inner canthus, and to have passed along between the eyeball and the inner wall of the orbit, until it reached the apex of that cavity. Here, turning downwards, inwards, and forwards, it described an angle of more than 180 degrees, and entered the sphenoidal sinus, wounding in its course the third and optic nerves. Clinically, the conditions found when the patient reached the Beaufort War Hospital Bristol, were "paralysis of the eyelids" (presumably ptosis is meant) and left optic atrophy. The ingenious and ultimately successful method adopted by Harris to remove the bullet may be read in the original. Visual details are not given.

Ernest Thomson.

BOOK NOTICES.

Quotations, Notes and Illustrations to supplement a Lecture on Curiosities and Defects of Sight. Delivered to Working Men and Women at the British Association Meeting, Manchester, 1915. By W. Stirling.

Dr. Stirling, the well-known Professor of Physiology at Manchester University, has taken much trouble in collecting numerous quotations from literature bearing on the activities of the human eye. He has also collected a great many illustrations bearing on the same subject, ranging from a portrait of Descartes with a cutting from the Tractatus de Homine to illustrate his views on the pineal gland and the relation of the eye to the soul, to specimens of photography with the compound eye of an insect. Various optical illusions are figured and elementary anatomy of the eye together with some account of its functions is included.

The pamphlet should serve to interest and attract the readers to whom it is addressed.

E. E. H.

Manchester Royal Eye Hospital. Centenary Report, 1815 to 1915.

The authorities of the Manchester Eye Hospital are to be congratulated on the progress shown by the Institution in its hundred years of activity. During the first year it treated 1885 patients and enjoyed an income of £202 19s. 11d., and in its last year it treated 39,116 patients with an income of £6,407 10s. 1d.

Forty-six pages of the report are occupied by the details of the 306 cataract operations performed in the last twelve months. The operation usually performed was the combined extraction, the section being purely corneal and a conjunctival flap made only in 121 cases. Loss of vitreous occurred in 21 cases. Vision between 6/60 and 6/6 was obtained in 265 cases and thirteen eyes were lost, four of these being due to suppuration.
The work of the refraction department was very heavy, as glasses were ordered in no fewer than 15,997 cases. Twenty beds are reserved for military cases.

E. E. H.

**Glare and the Student's Life.** By JAMES KERR. London: Adlard & Son and West Newman, Bartholomew Close, E.C. 1916.

This reprint of an article from *School Hygiene*, February, 1916, embodies Dr. James Kerr's views upon the deleterious influence of glare upon children's eyesight.

For the mass of students, as he remarks, glare "is more important than abnormal refraction or the provision of spectacles." After explaining what is meant by "glare" and how it comes about, he points out that the eye-strain due to its influence becomes increasingly obtrusive after the twelfth year; is especially insistent in reading, writing, and figuring; and is particularly distressing under artificial illumination. He urges as an absolute rule that "no naked filament, mantle or flame should be permitted, nor any source of light with greater intrinsic brilliancy than three foot candles per square inch."

The black board, as a source of glare, comes in for attention, and it is shown how reflections from its surface may be avoided, as by proper position, tilting, and correct illumination. The influence of paper in producing glare is explained. Finally, Dr. Kerr discusses the tests for glare, and after mentioning those devised by Ingersoll and Trotter respectively, remarks that a simple method of fixing definite measurements of glare is required. Excessive or misdirected light and other external factors of glare should be capable of local control, but are "now being overlooked and neglected in this country," while the ocular factors of glare, as nutritional conditions, fatigue, and over-work, "are being neglected for the provision of glasses."

S. S.

**The Effect of Industrial Conditions upon Eyesight.** Health of Munition Workers' Committee, Memorandum No. 15. London: Harrison & Sons, 1916.

The work of this committee of scientific men, on questions of industrial fatigue, hours of labour, and other matters affecting the personal health and physical efficiency of workers in munition factories and workshops, is of great and lasting value.

The total amount of time, and consequently output, sacrificed by trivial accidents, frequently preventable, and often inadequately treated, is a very serious one. Thus, to quote but one district, the Birmingham Eye and Coventry Hospitals calculate that from 500 to...
700 days’ work are lost annually from eye accidents, the majority of
which are trivial, and consist of impacted foreign bodies.

Naturally, there is a great increase of such accidents at the
present time, due partly to the increase in the number of workers,
and partly to their inexperience of metal and engineering works.
Lathe work and grinding are the chief sources of these minor
injuries.

The Committee does not consider that the effects of intense heat,
etc., such as glass-blowers’ cataract, call for consideration in the
present Memorandum, since the effects take too long to manifest
themselves.

Suggestions for the prevention of accidents, with a diagram of
two forms of inexpensive and efficient protective goggles, are added.
The Committee state that, to be effective, an eyeguard:
(a) Should prevent particles reaching the eyes from in front,
from either side, or from below. Practically nothing enters from
above.
(b) Should be light and comfortable, and allow free play of air,
so that moisture does not condense on the transparent medium.
(c) Should not impede vision, or become obscured by the impact
of particles.
(d) Should be strong and cheap.

