis 42
   Fig. 3.15 Hemorrhages 43
   Fig. 3.16 Opacity in the anterior chamber 45
   Fig. 3.17 Mydriasis/miosis 46
   Fig. 3.18 Posterior synechiae 47
   Fig. 3.19 Rubeosis irides 48
   Fig. 3.20 Acute chorioretinal inflammations 50
   Fig. 3.21 Chronic chorioretinal inflammation 50
4 Canine Orbit 53
Fig. 4.1 Microphthalmia 54
Fig. 4.2 Acute orbital cellulitis/retrobulbar abscess 55
Fig. 4.3 Zygomatic salivary mucocele 56
Fig. 4.4 Acute masticatory myositis 57
Fig. 4.5 Bilateral polymyositis 58
Fig. 4.6 Microphthalmos/strabismus 59
Fig. 4.7 Traumatic proptosis 60
Fig. 4.8 Orbital trauma 62
Fig. 4.9 Craniofacial osteopathia 62
Fig. 4.10 Orbital masses 63
Fig. 4.11 Enucleation 64
Fig. 4.12 Intraocular silicone prosthesis 65
Fig. 4.13 Phthisis bulbi 66

5 Canine Eyelids 67
Fig. 5.1 Ankyloblepharon 68
Fig. 5.2 Eyelid agenesis 68
Fig. 5.3 Dermoid 68
Fig. 5.4 Blepharophimosis 69
Fig. 5.5 Euryblepharon 69
Fig. 5.6 “V” notch in the central lower eyelid 70
Fig. 5.7 Entropion 71
Fig. 5.8 Ectropion 73
Fig. 5.9 Combined entropion–ectropion 74
Fig. 5.10 Distichia 75
Fig. 5.11 Ectopic cilia 76
Fig. 5.12 Trichomegaly 76
Fig. 5.13 Trichiasis 76
Fig. 5.14 Eyelid laceration 77
Fig. 5.15 Pyoderma blepharitis 78
Fig. 5.16 Sarcoptic mange 78
Fig. 5.17 Immune-mediated blepharitis 79
Fig. 5.18 Pyogranulomatous blepharitis 79
Fig. 5.19 Uveodermatologic syndrome 80
Fig. 5.20 Meibomianitis 81
Fig. 5.21 Hordeolum/chalazion 82
Fig. 5.22 Proliferative keratoconjunctivitis 82
Fig. 5.23 Adenoma of the meibomian gland 83
Fig. 5.24 Melanoma of the lower eyelid 84
Fig. 5.25 Squamous cell carcinoma/mast cell tumor 84
Fig. 5.26 Histiocytoma 85
Fig. 5.27 Oral papillomatosis 85

6 Canine Tear and Nasolacrimal Systems 87
Fig. 6.1 Acute keratoconjunctivitis sicca 88
Fig. 6.2 Chronic keratoconjunctivitis sicca 90
Fig. 6.3 Sequelae of acute keratoconjunctivitis sicca 91
Fig. 6.4 Qualitative keratoconjunctivitis sicca 92
Fig. 6.5 Entropion 93
Fig. 6.6 Acute dacryocystitis 93
Fig. 6.7 longer term dacryocystitis 94
Fig. 6.8 Dacryocele/dacryops 95
7 Canine Conjunctiva and Nictitating Membrane (Nictitans) 97
   Fig. 7.1 Encircling nictitans 98
   Fig. 7.2 Dermoid of the lateral bulbar conjunctiva 98
   Fig. 7.3 Everted cartilage 99
   Fig. 7.4 Prolapse of nictitans tear glands 100
   Fig. 7.5 Bilateral protrusion of the nictitans 101
   Fig. 7.6 Plasma cell infiltration of the nictitans 101
   Fig. 7.7 Foreign bodies in the nictitans 102
   Fig. 7.8 Primary neoplasms of the nictitans 103
   Fig. 7.9 Conjunctivitis 104
   Fig. 7.10 Follicular conjunctivitis 105
   Fig. 7.11 Chemosis of the conjunctiva 106
   Fig. 7.12 Subconjunctival hemorrhage 107
   Fig. 7.13 Non-neoplastic inflammatory masses of the conjunctivas and nictitans 108
   Fig. 7.14 Neoplasms of the canine conjunctiva 109

8 Canine Cornea and Sclera 111
   Fig. 8.1 Corneoconjunctival dermoid 112
   Fig. 8.2 Ocular dysgenesis 112
   Fig. 8.3 Persistent pupillary membranes 113
   Fig. 8.4 Corneal erosion 114
   Fig. 8.5 Corneal ulcer 115
   Fig. 8.6 Central corneal ulcer 118
   Fig. 8.7 Fungal keratitis 120
   Fig. 8.8 Pigmentary keratitis 121
   Fig. 8.9 Chronic superficial keratitis 122
   Fig. 8.10 Neuroparalytic keratitis 124
   Fig. 8.11 Neurotropic keratitis 125
   Fig. 8.12 Keratitis 125
   Fig. 8.13 Florida keratopathy 128
   Fig. 8.14 Corneal laceration 128
   Fig. 8.15 Corneal foreign bodies 130
   Fig. 8.16 Corneal stromal dystrophies 132
   Fig. 8.17 Endothelial corneal dystrophy 133
   Fig. 8.18 Corneal degeneration 135
   Fig. 8.19 Corneal cyst 137
   Fig. 8.20 Limbal melanoma 138
   Fig. 8.21 Scleral and conjunctival icterus 138
   Fig. 8.22 Staphyloma 139
   Fig. 8.23 Proliferative keratoconjunctivitis 139

9 Canine Glaucomas 143
   Fig. 9.1 Optic nerve head and primary open angle glaucoma 144
   Fig. 9.2 Optic nerve head changes in primary narrow/closed angle glaucoma 144
   Fig. 9.3 Congenital glaucoma 145
   Fig. 9.4 Congenital glaucoma 145
   Fig. 9.5 Primary narrow/closed angle glaucoma 146
   Fig. 9.6 Primary narrow/closed angle glaucoma with pectinate ligament dysplasia 148
   Fig. 9.7 Primary narrow/closed angle glaucoma and globe enlargement 150
   Fig. 9.8 Lens luxations or displacements 151
   Fig. 9.9 Cataract formation, resorption, lens-induced uveitis, and glaucoma 153
   Fig. 9.10 Chronic uveitis/uveal cysts syndrome 155
   Fig. 9.11 Secondary aphakic/pseudophakic glaucoma 157
10 Canine Anterior Uvea

