

# **Principles and Guidelines of a Curriculum for Education of the Ophthalmic Specialist**

**Presented By:  
International Task Force on Resident and Specialist Education in  
Ophthalmology**

**On Behalf of:  
The International Council of Ophthalmology (ICO)**

**Chairman of Task Force: Morton F. Goldberg, MD (USA)**

**Major Contributors:**

Morton F. Goldberg, MD (USA)  
Andrew G. Lee, MD, (USA)  
And Other Members of International Task Force\*

**Coordinator of Educational Programs of ICO and Editor:**

Mark O.M. Tso, MD (China) (USA)

**Executive Committee of ICO:**

Gottfried O.H. Naumann, MD, President (Germany)  
Mark O.M. Tso, MD, Vice-President (China) (USA)  
Bruce E. Spivey, MD, Secretary General (USA)  
Balder Gloor, MD, Treasurer (Switzerland)

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945 Green Street, San Francisco, California, USA 94133  
Fax: (+1) 415 409-8403 E-mail: [info@icoph.org](mailto:info@icoph.org) Web: [www.icoph.org](http://www.icoph.org)

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**Key to levels of training**

- Basic level =(Corresponding to United States Post-Graduate Year [PGY]-2)\*
- Standard level = (Corresponding to US Post-Graduate Year [PGY-3])
- Advanced level (Corresponding to US Post-Graduate Year [PGY-4])

\*In the United States, the post-graduate year 1 (after medical school) is a one year general training year (i.e., “internship”, “preliminary medicine, surgery, transitional year,” etc.).

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## I. PREAMBLE

An ophthalmologist is a doctor of medicine (MD or equivalent degree) who specializes in the eye and visual system. As a licensed medical doctor, the ophthalmologist's ethical and legal responsibilities include the care of individuals and populations suffering from diseases of the eye and visual system. Such care requires not only core competencies for an ophthalmic physician, but also a set of specialized cognitive capabilities and an array of technical skills. Specialist training is designed to provide a structured program of learning that facilitates the acquisition of knowledge, understanding, skills and attitudes to a level appropriate for an ophthalmic specialist who has been fully prepared to begin his/her career as an independent consultant in ophthalmology.

- **Goals**

The attached document provides an outline of essential intellectual and clinical information (cognitive and technical skills) that is necessary for a modern, comprehensive ophthalmologist.

Core competencies and technical skills are described briefly in this preamble, below. Skills in epidemiology and research methodologies, however, are not specifically addressed, but are important for the well-rounded ophthalmologist.

World blindness and reduced vision affect hundreds of millions of people, and the causes vary widely. The knowledge required to understand and treat the diseases commonly encountered in one part of the world may be entirely different from that required in other locations; for example, trachoma vs. age-related macular degeneration, or nutritional blindness vs. diabetic retinopathy, etc. Accordingly, the curricular components deemed essential in one geographical locale or one cultural system may be relatively unimportant in other regions, depending upon prevalence of diseases, the medical infrastructure, and other factors.

Levels of economic and social development also vary widely throughout the world. Treatments and techniques considered indispensable for one group of people may simply be unattainable or unimportant for others, due to lack of economic resources, unavailability of highly specialized personnel or equipment, and many other factors. Thus, the standards proposed herein should be considered aspirational guidelines to be sought and attained as soon as practicable. They cannot be instantly achieved in all parts of the world, desirable as they might be. They need to be modified according to local priorities, goals, needs, culture, governmental policies, social systems, financial constraints, varying use of para-ophthalmic personnel, and differing tangible resources. Even in highly developed societies, with large and well financed governmental systems of health care delivery, this document should be considered a "work in progress" and, with experience over time, revised and modified in order to best suit local needs, as well as to keep abreast of constantly expanding knowledge and technology. In this regard, feedback to the I.C.O., with specific suggestions for changes and improvement in these guidelines, is earnestly solicited from the readers and will be greatly appreciated by the authors of this document and by the leadership of the I.C.O.

- **History of Curricular Development**

The I.C.O. has had intense interest and commitment to ophthalmic education for many years. Under the leadership of Professor Maurice H. Luntz, for example, the International Committee for Teaching and Continuing Educational Systems of the International Council of Ophthalmology has described training programs throughout the world and has offered guidelines for education of ophthalmologists on numerous occasions during the 1980's and 1990's, including presentations at the 14<sup>th</sup>, 24<sup>th</sup> and 26<sup>th</sup> quadrennial meetings of the I.C.O.

In 2000, the I.C.O. and the Academia Ophthalmologica Internationalis (A.O.I) published "Vision for the Future," an international strategic plan to preserve and restore vision. Within this plan, a task force on resident and specialist training in ophthalmology, under the direction of Professor Ronald E. Smith, noted the following.

- Guidelines for ophthalmology training are not fixed and should not be viewed as rigid or mandatory.
- Training should be provided through a combination of lectures, supervised patient care, and graduated, hands-on procedural and surgical experience, research, and independent study.
- The focus should be not only on acquisition of knowledge and skills related to ophthalmology, but also on development of an appreciation for the importance of vision research, life-long learning, and the education of the public and other physicians.
- The curriculum should be approximately 3-5 years in length, depending upon the individual country or region, and should prepare the graduating ophthalmologist for an examination or testing process that leads to licensure, registration, or a related certification system.
- Facilities should include: up-to-date ophthalmic equipment and instruments; examining rooms dedicated to ophthalmic education; links to hospitals or other facilities for anesthesia, radiology, clinical testing laboratories, other diagnostic services, and modern surgical suites with appropriate equipment. In addition, repositories of library materials or internet access to ophthalmic educational materials, such as journals, texts, tests, videotapes, and related resources, should be available, along with facilities for lectures and conferences (including audio-visual equipment).
- A culture of learning and teaching should be established that includes not just modern facilities, but also a committed and dedicated cadre of skilled educators.
- Periodic audits and assessments of progress of individual trainees should include formal tests (oral or written). Examinations developed by Professor Peter Watson and a committee of specialists can be accessed by email at [ICO.exam@btinternet.com](mailto:ICO.exam@btinternet.com)); these examinations require extensive knowledge in both basic and clinical sciences. Review of case logbooks (surgical and non-surgical) should regularly occur at each stage of the training process. The logbook for all surgical procedures should include pre-operative indications,

intra-operative complications, and postoperative complications. The logbook is an important educational, clinical, and administrative tool.

- In addition, it is now considered desirable for supervised surgical training to begin as soon as possible after entry into the ophthalmic educational system. Graduated levels of responsibility should occur, commensurate with a trainee's education and set of skills. Various educational adjuncts should be available, including practice surgery on animal or outdated eye bank eyes, dissections of cadavers, videotapes, and web-based systems of instruction. Videotaping surgery performed by trainees is extremely useful, both for the surgeon in training and for the mentor. Assisting senior surgeons on a regular basis is a time-honored and helpful educational activity for the trainee. In addition to acquiring intra-operative skills, the ophthalmologist in training must acquire abilities for pre-operative selection of suitable surgical candidates and in postoperative care. Details of surgical training (i.e., minimum requirements) are not included here, because local customs and legal requirements differ throughout the world. In some countries, limited standardized training programs are offered for surgical technicians who have been perceived as not fully trained ophthalmologists, but who are necessary for the care of populations having no access to such ophthalmologists.

Guidelines for logbook requirements and minimum numbers of supervised surgical cases do vary from country to country. Valuable information on these issues can be obtained from: [www.rcophth.ac.uk](http://www.rcophth.ac.uk), [www.acgme.org](http://www.acgme.org), [www.ranzco.edu](http://www.ranzco.edu), and [www.aao.org](http://www.aao.org).

- Periodic audits of individual training programs are also desirable.

- **The I.C.O. Task Force on Resident and Specialist Training**

In order to prepare a document having value for widely different nationalities, cultures, medical status, and socioeconomic developments, ophthalmic curricula were initially solicited and evaluated from national and local agencies throughout the world. Representative documents were received and analyzed from over 30 countries. Based upon these and related materials, the I.C.O. Task Force on Ophthalmology for Resident and Specialist Training prepared the attached curricular guidelines and standards for international use. In draft form, this document was initially reviewed by over 100 representatives of the I.C.O., the A.O.I., other transnational and national eye organizations, the American Academy of Ophthalmology, the Association of University Professors of Ophthalmology in the United States, and numerous university departments of ophthalmology throughout the world. In addition, advice was received from ophthalmic leaders with different subspecialty skills and expertise in Africa, Asia, Australia and New Zealand, Europe, North America, Central America, South America, and the United Kingdom. This review process took over 18 months to complete. In addition, the draft document was placed on the website of the I.C.O. for over six months in order to elicit feedback and suggestions before promulgating it in its present (and modifiable) form. The draft was also presented in person to the Asia-Pacific

Ophthalmology meeting in Bangkok, Thailand, 2003, and to the American University Professors of Ophthalmology meeting in Sarasota, Florida, 2003.

- **Format of the I.C.O. Curriculum**

The ICO curriculum presented here is an outline for 3 years of supervised ophthalmic training at progressively more advanced levels. The “basic level” of education corresponds to United States post-graduate year #2 (PGY2); i.e., following both medical school graduation plus one year of postgraduate general (non-ophthalmic) medical training. The “standard level” corresponds to US PGY #3; and the “advanced level” corresponds to US PGY #4. As noted previously, local, national, or transnational cultural systems will require modification of this duration (and content) of training. Indeed, in some locations, where clinical needs are urgent and pressing, marked abbreviations of the training program will be necessary in order to provide the region with sufficient numbers of practitioners, both medical and surgical (although at reduced levels of competence in certain areas of knowledge). For each level within the curriculum presented here, both cognitive skills and technical skills are listed. There is some planned repetition within the standard and advanced levels, because some areas are complex or important enough to deserve this emphasis. The following categories of knowledge are included: optics; cataract and lens; contact lenses; cornea, external disease and refractive surgery; glaucoma; neuro-ophthalmology; histopathology; ocular plastic surgery and orbit; pediatric ophthalmology and strabismus; vitreoretinal disease; uveitis; ocular oncology; low vision rehabilitation; and ophthalmic practice and ethics.

In some countries, ophthalmic training extends beyond the 3-year curriculum offered here, so that exceptional mastery of select subspecialty areas (for example, cornea, retina, glaucoma, etc.) can be achieved. Graduates of such programs are designated by different titles (e.g., “fellows” in North America). It is not the goal of the attached curricular outline to encompass all the knowledge and skills of such subspecialty areas, but mastery of the advanced level of this curriculum will provide introductory and transitional knowledge and skills leading towards even higher levels of sophistication. Individuals at these subspecialty levels of training ordinarily should also have accomplished the goals of the attached three-year curricular outline that is offered here.

A list of references is provided for the curriculum, but obviously, future new information, which accrues regularly and rapidly, will need to be added to this list by the reader. Evidence-based medicine, in which therapeutic decisions are based on documented, verifiable and validated information, is appropriately assuming increasing importance as an educational framework upon which individual physicians should make recommendations for their patients. Whenever possible, those references and sources of knowledge providing such information should receive precedence and preference by both teachers and students of clinical ophthalmology. Links to the practice of evidence-based medicine can be found at [www.aaopt.org](http://www.aaopt.org).

- **Core Competencies and Subcompetencies**

In addition to the specialized cognitive and technical skills described in this curriculum, several generic core “competencies” are expected of ophthalmic, as well as other,

medical specialists, as promulgated by the Accreditation Council for Graduate Medical Education (ACGME). Their website is [www.acgme.org](http://www.acgme.org).

These core competencies include the following:

- Patient care,
- Medical knowledge,
- Practice-based learning and improvement,
- Interpersonal and communication skills,
- Professionalism, and
- Systems-based practice.

#### *Patient Care*

Trainees (“residents”) must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents are expected to:

- communicate effectively and demonstrate caring and respectful behaviors when interacting with patients and their families;
- gather essential and accurate information about their patients;
- make informed decisions about diagnostic and therapeutic interventions, based on patient information and preferences, up-to-date scientific evidence, and clinical judgment;
- develop and carry out patient management plans;
- counsel and educate patients and their families;
- use information technology to support patient care decisions and patient education;
- perform competently the medical and invasive procedures considered essential for the area of practice;
- provide health care services aimed at preventing health problems or maintaining health;
- work with health care professionals, including those from other disciplines, to provide patient-focused care.

#### *Medical Knowledge*

Residents must demonstrate knowledge about established and evolving biomedical, clinical, and cognate (e.g. epidemiological and social-behavioral) sciences and the application of this knowledge to patient care. Residents are expected to:

- demonstrate an investigatory and analytic thinking approach to clinical situations;

- know and apply the basic and clinically supportive sciences which are appropriate to ophthalmology.

*Practice-based Learning and Improvement*

Residents must be able to investigate and evaluate their patient care practices, appraise and assimilate scientific evidence, and improve their patient care practices. Residents are expected to:

- analyze practice experience and perform practice-based improvement activities using a systematic methodology;
- locate, appraise, and assimilate evidence from scientific studies related to their patients' health problems;
- obtain and use information about their own population of patients and the larger population from which their patients are drawn;
- apply knowledge of study designs and statistical methods to the appraisal of clinical studies and other information on diagnostic and therapeutic effectiveness;
- use information technology to manage information, access on-line medical information; and support their own education; and
- facilitate the learning of students and other health care professionals.

*Interpersonal and Communication Skills*

Residents must be able to demonstrate interpersonal and communication skills that result in effective information exchange and teaming with patients, patients' families, and professional associates. Residents are expected to:

- create and sustain a therapeutic and ethically sound relationship with patients;
- use effective listening skills and elicit and provide information using effective nonverbal, explanatory, questioning, and writing skills; and
- work effectively with others as a member or leader of a health care team or other professional group.

*Professionalism*

Residents must demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population. Residents are expected to:

- demonstrate respect, compassion, and integrity; a responsiveness to the needs of patients and society that supercedes self-interest; accountability to patients, society, and the profession; and a commitment to excellence and on-going professional development;

- demonstrate a commitment to ethical principles pertaining to provision or withholding of clinical care, confidentiality of patient information, informed consent, and business practices; and
- demonstrate sensitivity and responsiveness to patients' culture, age, gender, and disabilities.

*Systems-based Practice*

Residents must demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value. Residents are expected to:

- understand how their patient care and other professional practices affect other health care professionals, the health care organization and the larger society, and how these elements of the system affect their own practice;
- know how types of medical practice and delivery systems differ from one another, including methods of controlling health care costs and allocating resources;
- practice cost-effective health care and resource allocation that do not compromise quality of care;
- advocate for high quality patient care and assist patients in dealing with system complexities; and
- know how to partner with health care managers and health care providers to assess, coordinate, and improve health care and know how these activities can affect system performance

Professional attitudes and conduct require that trainees must also have developed a style of care which is:

- humane (reflecting compassion in providing bad news, if necessary; the management of the visually impaired; and recognition of the impact of visual impairment on the patient and society);
- reflective (including recognition of the limits of his/her knowledge, skills and understanding);
- ethical;
- integrative (including involvement in an inter-disciplinary team for the eye care of children, the handicapped, the systemically ill, and the elderly); and
- scientific (including critical appraisal of the scientific literature, evidence-based practice and use of information technology and statistics).

### **Basic, Standard and Advanced levels of the curriculum.**

The suggested curriculum in all chapters is designed to serve as a content outline for a fund of knowledge. The learning objectives are designed to emphasize recall of information (fund of knowledge), understanding and application of basic sciences (e.g., anatomy, physiology, biochemistry, embryology, pharmacology), application of pathogenetic mechanisms to clinical problems, ordering and interpreting clinical, laboratory, and imaging information, development of a differential diagnosis, implementation of a reasonable and appropriate therapeutic medical and/or surgical plan, and anticipation, recognition, and treatment of complications.

This curriculum is not designed to be all inclusive, and individual programs should modify and apply the content as deemed appropriate to meet local, regional, and national priorities. It is intended solely as a guideline for the training of ophthalmic specialists. We recognize that certain specialized and expensive techniques of diagnosis and therapy are not universally available. All of the goals cannot invariably be achieved, but they should serve as aspirational guidelines towards achieving modern methods of diagnosis and care of common eye problems. It should be noted that parenthetical listings preceded by “e.g.” represent examples only, and do not comprise a complete listing of items in the category.

### **BASIC LEVEL GOALS: PGY-2**

- A. To describe the basic principles of optics and refraction.
- B. To list the indications for and to prescribe the most common low vision aids.
- C. To perform the basic anterior segment (e.g., basic refraction, basic retinoscopy, slit lamp biomicroscopy) and posterior segment examination skills (e.g., dilated fundus examination, use of magnification and lenses, Hruby lens, 90 Diopter lens, three mirror Goldmann contact lens) and to understand and use basic ophthalmic instruments (e.g., tonometer, lensometer).
- D. To triage and manage ocular emergencies (e.g., central retinal artery occlusion, giant cell arteritis, chemical burn, acute angle closure glaucoma, endophthalmitis, traumatically open globe).
- E. To perform minor external and adnexal surgical procedures (e.g., chalazion excision, corneal foreign body removal, use of foreign body corneal drill for removal of a rust ring, conjunctival biopsy, corneal scraping, isolated entropion).
- F. To identify the key examination techniques and management of basic and most common medical problems in the subspecialty areas of glaucoma (e.g., primary open angle glaucoma), cornea (e.g., dry eye, microbial keratitis), orbit and oculoplastics (e.g., common lid lesions, ptosis), retina (e.g., macular disorders, retinal detachment, diabetic retinopathy), and neuro-ophthalmology (e.g., optic neuropathy, ocular motor neuropathy, pupillary abnormalities, visual field defects).
- G. To describe indications for, performance of, and complications of common anterior segment surgery, (e.g., cataract extraction, trabeculectomy, peripheral iridectomy), and to assist at surgery.
- H. To describe the common but serious genetic ocular disorders (e.g., retinal and macular dystrophies).
- I. To recognize the most common ophthalmic histopathology findings and to recognize basic

histopathology of common ocular lesions (e.g., retinal detachment, pterygium, corneal button removed at keratoplasty).

