

Contents

Foreword *xiii*

Acknowledgements *xv*

- 1 Fixation and processing of ocular tissues 1**
 - Fixatives 1
 - Fixation and sectioning artifacts 2
 - Fixation techniques 3
 - Trimming the fixed globe 5
 - Electron microscopy 13
 - References 14
- 2 General pathology of the eye 15**
 - Adaptations characterized by changes in cell size, number, or appearance 15
 - Neoplasia 19
 - Nomenclature 23
 - Distinguishing benign from malignant 25
 - Prognostication 27
 - Unsuccessful adaptation: cellular degeneration, necrosis, and apoptosis 27
 - Calcification, pigmentation, and cystic change 30
 - Ocular inflammation 32
 - Ocular manifestations of acute inflammation 34
 - Chronic inflammation 39
 - Ocular manifestations of chronic inflammation 39
 - Immune privilege 41
 - Lymphocytic–plasmacytic endophthalmitis 42
 - The sequelae of intraocular inflammation and other injuries 43
 - Limited regenerative ability 43
 - Susceptibility to scarring 43
 - Further reading 46
- 3 Congenital anomalies 49**
 - Introduction 49
 - Defective organogenesis 50
 - Defective early organogenesis 50
 - Anophthalmos and cystic globe 53
 - Anophthalmos and microphthalmos 54
 - Cyclopia and synophthalmos 56
 - Congenital anomalies of lens 56
 - Congenital retinal nonattachment 63
 - Aniridia – iridal hypoplasia or aplasia 63
 - Coloboma 63
 - Defective later organogenesis 64
 - Neurectodermal defects 64
 - Multifocal retinopathies 71
 - Multiple ocular anomalies (MOA) in Rocky Mountain horses 71

Anomalies of surface ectodermal origin that develop during later organogenesis	73
Congenital adnexal cysts	73
Dermoids	73
Defects of neural crest migration and mesenchymal differentiation that develop in later organogenesis	73
Congenital corneal disease	73
Congenital disorders of neurocrest and mesenchymal tissues that manifest in the uvea during later organogenesis	74
Persistent pupillary membranes (PPMs)	74
Congenital glaucoma	75
Uveal hypoplasia	78
Collie eye anomaly (CEA) and related defects	78
Persistence of embryonic vasculature	81
References	83
4 Histopathology of ocular trauma	89
Perforating and penetrating wounds of the globe and ocular tissues	89
Perforating wounds of the globe	89
Traumatic intraocular hemorrhage	89
Expulsive subchoroidal hemorrhage	90
Sequelae of intraocular hemorrhage	90
Posttraumatic inflammation	95
Phacoclastic endophthalmitis and traumatic cataract	95
Infectious endophthalmitis	95
Trauma to individual ocular tissues	95
Orbit and optic nerve	95
Cornea/sclera	95
Uvea	100
Lens	101
Vitreous and retina	101
Globe as a whole	101
Reaction to foreign materials	101
Complications of ocular surgery	102
Chemical and thermal burns	102
Effects of radiant energy	103
References	103
5 Diseases of the eyelid, conjunctiva, lacrimal, and nasolacrimal systems	105
Eyelids	105
Structural disorders	105
Dermoids	105
Hamartomas	105
Subconjunctival fat prolapse	105
Entropion, ectropion, and medial canthal pocket syndrome	105
Distichiasis, districhiasis, and ectopic cilia	106
Inflammatory disease	108
Pyogranulomatous (granulomatous) blepharitis	108
Juvenile sterile granulomatous dermatitis and lymphadenitis (juvenile cellulitis)	110
Chalazion	110
Medial canthal erosion syndrome	111
Proliferative pox virus blepharitis in birds	111
Parasitic eyelid disorders	111
Demodicosis	111
Cnemidocoptes pilae (scaly beak) infestation of avian species	113
Eyelid tumors and neoplasms	113
Cystic apocrine hyperplasia (hidrocystomas, sudoriferous cysts, and apocrine cysts)	113

