



AMERICAN ACADEMY™
OF OPHTHALMOLOGY

8

External Disease and Cornea

2017–2018
BCSC
Basic and Clinical
Science Course™

The American Academy of Ophthalmology is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians.

The American Academy of Ophthalmology designates this enduring material for a maximum of 15 *AMA PRA Category 1 Credits™*. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

CME expiration date: June 1, 2020. *AMA PRA Category 1 Credits™* may be claimed only once between June 1, 2017, and the expiration date.

BCSC® volumes are designed to increase the physician's ophthalmic knowledge through study and review. Users of this activity are encouraged to read the text and then answer the study questions provided at the back of the book.

To claim *AMA PRA Category 1 Credits™* upon completion of this activity, learners must demonstrate appropriate knowledge and participation in the activity by taking the posttest for Section 8 and achieving a score of 80% or higher. For further details, please see the instructions for requesting CME credit at the back of the book.

The Academy provides this material for educational purposes only. It is not intended to represent the only or best method or procedure in every case, nor to replace a physician's own judgment or give specific advice for case management. Including all indications, contraindications, side effects, and alternative agents for each drug or treatment is beyond the scope of this material. All information and recommendations should be verified, prior to use, with current information included in the manufacturers' package inserts or other independent sources, and considered in light of the patient's condition and history. Reference to certain drugs, instruments, and other products in this course is made for illustrative purposes only and is not intended to constitute an endorsement of such. Some material may include information on applications that are not considered community standard, that reflect indications not included in approved FDA labeling, or that are approved for use only in restricted research settings. **The FDA has stated that it is the responsibility of the physician to determine the FDA status of each drug or device he or she wishes to use, and to use them with appropriate, informed patient consent in compliance with applicable law.** The Academy specifically disclaims any and all liability for injury or other damages of any kind, from negligence or otherwise, for any and all claims that may arise from the use of any recommendations or other information contained herein.

AAO, AAOE, American Academy of Ophthalmology, Basic and Clinical Science Course, BCSC, EyeCare America, EyeNet, EyeSmart, EyeWiki, Focal Points, IRIS, ISRS, OKAP, ONE, Ophthalmic Technology Assessments, *Ophthalmology*, Preferred Practice Pattern, ProVision, SmartSight, The Ophthalmic News & Education Network, and the AAO logo (shown on cover) and tagline (Protecting Sight. Empowering Lives.) are, among other marks, the registered trademarks and trademarks of the American Academy of Ophthalmology.

Cover image: From BCSC Section 5, *Neuro-Ophthalmology*. Fundus photograph showing an arteriovenous malformation (racemose angioma) of the retina in a patient with Wyburn-Mason syndrome. (Courtesy of Mark J. Greenwald, MD.)

Copyright © 2017 American Academy of Ophthalmology. All rights reserved.
No part of this publication may be reproduced without written permission.

Printed in the United States of America.

Basic and Clinical Science Course

Louis B. Cantor, MD, Indianapolis, Indiana, *Senior Secretary for Clinical Education*

Christopher J. Rapuano, MD, Philadelphia, Pennsylvania, *Secretary for Lifelong Learning and Assessment*

George A. Cioffi, MD, New York, New York, *BCSC Course Chair*

Section 8

Faculty

Robert W. Weisenthal, MD, *Chair*, De Witt, New York

Mary K. Daly, MD, Lexington, Massachusetts

Robert S. Feder, MD, Chicago, Illinois

Stephen E. Orlin, MD, Philadelphia, Pennsylvania

Elmer Y. Tu, MD, Chicago, Illinois

Woodford S. Van Meter, MD, Lexington, Kentucky

David D. Verdier, MD, Grand Rapids, Michigan

Denise de Freitas, MD, *Consultant*, São Paulo, Brazil

The Academy wishes to acknowledge the *Cornea Society* for recommending faculty members to the BCSC Section 8 committee.

