unusual and refreshing, for Dr. Linksz follows his lectures closely, and, in places, perhaps verbatim. Through teaching optics to advanced and mature students whose only previous exposure to physics was probably in early college days, he has had an unusual opportunity to discover where the difficulties in grasping the concepts of optics really lie. As a result, the reader is led over the obstacles in the path and is shown the pitfalls in passing. Geometrical optics, so often presented as a series of algebraic gymnastics, is here made a live and interesting subject by the author's constantly pointing out connections with optical phenomena and presenting many examples. The ophthalmologist who reads and understands this book will approach his subject with a broader background and a better understanding of the optical properties of the eye. He will also be apt to be more tolerant of the patient who may dare to query him concerning phenomena of vision. The physicist may well read this book, too. He will react at first with considerable amusement at the lengths to which Dr. Linksz goes to explain obvious subjects, such as the action of mirrors, but on second thought he will realize that the simple laws of optics are not obvious to the student meeting them for the first time, and he may well learn a great deal concerning the teaching of optics from this book.

Optics; The Technique of Definition covers the subject of lens theory and geometrical optics from the point of view of the practical man who wants to learn as much as he can about the performance of photographic lenses without becoming involved in any but the simplest algebra. Each subject is approached from the experimental point of view and with the aid of many well-planned diagrams. As a result, the reader can obtain answers to most of his questions about lenses and at the same time gain a good understanding of the nature of the optical phenomena taking place. An example of a subject well treated here is the focal length of a complicated lens. The explanations of equivalent, front and back focal lengths, nodal points, and principal planes are given clearly, together with detailed instructions as to their measurement. The reasons for the various steps are well explained. The section on testing lenses for definition and aberrations is of particular value. This, together with a very complete listing of commercially available lenses and a qualitative description of their properties by basic type, offers a guide for the intelligent purchase of a lens for a particular purpose, and for testing its performance. The book is up to date and covers, in brief, such recent developments as low reflection coatings and reflection-type lens systems.

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Sight, Light and Efficiency. H. C. Weston. London W.C.1: H. K. Lewis, 1949. 308 pp. 2£ 2s. net.

The British Coal Mines General Regulations of 1947, concerned with improving the conditions of underground lighting, are based on the premise that good illumination not only facilitates the mining operations and decreases accident liability, but is a basic amenity as well. This philosophy, reflecting the dual function of industrial lighting, also characterizes Weston's approach.

Illumination is an environmental variable which, together with sight—a "personal" variable—affects work efficiency in a large number of industrial operations. What are the values of these variables needed for efficient work? This is the basic problem of Weston's book.

The introductory chapter on the structure and function of the eye is followed by the discussion of the causes and symptoms of eyestrain, defined as a condition due to the overactivity of the ciliary or oculomotor muscles; occupational demands upon sight (e.g., perception of fine details, color discrimination, depth perception, recognition of objects in motion or exposed to view for a short time); facilitation of visual tasks (correction of errors of refraction, acquisition of visual skills, use of special magnifiers and work glasses, provision of suitable color and brightness contrast between work object and the surroundings); lighting and visual efficiency (illumination required on work objects, individual differences in light need, methods for illuminating work objects, glare, spectral quality of light); incentive value of light and color; testing sight for work; and protection of sight.

In presenting the data on his central theme—the relation between illumination and output—Weston relies heavily on the results of investigations made with the support of the (British) Medical Research Council and the Department of Scientific and Industrial Research. These government-sponsored research bodies provided facilities and personnel for long range study of industrial physiology and psychology, including investigations on vision and lighting. The author served for thirty-odd years as investigator for the Industrial Fatigue (Health) Research Board and published a number of valuable contributions in its reports. He carried out extensive field investigations—"naturalistic" and experimental—on illumination and output, but did not neglect laboratory studies of "synthetic" visual tasks, made under rigorously controlled conditions and allowing experimental analysis of the critical visible characteristics (such as size, contrast, and motion) of the work objects. It is Weston's considered judgment that "It is largely to the results of laboratory investigations that we must look for a scientific basis for lighting practice" (p. 170).

Recommended levels of illumination are a practical fruit of research on lighting and vision. In this country, the matter is still highly controversial. As is frequently the case, lack of clarity and agreement about objectives, and inadequate experimental evidence had their share in making the controversy prolonged and, at times, bitter. The British, and Weston specifically, are less exposed to criticism on either count. For very fine objects, there is a continuing increment of performance over a large range of illumination intensities, with an approximately logarithmic relationship between illumination and performance. Weston recognizes that "maximum visibility" is not a practicable criterion of recommended illumination and proposes that a submaximal (90 percent) level of relative performance be used. The detailed schedule of levels of illumination, recommended in the (British) Illu-

minating Engineering Society's *Code* (1949), is presented in the appendix.

