be pushed forwards, and in places visibly in contact with the periphery of the cornea. By placing the vitreous reservoir 15 centimètres higher than the aqueous reservoir it was possible to empty the anterior chamber almost completely, and to apply the whole iris close to the cornea; and under these circumstances the escape by filtration from the whole eye appeared in some instances to be entirely arrested.

Similar experiments upon the freshly-excised eyes of oxen, and in one instance on a freshly-excised healthy human eye removed with an orbital tumour, gave closely similar results.

With regard to the escape at the papilla I made some further experiments with the smaller apparatus, shown half-size, in section, in Fig. 6. A circular piece, including choroid, sclera, retina, and optic nerve, is cut from the back of a sheep's eye immediately after death and placed in the box, and the inner tube is tightly pressed down upon it by screwing on the cap of the box. The inner tube is then filled with coloured fluid and connected by a flexible tube with a graduated glass tube and reservoir, as in the other apparatus. Under a pressure of 30 centimètres, as before, there was no perceptible exudation and no coloration on the outer surface after several hours.

These experiments show several points of importance with regard to the freshly-excised eye. They show, firstly, that fluid injected into the vitreous chamber escapes chiefly, if not entirely, through the aqueous chamber; secondly, that a slight excess of pressure in the vitreous chamber displaces the lens and iris forwards, compresses the filtration angle, and impedes the escape of fluid; thirdly, that there is little, if any, escape at the papilla. With regard to the currents in the living eye, they give, of course, no positive information.

(Since this lecture was delivered I have read with much interest that Dr. Leplat, adopting a method nearly the same as that above detailed, has made a further series of experiments upon living animals. His results confirm to a large extent those obtained by myself with the freshly-excised eye. He concludes that the escape at the papilla is about one-fiftieth of the escape at the filtration angle.²²)

If we compare these various observations concerning the movements of the vitreous fluid, it is not difficult, I think, to reconcile the apparent discrepancies.

It appears certain, from the movements of solid particles observed by Gifford, that there is a current passing backwards in the vitreous body, and escaping along the lymph-passages which surround the central vessels of the optic nerve. It appears equally certain that this current moves very slowly, and that the amount escaping in a given time is extremely small as compared with that from the aqueous chamber. Whether the small perivascular spaces in the papilla are rendered impervious by excision of the eye, or whether a small quantity of fluid does actually traverse them during artificial injection of the vitreous chamber, it is difficult to determine. In any case the absence of visible filtration here presents a striking contrast with the free escape which occurs at the filtration angle. It remains uncertain, I think, whether there is a persistent stream from the vitreous to the aqueous chamber. But we have seen that fluid can pass very readily in this direction under a slight excess of pressure in the vitreous chamber; and it seems probable that so long as the partition remains permeable, and the fluid diffusible, any excess of pressure in the vitreous chamber will relieve itself in this way. An intercommunication of this kind between the two chambers appears to be necessary for the maintenance of the lens in its normal position.

Our knowledge of these currents may, then, be briefly summarised as follows: The fluids which nourish the vitreous body and lens, and fill the aqueous chamber, are secreted chiefly by the ciliary portion of the uveal tract. The larger part of the secretion passes directly into the aqueous chamber, forwards through the pupil, and out at the filtration angle. A very much smaller portion passes backwards through the vitreous body, and escapes at the papilla. The hyaloid membrane and zonula which separate the two chambers are readily permeable by the vitreous fluid. The pressure which the fluid exerts against the walls of the chambers is equal to about 25 millimètres of mercury, and is the same, or nearly so, in the two chambers.

To conclude this physiological part of the subject, I may point out that while the circulation of the intra-ocular fluid is necessary to the eye as a living organ, its pressure is necessary to it as an optical instrument—an instrument which is built entirely of soft

materials, but which nevertheless can adjust itself with precision both for direction and for distance. In the larger chamber, where there are no moving parts, the fluid is supplemented by a transparent fibrous tissue, which adds to the safety of the organ. In the smaller chamber there is fluid only, so that the curtain which regulates the admission of light may have perfect freedom of movement. In both chambers the fluid exerts that particular degree of pressure which suffices to maintain the form of the globe, and gives precision to the action of the muscles, external and internal, but does not embarrass the circulation of the blood, the nutrition of the tissues, or the transmission of nerve-currents within the organ.

When the intra-ocular pressure rises above these physiological limitations, we get that complex disturbance which we call glaucoma.

REMARKS ON TROPICAL DIARRHŒA AS SEEN IN THIS COUNTRY.

Read before the Medical Society of London, April 1st, 1889.

By SIR JOSEPH FAYRER, K.C.S.I., M.D., F.R.S.