The Academy also wishes to acknowledge the following committees for review of this edition:

Committee on Aging: Rahul T. Pandit, MD, Houston, Texas

Vision Rehabilitation Committee: John D. Shepherd, MD, Omaha, Nebraska

Practicing Ophthalmologists Advisory Committee for Education: Dasa V. Gangadhar, MD, *Primary Reviewer*, Wichita, Kansas; Edward K. Isbey III, MD, *Chair*, Asheville, North Carolina; Alice Bashinsky, MD, Asheville, North Carolina; David Browning, MD, PhD, Charlotte, North Carolina; Bradley D. Fouraker, MD, Tampa, Florida; Steven J. Grosser, MD, Golden Valley, Minnesota; Stephen R. Klapper, MD, Carmel, Indiana; James A. Savage, MD, Memphis, Tennessee; Michelle S. Ying, MD, Ladson, South Carolina



European Board of Ophthalmology: Joseph Colin, MD, PhD, *EBO Chair*, Bordeaux, France; Marie-José Tassignon, MD, PhD, FEBO, *EBO Liaison*, Antwerp, Belgium; Massimo Busin, MD, Forlì, Italy; Béatrice Cochener-Lamard, MD, PhD, Brest, France; Sheraz M. Daya, MD, London, England, United Kingdom; Günther Grabner, MD, Salzburg, Austria; Rudy M.M.A. Nuijts, MD, PhD, Maastricht, the Netherlands

Financial Disclosures

Academy staff members who contributed to the development of this product state that within the 12 months prior to their contributions to this CME activity and for the duration of development, they have had no financial interest in or other relationship with any entity discussed in this course that produces, markets, resells, or distributes ophthalmic health care goods or services consumed by or used in patients, or with any competing commercial product or service.

The authors and reviewers state that within the 12 months prior to their contributions to this CME activity and for the duration of development, they have had the following financial relationships:*

Dr Browning: Aerpio Therapeutics (S), Alcon (S), Alimera Sciences (C), Genentech (S), Novartis Pharmaceuticals (S), Ohr Pharmaceutical (S), Pfizer (S), Regeneron Pharmaceuticals (S)

Dr Busin: Moria (L, P)

Dr Cochener-Lamard: Alcon (L), Bausch + Lomb (L), Laboratoires Théa (C), Novagali-Santen (C), PhysIOL (L), ReVision Optics, Inc (L)

Dr Colin: Abbott Medical Optics (C), Addition Technology, Inc (C), Alcon (C)

Dr Daya: Bausch + Lomb (C, L), PhysIOL (C), STAAR Surgical (C), Technolas Perfect Vision GmbH (C, L), Zeiss Acri.Tec (C)

Dr Fouraker: Addition Technology (C, L), Alcon (C, L), KeraVision (C, L), OASIS Medical (C, L)

Dr Grabner: Abbott Medical Optics (C, L, S), Acufocus Inc (L, S), Polytech (C)

Dr Grosser: Ivantis (O)

Dr Isbey: Alcon (S), Allscripts (C), Bausch + Lomb (S), Medflow (C), Oculis Clinical Research (S)

Dr Nuijts: Alcon (L, S), ASICO (P), Bausch + Lomb (C), SensoMotoric Instruments (C, L)

Dr Savage: Allergan (L)

Dr Tassignon: Morcher GmbH (P)

Dr Tu: Eye Bank Association of America (S), Seattle Genetics (C)

The other authors and reviewers state that within the 12 months prior to their contributions to this CME activity and for the duration of development, they have had no financial interest in or other relationship with any entity discussed in this course that produces, markets, resells, or distributes ophthalmic health care goods or services consumed by or used in patients, or with any competing commercial product or service.

*C = consultant fees, paid advisory boards, or fees for attending a meeting; L = lecture fees (honoraria), travel fees, or reimbursements when speaking at the invitation of a commercial sponsor; O = equity ownership/stock options of publicly or privately traded firms (excluding mutual funds) with manufacturers of commercial ophthalmic products or commercial ophthalmic services; P = patents and/or royalties that might be viewed as creating a potential conflict of interest; S = grant support for the past year (all sources) and all sources used for a specific talk or manuscript with no time limitation

Recent Past Faculty

Natalie A. Afshari, MD
Charles S. Bouchard, MD
Kathryn A. Colby, MD, PhD
David S. Rootman, MD

In addition, the Academy gratefully acknowledges the contributions of numerous past faculty and advisory committee members who have played an important role in the development of previous editions of the Basic and Clinical Science Course.