Fig. 10.1 Heterochromia iridis 164
Fig. 10.2 Merle ocular dysgenesis 165
Fig. 10.3 Persistent pupillary membranes 166
Fig. 10.4 Iridal nests 167
Fig. 10.5 Iridal coloboma 167
Fig. 10.6 Acute iridocyclitis 168
Fig. 10.7 Uveodermatologic syndrome/chronic anterior uveitis 170
Fig. 10.8 Anterior uveitis following rickettsial infestation 171
Fig. 10.9 Iridocyclitis following heartworm infestation 171
Fig. 10.10 Anterior uveitis secondary to infectious canine hepatitis 172
Fig. 10.11 Mycotic iridocyclitis and chorioretinitis 173
Fig. 10.12 Iridocyclitis and cataract 174
Fig. 10.13 Pigmentary uveitis 175
Fig. 10.14 Uveodermatologic syndrome 176
Fig. 10.15 Senile iris atrophy 178
Fig. 10.16 Anterior uveal trauma 179
Fig. 10.17 Hyphema 180
Fig. 10.18 Melanoma 182
Fig. 10.19 Ciliary body adenoma/adenocarcinoma 184
Fig. 10.20 Metastatic adenocarcinoma of the ciliary body 185
Fig. 10.21 Lymphoma 185

11 Canine Lens and Cataract Formation

Fig. 11.1 Microphakia 188
Fig. 11.2 Lens coloboma 188
Fig. 11.3 Lenticonus 188
Fig. 11.4 Persistent pupillary membranes leading to cataract 189
Fig. 11.5 Persistent hyaloid and posterior cataracts 190
Fig. 11.6 Cataract formation 191
Fig. 11.7 Nuclear sclerosis of the lens 192
Fig. 11.8 Cataract formation classified by stage of maturity 193
Fig. 11.9 Age of onset and area(s) or region of the lens first involved in cataract formation 196
Fig. 11.10 Diabetic cataract 199
Fig. 11.11 Cataract secondary to inflammation 200
Fig. 11.12 Lens injury following penetrating or blunt trauma 201
Fig. 11.13 Resorbing hypermature cataract 201
Fig. 11.14 Lens subluxation 204
Fig. 11.15 Anterior lens luxation 205
Fig. 11.16 Posterior lens luxation 206
Fig. 11.17 Intraocular lens placement after lens extraction 207

12 Canine Vitreous

Fig. 12.1 Hyaloid remnants 210
Fig. 12.2 Persistent hyperplastic tunica vasculosa lentis 210
13 Canine Ocular Fundus and Optic Nerve 215
Fig. 13.1 Normal variations of the ocular fundus and optic nerve head or disc 216
Fig. 13.2 Collie eye anomaly 217
Fig. 13.3 Retinal dysplasia 219
Fig. 13.4 Progressive retinal atrophy 221
Fig. 13.5 Retinal pigment epithelial dystrophy 223
Fig. 13.6 Inflammations of the retina and choroid 224
Fig. 13.7 Sudden acquired retinal degeneration 225
Fig. 13.8 Ophthalmic manifestations of systemic hypertension 226
Fig. 13.9 Lipemia retinalis 227
Fig. 13.10 Hyperviscosity syndrome 227
Fig. 13.11 Retinal detachment 229
Fig. 13.12 Granulomatous meningoencephalitis 230
Fig. 13.13 Neoplasms of the ocular fundus 231
Fig. 13.14 Optic nerve head disease 231
Fig. 13.15 Micropapilla 232
Fig. 13.16 Optic nerve hypoplasia 232
Fig. 13.17 Optic nerve coloboma 233
Fig. 13.18 Papilledema associated with orbital neoplasm 234
Fig. 13.19 Optic neuritis 234
Fig. 13.20 Optic nerve atrophy 235

14 Feline Ophthalmology 237
Fig. 14.1 Microphthalmia/syblepharon 238
Fig. 14.2 Proptosis 238
Fig. 14.3 Orbital cellulitis 239
Fig. 14.4 Orbital neoplasms 240
Fig. 14.5 Eyelid agenesis 241
Fig. 14.6 Entropion 243
Fig. 14.7 Blepharitis 243
Fig. 14.8 Eyelid neoplasia 244
Fig. 14.9 Keratoconjunctivitis sicca 246
Fig. 14.10 Ophthalmic manifestations of feline herpesvirus-1 247
Fig. 14.11 Recurrent feline herpesvirus-1 conjunctivitis 248
Fig. 14.12 *Chlamydia* conjunctivitis 248
Fig. 14.13 Mycoplasmal conjunctivitis 249
Fig. 14.14 Symblepharon 250
Fig. 14.15 Lipogranulomatous conjunctivitis 250
Fig. 14.16 Corneal ulceration following feline herpesvirus-1 infection 251
Fig. 14.17 Feline herpesvirus-1 stromal keratitis 252
Fig. 14.18 Corneal sequestration and corneal ulceration 252
Fig. 14.19 Eosinophilic keratoconjunctivitis 254
Fig. 14.20 Florida keratopathy 255
Fig. 14.21 Bullous keratopathy 255
Fig. 14.22 Limbal melanoma/conjunctival lymphoma 256
Fig. 14.23 Heterochromia iridis 256
Fig. 14.24 Persistent pupillary membranes 257
Fig. 14.25 Iridocyclitis or anterior uveitis 258
Fig. 14.26 Anterior uveitis in a cat with infectious peritonitis 259
Fig. 14.27 Anterior uveitis in a cat with feline leukemia 260
Fig. 14.28 Panuveitis caused by feline immunodeficiency virus 261
Fig. 14.29 Chronic panuveitis caused by toxoplasmosis 262
Fig. 14.30 Ophthalmic trauma 263
Fig. 14.31 Diffuse iridial melanoma 264
Fig. 14.32 Anterior uveal melanomas 266
Fig. 14.33 Ciliary body adenocarcinoma 267
Fig. 14.34 Trauma-associated sarcoma 268
Fig. 14.35 Ophthalmic manifestations of systemic lymphoma 268
Fig. 14.36 Bilateral congenital glaucoma 269
Fig. 14.37 Ophthalmic manifestations of primary glaucomas 270
Fig. 14.38 Aqueous misdirection 271
Fig. 14.39 Anterior lens luxation 272
Fig. 14.40 Cataracts 273
Fig. 14.41 Primary cataracts 274
Fig. 14.42 Secondary cataracts 275
Fig. 14.43 Normal feline ocular fundus 276
Fig. 14.44 Retinal dysplasia 277
Fig. 14.45 Taurine retinopathy 277
Fig. 14.46 Rod–cone dysplasia/rod–cone dystrophy 278
Fig. 14.47 Chorioretinitis 278
Fig. 14.48 Chorioretinitis secondary to cryptococcosis 280
Fig. 14.49 Hypertensive retinopathy 281
Fig. 14.50 Retinal degeneration 282
Fig. 14.51 Ocular ophthalmomyiasis 283
Fig. 14.52 Retinal detachments 284