**STANDARD LEVEL GOALS: PGY-3 (In addition to Basic Level goals)**

- A. To describe the more advanced principles of optics and refraction.
- B. To list the indications for and uses of more advanced low vision aids.
- C. To perform more advanced anterior segment (e.g., more complex refractions, including contact lens and post-operative refractions, intermediate retinoscopy, including moderate astigmatism, examination of young children, intermediate techniques of slit lamp biomicroscopy) and posterior segment examination skills (e.g., more advanced techniques of dilated fundus examination, including scleral depression, use of magnification and lenses to diagram and describe retinal lesions).
- D. To recognize and treat ocular emergencies (e.g. central retinal artery occlusion, giant cell arteritis, chemical burn, acute angle closure glaucoma, endophthalmitis, traumatically open globe), as well as the short and long term complications of these disorders.
- E. To perform more advanced external and adnexal surgical procedures (e.g., isolated ectropion and isolated entropion repair, removal of small, localized, and benign lid lesions, pterygium excision).
- F. To identify the key examination techniques and management of the less common surgical problems in the subspecialty areas of glaucoma (e.g., secondary open angle and closed angle glaucoma), cornea (e.g., fungal and other less common microbial keratitis, corneal transplantation), ophthalmic plastic surgery (e.g., extensive benign and common lid lesions, ptosis), retina (e.g., primary retinal detachment, mild to moderate proliferative and non-proliferative diabetic retinopathy and laser treatments), and neuro-ophthalmology (e.g., less common optic neuropathy, supranuclear palsies, myasthenia gravis, more complex visual field defects).
- G. To perform common anterior segment surgery (e.g., cataract extraction, trabeculectomy, peripheral iridectomy).
- H. To recognize, and refer if indicated, some major genetic ocular disorders (e.g., neurofibromatosis I and II, tuberous sclerosis, von Hippel-Lindau syndrome, retinoblastoma, retinitis pigmentosa, macular dystrophy).
- I. To recognize more complex and difficult ophthalmic histopathology findings.

**ADVANCED LEVEL GOALS: PGY-4 (In addition to Standard Level goals)**

- A. To describe the advanced principles of optics and refraction (e.g., pre- and post-refractive surgery, higher order aberrations).
- B. To list the indications for and uses of advanced low vision aids.
- C. To perform the most advanced anterior segment (e.g., complex refractions, advanced retinoscopy, advanced slit lamp biomicroscopy) and posterior segment examination skills (e.g., drawings of retinal detachments and scleral depressions; interpretation of macular disorders with slit lamp biomicroscopy).
- D. To manage or supervise the more junior trainees (e.g., medical students or medical residents) in the management ocular emergencies (e.g, central retinal artery occlusion, giant cell arteritis, chemical burn, angle closure glaucoma, endophthalmitis).

- E. To perform more advanced external and adnexal surgical procedures (e.g., lacrimal gland procedures, complex lid laceration repair, e.g., canalicular and lacrimal apparatus involvement).
- F. To identify the key examination techniques and management of complex but common medical and surgical problems in the subspecialty areas of glaucoma (e.g., complicated or post-operative primary and secondary open and closed angle glaucoma), cornea (e.g., unusual or rare types of microbial keratitis), ophthalmic plastic surgery (e.g., less common and more complex lid lesions, re-operation or complex or recurrent ptosis), retina (e.g., complex retinal detachment, tractional retinal detachments and severe proliferative diabetic retinopathy, proliferative vitreoretinopathy), and neuro-ophthalmology (e.g., unusual optic neuropathy, neuroimaging, supranuclear palsies, uncommon visual field defects).
- G. To perform and treat complications of common anterior segment surgery, (e.g., cataract extraction, trabeculectomy, peripheral iridectomy).
- H. To recognize, evaluate, and treat, if possible, the major genetic ocular disorders (e.g., neurofibromatosis I and II, tuberous sclerosis, von Hippel-Lindau syndrome, retinoblastoma, retinitis pigmentosa, macular degenerations).
- I. To recognize uncommon or rare but classic ophthalmic histopathology findings.

*Trainees at all levels of training should be able to describe the key features and apply in clinical practice the results of evidence-based medicine in ophthalmology, including, but not limited to, the results of the following clinical trials (see Appendix 1 for full references)*

*The Herpetic Eye Disease Study (HEDS)*

*The Fluorouracil Filtering Surgery Study (FFSS)*

*The Normal Tension Glaucoma Study*

*The Ocular Hypertension Study (OHTS)*

*The Glaucoma Laser Trial (GLT)*

*The Optic Neuritis Treatment Trial (ONTT)*

*The Ischemic Optic Neuropathy Decompression Trial (IONDT)*

*Studies of the Ocular Complications of AIDS (SOCA)*

*Branch Vein Occlusion Studies (BVOS)*

*Macular Photocoagulation Study (MPS)*

*Age-Related Eye Disease Study (AREDS)*

*Verteporfin in Photodynamic Therapy (VIP) Study*

*Treatment of Age-Related Macular Degeneration with Photodynamic Therapy (TAP)*

*Silicone (oil) Study*

*The Submacular Surgery Trials (SST)*

*The Multicenter Trial of Cryotherapy for Retinopathy of Prematurity (CRYO-ROP)*

*Central Vein Occlusion Studies (CVOS)*

*Diabetes Control and Complications Trial (DCCT)*

*Diabetic Retinopathy Study (DRS)*

*Early Treatment Diabetic Retinopathy Study (ETDRS)*

*Randomized Trial of Acetazolamide for Uveitis-Associated Cystoid Macular Edema*

*Collaborative Ocular Melanoma Study (COMS)*

## II. OPTICS

### BASIC LEVEL GOALS: PGY-2

*To understand the principles, concepts, instruments, and methods outlined below and be able to apply them in clinical practice.*

#### A. Physical optics

1. Properties of light
  - a. Electromagnetic spectrum
  - b. Wave theory
  - c. Photon-particle theory
2. Diffraction
3. Interference and coherence
4. Resolution
5. Polarization
6. Scattering
7. Transmission and absorption
8. Photometry
9. Lasers
10. Illumination
11. Image quality
12. Brightness and radiance
13. Light propagation –optical media and refractive index

#### B. Geometric optics

1. Reflection (mirrors)
  - a. Laws of reflection
  - b. Reflection at a plane surface (Image and field of a plane mirror)
  - c. Reflection at curved surfaces (Focal point and focal length of a spherical mirror)
  - d. Images and objects as light sources
  - e. Refractive index
  - f. Multiple lens system
2. Refraction
  - a. Laws of refraction (Snell's law)
    - 1) Passage of light from one medium to another
    - 2) Absolute index of refraction
    - 3) Total internal reflection
  - b. Refraction at a plane surface
  - c. Refraction at curved surfaces
  - d. Critical angle and total internal reflection
  - e. Image jump and displacement
3. Prisms
  - a. Definition

- b. Notation of prisms (e.g., prism diopters)
  - c. Uses in ophthalmology (diagnostic and therapeutic)
  - d. Types of prisms (plane; parallel; plate)
  - e. Prentice rule
  - f. Fresnel prisms
  - g. Refraction of light through a prism
  - h. Thin prisms
  - i. Prismatic effect of lenses
4. Spherical lenses
- a. Cardinal points
  - b. Thin lens formula
  - c. Thick lens formula
  - d. Formation of the image
  - e. Vergence of light (diopter; convergence; divergence; vergence formula)
  - f. Concave and convex
  - g. Magnification (linear; angular; relative size; electronic)
  - h. Spherical decentration and prism power
  - i. Lens form
  - j. Binocular balancing
  - k. Refracting the basic low vision patient
5. Astigmatic lenses
- a. Cylindrical lenses
    - 1) Sphero-cylinder lenses and surfaces
    - 2) Cross cylinders, e.g., Jackson cross cylinder
  - b. Maddox rod
  - c. Toric lenses
  - d. Conoid of Sturm
6. Notation of lenses
- a. Spectacle prescribing
  - b. Simple transposition
  - c. Toric transposition
7. Identification of unknown lenses
- a. Neutralization
  - b. Focimeter
  - c. Geneva lens measure
8. Aberrations of lenses
- a. Correction of aberrations relevant to the eye (spherical, coma, astigmatism, distortion, pantoscopic tilt)
  - b. Dychrome test
9. Lens materials

- C. Clinical optics
  - 1. Optics of the eye
  - 2. Transmittance of light by the optic media
  - 3. Schematic and reduced eye
  - 4. Pupillary response and its effect on the resolution of the optical system (Stiles Crawford effect)
  - 5. Visual acuity
    - a. Distance and near acuity measurement
    - b. Minimal (visible; perceptible; separable; legible)
    - c. Vernier acuity
  - 6. Contrast sensitivity
  - 7. Catoptric images
  - 8. Emmetropia
  - 9. Accommodation
  - 10. Purkinje shift
  - 11. Pinhole
  
  - 12. Ametropia
    - a. Myopia
    - b. Hypermetropia (hyperopia)
    - c. Astigmatism
    - d. Anisometropia
    - e. Aniseikonia (Knapp's rule)
    - f. Aphakia
    - g. Optical parameters affecting retinal image size
  
  - 13. Accommodative problems
    - a. Insufficiency
    - b. Excess
    - c. AC/A ratio
  
  - 14. Refractive errors
    - a. Prevalence
    - b. Inheritance
    - c. Changes with age
    - d. Surgically induced
  
  - 15. Correction of ametropia
    - a. Spectacle lenses
    - b. Contact lenses
    - c. Intraocular lenses
    - d. Principles of refractive surgery
  
  - 16. Problems of spectacles in aphakia

17. Effect of spectacles and contact lens correction on accommodation and convergence (amplitude, near point, far point)
18. Effective power of lenses
19. Back vertex distance
20. Spectacle magnification
21. Calculation of intraocular lens power
22. Presbyopia (measuring for near adds)

23. Low vision aids
  - a. High reading addition
  - b. Magnifying lenses
  - c. Telescopic aids –Galilean telescope, Keplerian telescope

D. Clinical refraction

1. Retinoscopy
2. Subjective refraction
3. Measurement of BVD
4. Muscle balance tests
5. Accommodative power
6. Measurement of IPD
7. Decentration of lenses and prismatic effect
8. Best form lens
9. Prescribing multifocal lenses
10. Prescribing for children
11. Cycloplegic refraction

E. Instruments and tests

1. Direct ophthalmoscope
2. Indirect ophthalmoscope
3. Retinoscope
4. Focimeter
5. Simple magnifying glass (loupe)
6. Lensmeter
7. Glare and contrast testing
8. Potential acuity meter
9. Automated refractor
10. Slitlamp microscope (including methods of examination)
11. Stereo tests
12. Corneal topographic measurements (placido disc, keratometer, automated corneal topography)
13. Applanation tonometer
14. Specular microscope
15. Operating microscope
16. Zoom lens principle
17. Corneal pachymeter
18. Lens screen/Hess chart

19. Synophthophore
20. Lenses used for fundus biomicroscopy (panfunduscope, Goldmann lens, Hruby lens, 90 D lens, etc.)
21. Fundus camera
22. Gonioscope
23. Tonometers
24. Color vision tests (Ishihara color plates; Hardy-Rand-Rittler plates, Farnsworth-Munsell testing)

**STANDARD LEVEL GOAL: PGY-3**

Improve proficiency in Basic Level skills

**ADVANCED LEVEL GOALS: PGY-4 (In addition to Standard and Basic Level goals)**

To apply, at the highest level of understanding, the relevant optics information, above, in the following situations

1. Refraction and prescribing of spectacles and contact lenses
2. Intraocular lens calculation
3. Cataract surgery
4. Use of prisms for diplopia
5. Low vision aid prescribing

**III. RETINOSCOPY AND REFRACTION**

**Overall goals**

1. To identify the principles and indications for retinoscopy.
2. To perform the technique of retinoscopy.
3. To identify media opacities with retinoscopy.
4. To perform an integrated refraction based upon retinoscopic results.

**BASIC LEVEL GOALS: PGY-2**

1. To describe the major types of refractive errors.
2. To describe basic ophthalmic optics and optical principles of refraction and retinoscopy.
3. To perform retinoscopy for detecting simple refractive errors.
4. To describe the indications for and to use trial lenses or a phoropter for simple refractive error.
5. To perform objective and subjective refraction techniques for simple refractive error.
6. To perform elementary refraction techniques (e.g., for myopia, hyperopia, near-vision add).
7. To describe the basic principles of a keratometer.

**STANDARD LEVEL GOALS: PGY-3 (In addition to Basic Level goals)**

1. To describe more complex types of refractive errors, including post-operative refractive errors.
2. To perform more advanced refraction techniques (e.g., astigmatism, complex refractions, asymmetric accommodative add).
3. To describe the more advanced ophthalmic optics and optical principles of refraction and retinoscopy (e.g., post-keratoplasty, post-cataract extraction).
4. To perform objective and subjective refraction techniques for more complex refractive errors, including astigmatism and post-operative refractive error.
5. To perform more advanced techniques of retinoscopy for detecting simple and complex refractive error.
6. To describe and use more advanced techniques using trial lenses or the phoropter for more complex refractive errors, including modification and refinement of subjective manifest refractive error and more complex refractive errors (e.g., advanced and irregular astigmatism, vertex distance).
7. To use the keratometer for detection of more advanced refractive error.

**ADVANCED LEVEL GOALS: PGY-4 (In addition to Standard Level goals)**

1. To describe the most complex types of refractive errors, including post-operative refractive errors, post-keratoplasty, and refractive surgery.
2. To perform the most advanced refraction techniques (e.g., irregular astigmatism, pre- and post-refractive surgery).
3. To describe the most advanced ophthalmic optics and optical principles of refraction and retinoscopy, including higher order aberrations.
4. To utilize the most advanced ophthalmic optics and optical principles for refraction and retinoscopy, including higher order aberrations.
5. To perform objective and subjective refraction techniques in the most complex refractive error, including astigmatism and post-operative refractive error.
6. To perform the most advanced techniques using trial lenses or the phoropter for more complex refractive errors, including modification and refinement of subjective manifest refractive error, cycloplegic retinoscopy and refraction, and post-cycloplegic refraction, irregular astigmatism, post-keratoplasty, and refractive surgery cases.
7. To use the keratometer for detection of subtle or complex advanced refractive error.
8. To use more advanced refraction instruments and techniques (e.g., distometer, automated refractor, automated corneal topography).

**IV. CATARACT AND LENS**

**General Goals**

- A. To describe the evaluation and management, indications for, and intra- and post-operative complications of cataract surgery and related anterior segment procedures.
- B. To perform the complete pre-operative ophthalmologic examination of cataract patients.
- C. To formulate the differential diagnoses of cataract and evaluate the normal and abnormal lens.

- D. To perform optimum refraction of the post-cataract surgery patient.
- E. To develop and exercise clinical and ethical decision-making in cataract patients.
- F. To develop good patient communication techniques regarding cataract surgery.
- G. To perform routine and advanced cataract surgery and intraocular lens (IOL) placement.
- H. To manage basic and advanced clinical and surgical cataract problems.
- I. To effectively diagnose and manage intraoperative and post-operative complications of cataract surgery.
- J. To work effectively as a member of the medical care team.
- K. To develop teaching skills about cataracts for training junior trainees and students.

## **BASIC LEVEL GOALS: PGY-2**

### *A. Cognitive skills*

- 1. To identify the most common causes and types of cataract (e.g., anterior polar, cortical nuclear sclerotic, posterior subcapsular).
- 2. To list the basic history and examination steps for pre-operative cataract evaluation.
- 3. To describe the steps in cataract surgical procedures.
- 4. To define the elementary refraction or contact lens fitting techniques to obtain best corrected vision prior to considering cataract extraction.
- 5. To describe the major etiologies of dislocated or subluxated lens (e.g., trauma, Marfan's syndrome, homocystinuria, Weill-Marchesani syndrome, syphilis).
- 6. To be familiar with the techniques of intracapsular cataract extraction, extracapsular cataract extraction, and phacoemulsification.
- 7. To describe the following:
  - a. Basic ophthalmic optics as related to cataracts
  - b. Types of refractive error in cataract
  - c. Retinoscopy techniques for cataracts
  - d. Subjective refraction techniques for cataract patients
  - e. Types of IOLs; IOL power calculation
- 8. To identify and describe the principles and mechanisms of the following instruments in the evaluation of cataracts:
  - a. Lensometer
  - b. Autorefractor
  - c. Retinoscope
  - d. Phoropter
  - e. Keratometer
  - f. Slit lamp biomicroscope
  - g. Glare and contrast testing devices
  - h. Potential acuity meter

### *B. Technical/surgical skills*

- 1. To perform basic slit lamp biomicroscopy, retinoscopy, and ophthalmoscopy.
- 2. To evaluate and classify common types of lens opacities.
- 3. To perform subjective refraction techniques and retinoscopy in patients with cataracts.

4. To perform direct and indirect ophthalmoscopy pre- and post-cataract surgery.
5. To perform basic steps of cataract surgery (e.g., incision, wound closure) in the practice lab.
6. To assist at cataract surgery and perform patient preparation, sterile draping, and anesthesia.
7. To perform the following steps of cataract surgery in the practice lab or under direct supervision, including any or all of the following:
  - a. Wound construction
  - b. Anterior capsulotomy/capsulorrhexis
  - c. Instillation and removal of viscoelastics
  - d. Extracapsular and phacoemulsification techniques (e.g., sculpting, divide & conquer, phaco-chop)
  - e. Irrigation and aspiration
  - f. Cortical clean-up
  - g. IOL implantation (e.g., anterior and posterior)

**STANDARD LEVEL GOALS: PGY-3 (in addition to Basic Level goals)**

*A. Cognitive skills*

1. To describe the less common causes of lens abnormalities (e.g., spherophakia, lenticonus, ectopia lentis).
2. To describe the pre-operative evaluation of the cataract patient, including:
  - a. The systemic diseases of interest or relevance to cataract surgery.
  - b. The relationship of external and corneal diseases of relevance to cataracts and cataract surgery (e.g., lid abnormalities, dry eye).
  - c. The relationships of glaucoma, uveitis, and capsular opacities related to cataract surgery
3. To describe glare analysis testing for cataract surgery.
4. To describe the use of A and B scan ultrasonography in cataract surgery.
5. To describe the instruments and techniques of cataract extraction, including extracapsular surgery and phacoemulsification (e.g., trouble-shooting the phacoemulsification machine, altering the machine parameters).
6. To describe the types, indications and techniques of anesthesia for cataract surgery (e.g., topical, local, general).
7. To describe indications, techniques, and complications of surgical procedures, including:
  - a. Extracapsular surgery
  - b. Intracapsular surgery
  - c. Phacoemulsification
  - d. Paracentesis
  - e. IOL placement
8. To describe history and techniques of basic IOL implantation.
9. To correlate the level of visual acuity with the lens or capsular opacities.
10. To describe the common complications of cataract and anterior segment surgery (e.g., intraocular pressure elevation, hyphema, endophthalmitis, cystoid macular edema, retinal detachment, intra-ocular lens dislocation, lens-induced glaucoma and uveitis).

