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Manual of Ocular Diagnosis and Therapy

Fifth Edition

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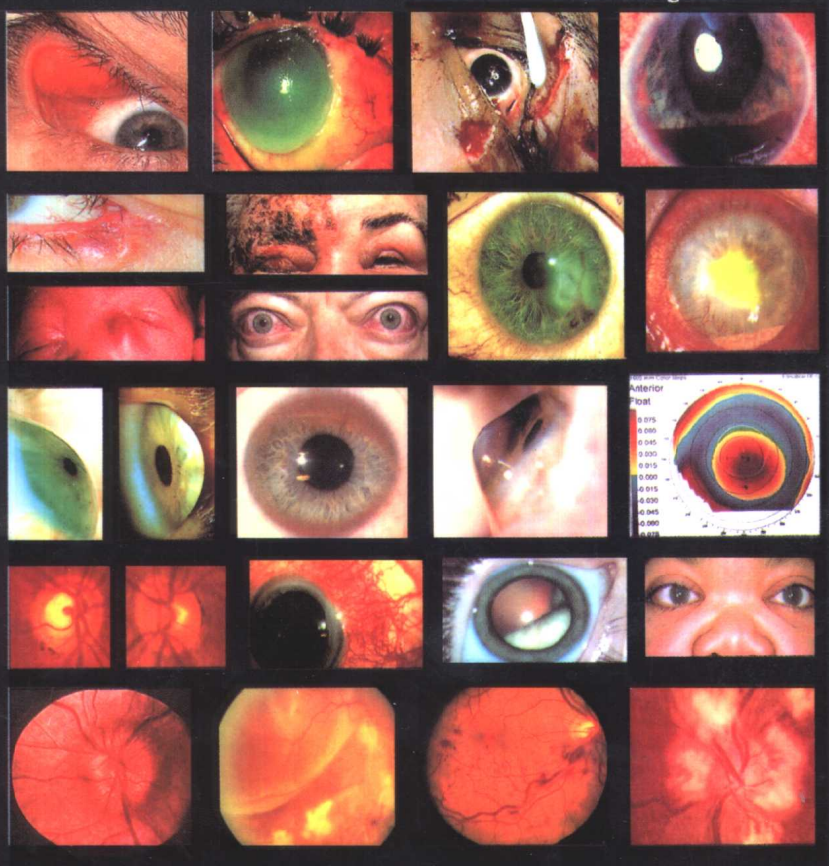
眼病诊断和治疗手册

Edited by
Deborah Pavan-Langston



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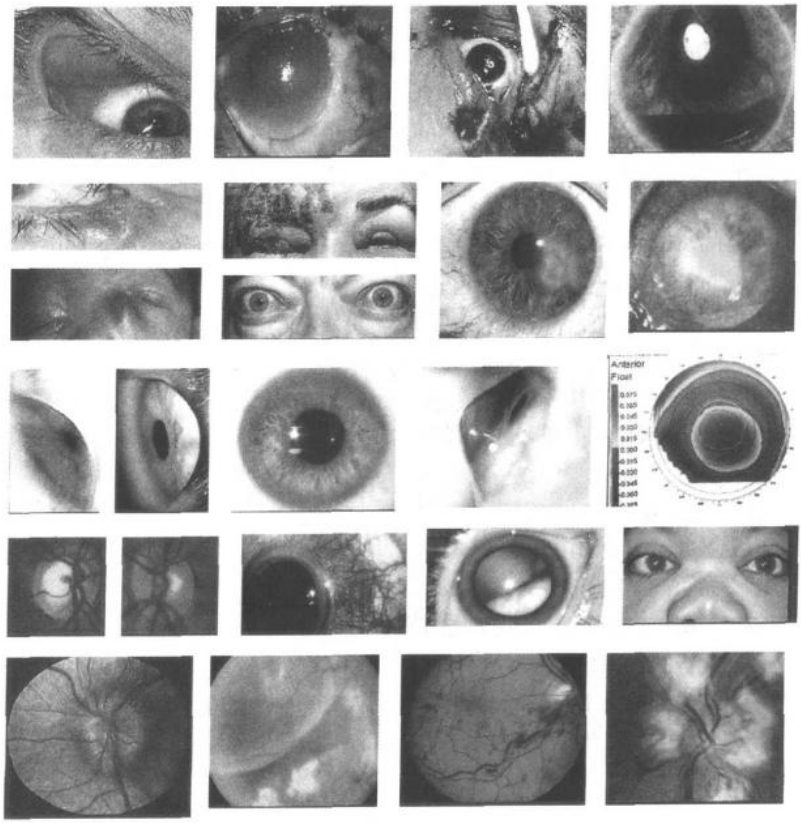

