
Weeks and Landis have examined the fields for white and coloured objects in a series of cases of arteriosclerosis with the following results:—With a 1° white object, contraction of 10-15° was noted along the temporal side only, in mild cases. In more severe cases, where the nutrition of the retina was affected to a greater degree, the contraction was more marked, though never exceeding 25° and it tended to become concentric. The loss of field was usually bilateral and symmetrical, and was frequently not evident when a 4° white object was used. In some cases, the field for blue was altered, but the field for red was always unaffected.

Two main changes were found in the field for blue (1) a definite enlargement of 5° to 20° in the blind spot, which enlargement was not evident with a white object. (2) A marked and often extreme contraction of the peripheral field. The authors then proceed to give an explanation of these changes. Contractions in the blue field are thought to indicate choroidal changes, or changes in the retina external to the ganglion cell layer, while contractions in the white field indicate primary involvement of the retinal vessels. It is thus possible by field examination with white and blue objects to determine the degree of involvement of the retinal and choroidal vascular systems respectively.

F. A. Williamson-Noble.

(2) Villoria, L. Lopez (Caracas).—Carotido-cavernous aneurysm without pulsating exophthalmos. (Anévrisme carotido-caverneux sans exophtalmie pulsatile.) Arch. d'Ophthal., March, 1929.

Villoria's case, published with full and precise clinical and radiographic notes, is noteworthy by reason of the absence of the almost constant condition of pulsating exophthalmos and the presence of some unusual concomitants.

The patient, a man aged 29, was struck two severe blows, one on the left malar region and one on the right malar region, four months before he came under observation. The injury was followed immediately by the onset of a persistent, very distressing bruit. On admission to the clinic the chief symptoms were: right-sided ptosis and almost complete ophthalmoplegia, miosis and immobility of the pupil, white atrophy of the optic disc, anaes-
thesia of the right forehead, cheek and side of nose. There was no exophthalmos; the vessels of the fundus were normal and did not pulsate except when pressure was made on the eyeball. A loud coarse bruit was audible all over the skull, but of maximum intensity over the right orbital region.

The radiograph showed the right orbit to be less transparent than the left; fracture of the small wing of the sphenoid, narrowing of the sphenoidal and the spheno-maxillary fissures and distortion of the optic foramen, all on the right side.

The case was successfully treated by ligation of the common carotid artery. During the first forty-eight hours after the operation there was some cyanosis and lowered temperature of the right side of the face. Shortly afterwards the measured arterial tension in the two radial arteries was equal.

J. B. Lawford.


(3) von Recklinghausen's disease is of interest to the oculist apart from the fact that the lids may be involved in the generalised cutaneous growths: there is the further factor of the association of this disease with buphthalmos. Achermann reports an interesting family group. In 1870 there was admitted to the Bâle Clinic a boy of fourteen who at the age of six had his right eye removed for buphthalmos, and had now come for treatment owing to soft masses on both right lids. These masses were excised but necessitated further treatment on account of recurrence, eight years and twenty years later. On the last occasion a typical picture of diffuse von Recklinghausen's disease was presented by the patient. The sequel is the medical history of the son. The son showed diffuse von Recklinghausen's disease at the age of ten; a point of interest was the absence of any involvement of the lids. At the age of 34 he was treated at the Bâle Clinic for chronic glaucoma in the left eye, and ten years later for involvement of the right. A six-year-old child of this patient shows no abnormality whatever of either eyes or skin.

This history is of interest on account of what appears to be a double inheritance: both of the skin lesions and of the tendency to hypertension—buphthalmos in the case of the father and chronic glaucoma in the case of the son. Unfortunately this history is complicated by the fact that the mother had suffered from glaucoma. (On the Continent heredity is considered a very important factor in glaucoma.)
Another point of interest is the history given by the first patient that the masses on the right lids only developed subsequent to the removal of the buphthalmic eye. This is not unlikely as trauma is known to excite or stimulate the growth of these cutaneous masses.

A. Sourasky.


Dengue, a tropical fever, was raging recently in Greece, and Bistis reports on his experience of ocular complications during the epidemic. In most cases there developed on the third day a catarrhal conjunctivitis, with little secretion and much photophobia. In one case there was paralysis of the right external rectus; this came on during convalescence and disappeared without treatment within a month. Paresis of accommodation tending towards recovery within six weeks was observed in other cases. These complications are probably of nervous origin, analogous to polyneuritis which is not uncommon in this disease. Retrobulbar neuritis was observed in another case, and of two cases of optic neuritis, one was probably the sequel of nephritis caused by the fever. Transient blindness was observed in a woman aged 26: she suffered from two attacks, both ending in complete recovery. After the second attack there was some diplopia which also cleared up ultimately. Multiple chalazia appeared in one patient simultaneously with furunculosis on the neck. Bistis mentions that at a discussion held in November, 1928, at the Athens Medico-Chirurgical Society other observers reported cases of keratic precipitates, dendritic keratitis, iritis and glaucoma.

