The most marked irregularity in these curves is the elevation at age 12 in the boys' height curve and in both the boys' and girls' weight curve; this, we think, is probably due to the fact that children leaving school are more likely to be inspected towards the end than the beginning of their twelfth year, and the averages for this year are probably greater than the true mean.

The elevations in both height curves at age 7 and in the girls' height curve at age 10 are not accompanied by any corresponding deflection of the weight curves, and we are unable to account for them. We constructed curves for the subsidiary areas and found that, generally, those for the urban areas were the most regular, those for the county areas being least so.

In comparing the averages for county and urban areas, it should be borne in mind that the areas of many county education authorities have a considerable urban population. The county averages are, with one exception, better than those for urban districts.

The averages for the South of England are, on the whole, better than those for the North, particularly at the

The two upper lines represent heights, the two lower lines weights. Boys ———; girls - - - -

later ages, though the differences between these two sets of averages are not so marked as between those of the county and urban areas.

The height and weight of girls are a little less than those of boys until the eleventh and twelfth years, when the relative positions become reversed. The greater development of girls at these ages is most marked in the South country averages.

We should like to take this opportunity of pointing out and apologizing for two errors in the printing of the tables we have already sent to those school medical officers who assisted us with their returns. They refer to the weight of North of England boys aged 5, and North of England girls aged 3; the correct averages are given in these tables.

THE DIAGNOSTIC VALUE OF RACHICENTESIS.

BY

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THE method of performing rachicentesis is simple. The patient should lie on one side or the other. To perform rachicentesis with the patient sitting is to incur grave risk. His hips should be close to the edge of the bed, his trunk well flexed. This position widens the space between the spinous processes of the vertebrae, renders tense the ligamentum subflavum, and raises the lower end of the spinal cord. The site of puncture is determined by the position of the fourth lumbar spine, which is crossed by a line dropped perpendicularly from the highest point of the iliac crest to the bed. The needle may be introduced in the mid-line or slightly to one side in the second or the third intervertebral space or just to the side of the spine of the corresponding vertebra. The spot selected is marked and the skin rubbed with lysol solution (1 in 20), and then with pure chloroform. The use of liquid carbolic acid or of pure lysol endangers the local vitality. The needle is passed steadily in with a slight

inclination upwards. There is resistance at the skin and at the ligamentum subflavum; after the latter is pierced the needle is liable to plunge if too great force be used; the subarachnoid space (from which the fluid is drawn) is generally 5 cm. from the entrance wound. When this is reached the cerebro-spinal fluid usually appears. If it do not come the needle should be turned round once or twice in case fibres of the ligament be blocking the point. If the needle strike bone it must be withdrawn 2 cm. and reintroduced in another direction. If the point have touched a small vessel the first portion of the fluid may be bloodstained. This contamination is inevitable if the skin have been incised before introducing the needle. The amount of fluid removed varies, but 10 to 12 c.cm. is a convenient quantity; it is allowed to drop from the end of the needle into a sterile test tube. During its escape the colour and pulse of the patient must be watched; any sign of collapse requires instant stoppage of the withdrawal and the administration of oxygen. In any case the flow should be stopped from time to time by a sterile swab if the needle have no stopcock. In a case of cerebral tumour there is very real danger in removing the fluid too freely or too rapidly. The puncture is sealed with collodion. The patient should lie flat for some hours afterwards.

The fluid should be examined without delay. The rate of flow is noted at the time. About 5 c.cm. of the fluid are centrifugalized for ten minutes, the supernatant fluid poured off, and the deposit transferred to a sterile slide. When dry this film is fixed and stained with methylene blue or other stain.

Normal cerebro-spinal fluid is clear, colourless, and alkaline; the degree of alkalinity seems to vary, but the significance of this is not known. It becomes slightly turbid when boiled; it reduces Fehling's solution, glucose being present in the proportion of 0.4 to 0.5 per cent. The glucose may disappear when meningitis develops. The fluid may become coloured. Yellow fluid may indicate tuberculous or chronic meningitis, or tumour of the spinal cord; in subdural haemorrhage or cerebral laceration it is red, but if the trauma be some days old the colour may be dark amber. Red colour may be due to accidental contamination; coagulation in the test tube is stated to be an infallible sign of this, but such a conclusion is not always justifiable. It has been asserted that bile does not appear in the fluid in cases of jaundice; one of the cases described contradicts this. Turbidity is an indication of meningitis, but the fluid may be clear in sub-acute tuberculous meningitis. It is clear also in extradural haemorrhage and in cerebral tumour.