American Academy of Ophthalmology Staff

Dale E. Fajardo, *Vice President, Education*
Beth Wilson, *Director, Continuing Professional Development*
Ann McGuire, *Acquisitions and Development Manager*
Stephanie Tanaka, *Publications Manager*
D. Jean Ray, *Production Manager*
Kimberly Torgerson, *Publications Editor*
Beth Collins, *Medical Editor*
Naomi Ruiz, *Publications Specialist*

American Academy of Ophthalmology
655 Beach Street
Box 7424
San Francisco, CA 94120-7424

Contents

General Introduction	xv
Objectives	1
1 Structure and Function of the External Eye and Cornea	3
Highlights	3
Eyelids	3
Lacrimal Functional Unit	4
Tear Film	5
Conjunctiva	6
Cornea	7
Corneal Epithelium	8
Bowman Layer	8
Corneal Stroma	8
Descemet Membrane	9
Corneal Endothelium	10
Limbus	10
Defense Mechanisms of the External Eye and Cornea	11
2 Examination Techniques for the External Eye and Cornea	15
Highlights	15
Direct Visualization	15
Slit-Lamp Biomicroscopy	15
Scanning	20
Ultrasound Biomicroscopy	20
Anterior Segment Optical Coherence Tomography	21
Specular Microscopy	23
Confocal Microscopy	24
Evaluation of Corneal Curvature	25
Zones of the Cornea	25
Shape, Curvature, and Power	25
Keratometry	26
Keratometry and Placido Disk-based Topography	27
Topography	28
Clinical Evaluation of the Ocular Surface	36
Ocular Surface Staining	36
Evaluation of Tear Production	38
Tear Film Quantitative Tests	39
Tear Film Qualitative Tests	40

Pachymetry	41
Corneal Esthesiometry	42
Handheld Esthesiometer	42
Measurement of Corneal Biomechanics	43
3 Clinical Approach to Ocular Surface Disease	45
Highlights	45
Common Clinical Findings in Ocular Surface Disease	45
Conjunctival Signs	47
Corneal Signs	49
Clinical Approach to Dry Eye	53
Mechanisms of Dry Eye	53
Aqueous Tear Deficiency	55
Evaporative Dry Eye	58
Treatment of Dry Eye	61
Eyelid Diseases Associated With Ocular Surface Disease	69
Rosacea	69
Seborrheic Blepharitis	72
Staphylococcal Blepharitis	72
Hordeola and Chalazia	76
4 Structural and Exogenous Conditions Associated With Ocular Surface Disorders	79
Highlights	79
Exposure Keratopathy	79
Neurotrophic Keratopathy and Persistent Corneal Epithelial Defects	80
Floppy Eyelid Syndrome	82
Superior Limbic Keratoconjunctivitis	83
Conjunctivochalasis	85
Recurrent Corneal Erosion	86
Trichiasis and Distichiasis	88
Factitious Ocular Surface Disorders	88
Mucus-Fishing Syndrome	89
Topical Anesthetic Abuse	89
Toxic Reactions to Topical Ophthalmic Medications	90
Dellen	92
Limbal Stem Cell Deficiency	92
5 Congenital Anomalies of the Cornea and Sclera	95
Highlights	95
Developmental Anomalies of the Anterior Segment	95
Anomalies of Size and Shape of the Cornea	95
Anomalies of Corneal and Associated Anterior Segment Structures	101
Congenital Corneal Opacities in Hereditary Syndromes and Corneal Dystrophies	107

Secondary Abnormalities Affecting the Fetal Cornea	107
Intrauterine Keratitis: Bacterial and Syphilitic	107
Congenital Corneal Keloid	107
Congenital Corneal Anesthesia	108
Congenital Glaucoma	108
Birth Trauma	109

6 Clinical Approach to Depositions and Degenerations of the Conjunctiva, Cornea, and Sclera 111

Highlights	111
Degenerations of the Conjunctiva	111
Age-Related Changes	112
Pinguecula	112
Pterygium	112
Conjunctival Concretions	113
Conjunctival Epithelial Inclusion Cysts	114
Conjunctivochalasis	114
Conjunctival Vascular Tortuosity and Hyperemia	114
Degenerations of the Cornea	115
Age-Related Changes	115
Epithelial and Subepithelial Degenerations	115
Stromal Degenerations	120
Endothelial Degenerations	126
Degenerations of the Sclera	128
Drug-Induced Deposition and Pigmentation	129
Corneal Epithelial Deposits	130
Stromal and Descemet Membrane Pigmentation	132
Endothelial Manifestations	132

7 Corneal Dystrophies and Ectasias 133

Highlights	133
Corneal Dystrophies	133
General Considerations	133
Epithelial and Subepithelial Dystrophies	135
Epithelial–Stromal <i>TGFB</i> Dystrophies	142
Stromal Dystrophies	149
Endothelial Dystrophies	156
Ectatic Disorders	161
Keratoconus	161
Pellucid Marginal Degeneration	168
Keratoglobus	169