15 Equine Ophthalmology 285
Fig. 15.1 Microphthalmia 286
Fig. 15.2 Strabismus 286
Fig. 15.3 Entropion 286
Fig. 15.4 Pigmented dermoid 287
Fig. 15.5 Nasolacrimal duct atresia 288
Fig. 15.6 Heterochromia iridis/iris hypoplasia 289
Fig. 15.7 Congenital glaucoma and lens subluxation 290
Fig. 15.8 Iridocyclitis 290
Fig. 15.9 Congenital cataract 291
Fig. 15.10 Optic nerve hypoplasia 292
Fig. 15.11 Orbit cellulitis 292
Fig. 15.12 Orbital trauma 293
Fig. 15.13 Orbital tumors 294
Fig. 15.14 Phthisis bulbus 295
Fig. 15.15 Eyelid laceration 295
Fig. 15.16 Squamous cell carcinoma 295
Fig. 15.17 Sarcoïd 297
Fig. 15.18 Melanoma 298
Fig. 15.19 Corpora nigra cyst 299
Fig. 15.20 Duct obstruction 300
Fig. 15.21 Dacyrocystitis and secondary conjunctivitis 300
Fig. 15.22 Habronemiasis 301
Fig. 15.23 Corneal ulceration 301
Fig. 15.24 Corneal stromal abscess 305
Fig. 15.25 Herpes viral keratitis 306
Fig. 15.26 Corneal lacerations 306
Fig. 15.27 Eosinophilic keratitis 307
Fig. 15.28 Traumatic hyphema 308
Fig. 15.29 Acute equine recurrent uveitis 309
<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.30</td>
<td>Chronic equine recurrent uveitis</td>
<td>309</td>
</tr>
<tr>
<td>15.31</td>
<td>Chronic equine recurrent uveitis and secondary cataract</td>
<td>310</td>
</tr>
<tr>
<td>15.32</td>
<td>Glaucoma</td>
<td>311</td>
</tr>
<tr>
<td>15.33</td>
<td>Acquired cataracts</td>
<td>311</td>
</tr>
<tr>
<td>15.34</td>
<td>Lens subluxation</td>
<td>312</td>
</tr>
<tr>
<td>15.35</td>
<td>Treatment after phacoemulsification</td>
<td>313</td>
</tr>
<tr>
<td>15.36</td>
<td>Normal ocular fundus of the horse</td>
<td>314</td>
</tr>
<tr>
<td>15.37</td>
<td>Chorioretinitis</td>
<td>315</td>
</tr>
<tr>
<td>15.38</td>
<td>Retinal detachment</td>
<td>315</td>
</tr>
<tr>
<td>15.39</td>
<td>Optic disc degeneration</td>
<td>315</td>
</tr>
<tr>
<td>15.40</td>
<td>Ophthalmic manifestations of proliferative neuropathy</td>
<td>316</td>
</tr>
<tr>
<td>15.41</td>
<td>Ischemic neuroretinopathy</td>
<td>316</td>
</tr>
</tbody>
</table>

**16 Food and Fiber Animal Ophthalmology** 317

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.1</td>
<td>Microphthalmia in a goat</td>
<td>318</td>
</tr>
<tr>
<td>16.2</td>
<td>Strabismus in cattle</td>
<td>318</td>
</tr>
<tr>
<td>16.3</td>
<td>Orbital neoplasia in cattle</td>
<td>319</td>
</tr>
<tr>
<td>16.4</td>
<td>Corneoorbital dermoid</td>
<td>320</td>
</tr>
<tr>
<td>16.5</td>
<td>Entropion in sheep</td>
<td>320</td>
</tr>
<tr>
<td>16.6</td>
<td>Infectious keratoconjunctivitis in a ram</td>
<td>320</td>
</tr>
<tr>
<td>16.7</td>
<td>Mycoplasmal infectious keratoconjunctivitis in a goat</td>
<td>321</td>
</tr>
<tr>
<td>16.8</td>
<td>Infectious bovine keratoconjunctivitis</td>
<td>322</td>
</tr>
<tr>
<td>16.9</td>
<td>Squamous cell carcinoma in cattle</td>
<td>323</td>
</tr>
<tr>
<td>16.10</td>
<td>Persistent pupillary membranes and pigmented anterior capsular cataract in a cow</td>
<td>325</td>
</tr>
<tr>
<td>16.11</td>
<td>Albinism and heterochromia iridis</td>
<td>326</td>
</tr>
<tr>
<td>16.12</td>
<td>Heterochromia iridis in pigs</td>
<td>326</td>
</tr>
<tr>
<td>16.13</td>
<td>Iridocyclitis in a cow secondary to infectious bovine rhinotracheitis</td>
<td>327</td>
</tr>
<tr>
<td>16.14</td>
<td>Secondary glaucoma secondary to infectious bovine keratoconjunctivitis</td>
<td>327</td>
</tr>
<tr>
<td>16.15</td>
<td>Congenital cataract</td>
<td>327</td>
</tr>
<tr>
<td>16.16</td>
<td>Cataract secondary to anterior uveitis</td>
<td>328</td>
</tr>
<tr>
<td>16.17</td>
<td>Normal ocular fundus of the cow/sheep/goat/pig</td>
<td>328</td>
</tr>
<tr>
<td>16.18</td>
<td>Typical or ventral optic nerve head coloboma</td>
<td>330</td>
</tr>
<tr>
<td>16.19</td>
<td>Ocular fundus inflammation associated with systemic infectious diseases</td>
<td>331</td>
</tr>
<tr>
<td>16.20</td>
<td>Nutritional retinal degeneration</td>
<td>331</td>
</tr>
<tr>
<td>16.21</td>
<td>Vitamin A deficiency</td>
<td>332</td>
</tr>
<tr>
<td>16.22</td>
<td>Normal eye and ophthalmic disease in alpaca and llama</td>
<td>333</td>
</tr>
</tbody>
</table>