11. To describe the indications for, principles of, and techniques of YAG laser capsulotomy, and to understand the proper timing of YAG laser capsulotomy.

*B. Technical/surgical skills*

1. To perform local injections of corticosteroids, antibiotics, and anesthetics.
2. To implement the basic preparatory procedures for cataract surgery (e.g, obtaining informed consent, identification of instruments, sterile technique, gloving and gowning, prep and drape, other pre-operative preparation).
3. To use the operating microscope for basic cataract surgery.
4. To perform extracapsular surgery in a practice setting (e.g, animal or practice lab) and then in the operating room under supervision, including mastery of the following skills:
  - a. Wound construction
  - b. Anterior capsulotomy/capsulorrhexis
  - c. Instillation and removal of viscoelastics
  - d. Extracapsular technique
    - e. Beginning phacoemulsification-techniques (e.g., sculpting, divide & conquer, phaco-chop)
    - f. Irrigation and aspiration
    - g. Cortical clean-up
    - h. IOL implantation (e.g., anterior and posterior, special IOLs)
5. To perform paracentesis of the anterior chamber.
6. In addition to performing the appropriate steps in cataract surgery, to assist in cataract surgery and perform more advanced steps in patient preparation and anesthesia.
7. To describe the more advanced applications of viscoelastics in surgery (e.g., control of iris prolapse, elevation of dropped nucleus, viscodissection, aspiration of residual/retained viscoelastic.)
8. To perform basic post-operative evaluation of the cataract patient.
9. To recognize and refer or treat common post-operative complications of cataract surgery (e.g., endophthalmitis, elevated intraocular pressure, cystoid macular edema, wound leak, uveitis).

**ADVANCED LEVEL GOALS: PGY-4 (in addition to Standard Level goals)**

*A. Cognitive skills*

1. To define the more complex indications for cataract surgery (e.g. better view of posterior segment), describe the performance of and describe the complications of more advanced anterior segment surgery (e.g., pseudoexfoliation, small pupils, mature cataract, hard nucleus, black cataract, post-traumatic, zonular dehiscence), including more advanced procedures (e.g., secondary IOLs and indications for specialized IOLs, capsular tension rings, iris hooks, use of indocyanine green staining of the anterior capsule).
2. To describe the instruments and techniques of cataract extraction, including extracapsular surgery and phacoemulsification (e.g., trouble-shooting the phacoemulsification machine, altering the machine parameters).

3. To describe the indications for, techniques of, and complications of cataract extraction in the context of the subspecialty disciplines of glaucoma (e.g., combined cataract and glaucoma procedures, glaucoma in cataractous eyes, cataract surgery in patients with prior glaucoma surgery), retina (e.g., cataract surgery in patients with scleral buckles or prior vitrectomy), cornea (e.g., cataract extraction in patients with corneal opacities), ophthalmic plastic surgery (e.g., ptosis following cataract surgery), and refractive surgery (e.g., cataract surgery in eyes that have undergone refractive surgery).
4. To independently evaluate complications of cataract and IOL implant surgery (e.g., posterior capsular tears, vitreous prolapse, intra-vitreous dislocation of cataractous fragments, choroidal effusions).
5. To understand indications for and technique of intracapsular surgery (e.g., rare cases may require this procedure, or patients may have had the procedure performed previously).
6. To describe indications for and instrumentation and techniques used to implant foldable and non-foldable IOLs.
7. To describe the evaluation and management of common and uncommon causes of post-operative endophthalmitis.
8. To perform repositioning, removal or exchange of IOLs.
9. To assist in the teaching and supervision of basic and standard level learners (i.e., first and second year residents).
10. To describe the government and hospital regulations that apply to cataract surgery.

*B. Technical/surgical skills*

1. To describe the principles, indications for, mechanics of, and performance of A scan ultrasonography and calculation of IOL power.
2. To perform phacoemulsification in a practice setting (e.g., animal or practice lab) and then in the operating room, including mastery of the following skills:
  - a. Wound construction
  - b. Anterior capsulotomy/capsulorrhexis
  - c. Viscoelastics
  - d. Intracapsular, extracapsular and phacoemulsification-techniques (e.g., sculpting, divide & conquer, phaco-chop, stop and chop)
  - e. Instrumentation and techniques of irrigation and aspiration
  - f. IOL implantation (e.g., anterior and posterior, special IOLs)
  - g. IOL repositioning, removal or exchange
3. To perform implantation of foldable and non-foldable IOLs.
4. To perform intraoperative and postoperative management of any event that may occur during or as a result of cataract surgery, including:
  - a. Vitreous loss
  - b. Capsular rupture
  - c. Anterior or posterior segment bleeding
  - d. Positive posterior pressure
  - e. Choroidal detachments
  - f. Expulsive hemorrhage
  - g. Loss of anesthesia
  - h. Elevated intraocular pressure
  - i. Use of topical and systemic medications

- j. Astigmatism
- k. Post operative refraction (simple and complex)
- l. Corneal edema
- m. Wound dehiscence
- n. Hyphema
- o. Residual cortex
- p. Dropped nucleus
- q. Uveitis
- r. Cystoid macular edema (CME)
- s. Elevated intraocular pressure and glaucoma
- t. Postoperative early and late intraocular infection

## V. CONTACT LENS

### BASIC LEVEL GOALS: PGY-2

#### A. Objectives

1. To perform a basic contact lens (CL) history and examination, and to be aware of additional basic tests and questions that are required for CL patients with more complex needs.
2. To perform the techniques of retinoscopy, refraction, and over-refraction in the routine CL patient.
3. To describe the optics of the soft contact lens and hard contact lens (e.g., rigid gas permeable CL); base curve changes, the lacrimal lens, and the optic zone.
4. To describe conversion of a spectacle prescription (Rx) to a CL Rx, including method of converting from plus to minus cylinder.
5. To describe basic CL design, using appropriate terminology.
6. To describe techniques for and perform basic CL fitting.
7. To describe selection of CL candidates with non-complex needs.
8. To use auxiliary CL instruments and tests (e.g., trial set, fluorescein testing).
9. To perform CL verification for vision correction, fit, and comfort.
10. To describe contraindications for contact lens use.

#### B. Cognitive skills

1. To describe fundamentals of ophthalmic optics in CL management (e.g., CL choices, techniques for fitting individuals).
2. To list indications for contact lenses in non-complex cases.
3. To describe CL choices and techniques for fitting individuals with non-complex CL needs.

#### C. Technical skills

1. To perform advanced retinoscopy techniques in a CL patient.
2. To perform advanced refraction techniques in a CL patient, including diagnostic fitting.
3. To perform techniques to verify and inspect contact lenses.
4. To utilize appropriate teaching skills to instruct patients in the safe insertion, removal, and care of contact lenses.

**STANDARD LEVEL GOALS: PGY-3 (in addition to the Basic Level objectives and skills)**

*A. Objectives*

1. To perform a more advanced CL history and examination, employing additional tests and questions appropriate for patients with more complex CL needs (e.g., keratoconus, difficult CL fittings).
2. To perform retinoscopy and refraction in the CL patient with more complex needs (e.g., keratoconus, post-keratoplasty).
3. To describe the more advanced optics of the soft contact lens (SCL) and hard contact lens (e.g., rigid gas permeable CL); base curve changes, the lacrimal lens, and the optic zone.
4. To describe more advanced CL design (e.g., special lenses and special CL shapes or materials).
5. To describe and perform more advanced CL fitting (e.g., post-keratoplasty).
6. To describe selection of CL candidates with more complex needs (e.g., post-surgical).
7. To use auxiliary CL instruments in patients with more complex needs (e.g., post-surgical topography).
8. To perform CL verification for vision, fit, and comfort in therapeutic CL cases.

*B. Cognitive skills*

1. To describe more advanced concepts of ophthalmic optics in CL.
2. To describe indications for more advanced CL (e.g., therapeutic lenses).

*C. Technical skills*

1. To perform more advanced retinoscopy techniques in a CL patient.
2. To perform more advanced refraction techniques in CL patient, including diagnostic fitting.
3. To perform advanced techniques to verify and inspect contact lenses in patients with complex CL needs.
4. To perform more advanced CL fitting in patients with complex needs (e.g., keratoconus, CL in children, active corneal disease).
5. To describe and use the CL instruments in more complex cases.
6. To describe the more advanced CL complications. (e.g. microbial keratitis, sterile corneal infiltrates, preservative toxicity)
7. To perform appropriate CL selection (e.g., material selection, CL modification).
8. To perform corneal topography to fit contact lenses.

**ADVANCED LEVEL GOALS: PGY-4 (in addition to Standard Level objectives and skills)**

*A. Objectives*

1. To perform the most advanced techniques in CL history and examination, and to understand what additional tests and questions are needed during the most complex CL examination (e.g., post-keratoplasty, multiple surgery, post-refractive, complex

- keratoconus fitting, active corneal disease).
2. To perform retinoscopy and refraction in the CL patient with the most complex needs (e.g., keratoglobus, keratoconus, following open globe repair [e.g., corneal laceration] or multiple keratoplasty).
  3. To describe the most advanced optics and applications of soft contact lenses and hard contact lenses (e.g., piggyback CL).
  4. To describe the most advanced CL design, using appropriate terminology (e.g., special fittings, special lenses for difficult-to-fit patients).
  5. To describe indications for and to perform the most advanced CL fitting (e.g., post-multiple keratoplasty or traumatic corneal repair).
  6. To describe indications for and apply the most complex CL in special circumstances or for candidates presenting increased level of difficulty (e.g., post surgical patients, children)
  7. To use the auxiliary CL instruments in patients with the most complex needs (e.g., topography, fluorescein testing, diagnostic lenses).

*B. Cognitive skills*

1. To describe the differences among CL material choices.
2. To describe methods of modifying a contact lens to improve comfort, vision, or physiological response.
3. To evaluate and to manage CL-induced complications.
4. To perform and interpret corneal topography in CL fitting.

*C. Technical skills*

1. To perform CL modification in complex cases.
2. To select the appropriate CL in more complex cases.

**VI. CORNEA, EXTERNAL DISEASE AND REFRACTIVE SURGERY**

**BASIC LEVEL GOALS: PGY-2**

*A. Cognitive skills*

1. To describe the basic anatomy, embryology, physiology, pathology, microbiology, immunology, genetics, epidemiology, and pharmacology of the cornea, conjunctiva, sclera, eyelids, lacrimal apparatus, and ocular adnexa.
2. To describe congenital abnormalities of the cornea, sclera, and globe (e.g., Peters' anomaly, microphthalmos, birth trauma, buphthalmos).
3. To describe characteristic corneal and conjunctival degenerations (e.g., pterygium, pinguecula, senile plaques of the sclera, keratoconus).
4. To recognize the common corneal dystrophies and degenerations (e.g., map-dot-fingerprint dystrophy, Meesman's dystrophy, Reiss-Buckler dystrophy, Francois dystrophy, Schnyder dystrophy, congenital hereditary stromal dystrophy, lattice dystrophy, granular dystrophy, macular dystrophy, congenital hereditary endothelial dystrophy, Fuchs' dystrophy, posterior polymorphous dystrophy, Salzmann's degeneration).

5. To recognize the common corneal inflammations and infections (e.g., herpes simplex, syphilis, interstitial keratitis).
6. To understand the fundamentals of corneal optics and refraction (e.g., keratoconus).
7. To describe the fundamentals of ocular microbiology and recognize corneal and conjunctival inflammations and infections (e.g., Staphylococcal hypersensitivity, simple microbial keratitis, trachoma, ophthalmia neonatorum, herpes zoster ophthalmicus, herpes simplex keratitis and conjunctivitis).
8. To recognize the basic presentations of ocular allergy (e.g., phlyctenules, seasonal hay fever, vernal conjunctivitis, allergic and atopic conjunctivitis, giant papillary conjunctivitis).
9. To recognize and treat lid margin disease (e.g., Staphylococcal blepharitis, meibomian gland dysfunction).
10. To describe the features of, diagnose, and treat (or refer) vitamin A deficiency (e.g., Bitot spots, dry eye, slowed dark adaptation) and neurotrophic corneal disease.
11. To describe the basic differential diagnosis of acute and chronic conjunctivitis or “red eye” (e.g., scleritis, episcleritis, conjunctivitis, orbital cellulitis, gonococcal and chlamydial conjunctivitis).
12. To describe the basic mechanisms of traumatic and toxic injury to the anterior segment (e.g., alkali burn, lid laceration, orbital fracture, etc.).
13. To understand the mechanisms of ocular immunology and recognize the external manifestations of anterior segment inflammation (e.g., red eye associated with acute and chronic iritis).
14. To describe the basic principles of ocular pharmacology of anti-infective, anti-inflammatory and immune modulating agents (e.g., indications and contraindications for topical corticosteroids, non-steroidal anti-inflammatory agents, and antibiotics).
15. To recognize corneal lacerations (perforating and non-perforating), pterygia that may require surgery, corneal and conjunctival foreign bodies.
16. To diagnose and treat corneal exposure (e.g., lubrication, temporary tarsorrhaphy).
17. To describe the epidemiology, differential diagnosis, evaluation and management of common benign and malignant lid lesions, including pigmented lesions of the conjunctiva and lid (e.g., nevi, melanoma, primary acquired melanosis)
18. To describe the epidemiology, classification, pathology, indications for surgery, and prognosis of common malpositions of the eyelids (e.g., blepharoptosis, trichiasis, distichiasis, essential blepharospasm, entropion, ectropion) and understand their relationship to secondary diseases of the cornea and conjunctiva (e.g., exposure keratopathy).
19. To recognize and describe the treatment for a chemical burn (e.g., types of agents, medical therapy).
20. To recognize and describe the etiologies of hyphema and microhyphema.
21. To describe the etiologies and treatment of superficial punctate keratitis (e.g., dry eye, Thygeson’s superficial punctate keratopathy), blepharitis, toxicity, ultraviolet photokeratopathy, contact lens related).
22. To describe the symptoms and signs, testing and evaluation for, and treatment of exposure keratopathy and dry eye (e.g., Schirmer testing).
23. To recognize the anterior segment manifestations of systemic disease (e.g., Wilson’s disease) and pharmacologic side effects (e.g., amiodarone vortex keratopathy).

24. To recognize, list the differential diagnosis, and evaluate aniridia and other developmental anterior segment abnormalities (e.g., Axenfeld's, Rieger's, Peters' anomalies and related syndromes).
25. To recognize and treat pyogenic granuloma.

*B. Technical/surgical skills*

1. To perform external examination (illuminated and magnified) and slit lamp biomicroscopy, including drawing of anterior segment findings.
2. To administer topical anesthesia, as well as special topical stains of the cornea (e.g., fluorescein dye and Rose Bengal).
3. To perform simple tests for dry eye (e.g., Schirmer test).
4. To perform punctal occlusion (temporary or permanent) or insert plugs.
5. To perform simple corneal sensation testing (e.g., cotton tip swab).
6. To perform tonometry (e.g., applanation, tonopen, Schiötz, pneumotometry).
7. To perform techniques of sampling for viral, bacterial, fungal, and protozoal ocular infections (e.g., corneal scraping and appropriate culture techniques).
8. To perform and interpret simple stains of the cornea and conjunctiva (e.g., culture techniques, culture media, Gram stain, Giemsa stain, calcofluor white, acid fast).
9. To manage corneal epithelial defects (e.g., pressure patching and bandage contact lenses).
10. To perform removal of a conjunctival or corneal foreign body (e.g., rust ring).
11. To perform primary pterygium excision.
12. To perform an isolated lid laceration repair.
13. To perform an isolated corneal laceration repair (e.g., linear laceration not extending to limbus).
14. To perform epilation.
15. To perform a lateral tarsorrhaphy.
16. To incise/drain or remove a primary chalazion/stye.
17. To perform a simple incisional or excisional biopsy of a lid lesion.
18. To perform irrigation of chemical burn to the eye.
19. To treat hyphema and microhyphema (e.g., and the complications of increased intraocular pressure and rebleeding).

