

MANUAL
OF THE
DISEASES OF THE EYE

FOR STUDENTS
AND GENERAL PRACTITIONERS

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PREFACE TO THE TENTH EDITION

THE ninth edition of this manual appeared in August, 1917, and was reprinted in August, 1919, July, 1920, and again in August, 1921; there have also been new editions of the British and of most of the foreign language editions; an eighth translation, the Chinese, is in press and will appear shortly.

In presenting the tenth edition, the author desires to express his appreciation of the continued favor with which his work is received. Every page has been carefully examined; alterations and additions have been incorporated to improve the text wherever possible.

The volume has been kept up to date, but has not been increased in size, the original plan of presenting a book for the student and general practitioner having been adhered to.

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PREFACE TO THE FIRST EDITION

IN the following pages the author has endeavored to present a concise, practical, and systematic Manual of the Diseases of the Eye, intended for the student and the general practitioner of medicine. The great difficulty in preparing a book of this sort is to say enough but not too much. With this idea in view, the author has made the volume sufficiently comprehensive, up to date, and yet of limited size.

This restriction in size has been accomplished by omitting excessive detail, extensive discussion, and lengthy accounts of theories and rare conditions. The author has endeavored to give the fundamental facts of ophthalmology and to cover all that is essential in this branch of medicine, always keeping in mind that the book has been written for students and

general practitioners. Space, therefore, has been allotted as the necessities of such readers require, estimated by an extended experience in teaching. Thus, rare conditions have merely been mentioned; uncommon affections, of interest chiefly to the specialist, have been dismissed with a few lines; and common diseases, which the general practitioner is most frequently called upon to treat, have been described with comparative fulness.

The book is not recommended as a substitute for the larger works, but as a means of supplying a foundation to which further knowledge may be added by reference to more extensive and comprehensive text-books.

The illustrations, excepting a few cuts of instruments, are original, and have been inserted wherever it seemed that they would be of value in elucidating the text. The colored plates present the common external diseases of the eye and those changes in the fundus, the recognition of which is important in connection with general diseases, including affections of the nervous system, as well as for ophthalmic diagnosis; hence the volume also supplies an atlas.

C. H. M.

August, 1900.

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DISEASES OF THE EYE

CHAPTER I

EXTERNAL EXAMINATION OF THE EYE BY MEANS OF INSPECTION AND PALPATION

Introduction.—Thorough examination of the eye requires the adoption of a certain routine. The history of the patient's complaint will lead the trained observer to concentrate his attention upon the affected part of the eye; but until proficiency is gained through experience it is not safe to depart from a systematic plan of examination.

The eye, being intimately associated with the rest of the body, must not be regarded as an isolated organ. Hence a knowledge of the condition of the system is often valuable in the diagnosis and successful treatment of ocular disease. The parts immediately surrounding the eye must also receive careful attention.

Systematic examination of the eye may be divided into

1. Objective.
2. Subjective or functional.

The *objective examination* may be subdivided into

(a) Examination of the appendages and the anterior portions of the eyeball by means of *inspection and palpation*; this part of the examination is usually conducted in *daylight*.

(b) Examination of the cornea and of the interior of the eyeball in the *dark room*, with *artificial light*, by means of *oblique illumination* and the *ophthalmoscope*.

Inspection.—Those parts of the eye which admit of examination by daylight are best illuminated by seating the patient so that he faces a window. Taking a general survey of the eyes, we notice certain prominent symptoms,

such as swelling, congestion, discharge, lachrymation, photophobia, etc.

Proceeding from the superficial to the deeper parts, we commence with the *lids*, noticing their thickness, color, and position; the condition of their margins, whether swollen, crusted, or ulcerated; the power of opening and closing; the size of the palpebral aperture; and the position and permeability of the lacrymal puncta. Passing to the region of the *tear-sac* we see whether this is swollen, and whether

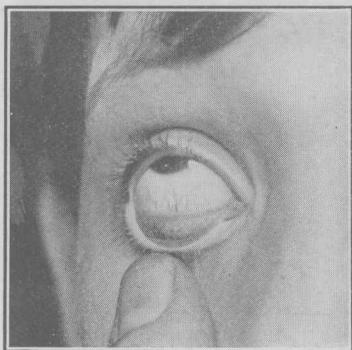


FIG. 2.—Eversion of the Lower Lid.