A. Sourasky.


In 1903 Krause first reported hypotonia of the eyeball in diabetic coma. Shortly thereafter Heine reported his observations corroborating those of Krause. Patek reports four cases in which he found hypotonia, though he did not use a tonometer to verify the impression of low tension registered by his digital touch. Hypotonia bulbi is not found in comas other than those of diabetic origin. Constancy of the sign in diabetic coma is not conceded, but the assertion is made that it is present with striking frequency. The hypotonia is most pronounced at the height of coma, and quickly recedes as the coma is overcome. The eyeball tension may not be lowered to an equal degree in the two eyes.

A. F. MacCallan.
II.—NEUROLOGY


(1) Although Armour's paper is chiefly of interest to the general surgeon, his wide experience in cases of head injury lends special value to his statements on the value of eye symptoms in these cases and may well be quoted at length.

"Immediately following upon the receipt of injury, the pupils are more or less dilated, depending upon the degree of the initial shock, and their reaction to light is correspondingly sluggish. During unconsciousness both these conditions are increased. As the stage of shock passes off the pupils usually return to their normal size and react to light, unless there be a definite increase in intracranial pressure, when the dilatation and sluggishness may remain. The pin-point pupil in the early stage of supracortical haemorrhage or oedema passes into dilatation as the stage of irritation passes into the paralytic stage.

Injury to cranial nerves occurs in about 12 per cent. of head injuries, usually in basal fractures. The order of frequency would appear to be the seventh, sixth, eighth, third and second, the remaining ones being rarely involved. The frequency of combined involvement is not very great; the nerves lying close together are usually involved (seventh and eighth; second, third, fourth and sixth) by single fractures; while in multiple fissures the groups, both as to the nerve involved and the side affected, are very irregular.

Varying conditions are concerned in the production of these paralyses of the cranial nerves. Probably the most frequent cause is injury of the nerve by bony compression, more rarely by laceration from displacement of the walls of the foramen. Where there has been no bony displacement, injury by bruising or laceration of the nerve sheath, with more or less severe reaction may have occurred. Certain cases are possibly due to compression from a meningeal haemorrhage.

But I wish to refer more particularly to the effect of increased intracranial pressure in the production of cranial nerve symptoms, more especially papilloedema, or perhaps more correctly "papillary stasis," as French neurologists call it. Cushing and Bordley some years ago showed by experiment how rapidly a retinal oedema may be made to appear in association with certain forms of increased intracranial tension, particularly when the compression has been brought about by the introduction into the cranial cavity of fluid under tension; and how rapidly also the oedema may disappear when relief from tension has been afforded.
In practice it should be remembered that great assistance in estimating the grade of intracranial tension may be obtained by an examination of the fundi, for in head injuries with increased tension there may be a degree of papilloedema proportionate to the severity and duration of the intracranial symptoms.

Early signs are dilatation of the retinal veins with venous stasis, and oedema not sufficient to be described in terms of dioptres. But with increasing tension there occurs an oedematous blurring of first the nasal margin and then the temporal margin of the disc, followed even by obscuration of the whole disc. As would be expected, fractures beneath the tentorium cause these changes more rapidly than those elsewhere. It is unusual, however, for these changes to appear within the first six hours.

In cases of local compression, but not when the tension is equally raised in all parts of the cranial cavity, the examination of the discs may be of great aid in determining on which side the primary focal compression is being exercised. This unilateral intracranial stasis may have confirmatory evidence in the condition of those extracranial vessels which empty into the cranial sinuses, as shown by a dilatation of the vessels of the scalp, forehead and eyelids, and even a slight degree of exophthalmos.

Pidoux, in his study of increased intracranial tension present some time after the receipt of the injury, calls attention to the frequent occurrence of a bilateral papillary stasis, which is independent of any basal fracture or compression by effusion. With the relief of the tension the discs return to normal."

E. E. H.


(2) Magnus gives a short analysis of 34 cases of pituitary tumour treated in the Göttingen Eye Clinic since 1919. Twenty-two of these were treated by Röntgen radiation with improvement of vision in 50 per cent.; the best results were obtained in the cases of acromegaly. In none of the patients was any appreciable improvement in the general condition noted.

In three of his cases he observed a symptom, not recorded in the literature but one for which he offers no explanation, viz. a temporal loss of the pupil-reflex in the one amaurotic eye, with absence of this in the other seeing eye.

THOS. SNOWBALL.

(3) Davis, having been impressed with his difficulty in accurately measuring the degree of papilloedema with the ophthalmoscope, and with the discrepancies in the measurements in dioptres of swelling by different competent ophthalmologists on the same patients, undertook a study of the graphs of the blind spots of patients with intracranial tumours.

