

# Contents

Preface .....	.xi
Preface to First Edition .....	xii
List of Contributors .....	xiii
Acknowledgements.....	xxi
Dedication .....	xxi

## PART 1: GENETICS ..... 1

*JANEY L. WIGGS - SECTION EDITOR*

<b>1.1</b> Fundamentals of human genetics .....	1
<i>Janey L. Wiggs</i>	
<b>1.2</b> Molecular genetics of selected ocular disorders.....	10
<i>Janey L. Wiggs</i>	
<b>1.3</b> Genetic testing and genetic counseling .....	19
<i>Janey L. Wiggs</i>	

## PART 2: OPTICS AND REFRACTION ..... 25

*DAVID MILLER - SECTION EDITOR*

<b>2.1</b> Visible light.....	25
<i>David Miller, Stephen K. Burns</i>	
<b>2.2</b> Physical optics for clinicians .....	30
<i>Edmond H. Thall, Russell Miller, Humberto Salinas</i>	
<b>2.3</b> Light damage to the eye .....	36
<i>David Miller, Clifford A. Scott</i>	
<b>2.4</b> Principles of lasers .....	41
<i>Neal H. Atebara, Edmond H. Thall</i>	
<b>2.5</b> Light units.....	49
<i>David Miller, Jerome S. Sarmiento, Stephen K. Burns</i>	
<b>2.6</b> Optics of the normal eye .....	52
<i>David Miller, Paulo Schor, Peter Magnante</i>	
<b>2.7</b> Epidemiology of refractive errors.....	61
<i>David Miller, Clifford A. Scott</i>	
<b>2.8</b> Testing of refraction.....	64
<i>Clifford A. Scott</i>	
<b>2.9</b> Contact lenses.....	71
<i>Paul F. White, Clifford A. Scott</i>	
<b>2.10</b> Ophthalmic instrumentation.....	77
<i>David Miller, Edmond H. Thall, Neal H. Atebara</i>	
<b>2.11</b> Perspectives on aberrations of the eye.....	96
<i>Edmond H. Thall, David Miller</i>	

## PART 3: REFRACTIVE SURGERY..... 107

*DIMITRI T. AZAR - SECTION EDITOR*

<b>3.1</b> Current concepts, classification, and history of refractive surgery .....	107
<i>Tatsuya Mimura, Dimitri T. Azar</i>	
<b>3.2</b> Preoperative evaluation for refractive surgery.....	118
<i>Joshua A. Young, Ernest W. Kormmehl</i>	
<b>3.3</b> Radial and astigmatic keratotomy .....	122
<i>Kerry K. Assil, Joelle Hallak, Dimitri T. Azar</i>	
<b>3.4</b> Excimer laser photorefractive keratectomy .....	131
<i>Natalia Kramarevsky, David R. Hardten</i>	
<b>3.5</b> LASIK.....	145
<i>Patricia Sierra Wilkinson, Elizabeth A. Davis, David R. Hardten</i>	

<b>3.6</b>	<b>Laser Subepithelial Keratomileusis (LASEK) and Epi-LASIK</b> .....	<b>159</b>
	<i>Leonard Ang, Dimitri T. Azar</i>	
<b>3.7</b>	<b>Wavefront-guided (customized) excimer laser refractive surgery</b> .....	<b>166</b>
	<i>Faisal M. Tobaigy, Dimitri T. Azar</i>	
<b>3.8</b>	<b>Conductive keratoplasty and laser thermal keratoplasty for correction of hyperopia and presbyopia</b> .....	<b>174</b>
	<i>Dimitri T. Azar, Kalliopi Stasi</i>	
<b>3.9</b>	<b>Intrastromal corneal ring segments for low and high myopia</b> .....	<b>181</b>
	<i>Takashi Kojima, Jonathan D. Primack, Dimitri T. Azar</i>	
<b>3.10</b>	<b>Phakic intraocular lenses</b> .....	<b>186</b>
	<i>Ramon C. Ghanem, Dimitri T. Azar</i>	

**PART 4: CORNEA AND OCULAR SURFACE DISEASES**..... **203**

**MICHAEL H. GOLDSTEIN - SECTION EDITOR**

**SECTION 1: BASIC PRINCIPLES**

<b>4.1</b>	<b>Corneal anatomy, physiology, and wound healing</b> .....	<b>203</b>
	<i>Ayad A. Farjo, Mark L. McDermott, H. Kaz Soong</i>	
<b>4.2</b>	<b>Corneal topography and wavefront imaging</b> .....	<b>209</b>
	<i>Michael J. Taravella, Richard S. Davidson</i>	

**SECTION 2: CONGENITAL ABNORMALITIES**

<b>4.3</b>	<b>Congenital corneal anomalies</b> .....	<b>214</b>
	<i>Joel Sugar, Hormuz P. Wadia</i>	