**STANDARD LEVEL GOALS: PGY-3 (In addition to Basic Level goals)**

*A. Cognitive skills*

1. To describe the more complex anatomy, embryology, physiology, pathology, microbiology, immunology, genetics, epidemiology, and pharmacology of the cornea, conjunctiva, sclera, eyelids, lacrimal apparatus, and ocular adnexa.
2. To describe the more complex congenital abnormalities of the cornea, sclera, and globe (e.g., hamartomas and choristomas).
3. To describe, recognize, evaluate, and treat peripheral corneal thinning (e.g., inflammatory, degenerative, dellen-related, infectious, immunologic).
4. To recognize common conjunctival neoplasms (e.g., benign, malignant tumors).
5. To recognize and treat less common corneal or conjunctival presentations of

- degenerations (e.g., inflamed, atypical, or recurrent pterygium, band keratopathy).
6. To describe the epidemiology, differential diagnosis, evaluation, and management of Bitot's spots.
  7. To describe the differential diagnosis, evaluation, and management of Thygeson's superficial punctate keratopathy.
  8. To understand more complex corneal optics and refraction (e.g., irregular astigmatism).
  9. To correlate the concordance of the visual acuity with the density of media opacity (e.g., cataract) and to evaluate the etiology of discordance between acuity and findings from examination of the media.
  10. To describe more complex ocular microbiology and describe the differential diagnosis of more complicated corneal and conjunctival infections (e.g., complex, mixed, or atypical bacterial, fungal, Acanthamoeba, viral, or parasitic keratitis).
  11. To describe differential diagnosis, evaluation, and treatment of interstitial keratitis (e.g., syphilis, viral diseases, non-infectious, immunologic, inflammation).
  12. To describe more complex differential diagnosis of the "red eye" (e.g., autoimmune and inflammatory disorders causing scleritis, episcleritis, conjunctivitis, orbital cellulitis).
  13. To describe key features of trachoma, including epidemiology, clinical features and staging, and its complications (e.g., cicatricization), prevention (e.g., facial hygiene), and topical and systemic antibiotic treatment (especially in hyperendemic regions), and surgery (e.g., tarsal rotation).
  14. To describe more complex mechanisms of traumatic and toxic injury to the anterior segment (e.g., long-term sequelae of acid and alkali burn, complex lid laceration involving the lacrimal system, full-thickness laceration).
  15. To describe the differential diagnosis and the external manifestations of more complex anterior segment inflammation (e.g., acute and chronic iritis with and without systemic disease).
  16. To describe the more complex principles of ocular pharmacology of anti-infective, anti-inflammatory and immune modulating agents (e.g., use of topical non-steroidal and steroidal agents, topical cyclosporine).
  17. To recognize and treat corneal lacerations (perforating and non-perforating).
  18. To recognize and treat large, recurrent, or atypical pterygia that may require surgery.
  19. To describe and treat corneal and conjunctival foreign bodies.
  20. To diagnose and treat severe corneal exposure (e.g., lubrication, temporary tarsorrhaphy)
  21. To recognize and treat common and uncommon benign and malignant lid lesions.
  22. To recognize and treat common malpositions of the eyelids (e.g., entropion, ectropion, and ptosis) as they apply to secondary corneal disease.
  23. To recognize and treat recurrent corneal erosions.
  24. To recognize and treat foreign body, animal, and plant substance injuries.
  25. To recognize and treat more complex hyphemas (e.g., surgical indications).
  26. To recognize, evaluate, and treat chronic conjunctivitis (e.g., chlamydia, trachoma, molluscum contagiosum, Parinaud's oculoglandular syndrome, ocular rosacea).
  27. To describe the clinical features, pathology, evaluation, and treatment of ocular cicatricial pemphigoid.
  28. To recognize, evaluate, and treat the ocular complications of severe diseases, such as chronic exposure keratopathy, contact dermatitis, and Stevens-Johnson syndrome.
  29. To describe the epidemiology, clinical features, pathology, evaluation, and treatment of

peripheral corneal thinning or ulceration (e.g., Terrien's marginal degeneration, Mooren's ulcer, rheumatoid arthritis-related corneal melt).

*B. Technical/surgical skills*

1. To perform more advanced techniques, including keratometry, keratoscopy, endothelial cell count and evaluation, specular microscopy, and pachymetry.
2. To perform stromal micropuncture.
3. To perform application of corneal glue.
4. To assist in more complex corneal surgery (e.g., penetrating keratoplasty and phototherapeutic keratectomy).
5. To perform more advanced tests for dry eye (e.g., modified Schirmer tests, assessment of tear break-up time, fluorescein dye testing, Rose Bengal dye).
6. To perform more complex pterygium excision, including conjunctival grafting.
7. To perform more complex lid laceration repair.
8. To perform manual superficial or lamellar keratectomy.
9. To perform more complex corneal laceration repair (e.g., stellate perforating laceration).
10. To repair simple lacerations of the lacrimal drainage apparatus (e.g., perform intubations and primary closure).

**ADVANCED LEVEL GOALS: PGY-4 (In addition to Standard Level goals)**

*A. Cognitive skills*

1. To describe the most complex anatomy, embryology, physiology, histopathology, microbiology, immunology, genetics, epidemiology, and pharmacology of the cornea, conjunctiva, sclera, eyelids, lacrimal apparatus, and ocular adnexa.
2. To describe the most complex and less common congenital abnormalities of the cornea, sclera, and globe (e.g., cornea plana, keratoglobus).
3. To recognize common and uncommon corneal and conjunctival neoplasms, dystrophies and degenerations (e.g., lattice dystrophy).
4. To understand the most complex corneal optics and refraction (e.g., post-keratoplasty).
5. To describe less common and rare ocular infections and describe the differential diagnosis of the most complicated corneal and conjunctival infections (e.g., amoebas, Leishmaniasis, nematodes).
6. In non-endemic areas, to describe the basic features of onchocerciasis.
7. In endemic areas to define the etiology, vector (e.g., black fly), and incidence, diagnostic features (e.g., microfilariae, keratitis, iritis), diagnosis (e.g., skin snip test), course and prognosis, treatment (e.g., Ivermectin, nodulectomy), and prevention (e.g., vector control, environmental and behavioral changes) of onchocerciasis.
8. To describe the most complex differential diagnosis of the "red eye" (e.g., pemphigoid, pemphigus, Stevens-Johnson syndrome).
9. To diagnose and treat the most complex traumatic and toxic injuries to the anterior segment (e.g., total lid avulsion, severe alkali burn).
10. To describe the differential diagnosis and the external manifestations of the most complex or uncommon anterior segment inflammations (e.g., syphilitic keratouveitis).

11. To describe the most complex principles of ocular pharmacology of anti-infective, anti-inflammatory and immune modulating agents (e.g., combination therapies of antiviral and anti-inflammatory agents).
12. To recognize and treat complex corneal lacerations (e.g., lacerations extending beyond the limbus).
13. To diagnose and treat the most severe corneal exposure cases (e.g., conjunctival flap).
14. To understand ocular surface transplantation, including conjunctival autograft/flap, amniotic membrane transplantation, limbal stem cell transplantation.
15. To understand the surgical indications (e.g., Fuchs' dystrophy, aphakic/pseudophakic bullous keratopathy), surgical techniques, and recognition and management of postoperative complications (especially immunologically-mediated rejection) of corneal transplantation (e.g, penetrating, lamellar).
16. To understand the preoperative assessment, patient selection, surgical management, and postoperative care of refractive surgical techniques, including keratotomy (radial, astigmatic), photoablation (photorefractive, phototherapeutic, LASIK), corneal wedge resection, thermokeratoplasty, intracorneal rings, phakic intraocular lens, and clear lens extraction.

*B. Technical/surgical skills*

1. To perform and interpret the most advanced corneal techniques (e.g., pachymetry, endothelial microscopy, computerized corneal topography).
2. To understand and perform specialized and complicated contact lens fitting (e.g., post-keratoplasty).
3. To perform more complex corneal surgery (e.g., penetrating or lamellar keratoplasty, keratorefractive procedures and phototherapeutic keratectomy).
4. To repair complex entropion and ectropion.
5. To perform a thin conjunctival flap (e.g., Gunderson flap).
6. To perform other complex conjunctival surgery (e.g., autograft, stem cell transplant).
7. To perform basic non-laser refractive surgery techniques (e.g., relaxing keratotomy).
8. To manage and treat more complex neoplasms of the conjunctiva (e.g., carcinoma, melanoma).

**VII. GLAUCOMA**

**BASIC LEVEL GOALS: PGY-2**

*A. Cognitive skills*

1. To describe the epidemiology and genetics of primary open angle glaucoma (POAG).
2. To perform evaluation of POAG.
3. To describe the mechanics of aqueous humor dynamics and the anatomy of the anterior chamber and its angle, and of the ciliary body.
4. To describe basic tonometry and to understand the principles of tonography.
5. To describe optic nerve and nerve fiber layer anatomy in glaucoma.
6. To describe fundamentals of perimetry, including kinetic and automated static perimetry.

7. To describe principles, indications, and basic techniques of gonioscopy, including normal and abnormal findings.
8. To describe principles of medical management, including indications for and side effects of treatment options (e.g., topical and systemic medications) for simple glaucoma (e.g., POAG, primary angle closure glaucoma).
9. To describe and recognize normal tension glaucoma (“low tension glaucoma”).
10. To describe the features of and recognize primary and secondary angle closure glaucoma and aqueous misdirection.
11. To describe the clinical features of and to recognize hypotony (e.g., Seidel test for transconjunctival leakage).
12. To list the main results of the major clinical trials in glaucoma (e.g., Glaucoma Laser Trial, Normal Tension Glaucoma Study, and Advanced Glaucoma Intervention Study [see Appendix]).

*B. Technical skills*

1. To perform basic tonometry (e.g., applanation, Schiøtz[if applicable], tonopen, airpuff) and recognize the pitfalls and artifacts of the testing.
2. To perform basic gonioscopy (e.g., recognize angle structures, identify angle closure).
3. To perform stereo examination of the optic nerve, using 90 diopter or other lens.
4. To interpret manual (e.g., Goldmann) and automated (e.g., Humphrey, Octopus) visual fields in routine glaucoma.
5. To perform corneal pachymetry and relate the findings to interpretation of intraocular pressure.

**STANDARD LEVEL GOALS: PGY-3 (in addition to Basic Level goals)**

*A. Cognitive skills*

1. To describe the epidemiology and perform screening for routine and more advanced primary and secondary open angle glaucoma.
2. To describe the treatment of disturbances of aqueous humor dynamics.
3. To describe the more complex etiologies for, evaluation of, and treatment of glaucoma (e.g., angle recession, inflammatory, steroid-induced, pigmentary, pseudoexfoliative, phacolytic, neovascular, post-operative, malignant, lens particle glaucomas; plateau iris; glaucomatocyclitic crisis; iridocorneal endothelial syndromes; aqueous misdirection).
4. To describe more advanced tonometric and tonographic (if applicable) methods (e.g., diurnal curve).
5. To describe more advanced optic nerve and nerve fiber layer anatomy in primary and secondary glaucoma and to recognize typical and atypical features associated with glaucomatous cupping (e.g., rim pallor, rapid progression, central acuity loss, hemianopic or other non-glaucomatous types of visual field loss).
6. To describe more advanced forms of perimetry (e.g., kinetic and automated static visual fields) and perimetry strategies (e.g., threshold testing, supra-threshold testing, special algorithms).
7. To describe the principles, indications, and more advanced anatomic findings and

- gonioscopic features of primary and secondary glaucomas (e.g., plateau iris, appositional closure).
8. To describe the principles of medical management of more advanced glaucomas (e.g., advanced POAG, secondary open and closed angle glaucomas, normal tension glaucoma)
  9. To describe the features of, recognize, and treat primary angle closure glaucoma and aqueous misdirection.
  10. To describe the clinical features of, recognize, and treat less common etiologies of ocular hypotony.
  11. To describe the results and apply the conclusions to clinical practice of the major clinical trials in glaucoma (e.g., Glaucoma Laser Trial, Normal Tension Glaucoma Study, and Advanced Glaucoma Intervention Study; see more complete list of clinical trials in Appendix 1).
  12. To recognize and treat the various adult secondary glaucomas.
  13. To describe the features of primary infantile and juvenile glaucomas.
  14. To describe and apply specific medical treatments of more advanced glaucoma.
  15. To describe the principles of laser treatments of glaucoma (e.g., indications, techniques, and complications, and use of various types of laser energy, spot size, laser wavelengths).
  16. To describe the surgical treatment of glaucoma: (e.g., trabeculectomy, combined cataract and trabeculectomy, setons, and cyclodestructive procedures, including indications, techniques, and complications).

*B. Technical/ surgical skills*

1. To perform YAG laser posterior capsulotomy for uncomplicated posterior capsule opacity.
2. To perform argon or YAG laser peripheral iridotomy for routine angle closure glaucoma.
3. To perform argon laser trabeculoplasty.
4. To perform cyclophotocoagulation.
5. To perform routine first trabeculectomy with or without antimetabolites.
6. To describe and manage a flat anterior chamber.
7. To perform routine revision of filtering blebs.

**ADVANCED LEVEL GOALS: PGY-4 (in addition to Standard Level goals)**

*A. Cognitive skills*

1. To describe the features of the most complex and most advanced forms of primary and secondary open angle glaucoma.
2. To describe the mechanics of aqueous humor dynamics in the most advanced and complex etiologies of glaucoma (e.g., angle recession, combined or multifactorial glaucoma, traumatic or inflammatory glaucoma, pigmentary dispersion glaucoma).
3. To apply in clinical practice tonometric and tonographic methods (e.g., diurnal curve) in complicated or atypical cases of glaucoma.
4. To apply the most advanced knowledge of optic nerve and nerve fiber layer anatomy and describe techniques, methods, and tools for analyzing the nerve fiber layer.
5. To recognize and evaluate atypical or multifactorial glaucomatous cupping (e.g., rim

- pallor).
6. To describe, interpret, and apply the results of the most complex and advanced forms of perimetry, including special kinetic and automated static perimetry strategies (e.g., special algorithms) in atypical or multifactorial glaucoma.
  7. To describe the principles and indications, and apply to clinical practice the findings of gonioscopy in the most complex primary and secondary glaucomas.
  8. To describe the principles of medical management of the most advanced and complex glaucoma (e.g., advanced POAG previously treated with medicine, laser or surgery; secondary glaucomas).
  9. To describe, recognize, and treat the most advanced cases of primary open angle glaucoma (e.g., monocular patients, repeat surgical cases), normal tension glaucoma, and secondary glaucomas (e.g., inflammatory glaucoma, angle recession).
  10. To describe the features of, recognize, and treat the most advanced cases of primary angle closure glaucoma and complex glaucomas (e.g., post-operative cases, secondary angle closure, aqueous misdirection).
  11. To describe the clinical features of, recognize and treat common and uncommon etiologies of ocular hypotony (e.g., choroidal detachment, leaking trabeculectomy bleb).
  12. To describe the results, apply the conclusions, and critically analyze the major clinical trials in glaucoma (e.g., Glaucoma Laser Trial, Normal Tension Glaucoma Study, and Advanced Glaucoma Intervention Study), as well as describe and use other publications in the management of glaucoma patients (see Appendix 1).
  13. To recognize and treat uncommon adult secondary glaucomas.
  14. To describe the features of and treat or refer the primary infantile and juvenile glaucomas.
  15. To describe and apply specific medical treatments in the most complex and most advanced glaucoma cases (e.g., refractory glaucoma, monocular patients, non-compliant patients).
  16. To describe the principles, indications, and complications of laser treatment of more advanced or complex glaucoma (repeat procedures).
  17. To describe the more advanced surgical treatment of glaucoma: (e.g., trabeculectomy, combined cataract and trabeculectomy, setons, and cyclodestructive procedures, including indications, techniques, and complications).

*B. Technical/surgical skills*

1. To perform YAG or argon laser procedures in glaucoma patients (e.g., monocular patient, repeat laser, vitreous lysis, suture lysis).
2. To perform laser peripheral iridotomy for more advanced glaucoma (e.g., monocular patient, acute angle closure, hazy cornea).
3. To perform laser treatments (e.g., argon laser trabeculoplasty, iridoplasty) for more advanced glaucoma cases (repeat treatments, monocular patient).
4. To perform cyclophotocoagulation for more advanced cases (e.g., prior surgery, monocular).
5. To perform routine and repeat trabeculectomy with or without antimetabolites.
6. To describe, manage, and treat surgically, if necessary, a flat anterior chamber.
7. To perform more advanced techniques for the revision of filtering blebs (e.g., failing

bleb, leaking bleb)

8. To recognize and treat complications of glaucoma surgery blebs.

## VIII. NEURO-OPHTHALMOLOGY

### BASIC LEVEL GOALS: PGY-2

#### *A. Cognitive skills*

1. To describe the neuro-anatomy of the visual pathways.
2. To describe the neuro-anatomy of the cranial nerves.
3. To describe the pupillary and accommodative neuro-anatomy.
4. To describe ocular motility and related neuronal pathways.
5. To describe the typical features, evaluation, and management of the most common optic neuropathies (e.g., demyelinating optic neuritis, ischemic optic neuropathy [arteritic and non-arteritic], toxic or nutritional optic neuropathy, Leber's hereditary optic neuropathy, ethambutol toxicity, neuroretinitis, and compressive, inflammatory, infiltrative, and traumatic optic neuropathies).
6. To describe the typical features, evaluation, and management of the most common ocular motor neuropathies (e.g., third, fourth, sixth nerve palsy).
7. To describe the typical features of cavernous sinus and superior orbital fissure syndromes (e.g., infectious, vascular, neoplastic, inflammatory etiologies).
8. To describe the typical features, evaluation, and management of the most common causes of nystagmus (e.g., congenital motor and sensory, downbeat, upbeat, gaze-evoked, drug-induced).
9. To describe the typical features, evaluation, and management of the most common pupillary abnormalities (e.g., relative afferent pupillary defect, anisocoria, Horner syndrome, third nerve palsy, Adie's tonic pupil).
10. To describe the typical features, evaluation, and management of the most common visual field defects (e.g., optic nerve, optic chiasm, optic radiation, occipital cortex).
11. To describe the clinical features, evaluation, and management of ocular myasthenia gravis.
12. To describe the clinical features, evaluation, and management of carotid-cavernous fistula.
13. To describe the differential diagnosis, evaluation and management of congenital optic nerve abnormalities (e.g., optic pit, disc coloboma, papillo-renal syndrome, morning glory syndrome, tilted disc, optic nerve hypoplasia, myelinated nerve fiber layer, melanocytoma, disc drusen, Bergmeister's papilla).

#### *B. Technical skills*

1. To perform a basic pupillary examination:
  - a. To describe indications for and perform basic pharmacologic pupillary testing for Horner syndrome, pharmacologic dilation, and Adie's tonic pupil.
  - b. To list the differential diagnosis of anisocoria (e.g., sympathetic or parasympathetic lesion, "physiologic" or normal).