Unfortunately, there is considerable objection on the part of the
workers to wear goggles. Glass is advised, and it is pointed out
that injury from the broken glass is very rare. Glass of sufficient
strength to turn a shot pellet, such as is used for shooting spectacles,
should be employed.

Instructions as to treatment are as follows.—“First aid treatment
is all that can be rendered effectively in the factory; but as the
subsequent history of the case depends so largely on the way in
which first aid is applied, every precaution should be taken to avoid
increasing the injury by well-meant but misdirected efforts to give
relief. Many factories are now provided with ambulance stations
or surgeries, and where this is the case all eye injuries should be
sent direct to the surgery, no treatment being attempted in the
workshop. If a doctor is on the premises, the case should be
referred to him at once. If the injury is not serious, and he is not
available, the nurse in charge of the surgery should render first aid,
and subsequently refer the patient to his own doctor or a hospital.
It is most desirable that even apparently slight injuries should be
seen by a doctor. At any factory where eye injuries are common
the nurse should have had some ophthalmic training.

“If there is no ambulance station or nurse, first aid can only be
given by a fellow workman who should be instructed as to the
routine treatment which may suitably be applied. He should be
forbidden to exceed these instructions in any way, otherwise, although
he may be successful in removing the offending particle, infected ulcers may follow the operation or he may even perforate the cornea. First aid is mainly needed to relieve pain, and should, as a rule, be limited either to the use of eye drops (caine 0.5 per cent., mercury perchloride 1 in 3,000 in castor oil), which may be applied from a suitable bottle, or to a pad and bandage. A camel’s hair brush kept in the appropriate solution may be provided for the removal of visible particles which are not impacted or embedded, but its use should not be encouraged. After relief from pain the patient should be sent at once to a doctor or a hospital."

The chief criticism we should like to make is that 1 in 3,000 perchloride had better be omitted from the drops if the object is the relief of pain, and that the camel’s hair brush should not be provided at all.

A further part of the Memorandum deals with the question of eye strain. Broadly speaking, this may be due to defects of vision or to the nature or conditions of the work. Operators employed on munition work should possess and maintain a certain standard, which should not be far below the normal, of visual acuity. Eye strain, including headache, may be one manifestation of general fatigue. The Committee urgently recommends, when workers are examined for glasses, that the nature of the work to be performed should be specified whenever possible. In our experience this is never done, even for patients coming from Woolwich.

There is no mention of the greatly increased danger from trivial eye injuries in the presence of disease of the lacrimal sac. The presence of a mucocele is so easily detected and so liable to lead to severe suppuration as a result of even a trivial corneal abrasion that we should feel inclined to reject for all lathe or grinding work any operative so affected until radically treated.

We consider that the Memorandum, although open to criticism in certain parts, is very good; but we are strongly of the opinion that ophthalmic questions should be referred to a committee of ophthalmic experts, and not be decided upon by a committee which has no ophthalmic surgeon among its members. E. E. H.


The monograph of Verhoeff and Bell places the reviewer in a quandary. The latter is desirous to show not only the conclusions reached, but the grounds upon which such conclusions are based, and yet, is practically precluded by limitations of space from doing
justice to both. In the present case, the conclusions are of such importance in view of the amount of talk which has been heard in recent years regarding the effects of ultra-violet radiation, that the reviewer feels compelled to give these conclusions almost in full and to leave the detailed study of the relative physical laws, of the apparatus employed, and, in general, of the experiments by which the authors reached their conclusions, to the critical reader himself.

The actual work by Verhoeff and Bell occupies pages 629 to 759 of the *Proceedings*, and is followed by a systematic review of the literature relating to the effects of radiant energy upon the eye by C. B. Walker. This latter occupies pages 760 to 793 and deals with a bibliography of 420 items. Following this again are eight plates of photomicrographs, spectra, and apparatus.

In Verhoeff and Bell's work the term "abiotic radiation" occurs with great frequency. The term is not anywhere defined, so far as the reviewer has ascertained. "Abiotic radiation" appears to mean radiation of a wave length shorter than 305 μμ, or, to put it in another way, radiation is only abiotic when it has a wave-length less than the above figure. The most appropriate definition of the adjective "abiotic" which the reviewer has been able to find is "antagonistic to life." If the meaning is not here properly interpreted the authors' pardon may be asked, accompanied by the wish that, for the sake of those to whom the term is unfamiliar, a definition thereof had been vouchsafed.

The authors' conclusions may now be given, not perhaps textually, but abbreviated only slightly.

The liminal exposure capable of producing photophthalmia to the extent of conjunctivitis, accompanied by stippling of the cornea, is, in terms of energy, about $2 \times 10^6$ erg seconds per square centimetre of abiotic radiation of the character derived, for example, from the quartz lamp or the magnetite arc. About $2\frac{1}{2}$ times this exposure is required to produce loss of corneal epithelium.