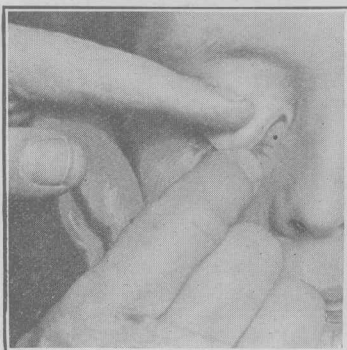


FIG. 3.—First Step in Eversion of the Upper Lid.

pressure with the tip of the index finger causes escape of secretion. We examine the condition and direction of the *cilia*, and notice whether any are misdirected.

Next we inspect the inner or *conjunctival surface of the lids*, observing any change in color, smoothness, thickness, and secretion of this membrane, and looking for foreign bodies.

Exposure of the Conjunctiva of the Lower Lid is easy: Place the thumb near the margin of the lid, press downward, while the patient looks up (Fig. 2).

Eversion of the Upper Lid requires a little practice: Grasp the central lashes between the thumb and index finger of the right hand and draw the lid strongly downward and away

from the globe, directing the patient to look down (Fig. 3); place the left thumb (or a probe held horizontally) at the upper margin of the tarsus and press downward, at the same time quickly turning the lid. Having turned the lid, it can be kept everted by shifting the left thumb against the margin,

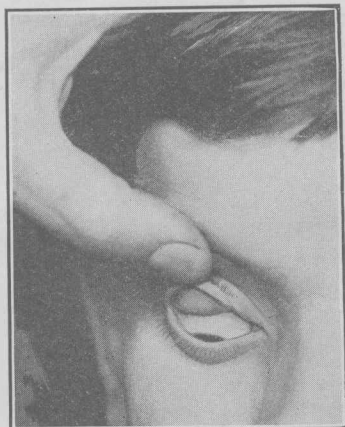


FIG. 4.—Keeping the Upper Lid Everted.

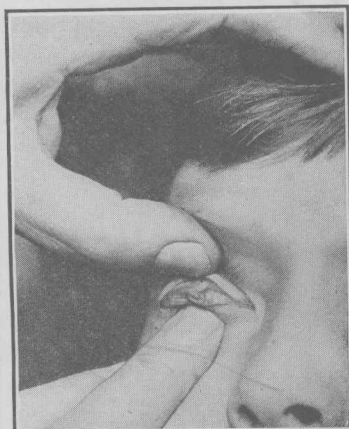


FIG 5.—Exposure of the Retrotarsal Fold of the Conjunctiva of the Upper Lid.

the other fingers of the left hand being applied above the patient's forehead (Fig. 4).

Another method of inverting the upper lid, which requires but one hand, is as follows: Place the tip of the index finger just above the margin of the upper lid and the thumb immediately below the border of the lower lid. Tell the patient to look down. Push the upper lid back so as to tilt its edge away from the eyeball. With the thumb slide the lower under the upper lid. The latter is now grasped between the index finger and thumb and is readily inverted by a sort of semirotatory movement. The whole act is continuous, easy, is done quickly and with little discomfort to the patient.

This exposes the tarsal portion of the conjunctiva. To

inspect the *retrotarsal fold* (and this is important in the examination for trachoma) it is necessary to continue as follows: Press the edge of the everted upper lid firmly against the supraorbital margin with the thumb of the left hand; then push the lower lid upward over the cornea with the right index finger, at the same time exerting gentle backward pressure upon the eyeball (Fig. 5). Another method of exposing the retrotarsal fold is to put the upper lid on the stretch by drawing it downward and forward, and pressing upon the skin above the tarsus with a flat, blunt instrument, such as a squint-hook, until the fornix comes into view.

Then we proceed to the *eyeball* and notice its situation in the orbit, whether this is normal or whether the globe is pushed forward (exophthalmos) or sunken (enophthalmos). Its position in reference to the visual lines should be roughly ascertained; we see whether the visual lines meet at the object looked at, by directing the patient to gaze at a finger held about a foot in front of the eyes; if they deviate, we investigate whether there is loss of motion in any direction (paralysis), or absence of muscle-balance, either latent (heterophoria) or manifest (strabismus), as explained in Chapter XXV.

We observe whether there is any cedema of the bulbar conjunctiva (chemosis), or *congestion* of the anterior part of the eyeball. If the latter is present, it should be examined carefully, for the nature of this injection points to the seat of inflammation as explained on page 93, and illustrated on Plate VII.



FIG. 6.—Placido's Disc.

The *cornea* is next inspected, and may reveal inflammation, ulceration, vascularization, opacities, or foreign bodies. As an aid, we may now use a strong convex lens with which to concentrate the light from the window, but this method (oblique illumination) gives better results in the dark room with artificial light, and is, therefore, described in Chapter III. The *corneal reflex* derived from the window bars

gives us information concerning the curvature and smoothness of this part of the eye. Placido's keratoscope (Fig. 6), a target-like disc consisting of alternate black and white circles, may be used. By causing the patient to look in different directions, every part of the surface of the cornea is explored; distortion of the corneal reflection of the circles or of the lines corresponding to the window panes indicates a change of curvature or roughness. A minute foreign body can often be detected in this manner (Fig. 7).