A film made from normal cerebro spinal fluid contains very few leucocytes, and many fields may be examined before one corpuscle is found. Absence of leucocytes excludes meningeal inflammation, locomotor ataxy, and superficial gumma of the brain. It does not exclude cerebral abscess unaccompanied by meningitis; this shows the value of making a leucocyte count of the blood at the time the cerebro-spinal fluid is examined.

In pathological states the number of leucocytes is increased, and in inflammatory conditions a varying number of endothelial cells may be seen. The variety of leucocyte which becomes the more abundant depends on the lesion. It is probable, however, that the explanation of the predominance of the one variety over the other lies in the fact that the inflammatory change is of a less active type, demanding fewer phagocytes.

The significance of the actual changes will now be considered:

1. Lymphocytosis generally means a chronic meningitis, and is found when the cause is syphilis or tubercle (the latter especially in children), in locomotor ataxy, in epilepsy, and in general paralysis of the insane. It is said to occur in acute parotitis and in herpes. Some cases of cerebral glioma have shown this lymphocytosis. It is absent during the initial stage of tuberculous meningitis. Development of lymphocytosis in the course of a disease means improvement, and in those cases of non-tuberculous meningitis which have recovered the number of lymphocytes has steadily increased.

2. A polymorphonuclear leucocytosis generally means acute meningeal disease. It is found during the initial stage of tuberculous meningitis, but is often persistent in this disease in adults. In cerebro-spinal meningitis it is present from the beginning, and is increased at each

exacerbation. The onset of acute anterior poliomyelitis is said to be accompanied by a leucocytosis of this kind.

The leucocytosis in the blood and in the cerebro-spinal fluid in the different conditions which have been referred to may be shown as follows:

	Cerebro-spinal Fluid.	Blood (thousands).
Meningitis (a) tuberculous...	Mononuclear (except at outset)	10-14
" (b) pyogenic ...	Polymorphonuclear (except when recovering)	15-22
Locomotor ataxy ...	Mononuclear	Normal
Epilepsy ...	"	"
General paralysis ...	"	"
Cerebral tumour ...	"	7-12
Cerebral abscess ...	No excess	14-18

The therapeutic use of rachicentesis will be discussed very briefly. In infective cases the removal of a fluid heavily laden with toxins and its replacement by a fluid with a bacteriotropic power as yet uncalled upon must be beneficial, whether the inflammation be in the meninges or in the peritoneum. Unfortunately, the excellent effects of laparotomy for tuberculous peritonitis have not been obtained in rachicentesis for tuberculous meningitis. Fluid would have to be withdrawn frequently before much effect would take place. In one case described now there was distinct improvement, which, though transient, would have been sufficient if important social or family affairs had had to be settled by the patient before he died. In such a case rachicentesis might be regarded as almost obligatory. High intracranial pressure, whether due to cerebral neoplasm or to effusion of blood after injury or rupture of a vessel, or to depressed bone, may be relieved by the withdrawal of fluid. When this has been done, the further excess may be absorbed, as happens in the pleural or the peritoneal cavity.

The following cases have been selected from a number with the design of illustrating the foregoing remarks:

CASE I.

Mrs. P., aged 57, had been losing weight for several weeks, and had epigastric pain which was worse after food. She was intensely jaundiced, and had been so for two months. There was oedema of the ankles; the umbilicus protruded, and the abdomen at this level measured 82 cm.; at the level of the ninth costal cartilage, 80.6 cm. In the epigastrium was a very hard, immovable hemispherical mass 7 cm. in diameter. Bile was abundant in the urine. Cerebro-spinal fluid came out at the rate of fifty drops per minute, and was clear with a distinct greenish tinge. It gave bile reactions with fuming nitric acid and with Lugol's solution, but not with Oliver's peptone solution. Films made from the deposit showed no leucocytes, endothelial cells, or bacteria. The necropsy revealed the presence of primary disease of the gall bladder with large secondary nodules in the liver.

CASE II.