- c. To describe, detect, and quantitate a relative afferent pupillary defect.
- d. To list the causes for light-near dissociation (e.g., Argyll-Robertson pupils, diabetic neuropathy, tonic pupil).
2. To perform a basic ocular motility examination:
  - a. To assess ocular alignment using simple techniques (e.g., Hirschberg, Krimsky).
  - b. To describe and perform basic cover/uncover testing for tropia.
  - c. To describe and perform alternate cover testing for phoria.
  - d. To perform simultaneous prism and cover testing.
  - e. To perform measurement of deviations with prisms.
  - f. To describe the indications for and apply Fresnel and grind-in prisms.
  - g. To describe the indications for and to perform forced duction and forced generation testing.
  - h. To perform an assessment of saccade accuracy and pursuit and optokinetic testing.
  - i. To perform a measurement of eyelid function (e.g., levator function, lid position).
3. To describe the indications for visual field testing and to perform and interpret perimetry studies:
  - a. To perform confrontational field testing (static and kinetic, central and peripheral, red and white targets).
  - b. To perform and interpret a tangent screen test.
  - c. To describe the indications for and perform basic Goldmann perimetry, and interpret results.
  - d. To describe the indications for and perform basic automated perimetry, and interpret results.
4. To perform basic direct, indirect, and magnified ophthalmoscopic examination of the optic disc (e.g., recognize optic disc swelling, optic atrophy, neuroretinitis).
5. To describe the anatomy and indications for, order appropriately, and interpret basic radiology studies of the brain and orbits, demonstrating the ability to communicate with radiologists in order to maximize both choice of proper diagnostic test and accuracy of interpretation.
6. To describe the indications for and interpret basic echography of orbits.

### **STANDARD LEVEL GOALS (in addition to Basic Level goals)**

#### *A. Cognitive skills*

1. To describe typical and atypical features, evaluation, and management of the most common optic neuropathies (e.g., papilledema, optic neuritis, ischemic, inflammatory, infectious, infiltrative, compressive, and hereditary optic neuropathies).
2. To describe typical and atypical features, evaluation, and management of the more complex supranuclear and internuclear palsies and less common ocular motor neuropathies (e.g., progressive supranuclear palsy and internuclear ophthalmoplegia).
3. To describe typical and atypical features, evaluation, and management of the more complex and less common forms of nystagmus (e.g., rebound, convergence, retraction).
4. To describe typical and atypical features, evaluation, and management of the more complex and less common pupillary abnormalities (e.g., light-near dissociation,

- pharmacologic miosis).
5. To describe typical and atypical features, evaluation, and management of the more complex and less common visual field defects (e.g., lateral geniculate, monocular temporal crescent).
  6. To describe more advanced aspects of visual field indications, selection, and interpretation (e.g., artifacts of automated perimetry, testing and thresholding strategies).
  7. To describe neuro-ophthalmic aspects of common systemic diseases (e.g., hypertension, diabetes, thyroid disease, myasthenia gravis, temporal arteritis, systemic infections and inflammation).
  8. To describe neuro-ophthalmologic findings in trauma (e.g., traumatic optic neuropathy, traumatic brain injury).
  9. To describe typical features of inherited neuro-ophthalmologic diseases (e.g., Leber's hereditary optic neuropathy, autosomal dominant optic atrophy, spinocerebellar degenerations).
  10. To recognize, evaluate, and treat ocular myasthenia gravis.

*B. Technical skills*

1. To describe the indications for, administer, and interpret the results of intravenous edrophonium (Tensilon) and prostigmine tests for myasthenia gravis.
2. To perform a detailed cranial nerve evaluation (e.g., testing of oculomotor, trochlear, trigeminal, and facial nerve function).
3. To describe the more advanced interpretation of neuro-radiologic images (e.g., indications and interpretation of orbital tumors, thyroid eye disease, pituitary adenoma, optic nerve glioma, optic nerve sheath meningioma).
4. To describe the evaluation, management, and specific testing (e.g., stereopsis, mirror test, red-green testing) of patients with "functional" (non-organic) visual loss (e.g., recognize non-organic spiral or tunnel visual fields).
5. To describe the indications for, to perform, and to list the complications of temporal artery biopsy.

**ADVANCED LEVEL GOALS (in addition to Standard Level goals)**

*A. Cognitive skills*

1. To describe typical and atypical features, evaluation, and management of the most advanced and least common optic neuropathies (e.g., chronic or recurrent optic neuritis, and posterior ischemic, autoimmune, toxic/nutritional).
2. To describe typical and atypical features, evaluation, and management of the most complex and least common ocular motor neuropathies and their mimics (e.g., progressive supranuclear palsy).
3. To describe typical and atypical features, evaluation, and management of the most complex and least common forms of nystagmus (e.g., surgical treatment options, using the null point in either prism or surgical therapy).
4. To describe typical and atypical features, evaluation, and management of the most

advanced and least common pupillary abnormalities (e.g., pupil findings in coma, transient pupillary phenomenon).

5. To describe typical and atypical features, evaluation, and management of the most complex and least common visual field defects (e.g., combination or bilateral lesions, cortical visual impairment).
6. To describe the most advanced aspects of visual field indications, selection, and interpretation (e.g., variability in automated perimetry, application of specific testing and thresholding strategies for different patient populations with different neuro-ophthalmic conditions, different testing abilities (e.g., young or old age, mental status, hand-eye coordination, reaction time)).
7. To describe, evaluate, and treat the neuro-ophthalmic aspects of systemic diseases (e.g., malignant hypertension, diabetic papillopathy, toxicity of systemic medications, pseudotumor cerebri).
8. To describe, evaluate, and treat the neuro-ophthalmologic manifestations of trauma (e.g., corticosteroid or surgical therapy in traumatic optic neuropathy).
9. To describe, evaluate, and provide appropriate genetic counseling for neuro-ophthalmologic diseases (e.g., Leber's hereditary optic neuropathy, chronic progressive external ophthalmoplegia, von Hippel-Lindau syndrome).
10. To recognize, evaluate, and treat (or refer) more complex forms of nystagmus.
11. To recognize, evaluate, and treat (or refer) transient monocular or binocular visual loss.

#### *B. Technical skills*

1. To perform and interpret the results of the intravenous edrophonium (Tensilon) and prostigmine tests for myasthenia gravis, and to recognize and treat the complications of the procedures.
2. To perform and interpret the complete cranial nerve evaluation and basic neurologic examination in the context of neuro-ophthalmic localization and disease.
3. To interpret neuro-radiologic images in neuro-ophthalmology (e.g., interpretation of orbital imaging for orbital pseudotumor and tumors, thyroid eye disease, intracranial imaging modalities and strategies for tumors, aneurysms, infection, inflammation, and ischemia), and to appropriately discuss, in advance of testing, the localizing clinico-radiologic features with the neuroradiologist in order to obtain the best study and interpretation of the results.
4. To recognize patients with "functional" visual loss (non-organic visual loss) and provide appropriate counseling and follow-up.

## **IX. OPTHALMIC HISTOPATHOLOGY**

### **BASIC LEVEL: PGY-2**

#### *A. Cognitive skills*

1. To describe basic ocular anatomy and to identify the histology of the major structures of the eye (e.g., conjunctiva, sclera, cornea, anterior chamber angle, iris, ciliary body, lens, vitreous, retina, retinal pigment epithelium, choroid, optic nerve).

2. To describe basic pathophysiology of the common disease processes of the eye and to identify the major histologic findings of each (e.g., infection, inflammation, neoplasm).
3. To identify the histology of important intraocular and adnexal diseases (e.g., endophthalmitis, retinoblastoma, choroidal melanoma, microbial keratitis).

*B. Technical skills (for an ocular pathology laboratory, as available)*

1. To describe appropriate steps in the basic handling and processing of gross specimens in the ocular pathology laboratory (e.g., basic preparation of the specimen) and to demonstrate proficiency in these steps in the laboratory.
2. To describe specific information necessary for communication with the pathologist regarding special handling of specimens for special stains or studies.
3. To describe indications for frozen sections in ocular pathology.
4. To perform cutting and gross examination of whole globes.
5. To participate under supervision in the microscopic examination of ophthalmology specimens from active cases.

**STANDARD LEVEL: PGY-3 (in addition to Basic Level skills)**

*A. Cognitive skills*

1. To describe more advanced ocular anatomy and to identify the histology of the major and minor structures of the eye (e.g., conjunctival glands, normal pigment, common variants).
2. To describe more advanced pathophysiology of the disease processes of the eye and to identify the major histologic findings of each (e.g., fungal keratitis, skin and adnexal neoplasms, and less common intraocular tumors).
3. To identify histology of the less common but potentially vision- or life-threatening intraocular and adnexal diseases (e.g., temporal arteritis, fungal endophthalmitis, extraocular spread of intraocular tumor, metastatic disease to the eye).
4. To describe more advanced techniques in ocular histopathology (e.g., electron microscopy, cytology, immunohistochemistry, flow cytometry, tumor free margins).

*B. Technical skills*

1. To describe appropriate steps in the more advanced handling and special processing of gross specimens in the ocular pathology laboratory.
2. To describe specific indications for special handling and to communicate to the pathologist the necessity for special handling of specimens for special stains or studies (e.g., electron microscopy, immunohistochemistry, flow cytometry, cytology).
3. To describe indications and to perform and prepare a biopsy specimen for frozen section in ocular pathology.
4. To prepare a basic histologic specimen for review by the pathologist.
5. To participate as an “at-the-elbow” observer during microscopic examination of active ophthalmology cases and to perform microscopic examination of a specimen with and without direct supervision.

**ADVANCED LEVEL: PGY-4 (in addition to Standard Level skills)**

*A. Cognitive skills*

1. To describe the most advanced ocular anatomy and to identify histology of the major and minor structures of the eye and their less common “normal” variants (e.g., pars plana cysts, iris heterochromia, cobblestone degeneration of the retina).
2. To describe the most advanced, less common, or more complex pathophysiology of the disease processes of the eye and to identify major histologic findings of each (e.g., inflammatory pseudotumor, lymphoma, artifacts of processing).
3. To identify the histology of the least common but potentially vision- or life- threatening intraocular and adnexal diseases (e.g., healed giant cell arteritis, mimics and masqueraders of inflammation or neoplasm, uncommon benign and malignant neoplasms).

*B. Technical skills*

1. To describe and to perform appropriate steps for handling gross or cytologic specimens in the ocular pathology laboratory.
2. To perform pre-operative, intra-operative, and post-operative consultation with the pathologist, regarding specific indications for special stains or processing (e.g., orientation of specimen, special handling).
3. To perform and interpret the pathologic report of frozen section in ocular pathology.
4. To perform the preparation of basic and more advanced histologic specimens for review by the pathologist (e.g., simple or special stains or fixation methods).
5. To participate as an “at-the-elbow” observer during the microscopic examination of active ophthalmology cases.
6. To perform microscopic examination of a specimen with and without direct supervision and to provide a relevant differential diagnosis.

**X. OCULOPLASTIC SURGERY AND ORBIT**

**BASIC LEVEL GOALS (PGY-2)**

*A. Cognitive skills*

1. To describe basic eyelid, lacrimal, and orbital anatomy and physiology (e.g., eyelid, orbicularis, orbital structures, meibomian glands, lacrimal glands, glands of Zeiss, Whitnall’s ligament, Muller’s muscle, Lockwood’s ligament, canaliculi, puncta, orbital bones, orbital foramina, paranasal sinuses, annulus of Zinn, arterial and venous vascular supply, lymphatics, nerves, extraocular muscles).
2. To describe basic mechanisms and indications for treatment of eyelid, orbital, and lacrimal trauma.
3. To describe epidemiology, clinical features, evaluation, and management of fetal alcohol syndrome.

4. To perform pre-operative and post-operative assessment of patients with common oculoplastic disorders.
5. To recognize simple orbital trauma (e.g., orbital foreign body, retrobulbar hemorrhage).
6. To recognize and treat floppy eyelid syndrome.
7. To recognize and treat localized trichiasis.
8. To recognize blepharospasm and hemifacial spasm.
9. To describe the differential diagnosis of common orbital tumors in children and adults.
10. To describe the differential diagnosis of lacrimal gland mass (e.g., inflammatory, neoplastic, congenital, infectious).
11. To identify normal orbital anatomy on imaging studies (e.g., magnetic resonance imaging, computed tomography, ultrasound).
12. To describe the differential diagnosis of proptosis in children and adults.
13. To describe techniques and complications of minor operating room procedures (e.g., incision and drainage of chalazia, excision of small eyelid lesions).
14. To describe typical features of orbital cellulitis.

*B. Technical/surgical skills*

1. To describe indications for and to perform the basic office examination techniques for the most common oculoplastic and orbital abnormalities.
2. To perform the basic assessment of the eyelids, eyebrows, and eyelashes (e.g., eversion, double eversion, margin to reflex distance, lid crease, levator function, eyelid/brow malpositions).
3. To identify indications for and to perform the basic lacrimal assessment (e.g., dye testing, punctal dilation, canalicular probing, lacrimal irrigation).
4. To identify indications for and to perform the basic assessment of the orbit (e.g., Hertel exophthalmometry, inspection, palpation, auscultation).
5. To identify indications for and to perform the basic socket assessment (e.g., types of implants, socket health).
6. To perform minor lid and conjunctival procedures (e.g., removal of benign eyelid skin lesions, chalazion curettage or excision, conjunctival biopsy).
7. To treat complications of minor operating room procedures (e.g., incision and drainage of chalazia, excision of small eyelid lesions).
8. To perform punctal plug insertion or removal.
9. To recognize and treat trichiasis (e.g., epilation, cryotherapy, surgical therapy).
10. To perform a simple enucleation or evisceration under supervision.

**STANDARD LEVEL GOALS: PGY-3 (in addition to Basic Level goals)**

*A. Cognitive skills*

1. To describe more advanced eyelid, lacrimal, and orbital anatomy and physiology (e.g., lacrimal apparatus, orbital vascular anatomy).
2. To describe the genetics (where known), clinical features, evaluation, and treatment of congenital eyelid deformities (e.g., coloboma, distichiasis, epicanthus, telecanthus, blepharophimosis, ankyloblepharon, epiblepharon, euryblepharon, and Goldenhar,

- Treacher-Collins, Waardenburg syndromes).
3. To describe the clinical features, evaluation and management of congenital orbital deformities (e.g., synophthalmia, anophthalmia, microphthalmia, cryptophthalmia, hypertelorism, hypotelorism).
  4. To describe the genetics, clinical features, evaluation, and management of common craniosynostoses and other congenital malformations (e.g., Crouzon and Apert syndromes).
  5. To treat (or refer for treatment) congenital eyelid abnormalities (see Basic Level, above).
  6. To perform pre-operative and post-operative assessment of patients with simple and more serious oculoplastic disorders (e.g., multi-disciplinary procedures).
  7. To describe the mechanisms and indications for treatment of more advanced eyelid, orbital, and lacrimal trauma (e.g., full thickness lid laceration, chemical burns to the face).
  8. To describe features of, evaluate, and treat more complicated cases of nasolacrimal duct obstruction, canaliculitis, dacryocystitis, acute and chronic dacryoadenitis, preseptal cellulitis, and orbital cellulitis.
  9. To recognize, evaluate and treat thyroid ophthalmopathy (e.g., epidemiology; symptoms and signs; associated systemic diseases; orbital imaging; differential diagnosis; surgical, medical, and radiation indications; side effects of treatment).
  10. To recognize, evaluate and treat orbital inflammatory pseudotumor (e.g., symptoms and signs, orbital imaging, differential diagnosis, biopsy indications, choice of treatments).
  11. To recognize, treat, or refer blepharospasm or hemifacial spasm.
  12. To recognize less common orbital tumors (e.g., metastatic lesions).

*B. Technical/surgical skills*

1. To describe indications for and to perform more advanced examination techniques for less common oculoplastic and orbital abnormalities (e.g., measurement of levator function, orbital ultrasound interpretation).
2. To identify indications for and to perform more advanced assessment of eyelids and eyebrows (e.g., hypoglobus, facial asymmetry, brow ptosis).
3. To identify indications for and to perform more advanced lacrimal assessment (e.g., interpretation of dye testing, canalicular probing in trauma).
4. To identify indications for and to perform more advanced assessment of the orbit (e.g., enophthalmus, interpretation of orbital ultrasound in common conditions).
5. To identify indications for and to perform more advanced socket assessment (e.g., extrusion of implants, anophthalmic socket complications).
6. To perform more complicated minor lid procedures (e.g., larger benign skin lesions) or surgery (e.g., recurrent or multiple chalazion).
7. To recognize the indications and complications and to perform more complex minor operating room or limited operating room procedures (e.g., incision and drainage of recurrent or larger chalazia, excision of moderate sized benign eyelid lesions).
8. To recognize and treat orbital trauma (e.g., intraorbital foreign body, retrobulbar hemorrhage, fracture).
9. To identify common orbital pathology (e.g., orbital fractures, orbital tumors) on imaging studies (e.g., magnetic resonance imaging, computed tomography, ultrasound).

10. To treat common presentations of preseptal or orbital cellulitis.
11. To describe, recognize the indications for and complications of, and perform the basic lacrimal procedures below:
  - a. Lacrimal drainage testing (irrigation, dye disappearance test)
  - b. Lacrimal intubation
  - c. Dacryocystorhinostomy (external)

**ADVANCED LEVEL GOALS: PGY-4 (in addition to Standard Level goals)**

*A. Cognitive skills*

1. To describe the most advanced eyelid, lacrimal, and orbital anatomy and physiology.
2. To evaluate and to treat simple and more advanced eyelid, orbital, and lacrimal trauma (e.g., full thickness lid laceration, chemical burns to the face).
3. To perform pre-operative and post-operative assessment and coordination of care of patients with more advanced or complex oculoplastic disorders (e.g., systemically ill patient, multi-disciplinary procedures).
4. To describe the etiology, evaluation, and medical and surgical treatment of the following eyelid diseases:
  - a. Complex ectropion (e.g., congenital, paralytic, involutional, cicatricial, mechanical, allergic).
  - b. Complex entropion (e.g., involutional, cicatricial, spastic, congenital).
  - c. Complex myogenic ptosis (e.g., chronic progressive external ophthalmoplegia).
  - d. Complex differential diagnosis for dermatochalasis (e.g., blepharochalasis).
  - e. Benign, pre-malignant, or malignant eyelid tumors (e.g., papilloma, keratoacanthoma, seborrheic keratosis, epidermal inclusion cyst, molluscum contagiosum, verruca vulgaris, actinic keratosis, basal cell carcinoma, squamous cell carcinoma, sebaceous cell carcinoma, melanoma).
  - f. Single or recurrent inflammatory lesions (e.g., recurrent chalazion or its mimics).
  - g. Facial dystonia (e.g., blepharospasm, hemifacial spasm).
  - h. Facial nerve palsy with exposure keratopathy (e.g. tarsorrhaphy, gold weights).
  - i. Complex lid and orbital trauma cases.