He also undertook some experimental work, introducing powdered agar in a capsule into the brains of animals, and producing a gradual rise in intracranial pressure, and papilloedema which closely simulated that caused by an intracranial tumour.

From studies of the pathology of papilloedema, Paton and Holmes concluded that the swelling of the disc is due almost entirely to infiltration of its tissues and the anterior layers of the lamina cribrosa with fluid. As the disc swells it displaces the retina laterally and often throws it up into small folds. As the swelling increases, the course of the nerve fibres becomes disturbed and some of the peripheral fibres take on a somewhat acute S-shaped curve. The physiological cup becomes filled with axial fibres and oedematous fluid beneath the internal limiting membrane. In some cases of papilloedema the physiological cup may remain clear and there may be a difference of 6 or 7 dioptres between the level of the disc in that portion and the highest point of swelling. On the other hand, the physiological pit may be obliterated and the difference between that portion of the disc and the highest point of the swelling may be only 3 or 4 dioptres. In both instances, however, the retina has been displaced laterally an equal distance, and the enlargement of the blind spot is equally great.

The clinical material on which the study is based consisted of 105 intracranial tumours, of which 72 were verified by microscopical sections. The blind spots were plotted out before operation for cure or for decompression, and afterwards to show the regression in size. The author considers that the size of the blind spots is a more trustworthy record of the progress of a case than ophthalmoscopic measurement of swelling in dioptres.

A. F. MacCallan.

(4) Gérard, Georges (Lille).—The frequency of sphenoidal sinusitis in ophthalmology. (La hantise de la sinusite sphénoidale en ophtalmologie.) *La Clin. Ophtal.*, September, 1928.

(4) The shade of meaning attached to the word hantise escapes the reviewer. *Hanter* literally means to haunt and if the author uses the word in this sense it will better explain his attitude than the
word frequency; for Gérard evidently means that a great deal too much has been made of sphenoidal sinus disease as a cause of disease of the optic nerve. He seems to mean, though he does not put it in so many words, that the diagnosis of sinus disease to explain optic neuritis and atrophy has become fashionable and that it is often arrived at on insufficient evidence. The author quotes Coppez: "The diagnosis of retrobulbar neuritis of sphenoidal origin is never firm, but simply probable and come to by exclusion." Lemaître also says "How often it happens that the ophthalmologist having observed a retrobulbar neuritis for which he can find no cause, thinks of sphenoidal sinusitis and sends the patient to the rhinologist who . . . is obliged to give a negative reply." Gérard gives two illustrative cases of his own, the first of which is almost amusing and is, indeed, what we would call a "mare's nest." A boy, aged 15 years, had a violent coryza which affected his nasal sinuses. An oto-rhino-laryngologist diagnosed maxillary sinusitis with, probably, affection of the sphenoidal sinus. Then an oculist, perhaps prejudiced by the poor acuity of the right eye, aggravated the prognosis by diagnosing optic neuritis and suggesting operation on the deep sinuses. The boy was then seen by Gérard who, happening to know that the mother was a squinter and that a sister had been under treatment for squint, finally determined that the visual defect was due to error of refraction and that there was no optic nerve affection at all. The second and much more serious case, a young man of 27 years, suffered from double optic atrophy which was supposed by the first oculist seen to be of sphenoidal origin. An operation was proposed but not accepted. The V.A. became worse and worse. He was then seen by Gérard who, in spite of a negative Wassermann reaction, suspected syphilis and treated the case accordingly. Improvement took place, but to what extent is not stated. The following sentence sums up Gérard's point of view:—"Even in the case where from the very first day there is a presumption of sphenoidal sinusitis the oculist ought not to be content with this exceptional aetiology. It must always be borne in mind that the case may be ordinary and simple even if the Wassermann reaction be negative. If the personal antecedents seem to rule out acquired syphilis then one must think of hereditary syphilis and commence specific treatment." In fact the last possible cause of which one ought to think in a case of optic nerve disease would seem to be sphenoidal sinus involvement. Such seems to be Gérard's view and he is supported by Terrien: "He (the oculist presumably) is justified, in the presence of a persistent retrobulbar neuritis of uncertain aetiology, in thinking of the possibility of a sinus origin and of the necessity of trephining the sphenoidal sinus."

Ernest Thomson.

(5) In this brief paper, which is confined to generalities and contains no illustrative cases, Jones lays great stress on the influence of eyestrain on the autonomic nervous system. He defines eyestrain as "the overcoming by unconscious effort, of an impediment in the focus of the eye, to obtain its best vision. It has no special relation to near work or fine work, and is most common in eyes which have perfect or nearly perfect vision either without glasses, or with the glasses they have. While usually associated with some ocular fatigue or discomfort, it is not necessarily so, as in many cases all the manifestations are below the clavicle." He is convinced that many abdominal conditions are more amenable to treatment by the correction of errors of refraction than in any other way. In addition, it acts as "a thief of nervous energy," and is thus responsible for a long train of neurasthenic symptoms.