THE subject of these remarks is a peculiar form of diarrhœa which derives its origin from tropical and subtropical countries, notably India, China, Ceylon, and Java, and which is of frequent occurrence in Europe wherever old residents of tropical climates resort. Its symptomatology, etiology, and as much of its pathology as has been ascertained, are described; and the author hopes to show that, though long regarded as a dangerous and even a fatal complaint, it is amenable to treatment if properly and vigorously dealt with.

This "white flux," which has various synonyms, though not always directly related to any well-marked form of climatic or malarial disease, is very insidious in its onset and progress, and very intractable if not early controlled. It is something more than ordinary chronic diarrhœa, though it often supervenes on that disease. In its worst symptoms are often manifested and a dangerous and protracted state of disease established, and it owes its fatality, when continued beyond a certain stage, to irreparable degeneration of the intestinal mucous membrane and glands, and the consequent inability to absorb nourishment. Death is due to anæmia and exhaustion from slow inanition, the channels for the admission of nutrient material being practically interrupted or destroyed.

It has been referred to by observers in India, China, and Java. Many of the examples which came under the author's observation during residence in India were of the variety known as hill diarrhœa, from its proneness to affect dwellers in the hill stations, especially those who had been subjected to the debilitating influences of the plains—atmospheric changes, vicissitudes of temperature, greater altitude, and probably the water being concerned in its causation. This hill diarrhœa and the "white flux" of other parts of India may be regarded as identical, while in some cases it is associated with, or may merge into, certain forms of chronic dysentery.

The author considers that it must be regarded as a climatic disease, though its etiological relations with malaria seem to be remote rather than direct. Though sometimes the sequel of other climatic disease, it may begin spontaneously and often affect, after their return to Europe, people who have not suffered from the diseases of the country they have left, though their health generally must have been affected by climatic influences. There is also a form of intermittent and irregular diarrhœa prone to attack people who return from India with hepatic and splenic derangement, which, though it may be the precursor of white flux is not of so dangerous a character, and from which recovery is often so rapid as to show that it is due rather to functional disorder than to structural degeneration of the intestine. Such forms of bowel-complaint generally do well after the portal system

²² *Annales d'Oculistique*, January-February, 1889.

has been relieved by the aid of saline laxatives, with due attention to diet, warmth, and other hygienic conditions of life.

This disease often begins with simple looseness of the bowels, with little or no pain, the action producing a sense of relief. The excreta at first are natural and bilious, but gradually become light-coloured, frothy, and copious; the patient at first feels no inconvenience beyond that of frequent calls to stool, and tenderness of the tongue; and it is not till he finds that he is losing flesh, strength, and energy that he begins to appreciate the serious nature of the complaint. As the disease advances the wasting increases, and though the patient may still retain a good appetite, its gratification is interfered with through the tenderness of the denuded mouth and tongue. The appearance of the dejecta, which is suggestive of deficiency of bile, and the passage of the *débris* of muscular and vegetable tissue through the tube may be ascribed to general causes rather than to any specific disease of the liver. In certain cases diarrhoea is not a constant or prominent symptom; the most characteristic are soreness of the mouth and tongue, the loss of epithelium, the degeneration of the intestinal mucous surfaces, and continued wasting. The entire absence of bilious colouring in the excreta, and of bile-pigment in the urine and skin, is remarkable; but though this condition may continue for months, normal coloration returns with health, and there is no evidence of liver complication beyond the shrinking which it shares with other organs, but which disappears as recovery advances.

The signs of the disease are anæmia and emaciation; a dry, flaccid, and flabby skin, which later on becomes discoloured, as in Addison's disease. Fat disappears, the eyes are pearly and sunken, the lips and conjunctiva blanched, the tongue is smooth, red, and glazed, and so tender as to be intolerant of wine or anything pungent; the papillæ are obliterated, and in advanced stages the organ is shrunken and contracted; its condition is significant of the stage and progress of the disease. The lips, tongue, and mucous membrane are sometimes the seat of painful aphthous ulceration and fissures, and in extreme cases a thick coating of epithelial scales sometimes loads the tongue and buccal mucous membrane. There may be also evidence of malarial action in the recurrence of fever or other vague condition of *malaise*, while dyspepsia, with flatulent distension of the bowel and general languor and debility, steadily increase.

These symptoms may for a time be mitigated by treatment, but the disease may still be progressing, and, should change of climate not prove effective, they go on increasing in gravity; the temperature becomes subnormal, the urine albuminous, the extremities cedematous; anæmia is profound, and the white, copious, and frothy evacuations are sometimes tinged with blood or mucus; and, if this evil condition be not arrested, fatal exhaustion soon closes the scene.