*B. Technical/surgical skills*

1. To describe the indications for and to perform more complicated and advanced “in office” examination techniques for less common but important oculoplastic and orbital abnormalities.
2. To perform preoperative and intraoperative assessment of the eyelids and eyebrows (e.g., intraoperative adjustments).
3. To recognize and treat more complex or difficult socket-related problems and complications (e.g., extrusion of implants, anophthalmic socket complications).
4. To perform more complicated lid procedures (e.g., larger benign, recurrent, or multiple skin lesions).
5. To perform more advanced lacrimal assessment (e.g., intraoperative and postoperative testing, more complex trauma to lacrimal system).
6. To describe management of and treat lacrimal system abnormalities, including:

- a. More complex congenital disorders (e.g., canalicular stenosis)
- b. More complex acquired disorders and their treatment (e.g., conjunctivodacryocystorhinostomy with Jones tube)
- c. Complex moderate trauma (e.g., requiring lacrimal intubation)
7. To recognize typical and atypical features and to describe the differential diagnosis, clinical features, and treatment of more complicated orbital disease, including:
  - a. More complex orbital infections (e.g., preseptal and orbital cellulitis, mucormycosis, aspergillosis)
  - b. Congenital tumors (e.g., dermoid)
  - c. Fibro-osseous disorders and tumors (e.g., fibrous dysplasia, osteoma, chondrosarcoma, osteosarcoma, Paget's disease)
  - d. Vascular tumors (e.g., capillary hemangioma, cavernous hemangioma, hemangiopericytoma, lymphangioma, Kaposi's sarcoma)
  - e. Xanthomatous tumors (e.g., xanthelasma, juvenile xanthogranuloma)
  - f. Lacrimal gland tumors (e.g., benign mixed tumor, adenoid cystic carcinoma, malignant mixed tumor, lymphoma)
  - g. Neural tumors (e.g., optic nerve glioma/meningioma, neurofibromatosis, neuroblastoma)
  - h. Rhabdomyosarcoma
  - i. Orbital pseudotumor
  - j. Lymphoid lesions (e.g., lymphoid hyperplasia, lymphoma, leukemia)
  - k. Thyroid-related orbitopathy
  - l. Metastatic tumors (e.g., from breast, lung, prostate, colon, melanoma)
  - m. Trauma (e.g., orbital fractures, traumatic optic neuropathy)
  - n. Anophthalmic socket – implant exposure, volume augmentation
8. To describe, recognize the indications for and complications of, and to perform the eyelid procedures listed below:
  - a. Basic biopsy techniques
  - b. Lateral tarsal strip
  - c. Specialized lid suture procedures (e.g., Quickert sutures)
  - d. Medial spindle
  - e. Retractor reinsertion
  - f. Levator advancement
  - g. Eyelid laceration/margin repair
  - h. Tarsorrhaphy
  - i. Lateral canthoplasty (canthotomy and cantholysis)
  - j. Blepharoplasty
  - k. Facial nerve palsy – gold weight placement in the lid
  - l. Simple eyelid reconstruction
  - m. Orbital approaches and incisions (e.g., Kronlein, Caldwell-Luc, transconjunctival, transnasal)
9. To describe, recognize the indications for and complications of, and perform basic orbital skills and procedures, including:
  - a. Anterior orbitotomy for tumor biopsy/excision
  - b. Orbital floor fracture repair
10. To describe the indications for and to interpret CT and MRI scans (e.g., orbital trauma,

orbital lesions and tumors).

11. To perform botulinum toxin injections (e.g., blepharospasm).
12. To identify more advanced orbital pathology (e.g., complex orbital fractures, orbital tumors) on imaging studies (e.g., magnetic resonance imaging, computed tomography, ultrasound).

## **XI. PEDIATRIC OPHTHALMOLOGY AND STRABISMUS**

### **BASIC LEVEL GOALS: PGY-2**

#### *A. Cognitive skills*

1. To describe basic examination techniques for strabismus (e.g., ductions and versions, cover and uncover testing, alternate cover testing, prism cover testing).
2. To describe basic visual development and visual assessment of the pediatric ophthalmology patient (e.g., central, steady, maintained fixation; illiterate E, Allen cards, Landolt C rings).
3. To describe basic anatomy and physiology of strabismus (e.g., innervation of extraocular muscles, primary actions, comitant and incomitant deviations, overaction and underaction, restrictive and paretic saccades and pursuit movements).
4. To describe basic sensory adaptations for binocular vision (e.g., normal and anomalous retinal correspondence, suppression, horopter, Panum's area, fusion, stereopsis).
5. To describe and recognize pseudostrabismus.
6. To describe different etiologies of amblyopia (e.g., deprivation, ametropic, strabismic, anisometropic, organic).
7. To describe etiologies of esotropia (e.g., congenital, comitant and incomitant, accommodative and non-accommodative, decompensated, sensory, neurogenic, myogenic, neuromuscular junction, restrictive, nystagmus blockage syndrome, spasm of the near, monofixation syndrome, consecutive).
8. To describe etiologies of exotropia (e.g., congenital, comitant and incomitant, decompensated, sensory, neurogenic, myogenic, neuromuscular junction, restrictive, basic, divergence excess, exophoria, convergence insufficiency).
9. To describe various strabismus patterns (e.g., A or V pattern).
10. To describe etiologies, evaluation, and management of vertical strabismus (e.g., neurogenic, myogenic, neuromuscular junction, oblique overaction or underaction, dissociated vertical deviation, restrictive).
11. To describe non-surgical treatment of strabismus.
12. To describe different forms of childhood nystagmus.
13. To describe features, classification, and treatment indications for retinopathy of prematurity.
14. To describe etiologies and types of pediatric cataracts.
15. To describe and recognize ocular findings in child abuse (e.g., retinal hemorrhages) and appropriately refer to child protective services or other authorities.
16. To describe common hereditary or congenital ocular motility or lid syndromes (e.g., Duane syndrome, Marcus Gunn jaw winking, Brown syndrome).
17. To describe typical features of retinoblastoma.

18. To describe basic features of dyslexia.
19. To describe basic evaluation of decreased vision in infants and children (e.g., retinopathy of prematurity, hereditary retinal disorders, congenital glaucoma, measles, vitamin A deficiency).
20. To describe identifiable congenital ocular anomalies (e.g., microphthalmia, persistent fetal vasculature).
21. To describe ocular findings in inherited, metabolic disorders
  - a. Mucopolysaccharidoses (e.g., Hurler syndrome, Scheie syndrome, Hunter syndrome, San Fillipo syndrome, Morquio syndrome, Sly syndrome).
  - b. Lipidoses (e.g., Tay-Sachs disease, Sandhoff, Niemann-Pick, Krabbe's, Gaucher's, Fabry's disease, metachromatic leukodystrophy).
  - c. Aminoacidurias (e.g., homocystinuria, cystinosis, Lowe and Zellweger syndromes).
22. To describe ocular findings in chromosomal abnormalities (e.g., Trisomy 21, Trisomy 13, Trisomy 18, Short arm 11 deletion, Long arm 13 deletion, Cri du Chat, Turner's syndrome).

*B. Technical skills*

1. To perform an extraocular muscle examination based on knowledge of the anatomy and physiology of ocular motility.
2. To assess ocular motility using testing of ductions and versions.
3. To apply Hering's and Sherrington's laws.
4. To perform basic measurement of strabismus (e.g., Hirschberg, Krimsky, cover testing, prism cover testing, simultaneous prism cover testing, alternate cover testing, Parks-Bielschowsky three-step test, Lancaster red-green test, Maddox rod testing, double Maddox rod testing).
5. To perform assessment of vision in the neonate, infant, and child.
6. To recognize and apply in a clinical setting the following skills in the ocular motility examination:
  - a. Stereoacuity testing
  - b. Accommodative convergence/accommodation ratio (e.g., heterophoria method, gradient method)
  - c. Tests of binocularity and retinal correspondence
  - d. Cycloplegic refraction (retinoscopy)
  - e. Anterior and posterior segment examination
  - f. Basic and advanced measurement of strabismus
  - g. Cover test measurement
  - h. Assessment of vision
    - 1) Teller acuity cards
    - 2) Fixation preference test
    - 3) Standard subjective visual acuity tests
    - 4) Induced tropia test
7. To assist a primary surgeon in performing extraocular muscle surgery including:
  - a. Recession
  - b. Resection

- c. Muscle weakening (e.g., tenotomy) and strengthening (e.g., tuck) procedures
- d. Transposition
- e. Use of adjustable sutures

**STANDARD LEVEL GOALS: PGY-3 (in addition to the Basic Level goals)**

*A. Cognitive skills*

1. To describe basic and more advanced strabismus examination techniques (e.g., combined vertical and horizontal prism cover testing, double Maddox rod testing).
2. To describe basic and more advanced visual development and visual assessment of the pediatric ophthalmology patient (e.g., blink to light or threat, measures of fixation and following behavior, objective measures of visual acuity).
3. To describe more advanced anatomy and physiology of strabismus (e.g., torsion, tertiary actions, consecutive deviations).
4. To describe more advanced sensory adaptations (e.g., anomalous head position).
5. To describe basics of binocular sensory testing (e.g., Titmus stereo testing, Randot stereo testing, Worth 4-dot, Bagolini lenses, afterimage testing).
6. To describe and to recognize different etiologies of amblyopia.
7. To describe and recognize etiologies of esotropia.
8. To describe and recognize etiologies of exotropia.
9. To describe and recognize various strabismus patterns (e.g., A or V pattern).
10. To describe and recognize the etiologies of vertical strabismus.
11. To describe and utilize the non-surgical treatment of strabismus and amblyopia (e.g., patching, atropine penalization, Fresnel and grind-in prism therapy).
12. To describe and recognize the different forms of childhood nystagmus (e.g., sensory, motor, congenital, acquired).
13. To describe and recognize retinopathy of prematurity (e.g., stages, treatment indications).
14. To describe and recognize etiologies and types of pediatric cataracts (e.g., congenital, traumatic, hereditary, idiopathic).
15. To describe and recognize less common hereditary or malformative ocular anomalies and syndromes (e.g., Mobius, Goldenhar syndrome).
16. To describe and recognize typical features of retinoblastoma (e.g., differential diagnosis, evaluation, treatment indications and types).
17. To describe the main features of dyslexia and its relationship to vision.
18. To describe basic evaluation and differential diagnosis of decreased vision in infants and children (e.g., retinal and optic nerve etiologies, amblyopia).
19. To describe recognizable causes of blindness in infants (e.g., albinism, optic nerve hypoplasia, achromatopsia, Leber's congenital amaurosis, retinal dystrophy, congenital optic atrophy).
20. To describe etiology, evaluation, and management of congenital infections (e.g., toxoplasmosis, rubella, cytomegalovirus, syphilis, herpes).
21. To describe and recognize the common causes of pediatric uveitis.

*B. Technical skills*

1. To perform a more advanced extraocular muscle examination based on knowledge of the anatomy and physiology of ocular motility.
2. To assess more advanced ocular motility problems (e.g., bilateral or multiple cranial neuropathy, myasthenia gravis, thyroid eye disease).
3. To apply Hering's and Sherrington's laws in more advanced cases (e.g., pseudoparesis of the contralateral antagonist, enhancement of ptosis in myasthenia gravis)
4. To perform more advanced measurements of strabismus (e.g., double Maddox rod testing, Lancaster red green testing, use of synoptophore or amblyoscope).
5. To perform assessment of vision in more difficult strabismus patients (e.g, uncooperative child, mentally impaired, nonverbal or preverbal).
6. To perform basic extraocular muscle surgery:
  - a. To exercise surgical judgement for the indications and contraindications for strabismus surgery
  - b. To perform pre-operative assessment, intraoperative techniques and to describe intraoperative and post-operative complications of strabismus surgery
  - c. To perform the following strabismus surgeries
    - 1) Recession
    - 2) Resection
    - 3) Muscle weakening (e.g., tenotomy) and strengthening (e.g., tuck) procedures
    - 4) Transposition
    - 5) Use of adjustable sutures
  - d. To manage the complications of strabismus surgery (e.g., slipped muscle, anterior segment ischemia).

**ADVANCED LEVEL GOALS: PGY-4 (in addition to Standard Level goals)**

*A. Cognitive skills*

1. To describe and perform the most advanced strabismus examination techniques (e.g., complicated prism cover testing in multiple cranial neuropathies, patients with nystagmus, dissociated vertical deviation, double Maddox rod testing).
2. To perform the most advanced techniques for assessment of visual development in complicated or non-cooperative pediatric ophthalmology patients (e.g., less common objective measures of visual acuity, electrophysiologic testing).
3. To apply the most advanced knowledge of strabismus anatomy and physiology (e.g., spiral of Tillaux, secondary and tertiary actions, spread of comitance) in evaluation of patients.
4. To describe clinical application of the most advanced sensory adaptations (e.g., anomalous head position, anomalous retinal correspondence).
5. To recognize and treat the most complicated etiologies of amblyopia (e.g., refraction non-compliance, patching failures, pharmacologic penalization).
6. To recognize and treat the most complex etiologies of esotropia (e.g., optical, prism-induced, post-surgical/consecutive).
7. To recognize and treat the most complex etiologies of exotropia (e.g., supranuclear, paralytic pontine exotropia, consecutive).
8. To recognize and treat the most complex strabismus patterns (e.g., aberrant regeneration,

- post-surgical, thyroid ophthalmopathy and myasthenia gravis).
9. To recognize and treat the most complex etiologies of vertical strabismus (e.g, skew deviation, post-surgical, restrictive).
  10. To apply non-surgical treatment (e.g., patching, atropine penalization) of more complicated forms of amblyopia (e.g., non-compliant, patching failures).
  11. To recognize, evaluate, and treat the most complex forms of childhood nystagmus (e.g., sensory, spasmus nutans, associated with neurologic or systemic disease).
  12. To recognize and treat (or refer for treatment) complex retinopathy of prematurity (e.g., stages, treatment indications, retinal detachment).
  13. To recognize and treat (or refer for treatment) uncommon etiologies and types of pediatric cataracts (e.g., congenital, traumatic, metabolic, inherited).
  14. To recognize and appropriately evaluate the more complex hereditary ocular syndromes (e.g., bilateral Duane syndrome, Mobius syndrome).
  15. To recognize and treat (or refer for treatment) patients with complicated retinoblastoma (e.g., bilateral cases, monocular patient, treatment failure, pineal involvement).
  16. To recognize and evaluate the less common congenital ocular anomalies (e.g., unusual genetic syndromes).
  17. To apply the most advanced principles of binocular vision and amblyopia (e.g., physiology of binocular vision, diplopia, confusion and suppression, normal and abnormal retinal correspondence, classification and characteristics of amblyopia).
  18. To recognize and treat complex pediatric retinal disease (e.g., inherited retinopathies).
  19. To recognize and treat complex pediatric glaucoma.
  20. To recognize and treat complex pediatric cataracts and anterior segment abnormalities (including surgical implications, techniques, and complications).
  21. To recognize and treat complex pediatric eyelid disorders (e.g., congenital deformities, lid lacerations, lid tumors).
  22. To recognize and treat (or refer) pediatric orbital disease (e.g., orbital tumors, orbital fractures, rhabdomyosarcoma, severe congenital orbital malformations).

*B. Technical/surgical skills*

1. To perform more complex extraocular muscle surgery (e.g., vertical and horizontal muscle surgery; re-operations).
2. To describe indications and contraindications for more complex strabismus surgery.
3. To describe and perform the pre-operative assessment, intraoperative techniques and to describe postoperative complications for more complicated strabismus surgery (e.g., re-operations, slipped muscle).
4. To describe indications for and to perform adjustable sutures in more complicated cases (e.g., thyroid ophthalmopathy).
5. To describe and manage more complex complications of strabismus surgery (e.g., globe perforation, endophthalmitis, overcorrection).

**XII. VITREORETINAL DISEASE**

**BASIC LEVEL: PGY-2**

*A. Cognitive skills*

1. To describe basic principles of retinal anatomy and physiology (layers of the retina, retinal physiology).
2. To describe fundamentals and demonstrate basic understanding of fluorescein angiography as applied to retinal vascular disease (e.g., indications, phases of the angiogram).
3. To describe etiologies and mechanisms of retinal detachment.
4. To describe macular anatomy and function and to describe typical features of common macular disease (e.g., age-related macular degeneration, macular hole, macular dystrophies, macular pucker).
5. To describe basic principles of laser photocoagulation.
6. To describe and recognize features of commotio retinae, traumatic choroidal rupture, and Purtscher's retinopathy.
7. To describe common forms of retinal vascular disease (e.g., branch, hemi- or central retinal vein and artery occlusion).
8. To describe typical features of retinitis pigmentosa.
9. To describe features of, recognize, and evaluate posterior vitreous detachments and retinal detachments.

*B. Technical skills*

1. To perform direct ophthalmoscopy.
2. To perform indirect ophthalmoscopy.
3. To perform slit lamp biomicroscopy with the Hruby, +78, +90 lenses, 3-mirror contact lens, and trans-equator (pan-funduscopy) contact lens.
4. To interpret basic fluorescein angiography in common retinal disorders (e.g., diabetic retinopathy, cystoid macular edema).