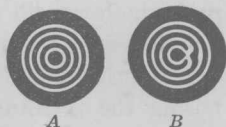


FIG. 7.—Corneal Reflection of Placido's Disc. A, Normal; B, distortion caused by a foreign body on the cornea.

To bring an abrasion, infiltration, or ulcer of the cornea more clearly into view, we may instil a drop of 2 per cent. solution of *fluorescein* (p. 405), washing off the excess with water. Wherever the cornea is infiltrated or its epithelium is absent there will be a green stain.

We often find evidences of previous ulceration of the cornea in the form of *opacities*. When a corneal opacity is very faint and cloud-like, it is called a *nebula*; when denser, a *macula*; and when perfectly opaque and white, a *leucoma* (Figs. 147, 148, 149).

The *sensitiveness* of the cornea may be noted by touching it gently with a thread or piece of soft paper, taking care not to touch the lids or lashes.

When there is much irritation, spasm of the lids (*blepharospasm*) prevents a proper examination. In such cases, the instillation of a solution of cocaine or holocain will aid us in exposing the eyeball.

In infants or very young children, when blepharospasm, swelling, inflammation, or obstinacy prevents us from inspecting the cornea in the usual way, the child is laid upon its back across the nurse's lap, and its head is steadied between the knees of the examiner who sits facing the nurse (Fig. 8). Holding the child's hands, the nurse steadies the patient's

body with her arms, allowing the legs to remain free, so that when the child struggles it will expend its energy in motion of the feet while the head remains the fixed point. Under such circumstances the lids may usually be everted by pulling upon them at a little distance from the margin. To



FIG. 8.—Method of Examining the Eyes of Infants and Young Children.

inspect the eyeball, we part the lids by placing our thumbs at the edges, rolling in the latter somewhat and then separating, keeping close to the surface of the eyeball (Fig. 9). Having exposed the eyeball, we may replace the thumb of the right hand by the index finger of the left, thus leaving the right hand free for other uses. The eye will usually be found turned upward, hence the cornea will be hidden from view; but after a minute it will appear in the palpebral aperture. Care must be taken not to scrape the cornea and cause an abrasion, nor to exert any pressure upon the eyeball, on ac-

count of the danger of perforation in case the cornea has become weakened by ulceration.

It is sometimes necessary to use *retractors* (Fig. 10) in order to separate the lids under such circumstances, and with these the same caution is required against wounding the cornea or pressing upon the eyeball.

If the method of examining the eyes of infants just described should prove unsatisfactory, a general anæsthetic must be employed. When forcibly separating the lids we must remember that pent-up secretions are released suddenly and may squirt into the eyes of the examiner.

Then we examine the *anterior chamber* and notice its depth, whether normal, shallow, or increased, and whether the *aqueous humor* is clear; if the latter is altered, we observe whether the exudation consists of pus (*hypopyon*), blood (*hyphæma*), spongy exudation, or the like.



FIG. 10.—Lid Retractor.

The *iris* comes next. We observe its color, smoothness, and thickness, whether its markings are clearly defined or blurred, ("muddy"), and whether it is steady or tremulous during movements of the eyeball. *Adhesions* to the cornea (*anterior synechiæ*) or to the capsule of the lens (*posterior synechiæ*) are looked for; these may require the instillation of a mydriatic for their detection.

Then we note the characteristics of the *pupil*: size, shape, and position, and compare its size with that of its fellow; also its reaction to light, and in accommodation and convergence as explained on page 175. Behind the pupil we see the central part of the anterior surface of the *lens* and

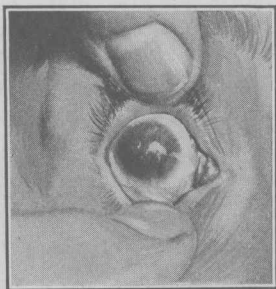


FIG. 9.—Method of Exposing the Eyeball

observe its transparency or any abnormality, such as cataract or deposits. To explore the lens fully, dilatation of the pupil and artificial illumination are required.

Palpation informs us of (1) presence or absence of *sensitiveness in the ciliary region*; (2) degree of *hardness of the eyeball*, and (3) existence of tumors and swellings in and about the orbit.