R. S., aged 44, fractured his skull in 1904, and in the five years following had three attacks of unconsciousness, unattended by convulsions. In March, 1910, he had a series of left-sided convulsions, which came on without warning, and were not attended by incontinence. These lasted five weeks, and recurred on September 30th, when what was apparently the "status epilepticus" set in and lasted until October 2nd. The reflexes in the right leg were distinctly more active than those in the left, but this was the only abnormality discovered. The urine contained 1.4 per cent. urea and no albumen. It was not until four days later that he knew where he was, and then he was able to walk while supported and without shuffling. His cerebro-spinal fluid was clear and strongly alkaline. The field gave an average of 1.6 leucocytes (all mononuclears) and no endothelial cells; the blood-count was 11,277. By itself this result did not exclude a cerebral tumour, but the patient improved steadily, and had no headache or vomiting. The diagnosis made was simple epilepsy.

CASE III.

E. L., aged 18 years, had intense pain on the left side of his skull for three weeks. Examination detected no local tenderness anywhere, except behind the knees on an attempt to elicit Kernig's sign, and in the nape of the neck. There was diplopia on looking down; optic neuritis was absent, and the fundal veins were rather engorged. Rotatory nystagmus to the left was very marked, and was increased on looking to the left; this caused no vertigo. Left pseudoptosis was present; the fields of vision appeared to be full. Continuous hissing tinnitus was present in the left ear. With tuning-fork she had very poor conduction for both low and high tones; Rinne's test was negative; Weber's test conducted to the right. His cerebro-spinal

fluid was clear; immediately after the withdrawal he became very collapsed. Later on he complained of headache, and was restless. The average field showed 55 leucocytes, and lymphocytes and polymorphs were present in almost exactly equal numbers in a total of 600 cells counted; the blood count was 12,000. The diagnosis was then a subacute meningitis, which might be due to a cerebral abscess or tumour, or to tuberculous disease. Pyogenic meningitis was excluded, the fluid being clear and showing no organisms; three culture tubes inoculated from the fluid remained sterile. The blood count was too low for an abscess. In tuberculous meningitis lymphocytes would probably predominate; no tubercle bacilli were found in the deposit; von Pirquet's reaction was negative; the tuberculo-opsonic index was .99. The condition thus came to be regarded as a cerebral glioma. He was treated with potassium iodide, and nine weeks later his condition had so far improved that he was allowed to resume a cautious outdoor life. At this time the nystagmus was well marked, diplopia unchanged, ptosis almost gone, knee-jerks normal, plantar reflex sluggish; there was no inco-ordination when he stood with his eyes shut, even when he was pushed. Nine weeks after this Wassermann's reaction (which had not previously been done) was found negative.

CASE IV.

R. T., aged 37 years, had syphilis at the age of 24 years; eleven years later he had dysuria, which still troubled him when he came under notice. At that time he had vomiting and sudden pain in the stomach lasting one day. A similar attack occurred eighteen months later, and another seven months after this. With this third attack he had dull heavy pain in his legs, which was sometimes worse at night. The fourth attack began two days before he came under observation. When seen he had Argyll Robertson pupils, no knee-jerks, no plantar response in right foot, slight extensor response in left foot. There was distinct inco-ordination in his arms, none in his legs. The disease was obviously locomotor ataxy—a diagnosis which was confirmed by his cerebro-spinal fluid, which was clear and alkaline, showing 7.3 lymphocytes to the field, a few endothelial cells, no polymorphs, and no bacteria.

CASE V.

H. T., aged 50 years, gave a history of pain in the left side of the abdomen and sickness after meals of ten years' duration. Recently this pain had become worse and he had lost weight. On account of these symptoms a diagnosis of malignant disease of the intestine had led to a laparotomy being performed, and after this he had felt better. Some weeks before he was seen he began to vomit more frequently, found that "his feet would not go where he wanted," and fumbled very much in fastening his buttons; there was no complaint of any visual defect. On examination his pupils reacted sluggishly to light and accommodation, the left optic disc seemed paler than the right; and the arteries were small. There was distinct inco-ordination in the arms; knee-jerks were slow; Romberg's sign was present. Plantar response was absent, gait was high stepping; with bare feet he could not tell when he had stepped from boards to a towel, but felt these to be different from a door-mat. The cerebro-spinal fluid showed only twelve cells on the film, ten being lymphocytes. This was not definite, but suggested an early stage of tabes dorsalis. The inco-ordination increased and the knee-jerks became more sluggish; but he was lost sight of after a month.

CASE VI.