E. E. H.

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**III.—CORNEA**


(1) Foster Moore and Heckford record in this paper two cases of considerable importance both from the clinical and medico-legal standpoints. One of the patients was a medical man who was attacked by mustard gas in 1917 and is in receipt of a pension on account of damaged sight in the left eye from corneal ulceration in 1922. The right cornea was unaffected until 1928, that is 11 years after the original cause. The second patient was also severely affected by mustard gas in 1917 and was invalided out in consequence. From that time to the present he has been bothered at intervals by bright lights but otherwise has had no particular trouble until July, 1928, when both corneae developed small deep ulcers.

Though differing in detail all the eyes had essentially similar features, and were clearly similar to the case published by Neame *(Proc. Roy. Soc. of Med., November, 1928)*. The authors describe the characteristic features of the ulcers as follows:

"We may now examine the special features of these ulcers. First, the intolerance of light is much less marked than might have been expected from the extent of the ulcer, and the circumcorneal
injection of the eyes was less than would be present in other forms of corneal ulcer of similar dimensions in patients of this age. The ulcers themselves showed a marked tendency to involve the parts exposed in the palpebral aperture—that is, of course, the part originally exposed to the gas. They were deeply excavated, had a gouged-out appearance, and the tissue at the edge appeared sodden and ill nourished. They extended deeply into the substantia propria—so deeply, in fact, as to expose Descemet's membrane in Case 1. They did not, however, perforate. In general appearance they reminded one a little of a Mooren's ulcer. The instillation of fluorescein did not produce extensive staining, but only showed up small spots or areas, chiefly at the edges.

From the shelving side of the ulcers infiltration could be seen extending into the adjoining cornea, and showed up as a grey area in it which had a linear arrangement. In one case iritis was present, but it was quite mild, and this in spite of the long persistence of the condition. In both our cases, as well as in Neame's, one or two small localized, deep, nearly circular ulcers developed at the limbus.

A marked feature of the ulcers was the long period, roughly ten years, between what clearly was their ultimate cause and their actual development; their extreme indolence; their situation in the palpebral aperture; their deep, gouged-out appearance; the comparatively mild symptoms; and their slow healing. The conjunctiva within the palpebral aperture has a very characteristic appearance, and even now is a good deal reminiscent of its appearance at the time of the gassing. It is somewhat swollen and in parts is almost of a homogeneous pearly white colour; in other parts, where it is less opaque, it has a marbled appearance, the "veining" effect being produced by the vessels, which in places show great irregularity in their calibre. It seems reasonable to suggest that it was the damage done to the vascular and nerve supply of the cornea by the gas, and the subsequent scarring, which has resulted in permanent impairment of the nutrition of the cornea and so to its ultimate ulceration.

With regard to treatment, we believe the most help is to be obtained from curetting any staining area, and cauterizing this small point very carefully with carbolic, or with the actual cautery. We have tried many other drugs without any clear advantage. We seriously contemplated sewing the lids together, and are inclined to believe, like Mr. Herbert Fisher, that this would prove valuable. We doubt whether any form of corneal section is advisable."

Two drawings illustrate the appearances.

E. E. H.
(2) Shiraishi, K. (Tokio).—The effect of crushing and extirpating the ciliary ganglion on the cornea of the contralateral eye. (Einfluss der Quetschung und Exstirpation des Ganglion ciliare auf die Hornhaut des anderseitigen Auges.) Arch. f. Ophthal., Vol. CXX, 1928.

(2) Shiraishi conducted on dogs a series of experiments in which the ciliary ganglion was crushed or excised, or the cervical sympathetic was extirpated. He found that in a number of the experiments crushing of this ganglion was followed, after 14 to 50 days, by opacity and ulceration of the cornea on the contralateral side; this was due, he suggests, to the chronic irritation of the ciliary ganglion of that side. The same result was obtained after excision of the ganglion but not so frequently, presumably because the irritation of the other ciliary ganglion was then not so prolonged. No such changes in the cornea followed the extirpation of the cervical sympathetic.

 Destruction of the ciliary ganglion in some cases produced a keratitis on the side of the operation, but it was accompanied by clinical features quite different from that in the other eye. It also caused a rise of tension in both eyes, with considerable variations from day to day, followed by a marked fall.

Thos. Snowball.


(3) Torok and Redway's paper opens with a résumé of current ideas as to the significance of Fleischer's haemosiderin ring which is found in cases of conical cornea midway between the periphery and centre. Fleischer believes it to be of common occurrence but the authors have failed to find it in 6 cases of keratoconus, three of which are reported in the test. The newer theories as to the aetiology of conical cornea can be divided into two groups:—

(1) That it is a congenital disturbance in the development of the cornea.
(2) That it is an acquired decrease in the resistance of the cornea arising as a consequence of diverse affections, particularly of the endocrine glands.