The abiotic action of the cornea and conjunctiva produced by any radiating sources follows the law of inverse squares, and is directly proportional to the total abiotic energy received. After exposure of the eye to abiotic radiations there is a latent period before any effects, clinical or histological, become perceptible.

The combined effect of repeated exposures to abiotic radiations is equivalent to that of a continuous exposure of the same total length, provided the intermissions are not long enough to establish reparative effects. Actual abiotic damage to the external eye renders it temporarily more sensitive to abiotic action.

Abiotic action for living tissues is confined to wave-lengths shorter than 305μμ, at which length abiotic effects are evanescent, while for shorter wave-lengths they increase with considerable rapidity.
For the quartz arc and the magnetite arc the abiotic activity of the rays absorbed by the cornea is 18 times greater than those which are transmitted by it. To affect any media back of the cornea requires, therefore, at least, 18 times the liminal exposure heretofore mentioned.

Even with exposures as great as 150 times the liminal for photophthalmia the lens substance is affected to a depth of less than 20μ, and this superficial effect undergoes in the rabbit complete repair. Such enormously intensive exposures, which are obtained with the magnetite arc and double quartz lens system, may completely destroy the corneal epithelium, corpuscles, and endothelium. The corneal stroma may be strongly affected by waves shorter than 295μ, which it completely absorbs, but is very slightly affected by the remaining abiotic radiation.

The histological changes produced by abiotic radiation are radically different from those produced by heat, and the cell changes are best seen in flat preparations of the lens capsule. The most characteristic change is the breaking up of the cytoplasm into eosinophilic and basophilic granules.

Abiotic radiations apparently depress mitosis. Their action in this respect is materially different from that of heat.

The lens protects completely the retina of the normal eye even from the small proportion of feebly abiotic rays which can penetrate the cornea and vitreous.

Experiments on rabbits, monkeys, and the human subject prove that the retina may be flooded for an hour or more with light of extreme intensity without any sign of permanent injury. The resulting scotoma disappears within a few hours. Only when the concentration of light involves enough heat energy to produce definite thermic lesions is the retina likely to be injured.

The retina of the aphakic eye, owing to the specific and general absorption of abiotic radiations by the cornea and vitreous, is adequately protected from injury from any exposures possible under the ordinary conditions of life, even without the added protection of the glasses necessary for aphakic patients.

Infra-red rays have no specific action on the tissues analogous to that of abiotic rays. Any effect due to them is simply a matter of thermic action, and such rays are, in the main, absorbed by the media of the eye before reaching the retina. Actual experiments made on the human eye show conclusively that no concentration of radiation on the retina from any artificial illuminant is sufficient to produce injury thereto under any practical conditions. Eclipse blindness is due to the action of the concentrated heat on the pigment epithelium and choroid, this heat being almost wholly due to radiations of the visible spectrum within which the maximum solar energy lies.
The abiotic energy in the solar spectrum aggregates hardly a quarter of 1 per cent. of the total. At high altitudes and in clear air it is sufficient to produce slight abiotic affects, such as are noted in snow blindness and solar erythema. The latter is usually accompanied by an erythema due to heat alone.

Erythropsia is not in any way connected with the exposure of the eye to ultra-violet radiations, but is merely a special case of colour fatigue. There is no evidence in the authors' opinion that vernal catarrh and senile cataract are due to radiations of any kind. Glass-blower's cataract is to be regarded as due, not to ultra-violet light, but probably to the over-heating of the eye as a whole with consequent disturbed nutrition of the lens.

Commercial illuminants the authors find to be entirely free of danger under the ordinary conditions of their use. The abiotic radiations, furnished by even the most powerful of them, are too small in amount to produce danger of photophthalmia under ordinary working conditions, even when accidentally used without their globes. The glass enclosing globes used with all practical commercial illuminants are amply sufficient to reduce any abiotic radiations far below the danger point.

Under ordinary conditions no glasses of any kind are required as protection against abiotic radiations. They reduce the total light to the comfortable point. Glasses which cut off both ends of the spectrum and transmit chiefly only the rays of relatively high luminosity, give the maximum visibility with the minimum reception of energy. For protection against abiotic radiation in experimentation, or in the snow fields, ordinary coloured glasses are quite sufficient.

So far as direct destruction of bacteria within the cornea or any other tissue of the body is concerned, abiotic radiations possess no therapeutic value. This is due to the fact that abiotic radiations that are able to penetrate the tissues are more destructive to the latter than to bacteria.

ERNEST THOMSON.

CORRESPONDENCE.

INTRA-CAPSULAR EXTRACTION OF CATARACT.

The Editor THE BRITISH JOURNAL OF OPHTHALMOLOGY.

SIR,—In the October to December number of The Ophthalmic Review (the last of that journal to appear) Lt.-Colonel J. Fisher, of Jaipur, makes the statement:—

"It is rather unfortunate that all three of "The Presidency" ophthalmic surgeons—Maynard (Calcutta), Herbert (Bombay), and