**STANDARD LEVEL GOALS: PGY-3 (in addition to Basic Level goals)**

*A. Cognitive skills*

1. To describe more advanced retinal anatomy and physiology.
2. To describe more advanced concepts of fluorescein/indocyanine green (ICG) angiography as applied to retinal vascular and other diseases (e.g., indications, phases of the angiogram).
3. To describe principles of retinal detachment recognition, various types of retinal detachment (e.g., exudative, rhegmatogenous, tractional), and their evaluation, management and repair (e.g., identify retinal break).
4. To describe and recognize typical features of less common macular disease (e.g., parafoveal telangiectasias, cone dystrophies, inherited macular dystrophies, fundus flavimaculatus, toxic maculopathies).
5. To describe indications for and complications of laser photocoagulation.
6. To describe the findings of major studies in retinal diseases, including the following:
  - a. Diabetic Retinopathy Study (DRS)

- b. Diabetic Vitrectomy Study (DVS)
  - c. Early Treatment of Diabetic Retinopathy Study (ETDRS)
  - d. Macular Photocoagulation Study (MPS)
  - e. Diabetes Control and Complications Trial (DCCT)
  - f. Branch Vein Occlusion Study (BVOS)
  - g. Central Vein Occlusion Study (CVOS)
  - h. United Kingdom Prospective Diabetes Study (UKPDS)
  - i. Age-Related Eye Disease Study (AREDS)
  - j. Verteporfin in Photodynamic Therapy Study (VIP)
  - k. Treatment of Age-Related Macular Degeneration with Photodynamic Therapy Study (TAP)
7. To describe the fundamentals of, evaluate, and treat (or refer) peripheral retinal disease and vitreous pathology (e.g., vitreous hemorrhage, retinal breaks).
  8. To describe, evaluate, and treat choroidal detachments, uveal effusion syndrome.
  9. To identify and evaluate retinoschisis (e.g., juvenile, senile).
  10. To diagnose, treat, and recognize the complications of retinopathy of prematurity (e.g., retinal detachment).
  11. To diagnose, evaluate, and treat the following retinal vascular diseases:
    - a. Arterial and venous obstructions
    - b. Diabetic retinopathy
    - c. Hypertensive retinopathy
    - d. Peripheral retinal vascular occlusive disease
    - e. Acquired retinal vascular diseases
    - f. Ocular ischemic syndrome
    - g. Sick cell retinopathy. Retinal pigment epithelial detachment
  12. To describe and recognize common and uncommon macular disorders:
    - a. Age-related macular degeneration (ARMD)
    - b. Choroidal neovascularization (e.g., ARMD, histoplasmosis)
    - c. High myopia
    - d. Macular dystrophies
    - e. Macular pucker (e.g., epiretinal membrane)
    - f. Macular holes
    - g. Cystoid macular edema
    - h. Central serous choroidopathy (retinopathy)
    - i. Optic pit and secondary serous detachment
    - j. Retinal pigment epithelial detachment
  13. To describe the fundamentals of retinal electrophysiology.
  14. To describe, recognize, and evaluate hereditary retinal and choroidal diseases (e.g., gyrate atrophy, choroideremia, retinitis pigmentosa, cone dystrophies, Stargardt's disease, Best's disease, congenital stationary night blindness).
  15. To recognize, evaluate, and treat (or refer) retinal and choroidal toxicity (e.g., phenothiazine, hydroxychloroquine/chloroquine toxicity, tamoxifen).
  16. To describe the techniques for retinal detachment repair (e.g., pneumatic retinopexy, scleral buckling, vitrectomy).
  17. To describe the basics of surgical vitrectomy (e.g., indications, mechanics, instruments, and technique).

18. To describe the indications for and perform basic laser treatment for diabetic retinopathy (e.g. pan-retinal photocoagulation; macular grid).
19. To describe the fundamentals of special vitreoretinal techniques:
  - a. Macular hole repair
  - b. Epiretinal membrane peeling
  - c. Complex vitrectomy for proliferative vitreoretinopathy
  - d. Use of heavy liquids and intraocular gases (e.g., perfluorocarbons)
20. To describe, evaluate, and treat posterior uveitis syndromes and endophthalmitis.

*B. Technical skills*

1. To perform indirect ophthalmoscopy with scleral indentation.
2. To perform ophthalmoscopic examination with contact lenses, including pan-fundusopic lenses.
3. To interpret fluorescein and ICG angiography.
4. To describe the indications for and interpret retinal imaging technology (e.g., ocular coherence tomography, retinal thickness analysis).
5. To perform posterior segment photocoagulation.
6. To perform diabetic focal/grid macular laser treatment.
7. To perform peripheral scatter photocoagulation (panretinal).
8. To perform laser retinopexy (demarcation) for isolated retinal breaks.
9. To describe the indications for and interpret basic electrophysiological tests (e.g., electroretinogram [ERG], electro-oculogram [EOG], visual evoked potential (VEP), dark adaptation).
10. To interpret basic ocular imaging techniques (e.g., B-scan echography, nerve fiber layer analysis).
11. To perform fundus drawings of the retina, showing complex vitreoretinal relationships and findings.
12. To perform cryotherapy of retinal holes and other pathology.
13. To perform scleral buckling.
14. To describe indications, techniques, and complications of pars plana vitrectomy and to assist in a retinal surgery or perform the procedure under supervision.

**ADVANCED LEVEL GOALS: PGY-4 (in addition to Standard Level goals)**

*A. Cognitive skills*

1. To apply in clinical practice the most advanced knowledge of retinal anatomy and physiology (e.g., surgical anatomy).
2. To apply in clinical practice the most advanced concepts of fluorescein/ICG angiography in complex retinal vascular and other diseases (e.g., occult choroidal neovascular membranes, recurrent neovascularization, vascular tumors, diseases of choroid and retinal pigment epithelium).
3. To evaluate, treat or refer the most complex retinal detachments (e.g., recurrent retinal detachment, proliferative vitreoretinopathy).
4. To evaluate, treat or refer the most complex macular disease (e.g., subfoveal or recurrent

- neovascular membranes).
5. To describe the indications for laser photocoagulation, including photodynamic therapy for the most complex retinal pathology (e.g., subfoveal neovascular membranes).
  6. To describe the findings of the major studies in retinal diseases and describe the indications and exceptions for application to individual patients:
    - a. Diabetic Retinopathy Study (DRS)
    - b. Diabetic Vitrectomy Study (DVS)
    - c. Early Treatment of Diabetic Retinopathy Study (ETDRS)
    - d. Macular Photocoagulation Study (MPS)
    - e. Diabetes Control and Complications Trial (DCCT)
    - f. Branch Vein Occlusion Study (BVOS)
    - g. Central Vein Occlusion Study (CVOS)
    - h. United Kingdom Prospective Diabetes Study (UKPDS)
    - i. Treatment of Age-related Macular Degeneration with Photodynamic Therapy (TAP; VIP)
  7. To apply in clinical practice understanding of the most complex peripheral retinal disease and vitreous pathology (e.g., Goldmann-Favre disease, incontinentia pigmenti, familial exudative vitreoretinopathy).
  8. To evaluate and treat complications of retinal photocoagulation (e.g., vitreous hemorrhage, chorioretinal anastomoses).
  9. To recognize and treat complex retinal detachments (e.g., giant tear).
  10. To evaluate, treat or refer the more complex cases of retinopathy of prematurity (e.g., tractional retinal detachment).
  11. To evaluate, treat or refer the most complex forms of retinal vascular disease:
    - a. Combined arterial and venous obstructions
    - b. Advanced diabetic retinopathy
    - c. Advanced hypertensive retinopathy
    - d. Peripheral retinal vascular occlusive disease
    - e. Acquired retinal vascular diseases
  12. To evaluate and treat or refer the uncommon manifestations or presentations of the following macular diseases:
    - a. Age-related macular degeneration (ARMD)/choroidal neovascularization, (e.g., recurrent subfoveal neovascularization).
    - b. Uncommon macular dystrophies
    - c. Refractory cystoid macular edema
    - d. Recurrent central serous choroidopathy (retinopathy)
    - e. Acute posterior multifocal placoid pigment epitheliopathy (choroidopathy)
    - f. Multiple evanescent white dot syndromes
    - g. Serpiginous choroiditis
    - h. Acute zonal outer retinopathy
    - i. Triangular syndrome
    - j. Polypoidal choroidopathy
  13. To apply in clinical practice the more complex retinal electrophysiology (e.g., multifocal electroretinography).
  14. To apply in clinical practice the more complex techniques for retinal detachment repair:
    - a. Repeat scleral buckling

- b. Pars plana vitrectomy (e.g., diagnostic tap; core vitrectomy, extensive vitrectomy)
- c. Repair of uveal effusion
- 15. To apply in clinical practice the more complex principles of surgical management of diabetic retinopathy (e.g., vitrectomy, membrane release).
- 16. To apply in clinical practice complex vitreoretinal techniques:
  - a. Macular hole repair
  - b. Epiretinal membrane peeling
  - c. Complex vitrectomy for proliferative vitreoretinopathy
  - d. Use of heavy liquids
- 17. To evaluate and treat or refer the etiologically more complex or uncommon cases of posterior uveitis (e.g., sympathetic ophthalmia) and endophthalmitis (e.g., endogenous).

*B. Technical/surgical skills*

- 1. To perform indirect ophthalmoscopy with scleral indentation in complex retinal cases (e.g., multiple holes, documented with detailed retinal drawing).
- 2. To perform ophthalmoscopic examination with pan-funduscopy or other lenses in complex retinal conditions (e.g., giant retinal tears, proliferative vitreoretinopathy).
- 3. To interpret and apply in clinical practice the results of fluorescein and ICG angiography and optical coherence tomography (OCT) in complex retinal or choroidal pathology (e.g., occult subretinal neovascular membrane).
- 4. To perform posterior segment photocoagulation in more complicated retinal cases:
  - a. Diabetic focal/grid macular treatment (e.g., monocular patient, repeat treatment)
  - b. Repeat peripheral scatter photocoagulation (panretinal)
  - c. Laser retinopexy (demarcation) of large or multiple breaks; cryotherapy
- 5. To interpret and apply in clinical practice electrophysiology (e.g., ERG, EOG, VEP, dark adaptation) in more complicated retinal pathology.
- 6. To interpret and apply in clinical practice ocular imaging techniques (e.g., B-scan echography) in more complex cases (e.g., choroidal osteoma).
- 7. To perform detailed fundus drawings of the retina with vitreoretinal relationships in the most complex retinal cases (e.g., recurrent retinal detachment, retinoschisis with and without retinal detachment).
- 8. To perform laser therapy or cryotherapy of retinal holes and other more complex retinal pathology.
- 9. To perform scleral buckling in complex retinal detachment.
- 10. To perform advanced pars plana vitrectomy.

**XIII. UVEITIS**

**BASIC LEVEL GOALS: PGY-2**

*A. Cognitive skills*

- 1. To describe basic principles of history taking and examination of patients with uveitis, and related diseases (e.g., scleritis, pemphigus).
- 2. To list signs and symptoms of anterior and posterior uveitis (e.g., red eye, blurred vision, anterior segment cell and flare, vitreous opacities, pars planitis, retinal or choroidal

- infiltrates).
3. To describe the different types of uveitis (e.g., acute and chronic uveitis, granulomatous and non-granulomatous uveitis, anterior, intermediate, and posterior uveitis).
  4. To describe typical features and differential diagnosis of anterior uveitis, including infectious (e.g., bacterial, viral, protozoal, parasite), inflammatory (e.g., sarcoid, HLA-B27-associated, Behcet's disease, collagen vascular disease), neoplastic (masquerade syndromes), post-surgical, post-traumatic, Fuchs' heterochromic uveitis, juvenile rheumatoid arthritis.
  5. To describe typical features and differential diagnosis of the following posterior segment uveitis
    - a. Toxoplasmosis
    - b. Sarcoidosis
    - c. Pars planitis
    - d. Acute retinal necrosis
    - e. Vogt-Koyanagi-Harada syndrome
    - f. Large cell lymphoma
    - g. Post-operative uveitis
    - h. Endophthalmitis (e.g., post-operative, traumatic, endogenous, fungal, phacoanaphylactic, sympathetic ophthalmia)
    - i. Unusual infectious etiologies for uveitis (e.g., human immunodeficiency virus, herpes simplex virus, herpes zoster virus, pneumocystis carinii, Lyme disease.)
    - j. Acquired and congenital ocular syphilis
    - k. Cytomegalovirus retinitis
    - l. Multiple sclerosis

*B. Technical skills*

1. To perform an examination of the anterior and posterior segment for uveitis (e.g., slit lamp biomicroscopy, scleral depression, magnified posterior segment exam, vitreous evaluation for cells, retinal, choroidal, and pars plana evaluations).
2. To describe indications for ancillary testing in the evaluation of uveitis (e.g., fluorescein angiography, ultrasound, laboratory testing, radiologic testing).

**STANDARD LEVEL GOALS: PGY-3 (in addition to Basic Level goals)**

*A. Cognitive skills*

1. To describe more advanced principles of history taking and examination of patients with uveitis (e.g., review of systems for Wegener's granulomatosis, polyarteritis nodosa, lupus erythematosus, rheumatoid arthritis, inflammatory bowel disease, systemic necrotizing vasculitis; evaluation of skin, cardiac, respiratory, renal, pulmonary, musculoskeletal systems).
2. To list less common signs and symptoms of anterior and posterior uveitis.
3. To list differentiating signs of less common forms of uveitis (e.g., iris nodules, conjunctival ulcer or granuloma).
4. To describe the differential diagnosis of less common forms of uveitis (e.g., chronic

uveitis, intermediate uveitis [e.g., pars planitis], and infectious [e.g., Whipple disease, syphilis] or inflammatory posterior uveitis; masquerade syndromes, including large cell lymphoma).

5. To evaluate and treat common causes of anterior and posterior uveitis.

*B. Technical skills*

1. To perform a directed examination of the anterior and posterior segments for uveitis (e.g., slit lamp biomicroscopy, scleral depression, magnified posterior segment exam, vitreous evaluation for cells).
2. To perform ancillary testing in the evaluation of uveitis (e.g., fluorescein angiography, ultrasound, laboratory testing, radiologic testing).

**ADVANCED LEVEL GOALS: PGY-4 (in addition to Standard Level goals)**

*A. Cognitive skills*

1. To recognize, evaluate and treat uveitis associated with immunosuppressed individuals (e.g., active and recovered acquired immune deficiency syndrome, pharmacologic immunosuppression).
2. To recognize, evaluate and treat acquired and congenital ocular syphilis.
3. To recognize, evaluate and treat (or refer) less common, rare, or tropical conditions associated with uveitis (e.g., Leishmaniasis).
4. To describe indications and contraindications for corticosteroid treatment of uveitis (e.g., topical, local, systemic), including risks and benefits of therapy.
5. To describe indications and contraindications for immunosuppressive therapy in uveitis; use of antimetabolites, cyclosporine, alkylating agents.

*B. Technical skills*

1. To administer steroids in the treatment of uveitis by various routes.
2. To administer immunosuppressive agents in uveitis (or refer for administration).
3. To evaluate and treat the complications of uveitis therapy (e.g., cataracts, glaucoma).
4. To biopsy, when indicated, the vitreous or uveal tract.
5. To insert intravitreal implants containing antiviral or corticosteroid medications.
6. To perform, when indicated, vitrectomy or scleral buckling procedures.

**XIV. OCULAR ONCOLOGY**

**BASIC LEVEL GOALS: PGY-2**

*A. Cognitive skills*

1. To describe the basic categorization of common extra- and intraocular tumors.
2. To describe the differential diagnosis, epidemiology, evaluation, and management of leucocoria (e.g., inflammatory, infectious, neoplastic, congenital, persistent fetal

- vasculature, cataract, Coats' disease, vitreous hemorrhage, retinal detachment).
3. To describe major diagnostic features of major intraocular tumor types (e.g. retinoblastoma, choroidal melanoma, metastatic lesions) and to describe the differentiating features of similar lesions.

*B. Technical skills*

1. To perform slit lamp, ophthalmoscopic and ocular transillumination examination of patients with intraocular tumors (e.g., choroidal melanoma).
2. To recognize an ocular tumor and refer appropriately.

**STANDARD LEVEL GOALS: PGY-3 (in addition to the Basic Level goals)**

*A. Cognitive skills*

1. To describe management options for different intraocular tumors.
2. To describe the findings of the Collaborative Ocular Melanoma Study (COMS).
3. To describe the classification of retinoblastoma and its treatment.
4. To describe basic histopathology of intraocular tumors.
5. To list the differential diagnoses for tumors of the iris, ciliary body, choroid, retina and optic disc (e.g, melanoma, retinoblastoma, hemangioma, melanocytoma).
6. To describe diagnostic techniques for common intraocular tumors (e.g., physical examination, imaging, laboratory, oncology referral).
7. To describe the prognostic significance of different types of ocular tumors and to be able to guide evaluation for systemic involvement.

*B. Technical skills*

1. To perform indirect ophthalmoscopy in the diagnosis and localization of intraocular tumors.
2. To perform transillumination for intraocular tumor.
3. To describe indications for an examination under anesthesia for pediatric intraocular tumors.
4. To describe indications for A- and B-scan echography of intraocular mass lesions.
5. To describe indications for fluorescein angiography of intraocular tumors.
6. To describe indications for destruction or excision of conjunctival, corneal and intraocular tumors.
7. To describe indications for laser photocoagulation for intraocular tumors.
8. To describe indications for and techniques of transpupillary thermal therapy for intraocular tumors.
9. To recognize major histopathologic appearance of common intraocular tumors.
10. To describe the indications for surgical or other therapeutic procedures and their complications, and for referral, if necessary, for:
  - a. Plaque or other radiotherapy
  - b. Iridectomy and iridocyclectomy
  - c. Resection of conjunctival tumors

11. To perform an enucleation.
12. To describe indications for and techniques and complications of radiation therapy for ocular tumors (e.g., radioactive plaque localization, external beam radiation; radiation retinopathy).
13. To discuss various treatment options with patients and their families in a detailed, ethical, and compassionate manner.

**ADVANCED LEVEL GOALS: PGY-4 (in addition to Standard Level goals)**

*A. Cognitive skills*

1. To describe management options for unusual intraocular tumors (e.g. choroidal metastasis, choroidal osteoma).
2. To apply the findings of the Collaborative Ocular Melanoma Study (COMS).
3. To recognize, evaluate, and treat most forms of extra- and intraocular tumors.