Post-mortem examination shows that the wasting which is so marked an indication of the disease in life has extended to the viscera. After death at an early period (from some other cause) the intestines have been found contracted, with the mucous lining thickened, congested, and ulcerated; but after death at a later period the coats of the bowel are found to be attenuated and diaphanous, the seat of fatty or lardaceous degeneration, with, not infrequently, ulceration of the ileum or colon. The intestinal and mesenteric glands are atrophied and degenerated; the latter, however, sometimes enlarged; the mesentery and liver wasted; the kidney and spleen sometimes in a similar condition. The liver or spleen may be enlarged, but that is not generally the case. The mucous membranes and follicles are found blanched and attenuated, while E. Goodeve and the author have both pointed out that they may be in a state of amyloid degeneration.

No reference is made to bacteria or other micro-organisms in respect of this disease, on the ground that it would be premature to offer any opinion on this head until more complete investigations have been made.

From the insidious character of this diarrhoea it often gains ground before radical measures are resorted to, and, though the journey to Europe is a step in the right direction, much remains to be done. Diet, clothing, habits, and mode of life are most important questions, and the whole object in view may be summed up in the expression "physiological rest." All irritating food must be avoided. Milk alone (cow's milk), which in rare cases may be diluted with a third or fourth of plain or alkaline water, should be the only food, and should be taken in small quantities (nothing else of any kind being given) of from four to six ounces every hour. When the patient is imbibing from two to three or

four quarts of milk in the twenty-four hours he is obtaining enough nourishment to support life and enable him to recover.

The author began this mode of treatment before his return to England in 1872, and, after prolonged experience here, finds it the most effective. In ordinary cases milk diet should be adhered to for from three weeks to a month or six weeks, and even then a more varied diet should be given tentatively and with great care. Beef-tea, raw beef or other animal juice, finely-minced meat not previously cooked, raw eggs with milk, and farinaceous food are uncertain in their effects, and experience shows that milk alone replaces all other food and dispenses with the necessity for drugs. Tea, coffee, and wines should be avoided. Stimulants may be allowed in small quantities to those long accustomed to them, the best being brandy or whisky with the milk or with some alkaline water. Regularity in times of administering nourishment, and care not to give too much at a time, and to discontinue anything that apparently disagrees are essential points, as are also warmth in an equable temperature and rest in a recumbent posture.

When the glazed appearance of the tongue disappears and the organ returns to its normal size, discipline may be relaxed. The patient should reside in some mild and sheltered part of the country, though the advantages of nursing and attention in a comfortable home outweigh those of any change of locality where they may be wanting.

As the case progresses, the excreta improve in character and diminish in frequency, but under milk diet are always copious in quantity, semi-solid or pultaceous, and gradually increasing in consistency, till constipation may require enemata or slight laxatives. The improvement of the excreta is an indication that the diet may be varied; but long after recovery is apparently complete the greatest care must be taken, and the stay in Europe must be prolonged over one hot season at least.

The administration of cholagogues is not necessary, and the only remedies used should be such as allay irritability of the bowel, and later on such as tend to improve the general health. Ipecacuanha may be beneficial in the early stages if there be hepatic or portal congestion, and, if the latter symptom be aggravated, a few doses of saline laxative, or if the bowel be much irritated, small doses of Dover's powder or tr. opii. Bismuth often does harm, and the author has practically abandoned all demulcent remedies in favour of milk. Later on quinine and iron are beneficial, but they must be laid aside at once if they appear to disagree. The Continental health-resorts may be of benefit, not so much for the waters as for the change, the kind of life led there and the mental attitude induced by the determination to do everything that can promote recovery.

No disease better illustrates the recuperative power of Nature than this. If perfect physiological rest be ensured early, repair rapidly takes place; if degenerative changes have gone too far, or if the diarrhoea be complicated with other diseases, the issue will probably be fatal; but even in such cases amelioration may be procured, while in ordinary cases milk diet, if properly carried out, affords a reasonable prospect of recovery.

The author has frequently seen cases of upwards of two years' duration, in persons between 20 and 50, in which the symptoms were marked, recover under the regimen described; and even in cases of longer duration, occurring in more advanced age, or complicated with visceral disease, a certain measure of relief may be obtained. When milk has failed it is generally because it has not been properly administered.

PARISIAN STUDENTS.—The students of the various Faculties in Paris recently resolved to wear a distinctive form of headgear. In order to mark themselves off still more conspicuously from the non-academical multitude they have now adopted a special badge. Medical students are to wear a black and red rosette, with the tasteful device of a death's-head in the centre; students of pharmacy are to have a green rosette, with a silver palmtree round which a golden snake is twined; whilst the law students have fixed on a black badge with a pair of scales in gold.

GERMAN MEDICAL CONGRESS.—The eighth German Medical Congress (*für innere Medicin*) will meet at Wiesbaden on April 15th and three following days, under the presidency of Professor v. Liebermeister, of Tübingen. The principal subjects for discussion will be (1) "Ileus and its Treatment," introduced by Drs. Curschmann and Leichtenstern, on April 15th; and (2) "The Nature and Treatment of Gout," introduced by Drs. Ebstein and Emil Pfeiffer on April 17th.