**SECTION 3: EXTERNAL DISEASES**

<b>4.4</b>	<b>Blepharitis</b> .....	<b>219</b>
	<i>Jyotsom B. Ganatra, Michael H. Goldstein</i>	
<b>4.5</b>	<b>Herpes zoster ophthalmicus (HZO)</b> .....	<b>222</b>
	<i>Huck A. Holz, Ladan Espandar, Majid Moshirfar</i>	

**SECTION 4: CONJUNCTIVAL DISEASES**.....

<b>4.6</b>	<b>Conjunctivitis: infectious and noninfectious</b> .....	<b>227</b>
	<i>Jonathan B. Rubenstein, Vanee Virasch</i>	
<b>4.7</b>	<b>Allergic conjunctivitis</b> .....	<b>237</b>
	<i>Jonathan B. Rubenstein, Vanee Virasch</i>	
<b>4.8</b>	<b>Tumors of conjunctiva and cornea</b> .....	<b>241</b>
	<i>James J. Augsburger, Zélia M. Corrêa</i>	
<b>4.9</b>	<b>Pterygium and conjunctival degenerations</b> .....	<b>248</b>
	<i>Qais A. Farjo, Alan Sugar</i>	
<b>4.10</b>	<b>Ocular cicatricial pemphigoid/mucous membrane pemphigoid</b> .....	<b>251</b>
	<i>Ahmed Al-Ghoul, Gene Kim, Deepinder K. Dhaliwal</i>	

**SECTION 5: SCLERAL AND EPISCLERAL DISEASES**

<b>4.11</b>	<b>Episcleritis and scleritis</b> .....	<b>255</b>
	<i>Debra A. Goldstein, Howard H. Tessler</i>	

**SECTION 6: CORNEAL DISEASES**

<b>4.12</b>	<b>Bacterial keratitis</b> .....	<b>262</b>
	<i>Stephen D. McLeod</i>	
<b>4.13</b>	<b>Fungal keratitis</b> .....	<b>271</b>
	<i>Stephen D. McLeod</i>	

<b>4.14</b>	Parasitic keratitis .....	274
	<i>Stephen D. McLeod</i>	
<b>4.15</b>	Herpes simplex keratitis .....	279
	<i>Sonal S. Tuli</i>	
<b>4.16</b>	Peripheral ulcerative keratitis .....	285
	<i>Sarkis Soukiasian</i>	
<b>4.17</b>	Noninfectious keratitis .....	289
	<i>Charles S. Bouchard</i>	
<b>4.18</b>	Keratoconus and other ectasias .....	299
	<i>Joel Sugar, Hormuz P. Wadia</i>	
<b>4.19</b>	Anterior corneal dystrophies .....	303
	<i>Bryan Edgington, Michael H. Goldstein</i>	
<b>4.20</b>	Stromal corneal dystrophies .....	306
	<i>Joel Sugar, Hormuz P. Wadia</i>	
<b>4.21</b>	Corneal endothelium .....	312
	<i>Steven T. Berger, Mark L. McDermott, Harvinder K. S. Atluri</i>	
<b>4.22</b>	Corneal degenerations .....	318
	<i>Qais A. Farjo, Alan Sugar</i>	
<b>4.23</b>	Dry eye .....	324
	<i>Elmer Y. Tu, Stephen D. Rheinstrom</i>	

#### SECTION 7: MISC

<b>4.24</b>	Contact lens-related complications .....	330
	<i>Thomas L. Steinemann, William Ehlers, Jeanine Suchecki</i>	
<b>4.25</b>	Corneal and external eye manifestations of systemic disease .....	340
	<i>Anna C. Newlin, Hormuz Wadia, Joel Sugar</i>	

#### SECTION 8: TRAUMA

<b>4.26</b>	Acid and alkali burns .....	348
	<i>Steven Rhee, Michael H. Goldstein</i>	

#### SECTION 9: SURGERY

<b>4.27</b>	Corneal surgery .....	351
	<i>Lisa Martén, Ming X. Wang, Carol L. Karp, Robert P. Selkin, Dimitri T. Azar</i>	
<b>4.28</b>	Excimer laser treatment of corneal pathology .....	360
	<i>Lisa Martén, Ming X. Wang, Carol L. Karp, Robert P. Selkin, Dimitri T. Azar</i>	
<b>4.29</b>	Conjunctival surgery .....	363
	<i>Lisa Martén, Ming X. Wang, Carol L. Karp, Robert P. Selkin, Dimitri T. Azar</i>	
<b>4.30</b>	Endothelial keratoplasty: targeted treatment for corneal endothelial dysfunction .....	366
	<i>Marianne O. Price, Francis W. Price, Jr.</i>	
<b>4.31</b>	Surgical ocular surface reconstruction .....	372
	<i>Vahid Feiz, Ivan R. Schwab</i>	
<b>4.32</b>	Management of corneal thinning, melting, and perforation .....	378
	<i>Nicoletta Fynn-Thompson, Michael H. Goldstein</i>	