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Manual of Ocular Diagnosis and Therapy

Fifth Edition

Editor

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Associate Professor of Ophthalmology
Harvard Medical School
Surgeon, Director of Clinical Virology
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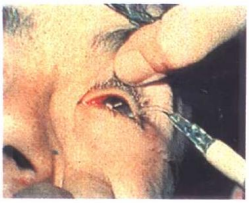

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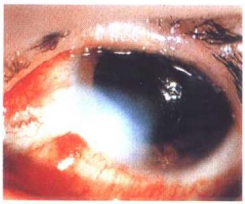

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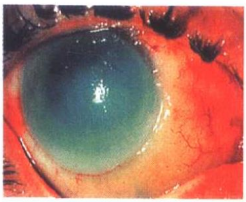

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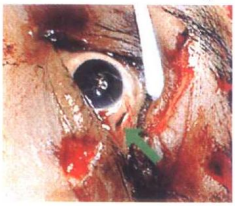

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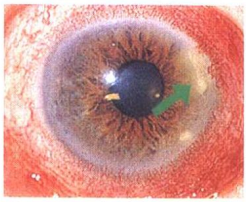

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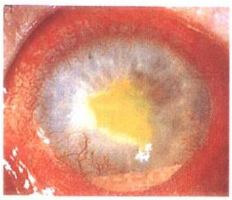

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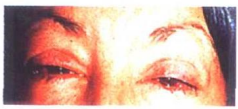

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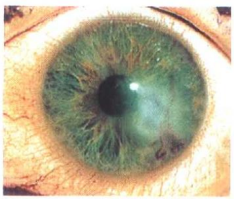

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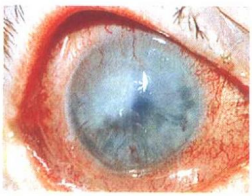

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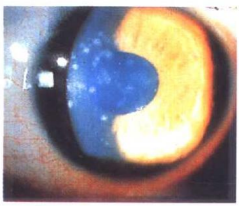

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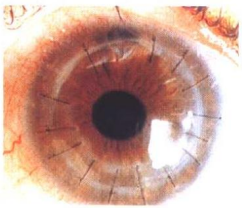

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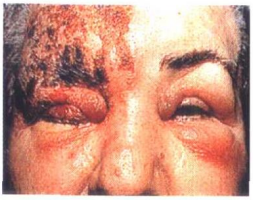

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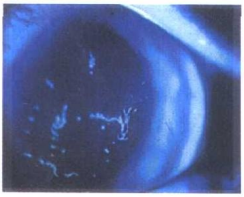

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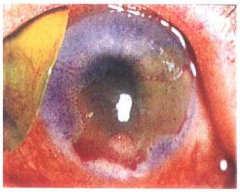

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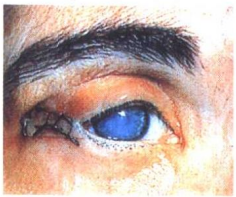

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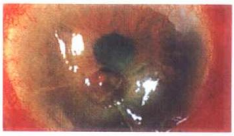

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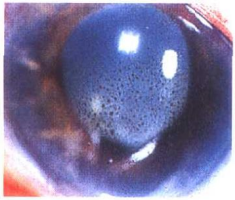

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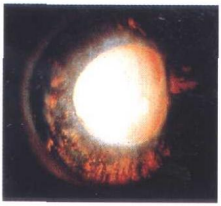
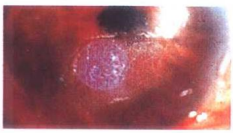


IRIS ATROPHY-TRANSILLUMINATION



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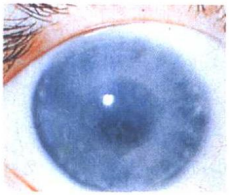

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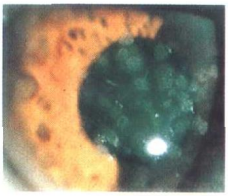