*B. Technical skills*

1. To perform indirect ophthalmoscopy for the diagnosis and localization of intraocular tumors prior to treatment.
2. To describe indications for and to perform an examination under anesthesia for pediatric intraocular tumors (e.g., retinoblastoma).
3. To describe indications for and to interpret A- and B-scan echography of intraocular mass lesions.
4. To describe indications for and to interpret fluorescein angiography of intraocular tumors.
5. To describe indications for and to perform excision or other treatment of conjunctival, corneal, and intraocular tumors.
6. To describe indications for and to perform laser photocoagulation for intraocular tumors.
7. To recognize major histopathologic appearance of common and less common intraocular tumors.
8. To describe indications for surgical procedures and their complications and be able to perform or to refer for:
  - a. Plaque radiotherapy
  - b. External beam radiotherapy
  - c. Iridectomy and iridocyclectomy
  - d. Resection or cryotherapy of conjunctival tumors, or use of antimetabolite eyedrops
  - e. Transpupillary thermal therapy
9. To perform a complicated enucleation (e.g., complicated by hemorrhaging, small orbit, scar tissue) or exenteration.

**XV. LOW VISION REHABILITATION**

**BASIC LEVEL GOALS: PGY-2**

*A. Cognitive skills*

1. To describe low vision assessment techniques (e.g., Early Treatment of Diabetic Retinopathy Study charts, Sloane charts).
2. To describe significant co-morbidities that impact low vision rehabilitation.
3. To describe various low vision aids.
4. To describe the optics of low vision devices.
5. To be sensitive to psychological and emotional aspects of visual impairment.
6. To describe challenges commonly encountered by individuals with visual impairments.
7. To prescribe simple but appropriate rehabilitative therapies and optical devices to help the patient meet his/her goals. (e.g., magnification, illumination).
8. To describe functional implications of various visual system pathologies and diseases.
9. To describe visual field enhancing techniques for hemianopic field loss.
10. To describe the difference between visual acuity testing at both distance and near and contrast sensitivity testing.
11. To describe the evaluation of and rationale for licensing automobile drivers who are visually impaired; to understand the local licensing regulations.
12. To describe evaluation of visual acuity and visual field for determination of disability.

**STANDARD LEVEL GOALS: PGY-3 (In addition to Basic Level goals)**

*A. Cognitive skills*

1. To recognize significant co-morbidities that impact low vision rehabilitation.
2. To recognize and describe clinical applications, indications, and limitations of the various low vision aids (e.g., closed circuit television, magnification, large print, Braille, computers with artificial speech).
3. To describe the more advanced optics of low vision devices.

*B. Technical skills*

1. To prescribe more complex rehabilitative therapies and optical devices to help the patient meet his/her goals.
2. To apply and prescribe visual field enhancing techniques for hemianopic field loss.
3. To perform evaluation of vision assessment in licensing drivers who are visually impaired.
4. To evaluate visual acuity and visual field for determination of disability (for legal and insurance purposes).
5. To demonstrate low vision devices and educate low vision patients on the uses and limitations of these devices.

**ADVANCED LEVEL GOALS: PGY-4 (In addition to Standard Level goals)**

*A. Cognitive skills*

1. To treat significant co-morbidities that impact low vision rehabilitation.
2. To describe indications for the most complex low vision aids.
3. To apply more complex principles of optics of low vision devices.

*B. Technical skills*

1. To prescribe the most complex rehabilitative therapies and optical devices to help the patient meet his/her goals.
2. To apply and prescribe the most complex visual field enhancing techniques for hemianopic field loss.

**XVI. OPHTHALMIC PRACTICE**

*(Some of the goals listed here are applicable only to selected countries, e.g., USA, etc.)*

**BASIC LEVEL GOALS: PGY-2**

1. To describe the fundamentals and principles of medical ethics in ophthalmology (e.g., patient care decision-making, informed consent, competency issues, ethics of inter-collegial relations, risk management, privacy issues).
2. To describe the basics of ophthalmic practice management (e.g., contractual negotiations, hiring and supervising employees, financial management, working with associates, billing/collecting).
3. To describe the basics of the health care system and reimbursement, as appropriate to the local, regional, and national market of the trainee (e.g., third party payers, managed care, Medicare (USA), medical documentation, Medicaid (USA), private insurance, nationalized health care systems (UK, Canada, others)).

**STANDARD LEVEL GOALS: PGY-3 (in addition to the Basic Level goals)**

1. To describe and apply more advanced principles of medical ethics (e.g., life and death patient care decision-making, ethics of optometric and non-physician relations, documentation requirements, insurance claims and risk management).
2. To describe and apply more advanced aspects of practice management (e.g., business models, documentation requirements and coding, privacy requirements, dealing with patients or employees with disabilities).
3. To describe and apply more advanced aspects of health care reimbursement (e.g., physicians' role in managed care organizations, administrative role, third party reimbursement, capitated programs).

**ADVANCED LEVEL GOALS: PGY-4 (in addition to Standard Level goals)**

1. To demonstrate proficiency in more advanced principles of medical ethics (e.g., informed consent in children, the mentally ill or disabled, or the demented patient; physician and industry relationships; acceptance and disclosure of gifts or consultation fees).
2. To utilize in clinical practice the principles of practice management (e.g., starting a practice, economics of starting a practice, licensing and credentialing applications).
3. To utilize in clinical practice more advanced aspects of health care reimbursement (e.g., denials of claims, hospital contracting, electronic billing).

## XVII. General References

1. Congdon NG, Friedman DS, Lietman T. Important causes of visual impairment in the world today. *J Am Med Assoc.* 2004;290(15):2057-60.
2. Liesegang TJ, Hoskins JD Jr, Albert DM, O'Day DM, Spivey BE, Sadun AA, Parke DW, Mondino BJ. Ophthalmic Education: Where have we come from and where are we going? *Am J Ophthalmol.* 2003;136(1):114-21.
3. Okada AA. International guidelines. All for one and one for all. *Arch Ophthalmol.* 2003;121(7):1043-4.
4. Lee AG. Using the American Journal of Ophthalmology's website for assessing residency subcompetencies in practice-based learning. *Am J Ophthalmol.* 2004;137(1):206-7.
5. Lee AG. The new competencies and their impact on resident training in ophthalmology. *Surv Ophthalmol.* 2003;48 (6):651-62.

### Useful Organization Websites

1. American Academy of Ophthalmology - [www.aao.org](http://www.aao.org); and [www.aao.org/education/index.cfm](http://www.aao.org/education/index.cfm).
2. American Board of Ophthalmology – [www.abop.org](http://www.abop.org)
3. Digital Journal of Ophthalmology – <http://www.djo.harvard.edu>
4. Diabetic Retinopathy Images – <http://www.eyesearch.com/diabetic/retinopathy.images.htm/>
5. EyeAtlas - Online Atlas of Ophthalmology – <http://www.eyeatlas.com>
6. Eye Cancer Network – <http://eyecancer.com>
7. EyeLibrary.Org – <http://www.eyelibrary.org>
8. Eye Text.Net – <http://www.eyetext.net>
9. Graduate medical education – [www.acgme.org](http://www.acgme.org)
10. Images of eye diseases – [www.redatlas.org](http://www.redatlas.org)
11. International Council of Ophthalmology – [www.icoph.org](http://www.icoph.org)  
(has links for Basic and Clinical Assessments, i.e. testing and examinations; email address: [assess@icoph.org](mailto:assess@icoph.org))
12. Multiple ophthalmic listings – google.com (type in --, i.e. search for ---“eye resources on the internet”). For example, <http://www.webeye.ophth.uiowa.edu/dept/websites/eyeres.htm> .
13. New York Eye & Ear Infirmary: Digital Atlas of Ophthalmology – [http://www.nyee.edu/page\\_deliv.html?page\\_no=50](http://www.nyee.edu/page_deliv.html?page_no=50)
14. Royal College of Ophthalmologists – [www.rcophth.ac.uk/education/index.html](http://www.rcophth.ac.uk/education/index.html)
15. Royal Australian and New Zealand College of Ophthalmology – [www.ranzco.edu](http://www.ranzco.edu)
16. Wilmer Ophthalmological Institute – [www.wilmereyeinstitute.net](http://www.wilmereyeinstitute.net)

### Selected Ophthalmology journal websites

1. Acta Ophthalmologica Scandinavica --[www.blackwellpublishing.com/journals/aos](http://www.blackwellpublishing.com/journals/aos)
2. American Journal of Ophthalmology  
Ophthalmology

Ophthalmology clinics of North America  
Survey of ophthalmology  
Several sub-specialty titles

[www.ophsource.org](http://www.ophsource.org)

3. Archives of Ophthalmology --[www.archophthalmol.com](http://www.archophthalmol.com)
4. British Journal of Ophthalmology --[www.bjophthalmol.com](http://www.bjophthalmol.com)
5. Canadian Journal of Ophthalmology --[www.eyesite.ca](http://www.eyesite.ca)
6. Clinical and Experimental Ophthalmology --  
[www.blackwellpublishing.com/journals/ceo](http://www.blackwellpublishing.com/journals/ceo)
7. Current Opinion in Ophthalmology--[www.co-ophthalmology.com](http://www.co-ophthalmology.com)
8. European Journal of Ophthalmology --[www.eur-j-ophthalmol.com/ejo/](http://www.eur-j-ophthalmol.com/ejo/)
9. Eye --[www.nature.com/eye/](http://www.nature.com/eye/)
10. Graefes Archive for Clinical and Experimental Ophthalmology --  
[www.springerlink.com](http://www.springerlink.com)
11. International Ophthalmology Clinics --[www.internat-ophthalmology.com](http://www.internat-ophthalmology.com)
12. Investigative Ophthalmology and Visual Science --[www.iovs.org](http://www.iovs.org)
13. Japanese Journal of Ophthalmology (new publisher as of 2004) --[www.springer-tokyo.jp.co](http://www.springer-tokyo.jp.co)
14. Ophthalmologica--[www.karger.com](http://www.karger.com)
15. Transactions of the American Ophthalmological Society --[www.aonline.org](http://www.aonline.org)
16. Lippincott Williams and Wilkins --[www.lwwonline.com](http://www.lwwonline.com)

*(Individual users only)*

Current Opinion in Ophthalmology  
International Ophthalmology Clinics  
Cornea  
Evidence-Based Eye Care  
Eye and Contact Lens  
Journal of Glaucoma  
Journal of Neuro-ophthalmology  
Ophthalmic Plastic and Reconstructive Surgery  
Optometry and Vision Science  
Retina  
Techniques in Ophthalmology

## XVIII. LITERATURE AND STUDIES FOR REVIEW

### General references (books)

1. Albert DM, Jakobiec FA: Principles and practice of ophthalmology. 2<sup>nd</sup> ed. Philadelphia, WB Saunders, 2000.
2. Duke-Elder S: System of ophthalmology. St. Louis, CV Mosby, 1976.
3. Easty DL, Sparrow JM: Oxford Textbook of Ophthalmology, 2v, Oxford, New York, Oxford University Press, 1999.
4. Forrester J et al: The eye. Basic sciences in practice. 2nd ed. Philadelphia, WB Saunders, 2002.
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6. Gold DH, Weingeist TA (eds): The eye in systemic disease. Philadelphia, JB Lippincott, 1990.
7. Gold DH, Weingeist TA (eds): Color atlas of the eye in systemic disease. Philadelphia, Lippincott
8. Kanski J: Clinical ophthalmology. 4th ed. Oxford; Boston, Butterworth-Heinemann, 1999.
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16. Spalton David J: Atlas oftalmologia clinica. Madrid, Mosby/Doyma Libros, 1995. (Spanish translation of Spalton's 2nd edition).
17. Varma R: Essentials of eye care. The Johns Hopkins Wilmer handbook. Philadelphia, Lippincott-Raven, 1997
18. Wilson FM: Practical ophthalmology, A manual for beginning residents, 4<sup>th</sup> ed., 1996. San Francisco, American Academy of Ophthalmology, 1996. Williams & Wilkins, 2001.
19. Yun Tong-ho, Yi Sang-uk, Ch'oe Ok.: Angwahak (Ophthalmology), 6th ed, Seoul, Ilchogak, 2002. (Korean).

**Journal articles:** The articles below are divided into two groups within each clinical study. Most represent clinical trials or “evidence-based medicine.” Group 1, labelled “Recommended reading,” includes articles that represent the most important findings and

**conclusions of the study. Group 2, labeled “Additional background reading,” includes articles that are considered less important in terms of timeliness and/or final outcome of the study.**

## CORNEA

### Herpetic Eye Disease Study (HEDS) I

#### Recommended reading

*(No authors listed): Acyclovir for the prevention of recurrent herpes simplex virus eye disease. Herpetic Eye Disease Study Group. N Engl J Med. 1998 Jul 30;339(5):300-6.*

*(No authors listed): A controlled trial of oral acyclovir for the prevention of stromal keratitis or iritis in patients with herpes simplex virus epithelial keratitis. The Epithelial Keratitis Trial. The Herpetic Eye Disease Study Group. Arch Ophthalmol. 1997 Jun;115(6):703-12. [erratum appears in Arch Ophthalmol 1997;115(9):1196].*

*(No authors listed): Oral acyclovir for herpes simplex virus eye disease: effect on prevention of epithelial keratitis and stromal keratitis. Herpetic Eye Disease Study Group. Arch Ophthalmol. 2000 Aug;118(8):1030-6.*

#### Additional background reading

*(No authors listed): A controlled trial of oral acyclovir for iridocyclitis caused by herpes simplex virus. The Herpetic Eye Disease Study Group. Arch Ophthalmol. 1996 Sep;114(9):1065-72.*

Wilhelmus KR, Dawson CR, Barron BA, Bacchetti P, Gee L, Jones DB, Kaufman HE, Sugar J, Hyndiuk RA, Laibson PR, Stulting RD, Asbell PA: Risk factors for herpes simplex virus epithelial keratitis recurring during treatment of stromal keratitis or iridocyclitis. Herpetic Eye Disease Study Group. Br J Ophthalmol. 1996 Nov;80(11):969-72.

Barron BA, Gee L, Hauck WW, Kurinij N, Dawson CR, Jones DB, Wilhelmus KR, Kaufman HE, Sugar J, Hyndiuk RA, et al: Herpetic Eye Disease Study. A controlled trial of oral acyclovir for herpes simplex stromal keratitis. Ophthalmology. 1994 Dec;101(12):1871-82.

Wilhelmus KR, Gee L, Hauck WW, Kurinij N, Dawson CR, Jones DB, Barron BA, Kaufman HE, Sugar J, Hyndiuk RA, et al: Herpetic Eye Disease Study. A controlled trial of topical corticosteroids for herpes simplex stromal keratitis. Ophthalmology. 1994 Dec;101(12):1883-95; discussion 1895-6.

Dawson CR, Jones DB, Kaufman HE, Barron BA, Hauck WW, Wilhelmus KR: Design and organization of the herpetic eye disease study (HEDS). Curr Eye Res. 1991;10 Suppl:105-10.

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(No authors listed): Predictors of recurrent herpes simplex virus keratitis. Herpetic Eye Disease Study Group. *Cornea*. 2001 Mar;20(2):123-8.

Sudesh S. Laibson PR: The impact of the herpetic eye disease studies on the management of herpes simplex virus ocular infections. *Curr Opin Ophthalmol*. 1999 Aug;10(4):230-3.

Kip KE. Cohen F. Cole SR. Wilhelmus KR. Patrick DL. Blair RC. Beck RW: Recall bias in a prospective cohort study of acute time-varying exposures: example from the herpetic eye disease study. *J Clin Epidemiol*. 2001 May;54(5):482-7.

Wilhelmus KR: The treatment of herpes simplex virus epithelial keratitis. *Trans Am Ophthalmol Soc*. 2000;98:505-32.

## GLAUCOMA

### Fluorouracil Filtering Surgery Study (FFSS)

#### Recommended reading

(No authors listed): Five-year follow-up of the Fluorouracil Filtering Surgery Study. The Fluorouracil Filtering Surgery Study Group. *Am J Ophthalmol*. 1996 Apr;121(4):349-66.

(No authors listed): Risk factors for suprachoroidal hemorrhage after filtering surgery. The Fluorouracil Filtering Surgery Study Group. *Am J Ophthalmol*. 1992 May 15;113(5):501-7.

Van Buskirk EM: Five-year follow-up of the Fluorouracil Filtering Surgery Study. *Am J Ophthalmol*. 1996 Nov;122(5):751-2.

#### Additional background reading

(No authors listed): Three-year follow-up of the Fluorouracil Filtering Surgery Study. *Am J Ophthalmol*. 1993 Jan;115(1):82-92.

(No authors listed): Fluorouracil Filtering Surgery Study one-year follow-up. The Fluorouracil Filtering Surgery Study Group. *Am J Ophthalmol*. 1989 Dec 15;108(6):625-35.

### Normal Tension Glaucoma Study

#### Recommended reading

Drance S, Anderson DR, Schulzer M Risk factors for progression of visual field abnormalities in normal-tension glaucoma. *Am J Ophthalmol*. 2001 Jun;131(6):699-708.

Drance SM: [The Collaborative Normal-Tension Glaucoma Study and some of its lessons.] *Can J Ophthalmol*. 1999 Feb;34(1):1-6.

### **Additional background reading**

Bayer AU, Erb C: Short wavelength automated perimetry, frequency doubling technology perimetry, and pattern electroretinography for prediction of progressive glaucomatous standard visual field defects.

Ophthalmology. 2002 May;109(5):1009-17.

Schulzer M: Errors in the diagnosis of visual field progression in normal-tension glaucoma. Ophthalmology. 1994 Sep;101(9):1589-94; discussion 1595.

### **Ocular Hypertension Treatment Study (OHTS)**

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## RETINA

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## COMS-Related Publications

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### **Additional Suggested Literature: Review Articles**

*Didactic review articles are an excellent source of information and perspective for ophthalmologists-in-training. Some examples of useful reviews are listed below; the list is by no means comprehensive. Residents should be encouraged to search the literature on a regular basis to stay aware of new reviews and original clinical studies.*

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