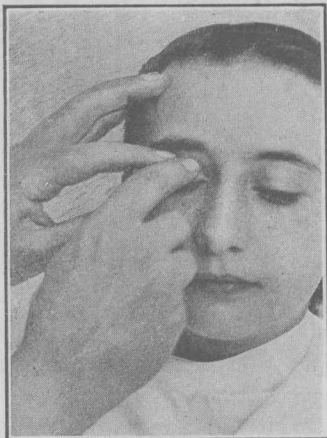


FIG. 11.—Testing the Tension of the Eyeball.

Ciliary Tenderness. — By pressing upon the sclera, just behind the cornea (Fig. 11), as described below, we may discover sensitiveness of the ciliary body; this is an important symptom of cyclitis.

Eyeball Tension.—To gauge tension, direct the patient to look down, and then gently palpate the sclera above the cornea with the two index fingers placed upon the upper lid (Fig. 11), just as in feeling for fluctuation in an abscess,

but pressing more downward than backward. We estimate the degree of tension by comparison with the other eye, if normal, or with another healthy eye. Increase of tension is a prominent symptom of glaucoma; degenerated conditions of the eyeball cause diminished tension; alternations in tension are sometimes found in cyclitis.

Tension is expressed by the sign T. followed by n. when normal, by + or — when increased or diminished, with numerals indicating the degree of change, as follows:

T.n. = Tension normal.

- | | | | |
|--------|-------------------------|--------|-------------------------|
| T. + | = Tension increased. | T. — | = Tension diminished. |
| T. + 1 | = Appreciable hardness. | T. — 1 | = Appreciable softness. |
| T. + 2 | = Decided hardness. | T. — 2 | = Decided softness. |
| T. + 3 | = Board-like hardness. | T. — 3 | = Eyeball very soft. |

This method serves to estimate and record tension roughly. For accurate measurement, an instrument known as the *tonometer* (Fig. 12) is employed, the model of Schiötz being in general use, although Gradle's modification is often substituted on account of greater ease in application. The tonometer records, in figures, the resistance offered to definite weights used to produce an impress upon the eye, by the movement of a needle upon a scale. The eye having been anæsthetized with repeated instillations of a 1-per-cent. solution of holocain, the patient either lying upon a couch or seated on a chair, the head is placed so that the cornea looks directly upwards; the lower end of the tonometer is then rested by its own weight upon the up-turned cornea, different weights having been superimposed, depending upon the degree of suspected increase in tension; the needle of the instrument becomes deflected to a certain number which, upon comparison with an accompanying scale, will be found to indicate a definite number of millimeters of mercury. Normal tension varies from 15 to 25 mm. of mercury as registered by the tonometer.

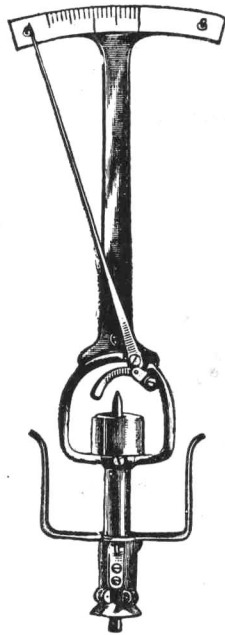


FIG. 12.—Tonometer of Schiötz.

Thus we conduct that part of the objective examination for which daylight furnishes suitable illumination. For minute inspection of the cornea, anterior chamber, iris, and lens, as well as for examination of the vitreous and fundus, we resort to oblique illumination and the use of the ophthalmoscope in the dark room (Chapter III.).

CHAPTER II

SUBJECTIVE OR FUNCTIONAL EXAMINATION OF THE EYE

THE subjective examination, dependent upon the statements of the patient, comprises the testing of the function (vision or sight) of each eye separately. This function may be subdivided into (1) the form sense; (2) the color sense; and (3) the light sense.

The *form sense* is the faculty which the eye possesses of perceiving the shape or form of objects, and is expressed as *acuteness of vision*. The *color sense* is the power which the eye has of distinguishing light of different wave lengths, *i.e.*, distinguishing colors. The *light sense* is the faculty of perceiving different degrees of intensity of illumination (brightness). We distinguish between *a.*, *central or direct*, and *b.*, *peripheral or indirect vision*.

THE ACUTENESS OF VISION

Central or Direct Vision.—When we wish to obtain a distinct image, we look directly at an object so that the image falls upon the macula lutea, the portion of the retina which is adapted for the most acute vision; this constitutes *direct vision*. The acuteness is tested both for *distant* and for *near* vision.