Granular cell tumor	113
Meibomian (tarsal gland) adenoma	115
Melanocytoma and melanoma	115
Histiocytoma	118
Mast cell tumor	118
Peripheral nerve sheath tumors	118
Equine sarcoid	121
Squamous cell carcinoma	122
Diseases of the conjunctiva	123
General pathology of the conjunctiva	124
Congenital conjunctival abnormalities	124
Infectious conjunctivitis	126
Herpesvirus	126
Chlamydomydia (chlamydia)	126
<i>Rickettsia rickettsi</i>	126
<i>Moraxella bovis</i>	126
Parasitic conjunctivitis	126
Noninfectious inflammatory disease	127
Episclerokerataconjunctivitis	127
Lipogranulomatous conjunctivitis of cats	127
Eosinophilic conjunctivitis	128
Miscellaneous conjunctival disorders	128
Conjunctival overgrowth in rabbits (pseudopterygium)	128
Membranous (ligneous) conjunctivitis	129
Conjunctival neoplasms	129
Conjunctival lymphoma	129
Conjunctival mast cell tumors	130
Conjunctival melanoma and melanocytoma	130
Viral papillomas	133
Conjunctiva squamous papilloma	133
Conjunctival squamous cell carcinoma	133
Conjunctival vascular neoplasia	133
Miscellaneous neoplasms of the third eyelid	133
Lacrimal and nasolacrimal disorders	136
Neoplasms of the gland of the third eyelid	136
Prolapsed gland of the third eyelid	138
Keratoconjunctivitis sicca (KCS)	138
Dacryops and canaliculops	138
References	138
6 Diseases of the cornea	143
Corneal wound healing	143
Epithelial wound healing	143
Stromal wound healing	147
Endothelial wound healing	149
Epithelial and fibrous ingrowth	151
Healing of corneal grafts	152
Nonspecific corneal responses to insult	152
Corneal vascularization	152
Corneal pigmentation	154
Corneal edema	154
Keratitis	154
Epithelial alterations of keratitis	154
Stromal alterations of keratitis	156
Endothelialitis	158

Specific inflammatory corneal disease	159
Immune-mediated nonulcerative keratitis	159
Immune-mediated ulcerative keratitis	159
Superficial punctate keratitis (punctate erosive corneal dystrophy)	159
Chronic superficial keratitis (pannus)	159
Eosinophilic keratitis	161
Miscellaneous corneal disorders: corneal sequestrum, indolent corneal ulceration, corneal dystrophy, corneal lipid infiltrates, and corneal degeneration	161
Corneal sequestrum	161
Indolent ulceration (boxer ulcer, spontaneous corneal epithelial defects)	164
Corneal dystrophies, corneal lipid infiltrates, and corneal calcific/lipid degeneration	165
Miscellaneous corneal disease	167
Corneal neoplasia	172
References	177

7 Diseases of the episclera and sclera 181

Primary episcleral and scleral inflammatory disorders: a brief introduction	181
Secondary scleritis	181
Scleral neoplasia	182
Limbal melanocytoma	184
Episcleritis (episclerokeratitis, episclerokeratoconjunctivitis)	185
Scleritis and necrotizing scleritis a continuum or separate conditions?	189
Non-necrotizing scleritis	193
Necrotizing scleritis	195
Parasitic episcleral disease (onchocerca vulpis/lienalis)	195
References	196