### PART 5: THE LENS .....

EMANUEL S. ROSEN - SECTION EDITOR

<b>5.1</b>	Basic science of the lens .....	381
	<i>Eric Dai, Michael E. Boulton</i>	
<b>5.2</b>	Evolution of intraocular lens implantation .....	394
	<i>Liliana Werner, Andrea M. Izak, Robert T. Isaacs, Suresh K. Pandey, David J. Apple</i>	
<b>5.3</b>	Patient work-up for cataract surgery .....	410
	<i>Frank W. Howes</i>	
<b>5.4</b>	Indications for lens surgery/indications for application of different lens surgery techniques .....	423
	<i>Frank W. Howes</i>	

<b>5.5</b>	The pharmacotherapy of cataract surgery .....	434
	<i>Steve A. Arshinoff, Yvonne A.V. Opalinski</i>	
<b>5.6</b>	Anesthesia for cataract surgery .....	441
	<i>Donna L. Greenhalgh</i>	
<b>5.7</b>	Phacoemulsification .....	447
	<i>David Allen</i>	
<b>5.8</b>	Refractive aspects of cataract surgery .....	451
	<i>Emanuel S. Rosen</i>	
<b>5.9</b>	Small incision cataract surgery .....	458
	<i>Mark Packer, I. Howard Fine, Richard S. Hoffman</i>	
<b>5.10</b>	Manual cataract extraction .....	465
	<i>Frank W. Howes</i>	
<b>5.11</b>	Combined procedures .....	471
	<i>David Allen, David Steel</i>	
<b>5.12</b>	Cataract surgery in complicated eyes .....	475
	<i>Gary S. Schwartz, Stephen S. Lane</i>	
<b>5.13</b>	Pediatric cataract surgery .....	479
	<i>Elie Dahan</i>	
<b>5.14</b>	Complications of cataract surgery .....	484
	<i>Thomas Kohnen, Li Wang, Neil J. Friedman, Douglas D. Koch</i>	
<b>5.15</b>	Outcomes of cataract surgery .....	493
	<i>Mats Lundstrom</i>	
<b>5.16</b>	Secondary cataract .....	497
	<i>Liliana Werner</i>	
<b>5.17</b>	Epidemiology, pathophysiology, causes, morphology, and visual effects of cataract .....	503
	<i>Mark Wevill</i>	

## PART 6: RETINA AND VITREOUS..... 511

JAY S. DUKER - SECTION EDITOR

### SECTION 1: BASIC SCIENCE

<b>6.1</b>	Structure and function of the neural retina .....	511
	<i>Hermann D. Schubert</i>	
<b>6.2</b>	Retinal pigment epithelium .....	515
	<i>Michael F. Marmor</i>	
<b>6.3</b>	Retinal and choroidal circulation .....	518
	<i>Shiyoung Roh, John J. Weiter</i>	

### SECTION 2: BASIC PRINCIPLES OF RETINAL SURGERY

<b>6.4</b>	Laser photocoagulation .....	522
	<i>Michael Ip, Carmen A. Puliafito</i>	
<b>6.5</b>	Scleral buckling surgery .....	525
	<i>George A. Williams</i>	
<b>6.6</b>	Vitrectomy .....	530
	<i>Michael Engelbert, Stanley Chang</i>	

### SECTION 3: ANCILLARY TESTS

<b>6.7</b>	Contact B-scan ultrasonography .....	534
	<i>Yale L. Fisher, James M. Klanck Jr., Hanna Rodriguez-Coleman, Antonio P. Ciardella, Nicole E. Gross</i>	
<b>6.8</b>	Fluorescein angiography, indocyanine green angiography, and optical coherence tomography .....	536
	<i>F. Ryan Prall, Jeffrey L. Olson, C.J. Barnett, Naresh Mandava</i>	
<b>6.9</b>	Electrophysiology .....	545
	<i>Tina Scheufele Cleary, Elias Reichel</i>	

### SECTION 4: DYSTROPHIES

<b>6.10</b>	Retinitis pigmentosa and related disorders .....	550
	<i>Paul A. Sieving, Rafael C. Caruso</i>	

<b>6.11</b>	Macular dystrophies .....	560
	<i>Steven N. Truong, Kimberly Dresner, David G. Telander, Lawrence S. Morse, Kent W. Small</i>	
<b>6.12</b>	Choroidal dystrophies.....	569
	<i>Sandeep Grover, Gerald A. Fishman</i>	
<b>6.13</b>	Congenital stationary night blindness .....	575
	<i>Kenneth G. Noble</i>	
<b>6.14</b>	Hereditary vitreoretinopathies .....	578
	<i>Alan E. Kimura</i>	