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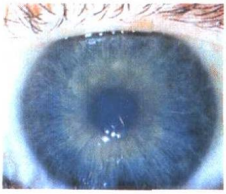

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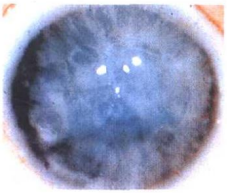

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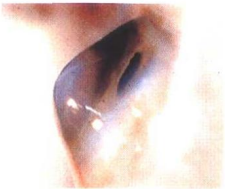
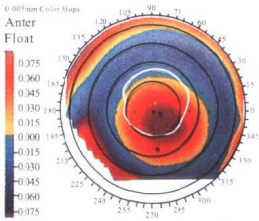
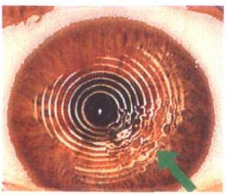


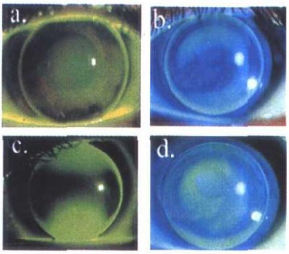
KERATOCONUS



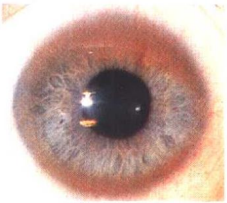
TOPOGRAPHY-KERATOCONUS



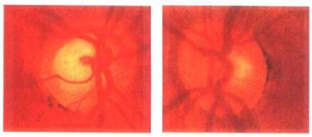
KERATOSCOPY: FOCAL IRREGULAR ASTIGMATISM



HCL FIT: a.GOOD. b.TOO FLAT. c.TOO ASTIGMATIC. d.TOO STEEP.



KAISER-FLEISCHER COPPER RING



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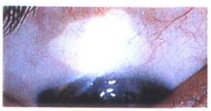
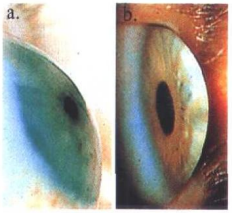
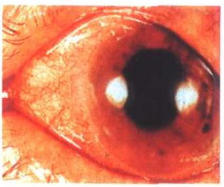


FILTERING BLEB



ANTERIOR CHAMBER: a.SHALLOW. b.DEEP

GONIOSCOPY: OPEN ANGLE



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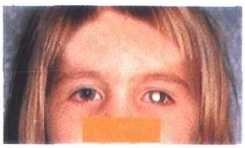

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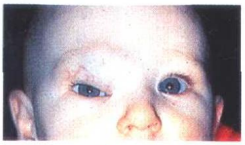

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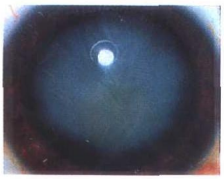

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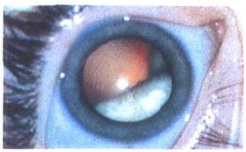

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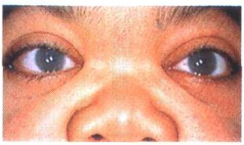

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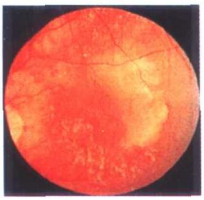

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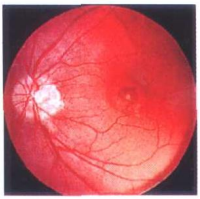
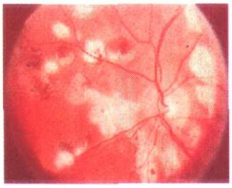


MACULAR EDEMA & HOLE



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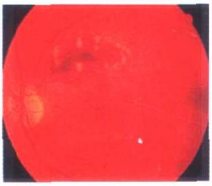

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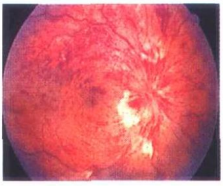

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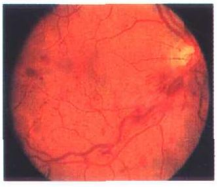

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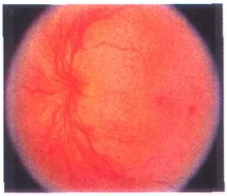