**17 Ophthalmology in Exotic Pets** 337

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.1</td>
<td>Diseases of the snake spectacle</td>
<td>338</td>
</tr>
<tr>
<td>17.2</td>
<td>Ophthalmic trauma in raptors</td>
<td>339</td>
</tr>
<tr>
<td>17.3</td>
<td>Exophthalmos in a rabbit</td>
<td>341</td>
</tr>
<tr>
<td>17.4</td>
<td>Entropion in a rabbit</td>
<td>341</td>
</tr>
<tr>
<td>17.5</td>
<td>Dacryocystitis and an obstructed nasolacrimal duct in a rabbit</td>
<td>342</td>
</tr>
<tr>
<td>17.6</td>
<td>Blepharconjunctivitis in a rabbit</td>
<td>342</td>
</tr>
<tr>
<td>17.7</td>
<td>Pasteurella conjunctivitis in a rabbit</td>
<td>344</td>
</tr>
<tr>
<td>17.8</td>
<td>Conjunctival overgrowth in a rabbit</td>
<td>344</td>
</tr>
<tr>
<td>17.9</td>
<td>Prolapse of the nictitans and its glands in a rabbit</td>
<td>345</td>
</tr>
<tr>
<td>17.10</td>
<td>Superficial corneal ulcer in a rabbit</td>
<td>346</td>
</tr>
<tr>
<td>17.11</td>
<td>Anterior uveitis in a rabbit</td>
<td>346</td>
</tr>
<tr>
<td>17.12</td>
<td>Inherited congenital glaucoma</td>
<td>347</td>
</tr>
<tr>
<td>17.13</td>
<td>Congenital glaucomas in rabbits</td>
<td>347</td>
</tr>
<tr>
<td>17.14</td>
<td>Normal rabbit ocular fundus</td>
<td>348</td>
</tr>
<tr>
<td>17.15</td>
<td>Cataract formation in ferrets</td>
<td>349</td>
</tr>
<tr>
<td>17.16</td>
<td>Bilateral exophthalmos and elevated nictitans in a ferret</td>
<td>349</td>
</tr>
</tbody>
</table>
18 Systemic Diseases with Ophthalmic Manifestations 351
Fig. 18.1 Merle ocular dysgenesis 352
Fig. 18.2 Oculoskeletal dysplasia 352
Fig. 18.3 Hydrocephalus 352
Fig. 18.4 Ocular sequelae of canine distemper 353
Fig. 18.5 Ocular signs of infectious canine hepatitis 354
Fig. 18.6 Focal papilloma 354
Fig. 18.7 Hemorrhage caused by Rocky Mountain spotted fever 354
Fig. 18.8 Canine brucellosis 355
Fig. 18.9 Mycotic infections or dermatophytosis affecting the eyelids 356
Fig. 18.10 Blastomycosis 357
Fig. 18.11 Coccidioidomycosis 357
Fig. 18.12 Histoplasmosis 358
Fig. 18.13 Cryptococcosis 358
Fig. 18.14 Ocular aspergillosis 359
Fig. 18.15 Ocular sequelae of toxoplasmosis 359
Fig. 18.16 Ocular sequelae of leishmaniasis 360
Fig. 18.17 Ocular sequelae of protothecosis 361
Fig. 18.18 Intraocular heartworm infestation in the dog 362
Fig. 18.19 Ophthalmomyiasis interna 362
Fig. 18.20 Demodex dermatitis 362
Fig. 18.21 Diabetic cataracts 363
Fig. 18.22 Ocular signs of systemic hypertension 363
Fig. 18.23 Ocular signs of hyperlipidemia 365
Fig. 18.24 Retinal hemorrhage 366
Fig. 18.25 Ocular sequelae of renal failure 366
Fig. 18.26 Uveodermal syndrome 366
Fig. 18.27 Ocular sequelae of uveodermal syndrome 367
Fig. 18.28 Ocular sequelae of lymphoma 367
Fig. 18.29 Ocular sequelae of feline herpesvirus 369
Fig. 18.30 Chlamydophila conjunctivitis 370
Fig. 18.31 Chorioretinitis caused by feline infectious peritonitis 371
Fig. 18.32 Anterior uveitis caused by feline immunodeficiency virus 372
Fig. 18.33 Anterior uveitis in a cat secondary to toxoplasmosis 372
Fig. 18.34 Ocular sequelae of feline leukemia virus 373
Fig. 18.35 Cryptococcosis chorioretinitis 373
Fig. 18.36 Feline panleukopenia 374
Fig. 18.37 Ocular signs of systemic hypertension 375
Fig. 18.38 Ocular anomalies in horses related to coat color 375
Fig. 18.39 Habronemiasis 376
Fig. 18.40 West Nile fever and facial nerve paralysis 377
Fig. 18.41 Conjunctival lymphoma 378
Fig. 18.42 Microphthalmos 378
Fig. 18.43 Ophthalmic anomalies of bovine viral diarrhea 378
Fig. 18.44 Ophthalmic anomalies of systemic infectious bovine rhinotracheitis 379
Fig. 18.45 Secondary chorioretinitis 379

19 Neuro-ophthalmic Syndromes 381
Fig. 19.1 Horner's syndrome in the dog/cat 382
Fig. 19.2 Horner's syndrome in the horse 383
Fig. 19.3 Facial nerve paralysis and neuroparalytic keratitis 383
Fig. 19.4 Hemifacial spasms 384
Fig. 19.5 Neurotropic keratitis and fifth nerve paralysis 385
Fig. 19.6 Neurogenic keratoconjunctivitis sicca 386
<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.7</td>
<td>Feline hemidilated pupil</td>
<td>386</td>
</tr>
<tr>
<td>19.8</td>
<td>Haw's syndrome</td>
<td>387</td>
</tr>
<tr>
<td>19.9</td>
<td>Feline strabismus or esotropia</td>
<td>388</td>
</tr>
<tr>
<td>19.10</td>
<td>Fibrosing strabismus</td>
<td>388</td>
</tr>
<tr>
<td>19.11</td>
<td>Lateral/unilateral strabismus</td>
<td>389</td>
</tr>
<tr>
<td>19.12</td>
<td>Convergence strabismus or esotropia</td>
<td>390</td>
</tr>
<tr>
<td>19.13</td>
<td>Bovine strabismus</td>
<td>390</td>
</tr>
<tr>
<td>19.14</td>
<td>Internal ophthalmoplegia or cavernous sinus syndrome</td>
<td>391</td>
</tr>
</tbody>
</table>