#### SECTION 5: VASCULAR DISORDERS

<b>6.15</b>	Hypertensive retinopathy .....	584
	<i>Adam H. Rogers</i>	
<b>6.16</b>	Retinal arterial obstruction.....	589
	<i>Jay S. Duker</i>	
<b>6.17</b>	Venous obstructive disease of the retina.....	597
	<i>Michael G. Morley, Jeffrey S. Heier</i>	
<b>6.18</b>	Retinopathy of prematurity .....	606
	<i>Kimberly A. Dresner, Antonio Capone Jr.</i>	
<b>6.19</b>	Diabetic retinopathy .....	613
	<i>Brett J. Rosenblatt, William E. Benson</i>	
<b>6.20</b>	Ocular ischemic syndrome .....	622
	<i>Matthew T.S. Tennant, Arunan Sivalingam, Gregory M. Fox, Gary C. Brown</i>	
<b>6.21</b>	Hemoglobinopathies .....	626
	<i>Allen C. Ho</i>	
<b>6.22</b>	Coats' disease and retinal telangiectasia .....	631
	<i>Diana V. Do, Julia A. Haller</i>	
<b>6.23</b>	Radiation retinopathy and papillopathy .....	636
	<i>Desmond B. Archer</i>	
<b>6.24</b>	Proliferative retinopathies.....	640
	<i>Srilaxmi Bearely, Jeevan R. Mathura Jr., Lee M. Jampol</i>	
<b>6.25</b>	Retinal arterial macroaneurysms .....	646
	<i>Janice E. Contreras, William F. Mieler, Robert A. Mitra, John S. Pollack, Julia Jiyamapa</i>	

#### SECTION 6: MACULAR DISORDERS

<b>6.26</b>	Choroidal neovascularization.....	651
	<i>Richard F. Spaide</i>	
<b>6.27</b>	Age-related macular degeneration .....	658
	<i>Philip J. Rosenfeld, Adam Martidis, Matthew T.S. Tennant</i>	
<b>6.28</b>	Degenerative myopia .....	674
	<i>Brad J. Baker, Ronald C. Pruett</i>	
<b>6.29</b>	Central serous chorioretinopathy.....	677
	<i>Anna S. Kitzmann, Jose S. Pulido, William J. Wiostko</i>	
<b>6.30</b>	Macular hole.....	682
	<i>Jay S. Duker</i>	
<b>6.31</b>	Epiretinal membrane.....	686
	<i>T. Mark Johnson, Mark W. Johnson</i>	
<b>6.32</b>	Vitreomacular traction syndrome.....	691
	<i>William E. Smiddy</i>	
<b>6.33</b>	Cystoid macular edema .....	696
	<i>Arthur Fu, Alex Bui, Richard Roe, Irma Ahmed, Everett Ai</i>	
<b>6.34</b>	Coexistent optic nerve and macular abnormalities.....	702
	<i>Gary C. Brown, Melissa M. Brown</i>	
<b>6.35</b>	Angioid streaks .....	707
	<i>James F. Vander</i>	

#### SECTION 7: RETINAL DETACHMENT

<b>6.36</b>	Peripheral retinal lesions .....	711
	<i>William S. Tasman</i>	
<b>6.37</b>	Retinal breaks.....	716
	<i>Craig M. Greven</i>	

<b>6.38</b>	Rhegmatogenous retinal detachment .....	720
	<i>Charles P. Wilkinson</i>	
<b>6.39</b>	Serous detachment of the neural retina .....	727
	<i>Rajiv Anand, Patrick D. Williams</i>	
<b>6.40</b>	Choroidal hemorrhage .....	734
	<i>Michael A. Kapusta, Pedro F. Lopez</i>	
<b>6.41</b>	Proliferative vitreoretinopathy .....	739
	<i>G. William Aylward</i>	

#### SECTION 8: TRAUMA

<b>6.42</b>	Posterior segment ocular trauma .....	744
	<i>Patrick E. Rubsamen</i>	
<b>6.43</b>	Distant trauma with posterior segment effects .....	750
	<i>Jason Hsu, Carl D. Regillo</i>	
<b>6.44</b>	Light toxicity and laser burns .....	755
	<i>Caroline R. Baumal</i>	
<b>6.45</b>	Retinal toxicity of systemically administered drugs .....	761
	<i>Richard Hamilton, David V. Weinberg</i>	