8 Systemic Disorders With Corneal and Other Anterior Segment Manifestations 173

Highlights	173
Introduction	173

Inherited Metabolic Diseases	174
Lysosomal Storage Diseases	174
Disorders of Lipoprotein Metabolism	179
Disorders of Amino Acid, Nucleic Acid, Protein, and Mineral Metabolism	181
Skeletal and Connective Tissue Disorders	190
Ehlers-Danlos Syndrome	190
Marfan Syndrome	193
Osteogenesis Imperfecta	194
Goldenhar-Gorlin Syndrome	195
Nutritional Disorder: Vitamin A Deficiency	196
Hematologic Disorders	197
Endocrine Diseases	199
Diabetes Mellitus	199
Multiple Endocrine Neoplasia	200
Parathyroid Disease	200
Dermatologic Diseases	201
Ichthyosis	201
Ectodermal Dysplasia	202
Xeroderma Pigmentosum	202

9 Infectious Diseases of the External Eye:

Basic Concepts and Viral Infections	205
Highlights	205
Normal Ocular Flora	205
Pathogenesis of Ocular Infections	206
Ocular Microbiology	207
Diagnostic Laboratory Techniques	208
Virology and Viral Infections	211
DNA Viruses: Herpesviruses	212
Herpes Simplex Eye Diseases	212
Varicella-Zoster Virus Dermatoblepharitis, Conjunctivitis, and Keratitis	225
Epstein-Barr Virus Dacryoadenitis, Conjunctivitis, and Keratitis	230
Cytomegalovirus Keratitis and Anterior Uveitis	231
DNA Viruses: Adenoviruses	233
DNA Viruses: Poxviruses	236
Molluscum Contagiosum	236
Vaccinia	237
DNA Viruses: Papovaviruses	238
RNA Viruses	239

10 Infectious Diseases of the External Eye:

Microbial and Parasitic Infections	243
Highlights	243
Bacteriology	243
Gram-positive Cocci	244

Gram-negative Cocci	245
Gram-positive Rods	245
Gram-negative Rods	247
Gram-positive Filaments	248
<i>Chlamydia</i> Species	248
<i>Borrelia burgdorferi</i>	249
Mycology	249
Yeasts	250
Molds	251
Parasitology	252
Protozoa	252
Helminths	252
Arthropods	253
Prions	254
Microbial and Parasitic Infections of the Eyelid Margin and	
Conjunctiva	254
Staphylococcal Blepharitis	254
Fungal and Parasitic Infections of the Eyelid Margin	254
Bacterial Conjunctivitis in Children and Adults	255
Parinaud Oculoglandular Syndrome	265
Microbial and Parasitic Infections of the Cornea and Sclera	266
Primary Infectious Keratitis	266
Corneal Stromal Inflammation Associated With Systemic	
Infections	279
Loiasis	282
Microbial Scleritis	282

11	Diagnosis and Management of Immune-Related Disorders of the External Eye	285
	Highlights	285
	Immune-Mediated Diseases of the Eyelid	285
	Contact Dermato-blepharitis	285
	Atopic Dermatitis	287
	Immune-Mediated Disorders of the Conjunctiva	288
	Hay Fever Conjunctivitis and Perennial Allergic Conjunctivitis	288
	Vernal Keratoconjunctivitis	289
	Atopic Keratoconjunctivitis	292
	Ligneous Conjunctivitis	294
	Stevens-Johnson Syndrome, Stevens-Johnson Syndrome/Toxic	
	Epidermal Necrolysis Overlap, and Toxic Epidermal Necrolysis	295
	Mucous Membrane Pemphigoid	299
	Ocular Graft-vs-Host Disease	303
	Conjunctivitis/Episcleritis Associated With Reactive Arthritis	305
	Other Immune-Mediated Diseases of the Skin and Mucous	
	Membranes	306
	Immune-Mediated Diseases of the Cornea	306

Thygeson Superficial Punctate Keratitis	306
Interstitial Keratitis Associated With Infectious Diseases	307
Cogan Syndrome	309
Marginal Corneal Infiltrates	310
Peripheral Ulcerative Keratitis Associated With Systemic Immune-Mediated Diseases	311
Mooren Ulcer	313
Corneal Transplant Rejection.	316
Angiogenesis and Lymphangiogenesis in the Cornea	317
Immune-Mediated Diseases of the Episclera and Sclera	318
Episcleritis	318
Scleritis	319