Distant Vision.—In testing for distance a range of 20 feet (6 meters) is selected, since rays of light from this distance are practically parallel. For this purpose we make use of *Snellen's test types*, which are constructed upon the following principle: Each letter is inscribed within a square (Fig. 13) which subtends a visual angle of 5' at the distance at which the normal eye should distinguish the letter. The visual angle is included between two lines drawn from the extrem-

ities of the object through the nodal point of the eye, which is situated 15 mm. in front of the retina and 7 mm. behind the cornea (Fig. 14). Each side of the square is subdivided into five equal parts; the smaller squares thus formed subtend a visual angle of $1'$, which is the minimum visual angle for the normal eye—that is, if two black objects on a white ground are separated by a space subtending a smaller angle, they will no longer be seen separate, because the two images will fall upon the same cone in the layer of rods and cones of the retina. In order to subtend the same visual angle, the size of the letters must increase the farther they are removed from the eye (Fig. 14).

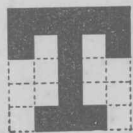


FIG. 13.—Construction of Snellen's Test Types.

Snellen's Test Types consist of square-shaped letters arranged upon a chart, the size of the letters diminishing from above downward. The height of each letter subtends a visual angle of $5'$, the width of the component limbs a visual angle of $1'$. The uppermost letter is of such a size that it

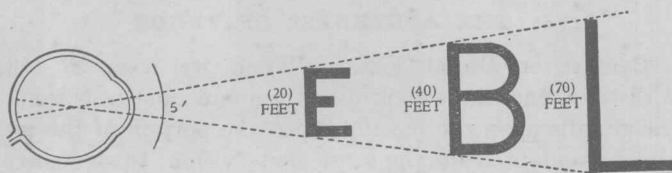


FIG. 14.—The Estimation of the Size of Snellen's Test Types at Various Distances.

can be read at 200 feet; then follow rows of letters which should be read at 100, 70, 50, 40, 30, 20, 15, and 10 feet respectively (Figs. 15 and 16).

The acuteness of vision is expressed by a fraction, the numerator of which corresponds to the number of feet separating the patient from the chart (preferably 20 feet), and the denominator to the number indicating the distance at which the smallest letters seen should be read by the normal

eye. If the patient's sight is normal, his acuteness of vision will equal $\frac{20}{20}$; this is expressed $V. = \frac{20}{20}$ (or $\frac{6}{6}$ if we use meters). If he can see only the third line from the top, $V. = \frac{20}{70}$. If he can not read more than the top letter, $V. = \frac{20}{200}$. If he reads some letters in the 50 line, but not all of this size, $V. = \frac{20}{50}$ — or $\frac{20}{70} +$. Many persons, especially during youth, can read the line which should be read at 15 feet, or even 10 feet, when

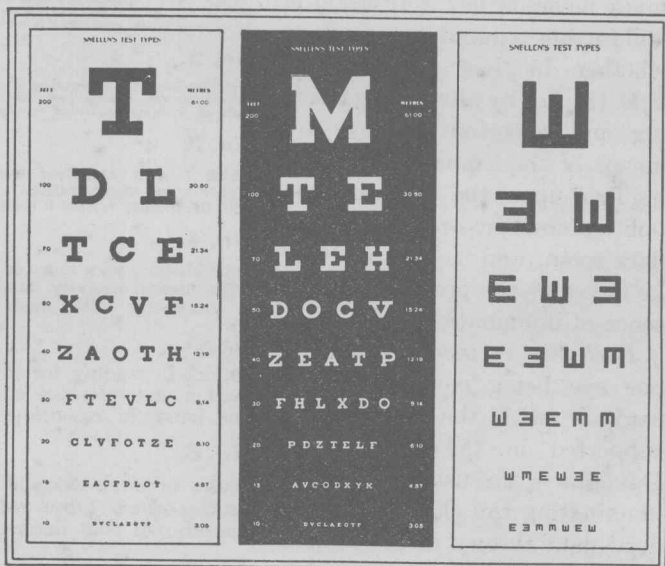


FIG. 15.—Snellen's Test Types. Usual Style of Chart.

FIG. 16.—Snellen's Test Types. White Letters on a Black Ground.

FIG. 17.—Test Types for Illiterates.

placed 20 feet from the chart; the fractions in these cases would be $\frac{20}{15}$ and $\frac{20}{10}$. Sometimes the acuteness of vision is expressed by 1 for $\frac{20}{20}$ and by smaller fractions for reduced sight, such as $\frac{1}{2}$ for $\frac{20}{40}$.

If the patient's vision is less than $\frac{20}{200}$, we reduce the distance from the chart. If he sees the largest letter at 8 feet, $V. = \frac{8}{200}$. If he cannot read the top letter at any distance,