The slit-lamp characteristics of conical cornea may be summarised as follows:—striae and irregular opacities both situated at the apex; ruptures of Descemet's membrane, the lines appearing bright in the zone of reflection and dark by transillumination; a shagreened and sometimes reddish appearance of the endothelium; thinning of the cornea; increased visibility of the corneal nerve fibres and finally the appearance of a brownish green zone in the epithelium (Fleischer's ring). According to Koëppe, the presence of
radial or concentric striae indicates that the condition is still progressive, while irregular scar tissue formation represents a stationary stage. With regard to treatment, the authors mention the ordinary methods but it is perhaps noteworthy that some patients have been able to wear contact glasses for months or even years with satisfactory results. They then proceed to a detailed report of the cases under their care in which the main points of interest are the following:—(1) The low basal metabolic rate, pointing possibly to thyroid insufficiency. (2) Areas of rarefaction in the cranial bones, discovered by X-rays and not present in the other bones. It was thought that this was due to some defect in calcium metabolism. (3) A markedly low haemoglobin percentage with a diminished red cell count. All the bloods belonged to type four, but this may have been a coincidence. The cases were treated by administration of thyroid extract with resultant improvement in vision. The authors conclude that conical cornea may be due to a combination of thyroid insufficiency and defective calcium metabolism.

F. A. Williamson-Noble.

(4) Moretti (Catania).—Clinical researches with the corneal microscope in trachomatous keratitis. (Recherches cliniques avec le microscope cornéen sur la kératite trachomateuse. Rev. Internat. du Trach., October, 1928.

(4) Moretti publishes some clinical researches on trachomatous keratitis using the corneal microscope. He rightly states that trachoma can be differentiated from follicular conjunctivitis in this way. In the earliest cases of trachoma, pannus can be demonstrated by this means. The author has omitted to consult the important paper on trachomatous pannus by Herbert in the Transactions of the Ophthalmological Society U.K., for 1904, which should form a starting point for all studies of trachoma.

A. F. MacCallan.

IV.—GLAUCOMA


(1) The first remedies to be considered by Gifford are adrenaline and glaukosan. The dangers attending the subconjunctival injection of the former are well known and led Hamburger to work out some preparation which would be effective by instillation. Such a preparation is laevo- or links-glaukosan, which consists of a 2 per cent. solution of ordinary laevo-rotary adrenaline to which has been added an optically inert substance produced during
its synthetic manufacture. To use it, two drops are instilled with the patient lying down, and this is repeated up to 5 times at 15 minute intervals, according to the effect desired. The result is to produce marked blanching of the conjunctiva, maximum mydriasis, and a fall of tension. Gredstedt has found that the decrease in tension with ordinary adrenaline is more marked than with links-glaukosan. A safe method of using the former is to soak a pledget of cotton wool with four minims of adrenaline and leave it in the upper cul-de-sac for 3 minutes. No systemic effects are produced, but mydriasis and a reduction of tension occur. In some cases the fall of tension begins almost at once, but in most it does not begin for three or four hours, and reaches a maximum on the following day. The duration of the reduction varies from one to as long as six or twelve days. Adrenaline alone is not recommended for the treatment of glaucoma, but, when combined with miotics, the tension may be kept normal where miotics alone are a failure. Hamburger recommends using glaukosan for 8—10 days, then returning to miotics and when these become ineffective using glaukosan again, a method by which he has kept the tension normal in many eyes for years. Adrenaline is probably of greatest use in simple glaucoma. Gifford found that out of 50 adrenaline treatments, 15 were ineffective, which group included nine simple glaucomas. In the remainder, the average fall of tension was 10 mm. In cases where the eye is inflamed or injected, the use of adrenaline may bring about an attack of acute glaucoma, during the period of mydriasis, and in such cases eserine or amino-glaukosan should be employed, the latter, however, has the disadvantage of producing marked chemosis often accompanied by swelling of the lids. The use of hypertonic saline is commented on, and Duke-Elder's article (Brit. JI. of Ophthal., Vol. 10, p. 30) is quoted. Tyramin has been used combined with histamin in a preparation known as tenosin (Bayer), 1/10-1/2 cc. being injected subconjunctivally by Thiel with good results. Calcium has been used by Weekers (3 grains of the chloride daily) with good results in some cases but the effects were not constant, while subconjunctival injections of calcium preparations have been used with success in animals, though the method has not been tried in human beings. Ergotamine has the advantage that it produces effects when given by the mouth, the dose being one to three tablets of 0.001 gm. three times daily. Illustrative cases treated by this method showed that in simple glaucoma the tension could be kept normal for several months and that after the first few weeks, miotics which were previously ineffective, became of service, so that the ergotamine could be discontinued. Gifford has found this drug useful in two cases of sympathetic ophthalmitis where there was secondary glaucoma. The last drug to receive consideration is pituitrin, which produced good results in
the hands of Samojloff who injected 0.3 to 5 cc. of pituitrin (Parke Davis & Co.) subconjunctivally. He obtained a marked fall of tension which fall was at a maximum on the second day and was maintained for several days afterwards, without the use of miotics. A rise of blood pressure was observed which disappeared after 20 minutes.