12 Clinical Approach to Neoplastic Disorders of the Conjunctiva and Cornea 327

Highlights	327
Introduction	327
Approach to the Patient With a Neoplastic Ocular Surface Lesion	328
Management of Patients With Ocular Surface Tumors	328
Surgical Treatment	329
Topical Chemotherapy.	330
Tumors of Epithelial Origin	332
Benign Epithelial Tumors	332
Ocular Surface Squamous Neoplasia	334
Glandular Tumors of the Conjunctiva	337
Oncocytoma	337
Sebaceous Gland Carcinoma	337
Tumors of Neuroectodermal Origin	338
Benign Pigmented Lesions	338
Preinvasive Pigmented Lesions	342
Malignant Pigmented Lesions	343
Neurogenic and Smooth-Muscle Tumors	345
Vascular and Mesenchymal Tumors	345
Benign Tumors	345
Malignant Tumors	347
Lymphatic and Lymphocytic Tumors	348
Lymphatic Malformations: Lymphangiectasia and Lymphangioma	348
Lymphoid Hyperplasia	348
Lymphoma	349
Metastatic Tumors	350

13 Therapeutic Interventions for Ocular Surface Disorders 351

Highlights	351
Introduction	351

Conjunctival Interventions for Ocular Surface Disorders	352
Pterygium Excision	352
Autologous Conjunctival Transplantation	356
Conjunctival Flap for Corneal Disease	356
Conjunctival Biopsy	360
Treatment of Conjunctivochalasis	361
Limbal Stem Cell Transplantation	362
Mucous Membrane Grafting	365
Corneal Interventions for Ocular Surface Disorders	366
Superficial Keratectomy and Corneal Biopsy	366
Management of Persistent Corneal Epithelial Defects, Thinning, and Perforation	368
Tattoo for Corneal Scars	371
Tarsorrhaphy	372

14 Clinical Aspects of Toxic and Traumatic Injuries of the Anterior Segment	375
Highlights	375
Chemical Injuries	375
Alkali Burns	375
Acid Burns	380
Management of Chemical Injuries	381
Injuries Caused by Temperature and Radiation	384
Thermal Burns	384
Ultraviolet Radiation	385
Ionizing Radiation	386
Injuries Caused by Animal and Plant Substances	386
Insect and Arachnid Injuries	386
Vegetative Injuries	387
Concussive (Blunt) Trauma	387
Subconjunctival Hemorrhage	387
Corneal Changes From Blunt Trauma	388
Traumatic Mydriasis and Miosis	388
Traumatic Anterior Uveitis	389
Iridodialysis and Cyclodialysis	390
Traumatic Hyphema	391
Penetrating and Perforating Ocular Trauma	396
Conjunctival Laceration	396
Conjunctival Foreign Body	397
Corneal Abrasion	398
Corneal Foreign Body	399
Evaluation and Management of Perforating Ocular Trauma	401
Evaluation	401
Nonsurgical Management	402
Surgical Management	403

15	Clinical Approach to Corneal Transplantation	411
	Highlights	411
	Corneal Transplantation	411
	Keratoplasty and Eye Banking	413
	Milestones in the History of Keratoplasty and Eye Banks	413
	Modern Eye Banking and Donor Selection	414
	Tissue Processing and Preservation	414
	Transplantation for the Treatment of Corneal Disease	417
	Preoperative Evaluation and Preparation of the	
	Transplant Patient	418
	Penetrating Keratoplasty	419
	Intraoperative Complications	419
	Postoperative Care and Complications	423
	Control of Postoperative Corneal Astigmatism and	
	Refractive Error	431
	Lamellar Keratoplasty	433
	Anterior Lamellar Keratoplasty	433
	Complications	435
	Endothelial Keratoplasty	436
	Advantages	438
	Disadvantages	438
	Intraoperative Complications	440
	Postoperative Care and Complications	440
	Novel Methods for Treatment of Endothelial Dysfunction	449
	Pediatric Corneal Transplantation	450
	Corneal Autograft Procedures	451
	Keratoprosthesis	452
	Basic Texts	455
	Related Academy Materials	457
	Requesting Continuing Medical Education Credit	459
	Study Questions	461
	Answer Sheet for Section 8 Study Questions	469
	Answers	471
	Index	479

General Introduction

The Basic and Clinical Science Course (BCSC) is designed to meet the needs of residents and practitioners for a comprehensive yet concise curriculum of the field of ophthalmology. The BCSC has developed from its original brief outline format, which relied heavily on outside readings, to a more convenient and educationally useful self-contained text. The Academy updates and revises the course annually, with the goals of integrating the basic science and clinical practice of ophthalmology and of keeping ophthalmologists current with new developments in the various subspecialties.