#### SECTION 9: RETINAL DETACHMENT/VITREOUS

<b>6.46</b>	Vitreous anatomy and pathology .....	766
	<i>J. Sebag</i>	

### PART 7: UVEITIS AND OTHER INTRAOCULAR INFLAMMATIONS .....

**775**

*NARSING A. RAO - SECTION EDITOR*

#### SECTION 1: BASIC PRINCIPLES

<b>7.1</b>	Anatomy of the uvea .....	775
	<i>Monica Evans</i>	
<b>7.2</b>	Mechanisms of uveitis .....	777
	<i>Igal Gery, Chi-Chao Chan</i>	
<b>7.3</b>	General approach to the uveitis patient and treatment strategies .....	783
	<i>David J. Forster</i>	

#### SECTION 2: INFECTIOUS CAUSES OF UVEITIS - VIRAL

<b>7.4</b>	Herpes and other viral infections .....	789
	<i>P. Kumar Rao</i>	
<b>7.5</b>	Cytomegalovirus retinitis (CMVR) in AIDS .....	794
	<i>Ehud Zamir</i>	

#### SECTION 3: INFECTIOUS CAUSES OF UVEITIS - BACTERIAL

<b>7.6</b>	Syphilitic and other spirochetal uveitis .....	798
	<i>Julie H. Tsai, Jennifer R. Chao, Narsing A. Rao</i>	
<b>7.7</b>	Tuberculosis, leprosy, and brucellosis .....	807
	<i>Amod Gupta, Vishali Gupta</i>	
<b>7.8</b>	Cat-scratch and Whipple's disease .....	812
	<i>Robert C. Wang</i>	
<b>7.9</b>	Endophthalmitis .....	815
	<i>Russell W. Read</i>	

#### SECTION 4: INFECTIOUS CAUSES OF UVEITIS - FUNGAL

<b>7.10</b>	Histoplasmosis .....	820
	<i>Ramana S. Moorthy</i>	
<b>7.11</b>	Fungal Endophthalmitis: candidiasis, aspergillosis, and coccidioidomycosis .....	824
	<i>Shailaja Valluri, Ramana S. Moorthy</i>	

SECTION 7: INFECTIOUS CAUSES OF  
UVEITIS—BACTERIAL AND PARASITIC

- 7.12** Ocular toxoplasmosis .....828  
*Stacy Pineles, Sarah M. Ridders, Ralph D. Levinson*
- 7.13** Posterior parasitic uveitis.....833  
*Jyotirmay Biswas*

SECTION 8: UVEITIS ASSOCIATED WITH  
SYSTEMIC DISEASE

- 7.14** Uveitis related to HLA-B27 and juvenile arthritis .....838  
*Carlos Pavesio, Nicholas Jones*
- 7.15** Sarcoidosis .....844  
*Claude L. Cowan Jr.*
- 7.16** Behçet's disease .....850  
*Annabelle A. Okada*
- 7.17** Vogt-Koyanagi-Harada disease .....854  
*Narsing A. Rao, Hajime Inomata*

SECTION 9: TRAUMATIC UVEITIS

- 7.18** Phacogenic uveitis .....857  
*David J. Forster*
- 7.19** Sympathetic uveitis .....861  
*Narsing A. Rao, George E. Marak Jr.*

SECTION 8: UVEITIS OF UNKNOWN CAUSES

- 7.20** Idiopathic and other anterior uveitis syndromes.....864  
*Julie H. Tsai, Narsing A. Rao*
- 7.21** Pars planitis and other intermediate uveitis.....868  
*Julie H. Tsai, Narsing A. Rao*
- 7.22** Posterior uveitis of unknown cause.....872  
*Ramana S. Moorthy, Lee M. Jampol*

SECTION 9: MASQUERADE SYNDROMES

- 7.23** Masquerade syndromes: neoplasms.....882  
*Russell W. Read*

PART 8: INTRAOCULAR TUMORS..... 887  
*JAMES J. AUGSBURGER - SECTION EDITOR*

SECTION 1: MALIGNANT INTRAOCULAR TUMORS

- 8.1** Retinoblastoma.....887  
*James J. Augsburger, Norbert Bornfeld, Michael Giblin*
- 8.2** Uveal melanoma.....895  
*James J. Augsburger, Bertil E. Damato, Norbert Bornfeld*
- 8.3** Metastatic cancer to the eye .....906  
*James J. Augsburger, Rudolf Guthoff*
- 8.4** Lymphoma and leukemia .....911  
*James J. Augsburger, William G. Tsiaras*
- 8.5** Medulloepithelioma .....915  
*James J. Augsburger, Zélia M. Corrêa*

SECTION 2: BENIGN INTRAOCULAR TUMORS

- 8.6** Uveal nevus .....917  
*James J. Augsburger, J. William Harbour, John R. Gonder*
- 8.7** Choroidal Hemangiomas.....921  
*James J. Augsburger, Rajiv Anand, George E. Sanborn*
- 8.8** Choroidal osteoma.....925  
*James J. Augsburger, Rudolf Guthoff*
- 8.9** Astrocytoma of retina.....927  
*James J. Augsburger, Alan F. Cruess*
- 8.10** Hemangiomas of retina .....929  
*James J. Augsburger, Norbert Bornfeld, Zélia M. Corrêa*