Appendix A: Glossary – Frequently Used Veterinary Ophthalmology Terms | 393
Appendix B: Eye Diseases in the Brachycephalic Breeds | 399
Appendix C: Inherited Cataracts in the Dog, Parts 1 and 2 | 401

Index | 403
Based on the success of the publication of the first edition of *Veterinary Ophthalmology* in 1981, subsequent editions were released in 1991, 1999, 2007, and 2013. The continued expansion and more rapid development of veterinary ophthalmology worldwide resulted in the current fifth edition having 35 chapters, 64 authors, and a text of more than 2100 pages. This second edition of the color atlas presents diseases based on their clinical appearances, and provides introductory information to complement the photos to further understand the characteristics of each disease. The most common eye diseases are emphasized, but to be inclusive, the less frequent diseases (and species) have been added.

Ophthalmology is heavily based on direct clinical examination and diagnostics, and hence often photographed. This heavily pictorial text introduces the veterinary medical student and veterinary practitioner to clinical veterinary ophthalmology based on the clinical appearances of the diseases that one would encounter in small and large animal practice. When possible, multiple photographs of selected ophthalmic diseases are included to demonstrate the different stages of these diseases as presented to the clinician, and when medical and/or surgical therapies alter their appearance. In contrast to most color atlases, we have provide a comprehensive text describing each ophthalmic disease (history, clinical findings, diagnosis, recommended therapy, and prognosis) as well as many species, including dog, cat, horse, cattle, and exotic animals. As a result, this color atlas has the largest collection of clinical photographs currently available in a single book, and for many readers a reasonably complete ophthalmic reference for your veterinary medical library and clinic.

This second edition has added chapters and more than doubled the color clinical photographs from the first edition. The first two new chapters are divided into: clinical anatomy with emphasis on the gross morphology and ophthalmic structures the clinician encounters during his/her clinical examination, and ophthalmic diagnostics most useful in general practice. Chapter 3 illustrates the different ophthalmic tissue responses to diseases common all animals, followed with chapters on canine ophthalmology (Chapters 4–13), feline ophthalmology (Chapter 14), equine ophthalmology (Chapter 15); food and fiber animal ophthalmology (Chapter 16); pet exotic animal ophthalmology (Chapter 17); systemic diseases with ophthalmic manifestations in the dog, cat, horse, and food animals (Chapter 18); and neuro-ophthalmology with emphasis on clinical syndromes (Chapter 19). Appendix 1 is a glossary or condensed selection of ophthalmic words, to assist the reader with sometimes confusing nomenclature (derived from the Greek rather than Latin).

Within each chapter, the diseases are divided into sections on: (1) congenital or developmental; (2) inflammatory; (3) traumatic; (4) degenerative; and (5) neoplasia. Often the text for a color atlas is a single sentence noting the disease. However, for this color atlas, additional clinical information has been included. The text for the color illustrations usually includes: (1) the clinical history; (2) the clinical signs and findings associated with the disease; (3) the rule outs or differential diagnoses; (4) the recommended treatment; and (5) prognosis. If a disease changes its appearance significantly over time or during therapy, multiple illustrations are used.

In diagnostic ophthalmology the clinician relies heavily on direct observations of the ophthalmic tissues and interpretations of these lesions. Only in ophthalmology can the examiner directly observe 2–3 cm into a complex organ, and directly observe the body’s vasculature, and part of the central nervous system. There is no substitute or shortcut for a complete ophthalmic examination. The majority of treatment failures are not based on the drug choices or surgical procedures, but because of an incorrect initial diagnosis. The goals of this color atlas are to expand your clinical proficiency and result in improved patient care.

A book of this magnitude and number of photographs has many contributors; the majority from the ophthalmology faculty members, residents, and graduate
students at the University of Florida, College of Veterinary Medicine, during nearly 40 years, and personal veterinary ophthalmology libraries of nearly 60,000 color photographs. Early photographs were recorded by 35 mm color film, and later digitized. Since about 2005, all photographs were digitalized. Additional photographs were provided over the years by other veterinary ophthalmologists, including the late Keith C. Barnett, Paul M. Barrett, Cheryl L. Cullen, Andras Komaromy, Charles L. Martin, Reuben Merideth, Alain Regnier, the late Glenn A. Severin, Ron L. Sigler, Aubrey A. Webb, and many others.

Kirk N. Gelatt, VMD, Diplomate Emeritus ACVO
Distinguished Professor of Comparative Ophthalmology Emeritus

Caryn E. Plummer, DVM, Diplomate ACVO
Associate Professor of Comparative Ophthalmology and
Service Chief, Veterinary Ophthalmology Service
1

Ocular Anatomy

The Globe

The eye is a very elegant organ, and a wonderful example of the intimate relationship of structure to function. Each part of the eye is designed to achieve or contribute to the special sense of sight. The globe is composed of three basic layers or coats. The outer coat is the fibrous tunic composed of the cornea, the sclera, and the juncture of the two called the limbus. The fibrous tunic gives the eye a constant shape and form which is imperative for a functional visual system. In addition, the anterior portion of the fibrous tunic, the cornea, is transparent, enabling light to pass through, and shaped in a manner that makes it a powerful lens which refracts light rays centrally towards the visual axis of the eye.

The middle layer, or vascular tunic, is the uvea which consists of the iris, the ciliary body, and the choroid. The most anterior portion of the vascular tunic, the iris, extends from the ciliary body centrally just anterior to the surface of the lens. The iris is heavily pigmented and contains muscles which change the shape and size of the iris and the pupillary aperture to control the amount of light that enters the posterior segment to stimulate the retina. The ciliary body is involved in both the production and outflow of aqueous humor, a fluid which flows through the anterior segment. Aqueous humor is secreted from ciliary body processes, which are heavily pigmented central extensions of the ciliary body. Aqueous humor leaves the eye through the iridocorneal angle, a portion of which (the uveal meshwork sinus) is of ciliary body origin. The ciliary body and its processes provide a base on which lenticular zonules are attached. These zonules are fine fibrous bands which attach to the outer portions of the lens and hold it in place. Contraction of ciliary body muscle alters the tension of these zonules and are able to change the shape or position of the lens. This process, called accommodation, alters the degree to which light is refracted. Thus, the lens acts as a fine focusing mechanism, while the cornea serves as the most powerful fixed “lens” of the visual system. The choroid, located in the posterior half of the eye, is found between the outer sclera and the retina. It functions to provide nourishment to the highly metabolic retina and to modify internal light reflection and scatter, as it is either heavily pigmented or reflective. In some species, a special reflective structure, called the tapetum, is located within the choroid and acts to improve photoreceptor stimulation in dim illumination.