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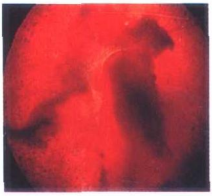

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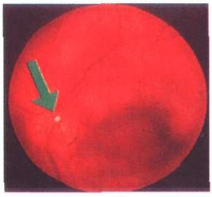
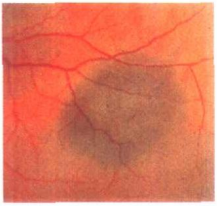
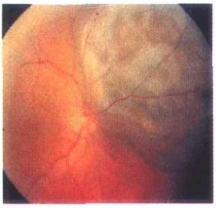


RETINAL EMBOLUS & INFARCTION



CHOROIDAL NEVUS



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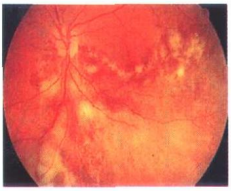

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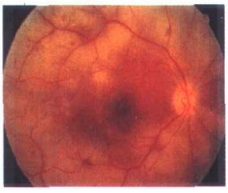

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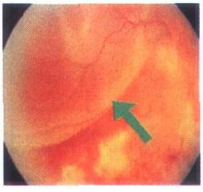

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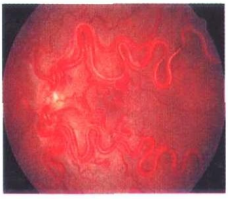

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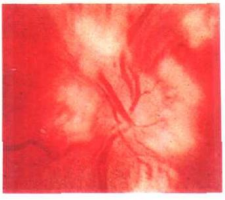

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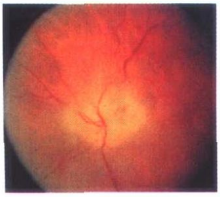

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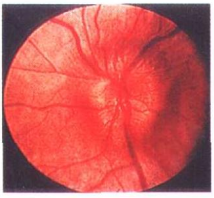

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PREFACE

This fifth edition of the Manual has, in many areas, undergone extensive revision from previous editions—revision promoted by the gratifying advances made in clinical and laboratory diagnosis, high technology, and new approaches in drug development. The object of the original exercise, however, remains unchanged: to publish a highly practical and specific book on ocular diagnosis and therapy that will be of use to the doctor on the "front lines," the one sitting face to face with a patient. This updated book is written for the widest possible audience: practicing eye care specialists, family practitioners, emergency room physicians, internists, neurologists, and pediatricians; that is, seasoned practitioners and house officers in virtually any discipline, as well as medical students first learning about ocular disease. It is for anyone involved in decisions concerning either care of the eyes or what the eyes can tell us about other care needed by the patient.

Each chapter covers the clinical findings of a multitude of ocular problems, diagnostic tests, differential diagnoses, and detailed treatments. The subject matter varies widely and includes the latest information on topics from the simple removal of corneal foreign bodies to new diagnostic techniques, management of hyphema, chemical burns, infections (bacterial, viral, fungal, parasitic), the great variety of glaucomas, cataract extraction and intraocular lenses, pediatric problems, extraocular muscle imbalance, neuroophthalmic disease, and the use of antiinfectives, corticosteroids, immunosuppressives, antiglaucoma drugs, and numerous other therapeutic agents. The updated indications and techniques of refractive surgery, laser therapy for the front and back of the eye, and expanded chapters on retinal and uveal disease are presented in the light of today's knowledge. The ocular findings in systemic disease and an extensive listing of the ocular toxicities of systemic drugs are thoroughly tabulated by disease and drug for easy reference. The straightforward outline form of the text, and the index, drug formulary, drawings, and tables are all designed so that information can be rapidly located and a pertinent review brought quickly to hand.

The contributing authors were selected primarily for their skills as practicing physicians or surgeons with widely acknowledged expertise in the area covered. Eight are currently the directors of their specialized clinical divisions. All are knowledgeable in clinical and laboratory research as well and are, therefore, up to date on new developments in the field. I am indebted to these fine physicians for their contributions to this book.

For the first time in the history of this manual, color plates have been included. Eighty-one full-color clinical photographs were contributed from the private collections of the authors. These labeled figures progress anatomically from the external ocular tissues to the anterior ocular segment and on to the back of the eye.