The BCSC incorporates the effort and expertise of more than 90 ophthalmologists, organized into 13 Section faculties, working with Academy editorial staff. In addition, the course continues to benefit from many lasting contributions made by the faculties of previous editions. Members of the Academy Practicing Ophthalmologists Advisory Committee for Education, Committee on Aging, and Vision Rehabilitation Committee review every volume before major revisions. Members of the European Board of Ophthalmology, organized into Section faculties, also review each volume before major revisions, focusing primarily on differences between American and European ophthalmology practice.

Organization of the Course

The Basic and Clinical Science Course comprises 13 volumes, incorporating fundamental ophthalmic knowledge, subspecialty areas, and special topics:

- 1 Update on General Medicine
- 2 Fundamentals and Principles of Ophthalmology
- 3 Clinical Optics
- 4 Ophthalmic Pathology and Intraocular Tumors
- 5 Neuro-Ophthalmology
- 6 Pediatric Ophthalmology and Strabismus
- 7 Orbit, Eyelids, and Lacrimal System
- 8 External Disease and Cornea
- 9 Intraocular Inflammation and Uveitis
- 10 Glaucoma
- 11 Lens and Cataract
- 12 Retina and Vitreous
- 13 Refractive Surgery

In addition, a comprehensive Master Index allows the reader to easily locate subjects throughout the entire series.

References

Readers who wish to explore specific topics in greater detail may consult the references cited within each chapter and listed in the Basic Texts section at the back of the book.

These references are intended to be selective rather than exhaustive, chosen by the BCSC faculty as being important, current, and readily available to residents and practitioners.

Videos

This edition of Section 8, *External Disease and Cornea*, includes videos related to topics covered in the book. The videos were selected by members of the BCSC faculty and are available to readers of the print and electronic versions of Section 8. Mobile-device users can scan the QR code below (a QR-code reader must already be installed on the device) to access the video content.

Study Questions and CME Credit

Each volume of the BCSC is designed as an independent study activity for ophthalmology residents and practitioners. The learning objectives for this volume are given on page 1. The text, illustrations, and references provide the information necessary to achieve the objectives; the study questions allow readers to test their understanding of the material and their mastery of the objectives. Physicians who wish to claim CME credit for this educational activity may do so by following the instructions given at the end of the book.

Conclusion

The Basic and Clinical Science Course has expanded greatly over the years, with the addition of much new text, numerous illustrations, and video content. Recent editions have sought to place a greater emphasis on clinical applicability while maintaining a solid foundation in basic science. As with any educational program, it reflects the experience of its authors. As its faculties change and medicine progresses, new viewpoints emerge on controversial subjects and techniques. Not all alternate approaches can be included in this series; as with any educational endeavor, the learner should seek additional sources, including Academy Preferred Practice Pattern Guidelines.

The BCSC faculty and staff continually strive to improve the educational usefulness of the course; you, the reader, can contribute to this ongoing process. If you have any suggestions or questions about the series, please do not hesitate to contact the faculty or the editors.

The authors, editors, and reviewers hope that your study of the BCSC will be of lasting value and that each Section will serve as a practical resource for quality patient care.

Objectives

Upon completion of BCSC Section 8, *External Disease and Cornea*, the reader should be able to

- describe the anatomy of the external eye and cornea
 - describe the techniques used for systematic evaluation of the cornea, including tests for assessing corneal topography, tensile strength, and endothelial function
 - identify the distinctive clinical signs of specific diseases of the ocular surface
 - identify the two most common underlying causes of dry eye
 - identify and differentiate the corneal dystrophies
 - select the appropriate management of the corneal dystrophies
 - recognize common corneal manifestations of systemic disease
 - outline an approach to the evaluation, diagnosis, and management of immune-related and neoplastic disorders of the external eye and anterior segment
 - describe the indications for and techniques of surgical procedures used in the management of corneal disease, trauma, and refractive error
 - discuss common surgical interventions for ocular surface disorders such as pterygium and corneal melts
 - explain the role of full-thickness and lamellar transplantation in the treatment of corneal disease
-