P. B., aged 18 years, had a very extensive pericardial effusion, which was treated by incision and drainage. As a full account of this case has appeared elsewhere,¹ it will suffice to say that four months after the pericardotomy he showed signs of a commencing meningitis. Lumbar puncture was accordingly done; the fluid was turbid and did not reduce Fehling's solution. The film showed many endothelial cells and an average of 94.5 leucocytes; a differential count gave lymphocytes 62.14 per cent., polymorphs 37.8 per cent. This pointed to a tuberculous meningitis of some standing, with the supervention of an acute non-tuberculous process. The necropsy revealed a tuberculous deposit over the heart, with miliary tubercles in the lungs and in most of the abdominal viscera. The pia arachnoid was oedematous, and showed a few scattered tubercles. Firm cerebral adhesions were seen at the optic tracts and in the Sylvian fissures. Pus was entirely absent, but the separated surfaces showed carpeting with minute grey tubercles, which were also found in the aqueduct of Sylvius and in the lining of the ventricles.

CASE VII.

F. J., aged 3 years, had a history of wasting, peevishness, and convulsions. Her head was retracted and burrowed into the pillow; the knee-jerks and plantar reflexes were much diminished. Only 0.5 c.cm. of fluid was obtained, and when evaporated on a slide this showed 65 leucocytes, with lymphocytes and polymorphs in almost exactly equal numbers; no bacilli were found; the blood count was 26,504. Tuberculous meningitis was diagnosed. Some days later she became very restless and recent haemorrhages were seen in both fundi. She died five weeks after the puncture. At the necropsy a chronic hydrocephalus was found. The surface of the cerebrum and of the caudate nucleus was finely granular, and the basal membranes were thickened. The dilatation of the ventricles probably explains the absence of pressure in the fluid.

CASE VIII.

S. E., aged 16 years, had a history and symptoms (of a week's duration) strongly suggestive of an early stage of tuberculous meningitis. By lumbar puncture 18 c.cm. of fluid were removed; it came out in a jet, was rather turbid, and began to show a deposit in five minutes. It was slightly alkaline and did not reduce Fehling's solution. The average field contained 100 leucocytes, of which 98 per cent. were mononuclear. During the night he answered questions and complained of headache. Next day 30 c.cm. of fluid were removed; this was quite cloudy and came out at the rate of 120 drops per minute. At night the temperature dropped from 101.4° F. to 98.6° F., and in the morning he quite understood questions put to him; 18 c.cm. of fluid were removed, but this was distinctly less turbid. The fluid next day was still clearer; 41 c.cm. were drawn off, and with it came a clot of lymph about 10 mm. long. In the evening he became unconscious and died. No tubercle bacilli were ever found in the fluid. At the necropsy was found dense inflammation and many tubercles in the membranes at the base of the brain and of the cord, being more marked in the dorsal region. No tubercles were seen in the thorax, but the great omentum, the visceral peritoneum, and the appendix were thickly covered with them. A tuberculous abscess was found over the right lobe of the liver and one in the spleen.

CASE IX.

V. H., aged 16 years, was a healthy-looking girl who came home from school with a violent headache, vomited once, and at night had a temperature of 105°. In the morning she was semi-conscious, and had a pulse-rate of 140; her knee-jerks were absent, and Kernig's and Babinski's signs were very marked on both sides. Her fluid was faintly turbid; the film showed a few diplococci and numerous polymorphs. Cultures on broth, agar, and Loeffler's medium were all negative. That evening the patient asked for tea and was able to talk to people; she remained conscious for forty-eight hours. When told to perform the movement of Kernig's sign she said that "her leg wouldn't go," but it did not hurt her to try. The following day she was again unconscious, and about 30 c.cm. of opalescent fluid were removed. The fluid contained 100 leucocytes, of which 97 per cent. were polymorphs. Cultures on agar and Loeffler's medium grew staphylococci freely, owing to a contamination. Films made from the growth and stained with methylene-blue and carbol-thionin showed a few extra-cellular diplococci, probably pneumococci; no tubercle bacilli were found. Death occurred about six hours later, and a necropsy was not allowed.

REFERENCE.

¹ *The Lancet*, April 22nd, 1911.

NOTE ON THE BLOOD IN SYMPATHETIC
OPHTHALMIA.