Kerry Barrett, Jonathan Pine, and Thomas Boyce of Lippincott Williams & Wilkins have been very encouraging and extremely helpful. For countless hours of copyediting, typing, and retyping with enthusiasm when exasperation was the easier reaction, I thank my long-time assistant, Mary Lou Moar. I also acknowledge the excellent drawings of Laurel Cook and Peter Mallen, and I am most indebted to Mrs. Georgiana Stevens for her generous support, and to my daughter, Wyndy, for her thoughtful advice. Without the help of all these people and countless others too numerous to mention by name, this book would not exist.

Deborah Pavan-Langston, M.D., FACS

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1. OCULAR EXAMINATION TECHNIQUES AND DIAGNOSTIC TESTS

Deborah Pavan-Langston

I. **General principles**

A. **Physical examination and evaluation of the ocular system** are greatly facilitated by a number of techniques that may be performed in the office, using equipment readily available through any optical or medical supply house. Some of the more complicated techniques, however, must be performed by a specialist in a hospital setting. These techniques are discussed with a view to (a) their indications, (b) how they are performed, so that the referring examiner can explain to a patient what might be expected, and (c) the necessary information to aid the examiner in management of the patient.

B. **Order of examination.** Examination of the eye and its surrounding tissues with and without special aids may yield valuable information for the diagnosis and treatment of primary ocular disease or disease secondary to systemic problems. So that nothing is overlooked, a systematic routine should be adopted and particular attention given to those factors that brought the patient to testing in the first place. With time and increased experience, an examination that initially may take a somewhat prolonged period of time can be shortened significantly with no loss of accuracy and frequently with increased accuracy of perception. Individual chapters should be referred to for related detail.

C. **The general order for nonemergency examination** is as follows:

1. **History.** Present complaints, previous eye disorders, family eye problems, present and past general illnesses, medications, and allergies.
2. **Visual acuity.** Distant and near without and with glasses, if used, and with pinhole if less than 20/30 is obtained.
3. **Extraocular muscle function.** Range of action in all fields of gaze, stereopsis testing, and screening for strabismus and diplopia.
4. **Color vision testing.**
5. **Anterior segment examination** under some magnification if possible (loupe or slitlamp), with and without fluorescein or rose bengal dyes.
6. **Intraocular pressures (IOPs).**
7. **Ophthalmoscopy** of the fundi.
8. **Visual field testing.**
9. **Other tests** as indicated by history and prior examination:
   - **a.** Tear film adequacy and drainage.
   - **b.** Corneal sensation.
   - **c.** Transillumination.
   - **d.** Exophthalmometry.
   - **e.** Keratoscopy.
   - **f.** Keratometry.
   - **g.** Gonioscopy.
   - **h.** Corneal topography.
   - **i.** Corneal pachymetry.
   - **j.** Specular microscopy.
   - **k.** Confocal slit-scanning microscopy.
   - **l.** Fluorescein and indocyanine green angiography.
   - **m.** Electroretinography (ERG) and electrooculography (EOG).
   - **n.** Ultrasonography.
   - **o.** Radiology, tomography, magnetic imaging.
   - **p.** Keratocentesis.
   - **q.** Scanning laser retinal nerve fiber analysis.

Procedures **e.** through **o.** are done by specialists in eye care, and referral should be made if such testing is indicated.

II. Routine office examination techniques

A. Visual acuity. Determination of visual acuity is a test of macular function and should be part of any eye examination, regardless of symptomatology or lack thereof.

1. Distant visual acuity. Visual acuity is examined one eye at a time, the other eye being occluded. Pressure on the occluded eye should be avoided so that there will be no distortion of the image when that eye is tested subsequently. If the patient normally wears glasses, the test should be made both with and without corrected lenses and recorded as "uncorrected" and "corrected" (sc or cc).

a. The chart most commonly used for distance vision with literate patients is the Snellen chart, which is situated 20 ft (approximately 6 m) away from the patient and diffusely illuminated without glare. At this distance the rays of light from the object in view are almost parallel, and no effort of accommodation (focusing) is necessary for the normal eye to see the subject clearly. The Snellen chart is made up of letters of graduated sizes; the distance at which each size subtends an angle of 5 minutes is indicated along the side of the chart. The farther one is from an object, the smaller the retinal image. By combining the two factors of size and distance, it is possible to determine the minimum visual angle, i.e., the smallest retinal image that can be seen by a given eye. A normal visual system can identify an entire letter subtending an angle of 5 minutes of arc and any components of the letter subtending 1 minute of arc at a distance of 20 ft. Some patients, however, may resolve letters subtending even smaller visual angles. The vision of a normal eye is recorded as 20/20, or 6/6 in metric measurement. If the patient is able to read down only to the 20/30 line, the vision is recorded as 20/30. If the patient is unable to read even the large E at the top, which subtends an arc of 400 degrees, he or she may be moved closer so that the distance measurement is changed. The visual acuity may then be recorded as 10/400, for instance, if the patient is able to read this letter at 10 ft from the chart.