F. A. WILLIAMSON-NOLE.

(2) Sedan, Jean (Marseilles).—Special technique of sclerectomy in glaucomatous patients affected by cicatrical trachoma. (Technique spéciale de la Scérectomie chez les glaucomateux, atteints de trachome scléro-cicatrical.) Rev. Internat. du Trach., July, 1928.

(2) This is an article on the special technique employed by Sedan in performing Lagrange’s sclerotomy in 9 cases of cicatrical trachoma. He prefers to make the conjunctival flap with scissors and forceps before making the section. The conjunctival flap is large, 6 mm. high and 8 mm. broad. He considers that in this way there is more chance of obtaining permanent fistulisation.

The author may be reminded that in the Report of the Director of the Egyptian Ophthalmic Hospitals for 1913 (National Printing Press, Cairo) a section is devoted to the question of decompression for glaucoma in trachomatous eyes based on the results of 317 operations performed during the year 1913. This should be of interest to surgeons who work in trachomatous countries.

A. F. MACCALLAN.


(3) Hudelo makes some play with the difference between pathogenesis and aetiology. He says that glaucoma has various aetiologies according to different observers and that it is necessary to relate these aetiological hypotheses to pathogenesis. “Up till the present, authors have only been able to establish the aetiology not the pathogenesis of glaucoma. The study of aetiology consists in observing a succession of facts without seeking to explain the reasons for their connection.” This sentence really contains the gist of the matter, for the rest of the article is occupied with proof of the contention that glaucoma is essentially the result of vascular stasis and that it should be interpreted in all cases as “le syndrome asphyxique du globe.” Those who wish to follow the author’s arguments and explanations, which are not very concisely stated, might refer to the author’s Paris Thesis, 1928, of which this article is probably a summary. (Imprimérìe Administrat. Centrale, Rue Furstemberg, Paris.)

ERNEST THOMSON.
Magitot (Paris).—The multiple sources of the aqueous humour. (Les sources multiples de l'humeur aqueuse.)

Magitot, after reviewing briefly the old theories on the circulation of the aqueous, states that the object of the present paper is to show the evolution of opinion concerning the origin and flow of the cerebro-spinal fluid and of the aqueous humour. He states that modern experimental methods in biochemistry and physical chemistry which govern physiology indicate that these two fluids are dialysates from the blood. Filtration is purely a passive process. Dialysis on the other hand is an active selective mechanism, depending on the presence of a semi-permeable membrane. This membrane has certain properties—to allow of osmotic pressure, to retard the movement of the ions, the accumulation of electrical charges, the modification of surface tensions, to intervene between electrolytes or colloidal solutions. The following are the reasons which lead to the above-mentioned conclusion: (a) The aqueous humour and the cerebro-spinal fluid contain only traces of colloidal substances, but their proteins are the same as those of blood plasma and in the same proportion. (b) These fluids contain diffusible substances (sugar, creatin, urea) and in very nearly the same proportion as that in which they occur in the blood. (c) On the other hand ionised substances behave differently. The anions—entirely dialysable—(chlorides) are found in larger quantity in the two fluids than in the blood. The kations (Na, Ca) which are to a certain point associated with protein molecules are in inverse proportion. (d) Substances not entirely diffusible (phosphates, etc.) are found in these fluids in smaller quantity than in the blood, but varying with variations in the blood content. (e) Substances introduced into the circulation behave in the same manner; colloids are held back from these fluids, diffusible substances fixed to protein molecules are partially held back, while substances entirely diffusible pass through (e.g., fluorescein, potassium ferrocyanide). (f) If the semi-permeability is increased many protein molecules formerly held back are found to pass through, anions diminish and kations associated with large protein molecules increase, while non-ionised substances remain unchanged. Second aqueous humour (after puncture of the anterior chamber), and also first aqueous in cases of inflammation, are examples of this owing to increased permeability of the capillary walls. Such a fluid may be called "plasmoid" (Duke-Elder).