The third layer of the eye is the nervous coat which is made up of the retina and associated optic nerve. Briefly, the retina contains light sensitive cells (photoreceptors) which, after a series of intermediate modifying processes, transmit impulses to the brain via the optic nerve.

In addition to the three tunics, additional ocular components fill the interior of the globe: (i) the intraocular fluids (aqueous humor and vitreous humor) and (ii) the crystalline lens.

Aqueous humor is continuously produced by ciliary body processes at a slow rate and fills the anterior and posterior chambers of the eye (between the cornea anteriorly and the lens posteriorly), then drains out of the eye into the bloodstream through the iridocorneal angle to regulate the intraocular pressure of the normal eye. Aqueous humor provides vital nutrients to the avascular lens and cornea and also assists in removing metabolic waste products.

Vitreous humor, a gelatinous fluid, occupies the large chamber in the back of the eye. The vitreous humor helps support and distend the globe and also provides an optically clear medium through which light can pass essentially unaltered.

The crystalline lens is a transparent, avascular, non-pigmented, flattened spheroidal structure lying behind the iris held in place by lenticular zonules. The lens is responsible for focusing light that has entered the eye onto the retina (Figure 1.1).
Figure 1.1 (A) The anterior eye showing the cornea, limbus, iris, ciliary body (pars plicata and pars plana), and the zonules that suspend the lens from the ciliary processes. The anterior chamber is the space between the interior cornea and the anterior lens and iris which is filled with aqueous humor. The bulbar conjunctiva covers the sclera which is the posterior continuation of the fibrous tunic (the cornea is the anterior portion). The pupil is the aperture in the center of the iris. (B) A normal horse eye. The iris in this animal is blue in color. There is a pigmented extension of the posterior pigmented epithelium of the iris along the dorsal pupil margin which is called the corpora nigrum or granula iridica. (C) A freshly enucleated canine globe from the front. (D) The globe from the side showing the cornea, limbus, anterior chamber, iridocorneal angle, posterior chamber, ciliary body (pars plicata, pars plana, and the ciliaris retinae), vitreal chamber, sclera, and optic nerve. The fundus is divided into tapetal and nontapetal sections. The tapetum is located within the dorsal choroid. The choroid, or the posterior aspect of the vascular tunic, lies interior to the sclera (the anterior extension of the vascular tunic is the ciliary body and the iris) and the retina lies interior to the choroid and adjacent to the vitreous body. (E) A normal horse eye in profile. (F) A freshly enucleated canine globe in profile. The optic nerve is observed extending from the posterior aspect of the globe. (G) Posterior aspect of a freshly enucleated canine globe. Running along the sclera anteriorly at the 3 and 9 o’clock positions are the long posterior ciliary arteries. These are important landmarks for surgical approaches to the eye. The insertions of the extraocular muscles (the muscles themselves have been removed) which move the globe are appreciable. (H) In this prosection, the cornea and a sector of the iris have been removed revealing the lens sitting within the patellar fossa of the vitreous. (J) The lens has been removed from the globe and placed upon a page of type. Note the clarity and the magnification. (K) In this prosection, the anterior segment and lens have been removed, revealing the retina (artificially detached in areas), the retinal vasculature, the tapetum in the dorsal choroid, the pigmented nontapetal fundus, and the optic disc. (L) Prosection of the posterior globe. In this example, the globe has been cut in order to flatten it. Source: (A, D) Gelatt KN and Gelatt JP 2011. Reproduced with permission of Elsevier.
Ocular Anatomy

Figure 1.1 (Continued)
The Adnexa

The orbit is a bony fossa that separates the eye from the cranial cavity, surrounds and protects it, and provides several pathways through foramina for the various blood vessels and nerves involved in the function of the eye. The orbit in the dog and cat is an incomplete bony orbit composed of five, sometimes six bones, the supraorbital ligament, and the periosteum. The ruminant large animals usually have enclosed orbits. Closure of the temporal side of the orbit is accomplished by the union of the zygomatic bone and the frontal bone. The enclosed orbit is essential for protective purposes.

The eyelids are dorsal and ventral folds of thin skin continuous with the facial skin. The free edges of the dorsal and ventral lids meet to form the lateral and medial canthi. The opening formed by the free edges is the palpebral fissure. The fissure is prevented from assuming a circular shape by medial (nasal) and lateral (temporal) palpebral ligaments which attach the canthi to the orbital wall. The medial ligament inserts into periosteum of the nasal bones whereas laterally it inserts into temporal fascia. The lateral ligament is absent or rudimentary in the dog and is replaced by the retractor anguli oculi muscle. Closure of the eyelids is achieved by the contraction of the orbicularis oculi muscle located deep in the lids around the palpebral fissure. Opening or parting of the lids is by relaxation of the orbicularis oculi and contraction of the levator palpebrae superioris which inserts on the orbicularis oculi muscle.

