(a) The number of patients of all ages suffering from convergence deficiency is large and the symptoms, which may include migraine, extremely unpleasant; the psychological element is often present and particular attention must be paid to the patient's mental approach both before and during treatment since the successful remedy lies largely in his own hands.

(b) Care should be taken when testing and treating a patient with an esophoria since many of these have a convergence deficiency as well.

(c) Even patients who are orthophoric and can actually converge may benefit from treatment, while many patients with small refractive errors are able to dispense with their correction after they have been treated.

(d) Above all, treatment can be quick and effective—on average, two tests and five half-hour lessons—but must be taken under trained supervision; it should aim at building up voluntary convergence and teaching the patient to relax once convergence is established, since voluntary convergence alone can prevent a recurrence of the symptoms in after years. If a patient is discharged as cured after undergoing the treatment described in this paper, it may be said with some certainty that with the exception of the patient with migraine symptoms who may need a subsequent refresher course, the risk of his having to return for further treatment is infinitesimal.

THE ULTRA-VIOLET OPHTHALMOSCOPE*

BY

J. DE MENT

OREGON, U. S. A.

THE ophthalmoscope has long been used for observing the interior of the eye, and thus determining the appearance of the media, the condition of the retina, choroid, and optic nerve, and for a variety of other conditions of this organ. As is well known, the present-day ophthalmoscope relies upon the use of white light and ordinary vision, though in past years a number of modifications have been introduced into the design and mode of operation of this instrument.

The fluorescence of the eyes of humans and lower organisms has been known since the earliest days of fluoro-chemistry, though the first accurate description of this phenomenon was probably

* Received for publication, November 4, 1944.

that of Helmholtz¹ in 1896. The fluorescence of the eyes of lower animals was described later by Kohler² and by Hess³.

In more recent years the fluorescence of the eye has been widely mentioned by writers in a number of different connections with fluoro-chemistry⁴. The fluorescence of the eye has assumed importance lately with the introduction of the uranine tests, such as those for circulation⁵ and for death⁶.

In studies on the use of uranine injections for distinguishing real and apparent death the writer has observed the interior eye structure of living animals such as humans, cats, dogs, and rabbits to have a bright green luminescence with filtered 3650A ultra-violet light (*e.g.*, radiation from a G.E. H-4 lamp). In an investigation of several hundred living and dead animals, however, it has been observed that after sudden death this bright green emission may change to a dull blue.

In previous studies, to my knowledge, where the fluorescence of the eye was being observed a beam of ultra-violet light was merely directed into the orbit and the radiation-response of the various structures noted qualitatively. In my more recent studies on the fluorescence of the interior structures of the eye, I have designed an ophthalmoscope which employs filtered ultra-violet light instead of visible light. It possesses certain other features which may make it of general interest to those engaged in the experimental study of ophthalmology and related fields. A description of the *ultra-violet ophthalmoscope* follows:

The device consists of a round mirror of silvered glass or unpolished aluminium, with a small perforation in the centre. The surface of the mirror can be either concave or plane, or, the mirror in a more improved form can be reversible, one side of which is plane and the other concave. Mounted in the central perforation of the mirror is a small circular window of an ultra-violet opaque medium, such as Noviol glass or Wratten 2-A filter. Behind this on a rotor may be mounted one or more filters of transmission suitable for special observations, such as colour analysis by filter radiometry.

The ultra-violet ophthalmoscope is used exactly like its conventional counterpart. A source of filtered ultra-violet light (of "long wavelength," *i.e.*, 3650A) is placed slightly behind the plane of the subject's face, and preferably on the same side as the eye to be examined. The filtered ultra-violet light beam is directed toward the reflecting mirror which is held in the line of vision of the subject and directed into the eye: observation is made through the centre aperture, the presence of the ultra-violet absorbing glass in the aperture preventing ultra-violet light from passing into the observer's eye, exciting fluorescence, and so creating a masking effect. A lens (double convex) of pyrex or quartz may be placed

at the appropriate distance between the ophthalmoscope and the eye under inspection if greater resolution is desired. The lens must not fluoresce, and all examinations are made in a darkened room.

There appear to be a number of interesting possibilities for the ultra-violet ophthalmoscope in medical and biological science, not only for the study of the internal eye structures, but also for the examination of such exposed regions as the brightly fluorescent sclera. As is well known, cataract tissue fluoresces differently than its normal surrounding tissue: hence, with this instrument greater assurance might be had of complete removal of all pathological tissue from the cornea; lesions of the cornea and sclera are revealed by their green fluorescence after uranine solution has been dropped into the eye; neoplasms and other disease tissue present marked differences under high intensity ultra-violet light, as frequently do the different kinds of normal tissue.

REFERENCES

1. HELMHOLTZ.—"Handbuch der physiologischen Optik." Pp. 284, 306, 1896.
2. KOHLER.—*Zeitschr. wiss. Mikros.*, Vol. XXI, p. 163, 1904.
3. HESS.—*Arch. vergl. Ophthal.*, Vol. II, p. 3, 1911; *Pflüger's Arch. Physiol.*, Vol. CXXXVII, p. 339, 1911.
4. RADLEY and GRANT.—"Fluorescence Analysis in Ultra-Violet Light. New York, D. van Nostrand Co., 1939; DE MENT.—"Fluorescent Chemicals and their Applications." New York, Chemical Publishing Co., 1941.
5. FISHBACK.—*Jl. Lab. Clin. Med.*, Vol. XXVI, p. 1966, 1941.
6. DE MENT.—*Military Eng.*, Vol. XXXIV, p. 538, 1942; *Jl. Chem. Educ.*, Vol. XXI, pp. 124-125, 1944.

MOSCOW EYE HOSPITAL *

BY

A. USPENSKY

ON Gorky Street, Moscow's main thoroughfare, stands the Moscow Eye Hospital, one of the largest and oldest ophthalmological institutions in the country.

Founded 120 years ago its scope was at first quite limited. There were only two staff doctors, only 30 people a day passed through the out-patients' department and the hospital was equipped with only 20 beds. Now the out-patients' department is visited daily by 500 people and the number of beds has increased to 250.

The growth of the hospital dates from the post-revolutionary years when the whole of the medical service was re-organized. Thus, for example, in 1917 only 200 clinical analyses per month

* Received for publication, November 21, 1945.