- 8.11** Combined hamartoma of retina ..... 933  
*James J. Augsburger, Sanford M. Meyers*
- 8.12** Hypertrophy of retinal pigment epithelium ..... 935  
*James J. Augsburger, James P. Bolling*

SECTION 3: PHAKOMATOSES

- 8.13** Phakomatoses ..... 937  
*James J. Augsburger, James P. Bolling*

PART 9: NEURO-OPHTHALMOLOGY ..... 943  
 ALFREDO A. SADUN - SECTION EDITOR

SECTION 1: IMAGING IN NEURO-OPHTHALMOLOGY

- 9.1** Principles of imaging in neuro-ophthalmology ..... 943  
*Swaraj Bose, Richard Rubin*

SECTION 2: THE AFFERENT VISUAL SYSTEM

- 9.2** Anatomy and physiology ..... 950  
*Alfredo A. Sadun*
- 9.3** Differentiation of optic nerve from retinal macular disease ... 954  
*Alfredo A. Sadun, Vivek Patel*
- 9.4** Congenital optic disc anomalies ..... 956  
*Michael C. Brodsky*
- 9.5** Papilledema and raised intracranial pressure ..... 960  
*Alfredo A. Sadun*
- 9.6** Inflammatory optic neuropathies and neuroretinitis ..... 964  
*Jason R. Guercio, Laura J. Balcer*
- 9.7** Ischemic optic neuropathies ..... 970  
*Anthony C. Arnold*
- 9.8** Hereditary, nutritional, and toxic optic atrophies ..... 976  
*Alfredo A. Sadun, Sevgi Gurkan, Vivek Patel*
- 9.9** Prechiasmal pathways - compression by optic  
 nerve and sheath tumors ..... 980  
*Thomas C. Spoor*
- 9.10** Traumatic optic neuropathies ..... 984  
*Thomas C. Spoor*
- 9.11** Optic chiasm, parasellar region, and pituitary fossa ..... 986  
*Richard M. Rubin, Alfredo A. Sadun, Alfio Piva*
- 9.12** Retrochiasmal pathways, higher cortical function, and  
 nonorganic visual loss ..... 995  
*Andrew W. Lawton*

SECTION 3: THE EFFERENT VISUAL SYSTEM

- 9.13** Disorders of supranuclear control of ocular motility ..... 1001  
*Patrick J.M. Lavin, Sean P. Donahue*
- 9.14** Nuclear and fascicular disorders of eye movement ..... 1009  
*Sean P. Donahue*
- 9.15** Paresis of isolated and multiple cranial nerves and painful  
 ophthalmoplegia ..... 1015  
*Mark L. Moster*
- 9.16** Disorders of the neuromuscular junction ..... 1026  
*Deborah I. Friedman*
- 9.17** Ocular myopathies ..... 1032  
*Richard M. Rubin, Alfredo A. Sadun*
- 9.18** Nystagmus, saccadic intrusions, and oscillations ..... 1040  
*Peter A. Quiros, Robert D. Yee*
- 9.19** The pupils ..... 1049  
*Randy H. Kardon*
- 9.20** Presbyopia and loss of accommodation ..... 1059  
*Sean P. Donahue*

SECTION 4: THE BRAIN

- 9.21** Headache and facial pain ..... 1061  
*Joel M. Weinstein*

<b>9.22</b>	Tumors, infections, inflammations, and neurodegenerations.....	1069
	<i>Hossein G. Saadati, Alfredo A. Sadun</i>	

SECTION 5: NEURO-OPHTHALMOLOGIC EMERGENCIES

<b>9.23</b>	Urgent Neuro-ophthalmic pathologies.....	1076
	<i>Peter A. Quiros</i>	
<b>9.24</b>	Trauma, drugs, and toxins.....	1081
	<i>Deborah I. Friedman, Luis J. Mejico</i>	
<b>9.25</b>	Vascular disorders.....	1085
	<i>Thomas R. Hedges Jr., Peter A. Quiros</i>	

PART 10: GLAUCOMA..... 1095  
*JOEL S. SCHUMAN - SECTION EDITOR*

SECTION 1: EPIDEMIOLOGY AND MECHANISMS  
OF GLAUCOMA

<b>10.1</b>	Epidemiology of glaucoma.....	1095
	<i>Pradeep Ramulu, David S. Friedman</i>	
<b>10.2</b>	Screening for glaucoma.....	1102
	<i>Joshua D. Stein, Paul P. Lee</i>	
<b>10.3</b>	Mechanisms of glaucoma.....	1108
	<i>Martin Wax, Abe Clark, Mortimer M. Civan</i>	