The free margin of the eyelid can contain a row of cilia or lashes. These lashes are directed away from the anterior surface of the cornea. The inner surface of the lids is lined with a mucous membrane, the (palpebral) conjunctiva. The conjunctiva is reflected onto the globe (bulbar conjunctiva). The junction between the palpebral and
Figure 1.2. (A) The eyelids. A. Haired skin. B. Orbicularis oculi (eyelid musculature responsible for closure of the palpebral fissure). C. Tarsal plate. D. Insertion of the levator palpebrae superioris (responsible for elevation of the upper eyelid). E. Meibomian glands. F. Palpebral conjunctiva. G. Cilia (eyelash). (B) The eyelid musculature showing the muscles of facial expression and eyelid movement. The levator palpebrae superioris and the Müller's muscles, responsible for eyelid opening, are not shown. (C) The location of the lacrimal glands (orbital and gland of the third eyelid) and the meibomian glands lining the upper and lower eyelids along their margins. (D) The location of the lacrimal puncta of the nasolacrimal apparatus in the medial canthus and the subcutaneous pathway into the nasolacrimal duct. (E) A normal dog eye. Note the apposition of the eyelids to the globe, the smooth, regular margins of the lids and the third eyelid, and the normal appearance of the conjunctiva and the nictitans. Source: (A-D) Gelatt KN and Gelatt JP 2011. Reproduced with permission of Elsevier.
bulbar conjunctiva is the fornix. The conjunctiva is the most exposed of all mucous membranes. Its primary functions are preventing dessication of the cornea, increasing mobility of the eyelids and globe, and providing a barrier against microorganisms and foreign bodies. Ventrally, an additional fold is formed by the reflection of the conjunctiva over the nictitans. The nictitans (third eyelid) is a large, semilunar fold of conjunctiva that protrudes from the medial canthus over the anterior surface of the globe (from the dorsomedial orbit in birds). It contains a cartilaginous plate which is T-shaped, the horizontal part of it being parallel with the free edge of the membrane. The nictitans gland surrounds the caudal end of the shaft of the cartilaginous plate with the majority of the gland on the bulbar surface. It produces approximately 30% of the tears. The largest lacrimal gland, which is responsible for producing the majority of the aqueous tears, is located in the dorsal orbit.

Visible through the conjunctiva on the posterior surface of the eyelid margin are the meibomian glands. These form parallel rows of lobules which have their ducts opening close to the lid margins. The glands in the distal eyelid stroma are sebaceous in nature and contribute to the oily component of tear film. Each gland is made of a number of holocrine acini which are arranged in vertical columns and open into a central duct.

The tear film is considered an anatomic structure as well. This fluid covering the partially exposed anterior segment of the globe is necessary for maintaining an optically uniform corneal surface, removing foreign material and debris from the cornea and conjunctival sac, providing oxygen and other nutritional requirements to the cornea, and preventing the development of ocular surface infections. It normally consists of an aqueous component, a lipid component, and a mucous component. Aqueous tear fluid, once it has fulfilled its duties, drains through lacrimal puncta in the upper and/or lower eyelids at the medial canthus into the nasolacrimal sac and duct which subsequently drain into the nasal passages or the oropharynx (Figure 1.2).
A thorough ophthalmic examination can provide a rapid and accurate diagnosis for many ophthalmic diseases, because most ocular structures can be visualized either directly or indirectly. Furthermore, the eye lends itself to numerous simple and efficient diagnostic procedures, many of which can be performed during a routine examination. This chapter demonstrates examination and diagnostic techniques. Most of these procedures are noninvasive, and a thorough understanding of them can facilitate the identification and diagnosis of many ocular disorders.

The basic equipment necessary to perform a proper ocular examination includes a bright, focal light source (a Finoff transilluminator is ideal), Schirmer tear test strips, ocular stains (vital dyes), topical anesthetic, mydriatic agent, eyewash, sterile culture swabs, forceps, surgical blades, glass slides, cannulas for nasolacrimal duct irrigations, and an ophthalmoscope for examination of the fundus. Magnification is very helpful to identify small or subtle lesions.

The eye examination must be complete, organized, and strategic. Certain tests or observations must precede others to avoid interference or spurious conclusions. If indications for microbiologic sampling are present, samples are taken on moistened sterile swabs before instillation of any diagnostic drugs (stains, mydriatics, local anesthetics) as they can contain preservatives that prevent microbial growth. The Schirmer tear test must be performed before excessive ocular manipulation and instillation of any ophthalmic solutions or ointments, otherwise the result will be an inadequate reflection of tear production. The pupillary light reflexes should be evaluated before mydriatics or miotics are used. Similarly, measurement of intraocular pressure (IOP) should precede instillation of mydriatics. A thorough examination assesses all ocular and periocular structures, outside to inside and front to back. Accurate recording of examination will permit assessment of progress (Figure 2.1).

**External Examination**

The ophthalmic examination begins with an indirect assessment of vision (menace response, visual placing, maze testing) and comfort, and should be performed prior to sedation and nerve blocks, if these are necessary. The distant examination assesses the size, position, and direction of the globe and its movements. Any ocular discharge and asymmetry should be noted. It is important to examine each eye successively and to assess ocular and adnexal structures for symmetry.

The distant examination should be performed from different angles when facing the patient as subtle changes in globe position can become apparent when viewing, say, from above the animal’s head. Evaluation of ocular movements can be achieved by turning the animal’s head from side to side. Normal saccadic and optokinetic movements are noted as the eyes move back and forth in synchronicity, with the fast phase occurring in the direction of head movement. Complete external examination should include palpation of the orbit and retropulsion of both globes (Figure 2.2).

**Nerve Blocks**

Akinesia of the palpebral or auriculopalpebral (branch of palpebral) nerves facilitates examination of the eye in large animals, particularly equids. There are three main points at which the auriculopalpebral or palpebral nerves can be blocked in the horse. The first is just anterior to the base of the ear where the auriculopalpebral nerve emerges from the parotid salivary gland and becomes subcutaneous on the lateral aspect of the coronoid process. Here local anesthetic can be injected into the depression just caudal to the ramus of the mandible at the ventral edge of the temporal portion of the zygomatic arch. The rostral auricular artery and vein should be...
avoided. The second is just lateral to the highest point of the caudal zygomatic arch where the palpebral nerve can be “strummed” under the skin over the dorsal border of the bone. The third is where the palpebral nerve lies on the zygomatic arch caudal to the bony process of the frontal bone (Figure 2.3).

**Tear Film Assessment**

The nasolacrimal system has both secretory and drainage functions. Evaluation of this apparatus should note any tearing or hypofunction, as well as the endpoint of drainage. Excessive tearing can be caused by partial or complete obstruction of the drainage apparatus and increased lacrimation by ocular irritation and uveitis. The quality and quantity of the tear secretion is indirectly assessed by observation of the normal preocular tear film, which consists of three main components. The middle, or aqueous, layer is produced primarily by the lacrimal and nictitans glands in mammals, and deficiencies can be identified via the Schirmer tear test (Figure 2.4). The folded end of the Schirmer tear test strip is inserted in the lower conjunctival fornix, in contact with the cornea, near the junction of the middle and temporal thirds of the eyelids where it should remain for 1 minute. Tears are measured from the fold of the strip in millimeters per minute, immediately following removal. In common domestic species, tear production greater than 15 mm/minute in the absence of disease is considered adequate. The inner, mucin layer of the tear film is produced primarily by conjunctival goblet cells and the outer, lipid layer is produced by the meibomian glands in the eyelids. Deficiencies of the outer and inner layers result in qualitative dry eye. These can be assessed by tear film break up time (rapid evaporation) which utilizes topical fluorescein, rose Bengal, or lissamine green stains to delineate foci of mucin absence.