b. Pinhole vision is tested if the patient is unable to read the 20/30 line. A pinhole aperture is placed in front of the eye to ascertain any improvement in acuity. The use of a pinhole will correct for any uncorrected refractive error such as nearsightedness, farsightedness, and astigmatism (regular or irregular from corneal surface abnormalities) without the need for lenses. Through the pinhole a patient with a refractive error should read close to 20/20. If the pinhole fails to improve the patient's visual acuity score, the examiner must suspect another cause for the reduced vision, such macular or optic nerve disease.

c. Preschool children or **patients who are unable to read** should be shown the Illiterate E chart, which is made up entirely of the letter E facing in different directions. Patients are instructed to point their finger in the direction of the bars of the E. Children as young as 3 years of age may be able to cooperate in this testing. Another form of testing is with Allen cards, which are small cards with test pictures printed on each one; at a distance of 20 ft, a visual acuity of 20/30 may be tested. If the patient is unable to identify the pictures at that distance, the distance at which the picture is identified is recorded, e.g., 10/30, 5/30, and so on.

d. If a patient is unable to identify any letter on the chart at any distance, visual acuity is recorded as counting fingers (CF) at whatever distance the patient is able to perform this function, e.g., CF 3. Vision less than CF is recorded as hand motion or light perception (LP). If an eye is unable to perceive light, the examiner should record no light perception rather than the misleading term *blind.*

e. **Tests of light projection** may demonstrate normal retinal function when vision is extremely poor and the **examiner is unable to see the retina,** as in the presence of mature cataract or severe corneal scarring.

This test is done by covering the other eye completely and holding a light source in four different quadrants in front of the eye in question. The patient is asked to identify the direction from which the light is approaching the eye. A red lens is then held in front of the light and the patient is asked to differentiate the red from the white light. If all answers are correct, the examiner may be reasonably certain that retinal function is normal. It is important to note that normal retinal and macular function may be present despite abnormal LP due to unusually dense anterior segment disease, which prevents light sufficient to give the retina proper stimulation from reaching it.

f. **The potential acuity meter (PAM)** is a reasonably accurate device for differentiating between visual loss from anterior segment (corneal scarring, cataract) and macular disease. It allows a preoperative prediction for what the potential postoperative vision might be. For example, if the vision is 20/400 by routine testing but 20/40 with PAM, one can, in most cases, assume good macular function and good correction of vision once the anterior segment defect has been corrected. Conversely, if the vision is 20/400 both by regular and PAM testing, one can assume that almost all of the visual loss is due to macular disease and that anterior segment surgery or medical therapy will be to no avail. The PAM attaches easily to a standard slitlamp and projects a Snellen acuity chart into the eye using a 1.5-mm-diameter pinhole aperture. In cases in which the cornea is clear but cataract obstructs vision, the patient is tested at different points on the cornea in an attempt to project through clearer areas in the lens and allow the best possible reading.

g. **Macular photostress test.** Very early macular dysfunction, whether from spontaneous or toxic degeneration, may be detected by the macular photostress test. The patient looks at a flashlight held 2 cm from the eye for 10 seconds. The time it takes for visual recovery to one line less than the visual acuity determined prior to this test is measured. Normal time is about 55 seconds. Recovery taking longer than this (90 to 180 seconds) indicates macular dysfunction, even though the area may appear anatomically normal.

h. **Macular function** may be tested in the presence of **opaque media** by gently massaging the globe through closed lids with the lighted end of a small flashlight. If the macula is functioning normally, the patient will usually see a red central area surrounded by retinal blood vessels. If macular function is abnormal, the central area will be dark rather than red and no blood vessels will be seen.

i. **Legal blindness.** Visual acuity correctable by glasses or contact lenses to 20/200 or less in both eyes, or visual fields in both eyes of less than 10 degrees centrally, constitutes legal blindness in the United States. Its presence requires that the patient be reported to the Commission for the Blind in the patient's home state. Report forms are short and readily available from the Commission.