8 Histologic manifestations of disorders of the uvea 197

Normal aging changes	203
Degenerative diseases of the uvea	205
Uveal atrophy	205
Uveal cysts	205
Cystoid degeneration of the pars plana ciliary epithelium	205
Pre-iridal fibrovascular membranes (PIFMs)	208
Heterotopic bony metaplasia of the ciliary body in guinea pigs	208
Uveitis	210
The nomenclature of uveitis	210
The intraocular events of uveitis	210
The etiologic implications of inflammatory exudates	216
Immune privilege	218
Consequences of uveitis	218
Histologic basis of the common infectious, idiopathic, and immune-mediated uveitis syndromes in domestic animals	221
Lens-induced uveitis	221
Phacolytic uveitis	223
Phacoclastic uveitis	224
Equine recurrent uveitis	227
Feline lymphocytic–plasmacytic uveitis	231
Pigmentary uveitis/pigmentary glaucoma of dogs	231
Equine heterochromic iridocyclitis with secondary keratitis	233
Vogt–Koyanagi–Harada-like or uveodermatologic syndrome in dogs	233
Uveal xanthogranuloma in miniature schnauzers	235
Uveitis associated with specific infectious agents	235

Viruses	235
Feline infectious peritonitis	235
Canine adenovirus-associated uveitis	238
Canine distemper virus-associated uveitis	239
Bovine malignant catarrhal fever (MCF)-associated uveitis	239
Bovine viral diarrhoea mucosal disease-associated uveitis	239
Ovine bluetongue	239
Equine viral arteritis (EVA)-associated uveitis	239
West Nile-associated avian uveitis	239
Hog cholera	239
Bacteria	240
Fungi	241
Other infectious causes for endophthalmitis	245
Algal endophthalmitis	246
Protozoan endophthalmitis	246
Metazoan parasitic uveitis	246
References	250
9 Histologic basis of glaucoma	255
Introduction	255
The gross, subgross, and histologic lesions of elevated IOP	255
Retinal changes	257
Optic nerve changes	262
Classification of canine glaucoma and introduction to open and closed angles	266
Congenital glaucoma	267
Primary glaucoma	270
Open angle glaucoma of beagle dogs	274
Primary (congenital) glaucoma in New Zealand white rabbit	274
Secondary glaucoma	274
Pre-iridal Fibrovascular Membrane	274
Posterior Synechia with Pupillary Block	275
Vitreous degeneration, syneresis, and anterior chamber prolapse	275
Trabecular obstruction by tumor	278
Other causes of secondary glaucoma in dogs	278
Glaucoma in cats	283
Glaucoma in horses	284
References	286
10 Histologic manifestations of acquired and inherited diseases of the lens	289
Embryology and anatomy of the lens	289
Physiology of the lens	292
Pathology of the lens	292
Aging changes	294
Cataract	294
The classification of cataracts	294
The histopathology of cataract	294
The pathogenesis of cataracts	299
Etiologies of cataract	299
Lens luxation	302
Inherited lens zonular dysplasia	303
References	305

11 Acquired diseases of the vitreous 307

- Primary disorders of the vitreous 310
 - Vitreous degeneration 310
 - Asteroid hyalosis 315
 - Posterior vitreous detachment 315
 - Synchysis scintillans 315
- Uveal and neuroectodermal pigment and cysts within the vitreous and incidental parasitic encounters 317
- Neovascularization 317
- Conditions with secondary vitreous involvement 317
 - Vitritis 317
 - Vitreous hemorrhage 319
- References 322