The passage of tears through the nasolacrimal duct can be indirectly observed with fluorescein passage (Jones’ test). If fluorescein is not observed at the nares, active flushing, or the injection of normal saline solution through the nasolacrimal drainage apparatus either orthograde (i.e., from the lacrimal puncta) or retrograde (i.e., from the distal nare’s opening), can be performed.

**Corneoconjunctival Culture**

Culture and sensitivity testing provide useful information for the diagnosis and determination of appropriate antimicrobial therapy in many corneal and conjunctival diseases. Cultures should be obtained very carefully from any deep or progressive corneal ulcers, or those that fail to heal in a reasonable amount of time. Cultures can also be taken from purulent or granulomatous conjunctival lesions or from animals with chronic conjunctivitis that does not respond to therapy. Both corneal and conjunctival cultures should be obtained early in the ophthalmic examination, before administration of topical solutions or ointments (Figure 2.5).

**Corneoconjunctival Cytology**

Corneal or conjunctival cytology is extremely useful in the diagnosis of certain forms of inflammatory or neoplastic conditions and is very helpful for the planning of

Figure 2.1  (A) Essential equipment for ophthalmic examination.
### B: Examination Form

<table>
<thead>
<tr>
<th>Reflexes</th>
<th>Right</th>
<th>Left</th>
<th>Tests</th>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct PLR</td>
<td>+ / −</td>
<td>+ / −</td>
<td>Schirmer Tear Test</td>
<td>mm/min</td>
<td>mm/min</td>
</tr>
<tr>
<td>Consensual PLR</td>
<td>+ / −</td>
<td>+ / −</td>
<td>IOP</td>
<td>mmHg</td>
<td>mmHg</td>
</tr>
<tr>
<td>Menace</td>
<td>+ / −</td>
<td>+ / −</td>
<td>Fluorescein</td>
<td>+ / −</td>
<td>+ / −</td>
</tr>
<tr>
<td>Dazzle</td>
<td>+ / −</td>
<td>+ / −</td>
<td>Jones Test</td>
<td>+ / −</td>
<td>+ / −</td>
</tr>
<tr>
<td>Palpebral</td>
<td>+ / −</td>
<td>+ / −</td>
<td>Rose Bengal</td>
<td>+ / −</td>
<td>+ / −</td>
</tr>
</tbody>
</table>

**Eyelids/Nictitans**

- Conjunctiva
- Cornea

**Lacrimal System**

**Cornea**

- Anterior Chamber
- Pupil & Iris

**Pupil & Iris**

**Lens**

**Anterior Chamber**

**Vitreous & Fundus**

**Special Procedures:**
- ERG
- Gonioscopy
- N-L Flush
- Photography
- Culture
- Cytology
- Ultrasound
- Other

**Sedation:**

**General Comments:**

*Figure 2.1 (Continued) (B) An example of an examination form for recording findings.*
Figure 2.2  (A) Pupillary light reflexes should be assessed with a bright light (here, a Finoff transilluminator is being used) in both bright and dim lighting conditions. (B) Retropulsion of the globes should be equal on each side and nonpainful to the patient. (C) Assessing the patient for asymmetry is an important part of the ophthalmic examination. In this case, a retrobulbar mass has resulted in relative exophthalmos and strabismus. Radiation therapy has resulted in cataract formation and whitening of the hair coat.
The Ophthalmic Examination and Diagnostics

Empiric therapy for corneal ulcers. Instruments for collecting cytologic samples include cotton or Dacron swabs, cytobrushes, spatulas (Kimura platinum spatula), and the blunt end of a scalpel blade (Figure 2.6). Impression cytology can also be used for sample collection in some instances. Topical anesthesia (i.e., 0.5% tetracaine or 0.5% proparacaine) should be applied to the ocular surface prior to sample acquisition, and care must be taken to avoid ocular trauma.

Ophthalmic Stains

Fluorescein dye is used to detect corneal and conjunctival defects, aqueous humor leakage (Seidel’s test), precorneal tear film (PTF) deficiencies (tear film break-up time; TFBUT), and to assess nasolacrimal duct patency (Figure 2.7). TFBUT is a measure of the stability of the PTF which involves recording the time it takes for fluorescein applied to the ocular surface to dissipate, or the PTF to dissociate (dark spots in a diffuse film of fluorescein will develop and indicate break-up). Patency of the nasolacrimal apparatus is tested by applying sodium fluorescein to the eye and timing the passage of fluorescein through the system to the external nares (i.e., Jones’ test). This dye is hydrophilic, binding readily to exposed corneal stroma when ulcers are present. The dye will not bind to intact healthy corneal epithelium, however, or to the endothelium and Descemet’s membrane.

Rose Bengal is used to assist in the diagnosis of PTF disorders (mucin deficiency) and superficial corneal epithelial abnormalities. Besides being used to assess the integrity of the PTF, rose Bengal can also be used to demonstrate very small superficial ulcers and erosions such as the punctate corneal lesions often present in early stages of keratomycosis in the eye.

Figure 2.2 (Continued) (D) Characterization of any ocular discharge can help with diagnosis and staging of severity and chronicity of ocular conditions.

Figure 2.3 Landmarks for the auriculopalpebral motor block to facilitate a complete ophthalmic examination in a horse.
Figure 2.4 (A) Schirmer tear test 1 being performed in a dog. The notched end of the strip is inserted behind the eyelid margin along the lateral lower eyelid so that it comes into contact with the globe. (B) Nasolacrimal patency can be assessed indirectly with the application of topical fluorescing stain to the ocular surface. After several minutes, the dye should be seen exiting the nares (Jones’ test positive). Note the green colored nasal discharge from the left nare. (C) Cats may not have fluorescein exit from their nares. Some individuals drain tears into their oral pharynx, so assessment of nasolacrimal patency includes opening the mouth and observing the base of the tongue for fluorescein.