Some chemical substances in the cerebro-spinal fluid and the aqueous are at the same concentration as in the blood, others are at a different strength. One of the most important of the latter is
sodium chloride which is in a higher concentration than in the blood. This fact is inexplicable on the hypothesis of simple filtration. In experiments where the delicate equilibrium is upset by the absence of colloids, a compensation is set up by means of sodium with the help of calcium, magnesium and phosphoric acid. There is therefore a chemical and a physico-chemical equilibrium. The physical equilibrium is obtained by osmotic and hydrostatic pressures. The osmotic pressure of the aqueous humour has been shown to be equal to the osmotic pressure of a dialysate of blood plasma in vitro (Duke-Elder). As to the hydrodynamic pressure, knowledge is less certain. Recent investigations show a remarkable parallelism between the cerebro-spinal fluid and the aqueous humour. Modern methods of histological examination show the formation of vesicles of fluid in the cells covering the choroid plexuses in the central nervous system. These vesicles are believed to be of cerebro-spinal fluid in the process of dialysation. Pilocarpine, muscarine, ether and bleeding exaggerate the formation of vesicles. A similar vacuole formation is seen by similar methods of staining in the cells of the ciliary body and a similar increase in the vacuoles is produced by pilocarpine. The epithelium of the iris and the endothelium of the cornea also show vacuoles. Much recent work has produced evidence of the multiplicity of the sources of the cerebro-spinal fluid. This idea has been carried to the extent of considering the same fluid to be produced by dialysis through the capillaries of the pia mater into the spinal canal and other cavities filled with cerebro-spinal fluid, and also through the capillaries within the nervous tissue itself. The eye, embryological outgrowth of the brain, has been the subject of an immense amount of investigation in the attempt to solve the problem of the origin of its fluids. Leber's theory of filtration from the ciliary blood vessels and Boucheron's and Nicati's of secretion by the ciliary epithelium are the most noteworthy of those of the earlier workers. However, recent work confirms the theory of dialysis. If this be so, it is difficult to understand how the aqueous humour is formed only through the ciliary epithelium—a wall of two layers of epithelium and connective tissue between the blood vessels and the vitreous. The ciliary processes are not constructed for the purposes of fluid production so much as for the important rôle of accommodation.