BY

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At a meeting of the Ophthalmological Section of the British Medical Association in London, July, 1910,¹ Mr. A. W. Ormonde referred to the results of blood examinations made by one of us (C. P. J.) of three cases of sympathetic ophthalmia, which showed great increases from the normal in the relative percentages of the large mononuclear cells, amounting in one case to as much as 20 per cent., and associated with a diminished percentage of polymorphonuclear leucocytes—a condition which suggested a protozoal and not a bacillary infection.

Prior to this, and also subsequently, we have had the opportunity of examining the blood in nine cases of sympathetic ophthalmia, and have in all specimens found a similar blood-cell type, as is shown in Table I.

Unfortunately, the total white cell counts were not made, but assuming there was in no case any leucocytosis, and taking the average normal absolute numbers per cubic millimetre of lymphocytes as 1,500, of large mononuclears as 500, and of polymorphonuclear leucocytes, as 5,000, and the average normal total white cell count as 7,000 per cubic millimetre, the absolute numbers in the above cases may be calculated; they are expressed in Table II.

From these figures it appears that in all cases the lymphocytes are increased in absolute number per cubic millimetre on an average for the 9 cases of about 30 per cent., the range of increase varying from 2 per cent. to 42 per cent.

TABLE I.

Case.	Lymphocytes per Cent.	Mononuclears per Cent.	Polymorphs per Cent.	Eosinophiles per Cent.	Mast Cells per Cent.
416	27.4	20.4	47.0	4.6	0.6
3,987	27.2	13.0	58.8	0	0.6
363	34.6	16.4	46.8	2.2	0
360	28.6	16.2	51.4	3.4	0.4
353	21.8	12.0	63.6	2.0	0.6
113	29.6	14.3	48.0	1.3	0
48-2	30.6	30.0	38.6	0.6	0
100	31.0	12.3	49.0	3.6	0.6
104	22.6	42.0	34.6	0.3	0.3

TABLE II.

Case.	Lymphocytes.		Mononuclear Cells.		Polymorphs.	
	No.	Increase.	No.	Increase.	No.	Diminution.
416	1,918	No. 418 = 27	1,428	No. 928 = 185	3,290	No. 1,710 = 34
3,987	1,904	404 = 26	910	410 = 82	4,116	884 = 17
363	2,422	922 = 61	1,148	648 = 129	3,276	1,724 = 34
360	2,002	502 = 33	1,134	634 = 126	3,598	1,402 = 28
353	1,526	26 = 2	840	340 = 68	4,452	548 = 11
113	2,072	572 = 38	1,001	501 = 100	3,360	1,640 = 32
48-2	2,142	642 = 42	2,100	1,600 = 320	2,702	2,298 = 46
100	2,170	670 = 44	861	361 = 72	3,430	1,570 = 31
104	1,582	82 = 5	2,940	2,440 = 488	2,422	2,578 = 51

The large mononuclear cells are increased in absolute numbers per cubic millimetre on an average for the 9 cases of 170 per cent., the range of increase varying from 68 per cent. to 488 per cent. The polymorphonuclear leucocytes are in all cases diminished in absolute number per cubic millimetre on an average of about 30 per cent., the range of diminution varying from 10 per cent. to 51 per cent.

This type of blood is met with in protozoal infections. With this view it was desirable to exclude the possibility of syphilis, and in 6 cases Wassermann's test was applied, and in each instance gave a negative result.

Of further interest are the results obtained in 2 cases after the administration of salvarsan. Table III shows the differences in the blood counts taken before and after the injection.

TABLE III.

Case.	Lymphocytes.	Mononuclears.	Polymorphs.	Eosinophiles.	Mast Cells.	
416	27.4	20.4	47.0	4.0	0.6	
416	12.8	7.8	76.6	2.6	0.2	24 hours after.
48-2	30.6	30.0	38.6	0.6	0.0	
48-2	11.0	20.6	67.0	0.3	1.0	3 weeks after.

These remarkable changes in the type of the blood after treatment seem to support the above suggestion that sympathetic ophthalmia is a protozoal infection.

In a future communication we hope to give results of salvarsan treatment in an extended series of these cases, but the probably great diagnostic value of blood examination appears to us to deserve the more immediate attention of the profession.

REFERENCE.

¹ *BRITISH MEDICAL JOURNAL*, 1910, p. 1326.

A PORTRAIT of Faraday has been presented to the Royal Institution of Great Britain, where he worked and lectured so long, by Dr. Donald Hood.

THE Honorary Secretaries of the South African Civil Surgeons' Dinner write to state that the dinners are now held every third year, and that the next will take place in 1914.