SECTION 2: EVALUATION AND DIAGNOSIS

<b>10.4</b>	Clinical examination of glaucoma.....	1117
	<i>Jerome C. Ramos-Esteban, L. Jay Katz, William Goldberg, Anna Goldberg</i>	
<b>10.5</b>	Visual field testing in glaucoma.....	1128
	<i>Donald L. Budenz</i>	
<b>10.6</b>	Advanced psychophysical tests for glaucoma.....	1137
	<i>Chris A. Johnson</i>	
<b>10.7</b>	Optic nerve analysis.....	1141
	<i>Gadi Wollstein, Joel S. Schuman</i>	
<b>10.8</b>	Optic nerve blood flow measurement.....	1147
	<i>Alon Harris, Ehud Rechtman</i>	
<b>10.9</b>	Ocular hypertension.....	1151
	<i>Polly Henderson, Thad Labbe, Michael A. Kass</i>	

SECTION 3: SPECIFIC TYPES OF GLAUCOMA

<b>10.10</b>	Primary open-angle glaucoma.....	1154
	<i>James C. Tan, Paul L. Kaufman</i>	
<b>10.11</b>	Normal-tension glaucoma.....	1159
	<i>Roger A. Hitchings</i>	
<b>10.12</b>	Angle-closure glaucoma.....	1162
	<i>Jovina L.S. See, Paul T.K. Chew</i>	
<b>10.13</b>	Pseudoexfoliative glaucoma.....	1172
	<i>Patrick J. Riedel, Thomas W. Samuelson</i>	
<b>10.14</b>	Pigmentary glaucoma.....	1175
	<i>M. Bruce Shields</i>	
<b>10.15</b>	Neovascular glaucoma.....	1178
	<i>Malik Y. Kahook</i>	
<b>10.16</b>	Ocular inflammatory and corticosteroid-induced glaucoma.....	1182
	<i>Ivan Goldberg, Ridia Lim</i>	
<b>10.17</b>	Glaucoma associated with ocular trauma.....	1187
	<i>David P. Tingey, Bradford J. Shingleton</i>	
<b>10.18</b>	Glaucoma and raised episcleral venous pressure.....	1193
	<i>E. Randy Craven</i>	
<b>10.19</b>	Aqueous misdirection syndrome.....	1195
	<i>Nishat P. Alvi, Louis B. Cantor</i>	

<b>10.20</b>	Glaucomas associated with abnormalities of cornea and iris, tumors, and retinal disease .....	1197
	<i>Elliott Kanner, James C. Tsai</i>	
<b>10.21</b>	Congenital glaucoma .....	1205
	<i>James D. Brandt</i>	
SECTION 4: THERAPY		
<b>10.22</b>	When to treat glaucoma .....	1211
	<i>Rebecca S. Walker, Jody R. Piltz-Seymour</i>	
<b>10.23</b>	Which therapy to use in glaucoma? .....	1216
	<i>Douglas J. Rhee, Clive S. Migdal</i>	
<b>10.24</b>	Current medical management of glaucoma .....	1220
	<i>Ronald L. Gross</i>	
<b>10.25</b>	Laser Trabeculoplasty and Laser Peripheral Iridectomy. ....	1227
	<i>Karim F. Damji</i>	
<b>10.26</b>	Laser filtration procedures .....	1233
	<i>Martha Motuz Leen</i>	
<b>10.27</b>	Cyclodestructive procedures in glaucoma .....	1236
	<i>Robert J. Noecker</i>	
<b>10.28</b>	Goniotomy and trabeculotomy .....	1241
	<i>Sarwat Salim, David S. Walton</i>	
<b>10.29</b>	Nonpenetrating glaucoma surgery .....	1246
	<i>Iqbal Ike K. Ahmed, Baseer U. Khan</i>	
<b>10.30</b>	Trabeculectomy .....	1261
	<i>Cynthia Mattox</i>	
<b>10.31</b>	Antifibrotic agents in glaucoma surgery .....	1269
	<i>Peng Tee Khaw, Jonathan Clarke</i>	
<b>10.32</b>	Drainage implants .....	1277
	<i>Jeffrey Freedman, Graham E. Trope</i>	
<b>10.33</b>	Complications of glaucoma surgery and their management .....	1283
	<i>Leon W. Herndon</i>	
<b>10.34</b>	Genes associated with human glaucoma .....	1289
	<i>Janey L. Wiggs</i>	
<b>10.35</b>	Evidence-based medicine in glaucoma .....	1293
	<i>Henry Jampel, Kimberly E. Brown</i>	