The summary of the British researches on illumination and output will be welcomed by many who do not have easy access to the original work. As a whole, the volume will be valuable to all concerned with matters of vision and lighting in factory and mine, office and school.

JOSEF BROŽEK
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Text-book of Ophthalmology: The Neurology of Vision, Motor and Optical Anomalies, Vol. IV. W. Stewart Duke-Elder. St. Louis, Mo.: C. V. Mosby, 1949. 3473–4627 pp. $20.00.

This great work should command a prominent place on the desk of every ophthalmologist, for it is a masterly compilation of an enormous amount of important information, written in the superb and unexcelled style for which its author is famous. As stated in Vol. I, the aims are to present a survey of authoritative opinion and to provide a reference textbook of ophthalmology.

The printed work—with its connotation of authority and final truth—easily molds and fixes the impressionable mind. Since ophthalmic thought is profoundly affected by the powerful influence of the literature, it is essential that this major publication receive careful scrutiny by the profession. The value of any book should be enhanced by an appreciation of its weaknesses.

The 1154 pages of text are divided approximately equally into three sections, dealing with neurological, motor, and refractive disorders of the eye.

Section XIV, on "Neurology of Vision," discusses the visual pathways, disorders of the higher visual centers, and anomalies of the pupils. In the visual field charts the solid black area outside the peripheral isopter implies absolute blindness which usually does not exist; visual function would be elicited if this area were tested with a stronger stimulus. This practice of blacking an area is detrimental to the valuable concept of quantitative perimetry. Many x-rays, shown as positives, would be more instructive if printed as negatives as they are usually viewed.

The chapter on the pupils is based largely upon Lowenstein's elaborate studies with which the informed ophthalmologist should be familiar. These data are well tempered with a description of the pupillary reactions revealed by ordinary clinical methods, which must serve us until pupillography is established as a routine procedure.

Section XV, on the "Motor Anomalies of the Eyes," presents chapters on the anomalies of the ocular movements and binocular fixation, concomitant and noncomitant squint, ocular deviations, and pathological nystagmus. This section is a most welcome contribution to both the beginning resident and the advanced surgeon. It cleverly and tactfully interweaves with diplomatic acceptance and rejection the conflicting views of many authors. A tangled skein of contradictory concepts is unravelled into a continuous thread, which carries one logically through a sound consideration of the physiology, pathology, diagnosis, and treatment of all types of motor disorders. A serious study of this material will improve the confidence of any ophthalmologist in his approach and treatment of these cases encountered in daily practice. I believe this is the most valuable section in the volume.

Section XVI, on "Optical Anomalies of the Eye," considers errors of refraction, anomalies of accommodation, aniseikonia, eyestrain and visual hygiene, and clinical optical appliances. Especially excellent is the discussion on the nature of emmetropia and ametropia as regards the relative roles of refractive power and axial length in the determination of the total refractive state. Duke-Elder deserves great credit for bringing this long overdue information to our attention. His attitude toward cycloplegic drugs and his broad principles employed in the treatment of ametropia are packed with sound logic and common sense.

With sincere respect for this work, however, the reviewer disagrees with the scattered comments criticizing the subjective determination of refractive errors. On page 4397 it is stated that the aim of refraction is "to provide the patient with the optical correction nearest to the optical ideal with which he sees best and is most comfortable," and that few patients possess the attributes of intelligence, cooperation, and observational ability to any great degree and therefore accurate results cannot be attained often. In my experience most patients do possess these qualities, if the subjective methods employed are correct. The descriptions of subjective methods are inadequate and one could not learn from them how to proceed with a subjective determination. The short paragraph on the cross cylinder, page 4405, is ambiguous and reveals a lack of familiarity with this valuable instrument in its use for measuring cylindrical power.

Resident ophthalmologists should be aware that subjective refraction, properly performed, is a necessary procedure and is highly respected in the United States. A number of leading American ophthalmologists employ subjective refraction almost exclusively.

The factual value of the book is largely dependent upon that of the original articles listed in the bibliographies. Careful study of these articles reveals conclusions that frequently appear unwarranted upon the basis of the accompanying experimental and clinical data. Fortunately, Duke-Elder usually evaluates his abstracts, but some statements are recopied that have failed the test of time; so one must read always with skepticism and accept or refuse the statements as justified by his personal experiences.

The inferior quality of many articles is frequently hidden in the cloak of Duke-Elder's masterful command of English. Considering the great amount of unworthy literature in our libraries, however, one realizes that he has done an admirable job of extracting the excellent and excluding the inferior.

The best writing is in the longer passages, notable for the absence of frequent parenthesized references which trip the reader's continuity. They apparently voice the author's opinions, based upon his own experiences, and they move like flowing oil, so beautifully are they expressed.