12 Histologic manifestations of retinal disease 325

- Introduction 325
- Retinal diseases by histologic pattern 328
- Retinal atrophy 329
 - Inner retinal atrophies 329
 - The pathogenesis of retinal degeneration secondary to glaucoma 329
 - Retinal atrophy secondary to non-glaucomatous optic nerve injury and vascular disease 335
 - Optic nerve hypoplasia/aplasia 336
 - Outer retinal (photoreceptor) atrophies 336
 - Inherited photoreceptor dysplasias and degenerations 336
 - Retinal detachment 340
- Toxic and nutritional retinopathies 346
 - Fluoroquinolone-induced retinal degeneration 346
 - Vitamin A deficiency 347
 - Vitamin E deficiency 347
 - Taurine deficiency 347
 - Light-induced retinal degeneration 347
 - Sudden acquired retinal degeneration (SARD) and immune mediated retinopathy (IMR) of dogs 352
- Diseases targeting the retinal pigment epithelium 352
 - Retinal pigment epithelial dystrophy (central progressive retinal atrophy) 352
 - Hereditary retinal pigment epithelial disorders (congenital stationary night blindness of briard dogs, multifocal retinopathies) 352
 - Canine multifocal retinopathy 354
 - Retinal pigment epithelial dysplasia in the royal college of surgeons rat 354
 - Localized chorioretinal atrophy in rats 354
- Retinitis 354
 - Bystander retinitis 356
 - Retinitis as a manifestation of neurologic disease 356
 - Histophilus somni* (formerly *Hemophilus somnus*) infection in cattle 356
 - Canine distemper 356
- Retinal lesions reflecting noninfectious systemic disease 357
 - Retinal lesions of systemic hypertension 357
 - Retinal lesions resulting from inborn errors in the intermediary metabolism (lysosomal storage diseases and others) 357
- Retinal injury from thermal energy 358
- Retinal neoplasms 358
 - Medulloepitheliomas 360
 - Retinoblastoma 360
- References 360

- 13 Acquired diseases of the optic nerve 367**
- Intraocular disorders with associated optic neuropathy 367
 - Glaucomatous optic neuropathy 367
 - Endophthalmitis and ascending optic neuritis 372
 - Canine distemper optic neuritis 372
 - Orbital disorders that affect the optic nerve 372
 - Proptotic optic neuropathy 372
 - Orbital cellulitis/abscess with optic nerve sepsis 372
 - CNS conditions that affect the optic nerve 372
 - Optic nerve disorders 376
 - Granulomatous meningoencephalitis 376
 - Unilateral granulomatous optic neuritis 376
 - Optic neuropathy in horses 376
 - Feline optic neuropathies 376
 - Other causes of optic neuritis 378
 - Toxic optic neuropathy 378
 - Vitamin A deficiency 379
 - Primary optic nerve neoplasms 381
 - Meningioma 381
 - Optic nerve gliomas 382
 - Peripapillary medulloepitheliomas 382
 - Lymphosarcoma and other metastatic neoplasms 382
 - References 384
- 14 Acquired diseases of the orbit 387**
- Introduction 387
 - Inflammatory disease 387
 - Extraocular myositis 388
 - Lacrimal adenitis 389
 - Orbital trauma/hematoma 390
 - Zygomatic sialocoele 391
 - Orbital cysts and post-enucleation orbital mucocoeles 393
 - Parasitic orbital disease 396
 - Orbital neoplasia 396
 - Multilobular tumor of bone (multilobular osteochondroma) 398
 - Primary orbital osteoma and osteosarcoma 402
 - Lacrimal adenoma and adenocarcinoma 404
 - Harderian gland adenomas and adenocarcinomas 404
 - Rhabdomyosarcoma 404
 - Orbital myofibroblastic sarcoma 404
 - Vascular anomalies 406
 - References 406
- 15 Intraocular neoplasia 409**
- Non-neoplastic hyperpigmented lesions 410
 - Benign melanocytic neoplasia 410
 - Uveal melanocytoma 410
 - Uveal melanocytosis (melanosis) 415
 - Malignant uveal melanomas 415
 - Canine and feline uveal malignant melanoma 415
 - Diffuse iris melanoma of cats 417
 - Iris and ciliary epithelial neoplasia 422
 - Medulloepithelioma and retinoblastoma (primitive neuroectodermal tumors) 426

Primary ocular sarcomas of cats and rabbits	428
Schwannomas of blue eyed dogs	430
Osteosarcoma and chondrosarcoma	430
Miscellaneous primary intraocular tumors	432
Metastatic uveal neoplasia	433
Lymphosarcoma	433
Secondary intraocular neoplastic extension from primary nasal and orbital and adnexal neoplasms	435
References	436
Index	443