2. **Close visual acuity** is usually measured using a multipurpose reading card such as the Rosenbaum Pocket Vision Screener or the Lebensohn chart. The patient holds the chart approximately 35 cm from the eye and, reading separately with each eye with and without glasses, reads the smallest print he or she is able to identify. This may then be recorded directly from the chart as 20/30, 20/25, or as Jaeger equivalents J-1, J-2. In patients older than the late 30s, the examiner should suspect uncorrected presbyopia if the patient is unable to read a normal visual acuity at 35 cm, but is able to read it completely or at least better if the card is held farther away. Abnormally low close vision in an elderly patient without reading

glasses is meaningless per se, except for comparative purposes in serial examinations of the severely ill.

B. Extraocular muscle function. The movement of the eyes in all fields of gaze should be examined (see Chapter 12, secs. **I.** and **XI.**).

1. **In the primary position of gaze** (i.e., straight ahead) the straightness, or orthophoria, of the eyes may be ascertained by observing the reflection of light on the central corneas. The patient is asked to look directly at a flashlight held 30 cm in front of the eye. Normally, the light reflection is symmetric and central in both corneas. The asymmetric positioning of a light reflex in one eye indicates deviation of that eye. Location of the reflex on the nasal side of the central cornea indicates that the eye is aimed outward, or exotropic; location of the reflex temporal to the central cornea indicates that the eye is deviated inward, or esotropic. Each millimeter of deviation is equivalent to 7 degrees or 15 diopters (D) of turn. A paretic or paralyzed extraocular muscle is the cause of such ocular deviation. Vertical deviation may be determined by noting the location of a light reflex above or below the central cornea. In some patients, the light reflex will be slightly inside or outside the central cornea due to a normal difference between the visual axis and the anatomic axis between the central cornea and the fovea. This angle is referred to as the **angle kappa** and is positive if the eye appears to be deviating outward, and negative if the eye appears to be deviating inward. No ocular movement will occur on cover–uncover testing if the apparent deviation is due to angle kappa alone (see Chapter 12, sec. **III.B.**).
2. **Cardinal positions of gaze.** The patient is asked to look in the six cardinal positions of gaze, i.e., left, right, up and right, up and left, down and right, and down and left. **Congruity** (parallelism) of gaze between the two eyes should be noted as well as the extent of the excursion. The examiner should check for restriction of gaze in any direction or for double vision in any field of gaze due to restriction of one eye. Occasionally, involuntary movement may occur in normal patients at the extremes of gaze; this movement is referred to as *end-gaze* or *physiologic nystagmus*. **Nystagmus** is a short-excursion, back and forward movement of the eye that may be fine or coarse, slow or rapid. Occasionally, fine rotational nystagmus may also be observed. Except in end-gaze nystagmus, this rotational nystagmus may bear further investigation (see Chapter 12, secs. **XI.** and **XIII.**).
3. **The near point of conversion (NPC)** is the point closest to the patient at which both eyes converge on an object as it is brought toward the eyes. This point is normally 50 to 70 mm in front of the eye. The moment one eye begins to deviate outward, the limit of conversion has been reached. An NPC greater than 10 cm is considered abnormal and may result in excessive tiring of the eyes on close work such as reading or sewing.
4. **Stereopsis** is tested grossly by having the patient touch the end of one finger to the tip of the examiner's finger coming in horizontally end to end. Past pointing may indicate lack of depth perception in the absence of central nervous system (CNS) disease. More refined testing is done using the Wirt test fly, circle, and animal figures with three-dimensional (3-D) glasses. Stereopsis may be graded from the equivalent of 20/400 (large fly) to 20/20 (nine circle depth perception) using this commercially available test. Simultaneous perception of four red and green lights while wearing glasses with a red lens over one eye (eye sees only red) and a green lens over the other (eye sees only green) indicates a more gross but significant form of fusion. This test is the Worth four-dot test and is also available commercially.

C. Color vision testing

1. **Purpose.** Demonstration of adequate color vision is mandatory for certain jobs in a number of states and for obtaining a driver's license. Jobs affected are armed services trainees, transportation workers, and others whose