As the cerebro-spinal fluid may be produced from the capillaries in the brain substance, so there is every reason to suppose that the capillaries of the retina—the analogue of the brain—may also contribute to the formation of the aqueous humour. As a result of the work done, especially since 1920 (Dandy, Blackfan, Cushing, Becht, Dahlstrom, Wideroe, Salmon, Thomson, Pfeiffer, Cestan, Riser, Peres and Laborde), it has been discovered that the cerebro-spinal fluid is not subject to a regular circulation. Ordinarily it
is practically stationary, and certainly not a dialysate as through a parchment. The passage from capillaries into cerebro-spinal or subarachnoid fluid is dependent on movements resulting from respiration and pulse-beat. Permeability of capillaries is modified by nervous influences (vaso-motor), hormonal influences and hydromechanical influences (viz., as after abstraction of much fluid). The effect of an intracranial tumour blocking the aqueduct of Sylvius is not the result of stopping the circulation of the cerebro-spinal fluid, but probably an irritant effect of growth on the surrounding vessels or due to its own vessels which transude excessively (e.g., growths which are especially moist, or especially vascular). Similar conditions occur in regard to the ocular tension and intraocular neoplasms. The effect is not one of obstructing the exit of fluid, but of formation of capillary reservoirs and altered permeability of their walls. The origin of the theory of an intraocular fluid current came from Schwalbe's observation of the filling of the ciliary veins on the introduction of coloured fluid into the anterior chamber. The theory was supported by the hypotony which developed with drainage through a traumatic filtering cicatrix. An intermediary channel was sought. The canal of Schlemm was chosen. Then Knies noted the closure of the angle of the anterior chamber by adhesions of the iris root. It was admitted that aqueous humour escaped by filtration. Calculations showed a rate of drainage equivalent to 180 cubic millimetres per hour (normal human anterior chamber capacity = 150 c.mm.). Seidel, supporting Leber's theory, estimated that the pores of the canal of Schlemm were such as to render this comparable with a membrane of 3 per cent. collodion. He also considered some fluid to escape by the veins of the iris, and estimated the porosity here to be equivalent to that of a 4 per cent. collodion membrane. Seidel endeavoured to prove that the intraocular pressure was higher than that in the ocular veins. Duke-Elder criticised the figures for retinal arterial pressure of Magitot and Bailliart and considered them too low, and also did not consider the intraocular pressure higher than that in the veins. Explanation is needed for the fact that for ten days after the evacuation of aqueous humour by puncture the new aqueous is abnormal in content of chlorides, antibodies and cholesterin. That the albumen disappears early does not need the theory of filtration through a membrane of a particular porosity (3 per cent. or 4 per cent. collodion). The albumen is broken up by ferments whose presence in the human aqueous has been confirmed. Magitot considers that there is no more current in the aqueous than in the cerebro-spinal fluid. Normally it is practically stationary and is renewed very slowly. It is the result of dialysis from uveal and retinal capillaries. Hydrostatic, osmotic, electrical and chemical phenomena control its production and resorption. Ordinarily no movements occur within the cavity of
the eyeball except such as result from the rhythm of respiration and circulation, arterial and venous pulsations and by contraction of the ocular muscles. With the formation of a fistula the hydrostatic conditions are altered, capillary permeability is affected, as also in vascular disease, and by the use of certain drugs. Closure of the carotid acts in a similar manner to the sub-conjunctival injection of adrenaline—the reduction of albumen in the aqueous—by means in each case of diminution of arterial tension. Magitot considers the capillaries of the uvea, particularly of the iris, and also of the retina, to be the site of the slow interchange which takes place. He considers the cerebro-spinal fluid and the aqueous humour to be nothing more than the inter-cellular fluid of other parts, which nourishes individual cells—the interstitial fluid. The blood is not directly the nourishing fluid, it is an intermediary which supplies substances necessary for the cells and takes away waste products through the intercellular fluid. In lowly forms this fluid is sufficient without the help of blood and blood vessels. In the highest forms there is a further development in the lymphatic system which has its roots in the lacunar system of tissue spaces and serous cavities. In man and the higher animals the "lacunar" fluids vary in composition according to the function they have to perform. This variation depends on the permeability of the capillary walls. In serous cavities, albumen is passed so that the fluid has the characteristics of a lubricant. Other examples of fluid of a different type are the cerebro-spinal fluid, the aqueous humour, the endolymph and peri-lymph of the ear, and the amniotic fluid, which have to perform the function of filling and supporting as well as of nourishment. Magitot quotes Mestrezat (Congrès de Physiol., Stockholm, 1926) in the latter's comparison of these dialysates from the blood serum with the lymph of the blood capillaries. This latter is not to be confused with the thoracic lymph, nor with the fluid of oedema which is not strictly physiological in origin. It is found occasionally, however, in animals and in man in the biliary passages. In certain conditions a collection of fluid is formed in portions of the biliary passages which are completely shut off from the entrance of biliary fluid. This fluid is referred to by surgeons as *white bile* (*bile blanche*). It has a chemical composition identical with that of cerebro-spinal fluid and aqueous humour. Histological investigations show an intimate connection of such fluid collections with an abundant network of capillaries. Similar capillary formations are present in the pia mater. It is concluded that these collections of fluid are a simple dialysate from the capillaries, and that the subarachnoid fluid, the aqueous humour and the fluid in the canals of the internal ear are of similar origin. Similar fluid occupies the intercellular spaces of the cornea, fills the anterior chamber, permeates the vitreous, is in the spaces around the retinal vessels, and
in the sclerotic, and is present behind the lamina cribrosa as cerebro-spinal fluid. That an interchange of substances for the nutrition of the structures within the eye takes place was shown by Magitot and d'Autrevaux in the following manner. After an ocular contusion it was found that there was no glucose in the aqueous humour. Presumably all the available glucose was absorbed by the damaged cells in the process of recovery. Forty-eight hours elapsed before the normal proportion of glucose was restored in the aqueous. In conclusion, Magitot states that the capillary network may be affected in three ways: A. Hormonal causes; internal secretions and substances introduced into the blood (e.g., urotropine introduced into the bloodstream allows the passage of iron into the aqueous [quotes Fradkin, Gamsoeva, Svereva]). B. Causes connected with nervous system; (1) trophic influences acting on the living capillary membrane, (2) vasodilatation by reflex action (e.g., alterations in the aqueous humour after contusion of the opposite eye, or after sub-conjunctival injection of irritants, or in all inflammations of the anterior segment of the eye). In all these cases dialysis is disturbed and protein molecules pass abundantly into the aqueous humour. C. Hydrostatic causes; changes resulting from alterations in blood pressure. Obstruction of the vortex veins produces a rise of intraocular tension, but strangely enough does not increase the quantity of albumen in the aqueous (Magitot and d'Autrevaux). Puncture of the anterior chamber, however, lowers tension and causes a large increase in the amount of albumen in the new aqueous. Ligature of the homolateral carotid artery, or retrobulbar injection of adrenalin reduces the retinal arterial blood pressure and stops the entry of all trace of albumen (Magitot and d'Autrevaux).

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BOOK NOTICES


The author is the Director of the Wellcome Museum of Medical Science, and this little book is an amplification of a thesis for the M.D. Cantab. In it he appeals for the reorganisation of medical museums in order to improve their teaching value. He would have each case of disease treated as a whole, the primary lesion and all the secondary conditions resulting therefrom being shown together. Besides this he would have far more use made of pictures, models, radiographs, temperature charts and other details bearing on disease. Catalogues should be simplified and kept up-to-date, typography being superior to printing in this respect as being much cheaper.