## **PART 11: PEDIATRIC AND ADULT STRABISMUS ... 1301**

### **GARY R. DIAMOND - SECTION EDITOR**

#### **SECTION 1: BASIC SCIENCE**

<b>11.1</b>	<b>Anatomy and physiology of the extraocular muscles and surrounding tissues. ....</b>	<b>1301</b>
	<i>Brian N. Campolattaro, Frederick M. Wang</i>	

#### **SECTION 2: EVALUATION AND DIAGNOSIS**

<b>11.2</b>	<b>Evaluating vision in preverbal and preliterate infants and children .....</b>	<b>1309</b>
	<i>Gary R. Diamond</i>	
<b>11.3</b>	<b>Examination of ocular alignment and eye movements .....</b>	<b>1313</b>
	<i>Gary R. Diamond</i>	
<b>11.4</b>	<b>Sensory adaptations in strabismus .....</b>	<b>1319</b>
	<i>Gary R. Diamond</i>	

#### **SECTION 3: OCULAR MANIFESTATIONS**

<b>11.5</b>	<b>Sensory status in strabismus .....</b>	<b>1323</b>
	<i>Gary R. Diamond</i>	
<b>11.6</b>	<b>Esotropia .....</b>	<b>1328</b>
	<i>Gary R. Diamond</i>	
<b>11.7</b>	<b>Exotropia .....</b>	<b>1336</b>
	<i>Gary R. Diamond</i>	

<b>11.8</b>	Oblique muscle dysfunctions .....	1340
	<i>Gary R. Diamond</i>	
<b>11.9</b>	Alphabet pattern strabismus.....	1344
	<i>Gary R. Diamond</i>	
<b>11.10</b>	Paralytic strabismus .....	1348
	<i>Steven E. Rubin</i>	
<b>11.11</b>	Other vertical strabismus forms .....	1357
	<i>Howard M. Eggers</i>	
<b>11.12</b>	Amblyopia .....	1362
	<i>Gary R. Diamond</i>	

#### SECTION 4: TREATMENT

<b>11.13</b>	Forms of nonsurgical strabismus management.....	1368
	<i>Gary R. Diamond</i>	
<b>11.14</b>	Techniques of strabismus surgery.....	1370
	<i>Robert W. Lingua, Gary R. Diamond</i>	

### PART 12: ORBIT AND OCULOPLASTICS..... 1379

*JONATHAN J. DUTTON - SECTION EDITOR*

#### SECTION 1: ORBITAL ANATOMY AND IMAGING

<b>12.1</b>	Clinical anatomy of the eyelids .....	1379
	<i>Jonathan J. Dutton</i>	
<b>12.2</b>	Clinical anatomy of the orbit .....	1383
	<i>Jonathan J. Dutton</i>	
<b>12.3</b>	Orbital imaging techniques .....	1389
	<i>Jonathan J. Dutton</i>	

#### SECTION 2: EYELIDS

<b>12.4</b>	Eyelid retraction .....	1393
	<i>Gene R. Howard</i>	
<b>12.5</b>	Blepharoptosis.....	1397
	<i>Philip L. Custer</i>	

<b>12.6</b>	Entropion.....	1404
	<i>James W. Gigantelli</i>	
<b>12.7</b>	Ectropion.....	1412
	<i>Fiona O. Robinson, J. Richard O. Collin</i>	
<b>12.8</b>	Essential blepharospasm.....	1419
	<i>Donald C. Faucett</i>	
<b>12.9</b>	Benign eyelid lesions.....	1422
	<i>Ann G. Neff, Keith D. Carter</i>	
<b>12.10</b>	Eyelid malignancies.....	1434
	<i>Gregory J. Vaughn, Richard K. Dortzbach, Gregg S. Gayre</i>	
<b>12.11</b>	Eyelid trauma and reconstruction techniques.....	1443
	<i>Jeffrey P. Green, George C. Charonis, Robert Alan Goldberg</i>	
SECTION 3: ORBIT AND LACRIMAL GLAND		
<b>12.12</b>	Orbital diseases.....	1450
	<i>Jonathan J. Dutton</i>	
<b>12.13</b>	Orbital surgery.....	1466
	<i>Jonathan J. Dutton</i>	
<b>12.14</b>	Enucleation, evisceration, and exenteration.....	1474
	<i>Myron Tanenbaum</i>	
<b>12.15</b>	The lacrimal drainage system.....	1482
	<i>Jeffrey J. Hurwitz</i>	
SECTION 4: PERIORBITAL AESTHETIC PROCEDURES		
<b>12.16</b>	Cosmetic blepharoplasty and browplasty.....	1488
	<i>François Codère, Nancy Tucker</i>	
<b>12.17</b>	Injectable skin fillers.....	1495
	<i>Gregg S. Gayre</i>	
<b>12.18</b>	Cosmetic wrinkle reduction with botulinum toxin.....	1501
	<i>William J. Lipham</i>	
	Index.....	1507