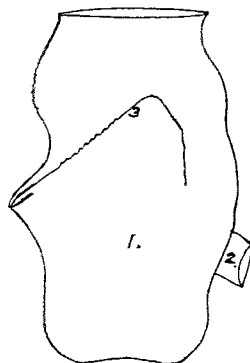


because the pain complained of at first had disappeared, operation was again postponed. During the next week a third radiogram showed that there was no change in the position of the pin in spite of the bowels having been moved from time to time. It was thus obvious that the pin had become impacted, and the constancy of its position with regard to the sacro-iliac joint pointed to the ascending colon as the seat of its arrest rather than to the small intestine. I therefore advised its removal—an opinion which was confirmed by Mr. Raymond Johnson, who kindly saw the case for me. The operation was accordingly carried out, the cæcum being approached by an incision to the left of the linea semilunaris in preference to the usual trap-door incision for appendicectomy, as I considered that this would leave me more room for exploration in the event of the pin not being present in the colon. It was, however, felt in the latter, lying about 4 inches below the ileo-cæcal valve. Contrary to expectation and to the showing of a fourth radiogram taken shortly before operation, it was found to be almost transverse to the long axis of the bowel, bent like a spring, one end causing the wall of the bowel to stand out acutely on the anterior aspect, and being at the higher level. This point was gripped and the bowel partially withdrawn from the



Diagrammatic sketch of condition. 1. Cæcum. 2. Ileum. 3. Hairpin.

abdomen, with the result that the patient became rather collapsed and the bowel had to be released again. A second attempt a little later was successful, and it was then found that nothing remained to cover the projection but the thinnest layer of peritoneum, the mucous and muscular layers having been perforated. A slight prick with a scalpel served to release the pin, the *blunt hooked end* of which at once appeared, and being withdrawn was found to be bent in the manner shown in the outline sketch; it must thus have very shortly perforated the remaining layer of the bowel wall had it not been removed. The puncture hole was surrounded by a purse-string suture, the bowel washed and dropped back into the abdomen, and the wound closed. The patient's convalescence was uninterrupted.

The case is of some interest, not only from the unusual nature of the accident, but from the apparent ease with which so pliable and sharp-pointed a foreign body should have passed the cardiac, pyloric, and ileo-cæcal orifices, as well as the whole length of the small intestine, without arrest. So far as the cardiac and ileo-cæcal orifices and the small intestine are concerned, this must be put down to its elongated character, but only good luck could have helped its five inches of length through the pylorus. Having arrived at the colon it would there have greater width in which to alter its position and so become impacted transversely. The second point of interest was the false idea given of its real direction by an excellent radiogram. In this connexion it is wise to remember that the value of a radiogram of a foreign body in the intestine is chiefly limited to denoting the quarter of the abdomen in which it lies, since in a coil of jejunum lying low down it may appear to be in the cæcum or the sigmoid, while in a coil of ileum lying high up it may suggest the stomach or the transverse colon; it cannot denote the actual section of bowel with any certainty. As an example of this I recently had occasion to operate upon a child who had swallowed a two-inch French nail. The radiogram clearly showed the nail in the epigastric angle close to the ensiform cartilage, and therefore presumably in the stomach. This organ was explored by palpation through the lesser omental sac, and was then opened and explored with the finger, but nothing was found; the transverse colon was examined inch by inch, as were also the nearest coils of ileum and the whole of the duodenum and commencement of the jejunum with a like result, and yet on the day following operation the radiogram showed the nail in exactly the same position. No further operation was permitted and the boy left hospital still in possession of the nail.

The last point of interest is the almost complete absence of pain and tenderness in spite of the fact that the point was impinging forcibly on the peritoneum. In view of this fact it would certainly seem wise in all such cases to

attempt the removal of any sharp-pointed foreign body rather than to trust to diet and the often imperfect attempts of nature to pass it along. The fatality frequently attending the swallowing by dogs of splinters of chicken and rabbit bones points especially to this conclusion, the more so when one considers the greater thickness of the intestinal wall in these animals. In this particular case a fortunate coincidence directed the pin with the blunt-hooked end leading, and yet on its arrival in the colon it was just this blunt end which was on the point of perforating the bowel. The sharp end could be felt on the deep aspect of the colon projecting into the mesocolic tissue, but in view of the uninterrupted convalescence it had presumably not caused a perforation here.

Weymouth-street, W.

MYELOID LEUKÆMIA IN A CHILD WITH BLOOD PICTURE OF SO- CALLED MEGALOBlastic DEGENERATION.

BY C. H. TREADGOLD, M.A., M.D. CANTAB.

THE following case is reported on account of the megaloblastic degeneration which throughout was the dominating feature of the peripheral blood. Clinically the resemblance to acute leukæmia was marked, although the white cells were not at first characteristic of that condition. Accordingly the diagnosis of leukanæmia was made.¹ Before death, however, the white cell moiety of the blood became typically leukæmic.

The patient, a boy aged 13½ years, was admitted to the West London Hospital on May 19th, 1912. The father stated that the boy had always been strong and healthy up to the middle of the previous month, when pallor was noticed; that during the next three weeks he had complained of fatigue and bleeding from the nose, and that four days before admission the bleeding had been severe, lasting on and off for 24 hours.

On admission there was marked pallor of the skin and mucous membranes; the former was of a pale yellow colour like that of Addisonian anæmia, but there was no sign of jaundice on this or any other occasion. A faint mottling was present on the chest which resembled a disappearing purpuric eruption, but there was no history of such. None of the superficial glands were definitely enlarged, but the inguinal glands were palpable, and a small gland could be felt in each axilla. The respirations were 28 per minute, the temperature was 101° F., and the pulse was 116. The latter was markedly collapsing in character, but quite regular. The heart was considerably enlarged, the area of dullness extending half an inch beyond the right sternal margin and half an inch outside the nipple line. The second sound was everywhere short and sharp. A systolic apical bruit obscured the first sound; a pulmonary systolic bruit together with a faint double murmur over the aortic area were also audible; all were soft and blowing in character. The breath was heavy and offensive; the tongue was furred, but its epithelium was normal in other respects; the teeth were excellent. Examination of the abdomen was difficult owing to distension and rigidity. The liver was not enlarged in an upward direction, but there was a doubtful increase of resistance and impaired resonance immediately beneath the right costal margin. The splenic dullness, too, seemed to be increased, but neither the liver nor the spleen could be felt. No abnormality was detected in the respiratory or central nervous systems. The urine was acid, specific gravity 1010, and contained no albumin. A specimen was afterwards tested for urobilin. None was found, although urobilinogen was present in pathological quantity. Ten days later the same specimen still gave the test for this substance to a modified degree, but none of it had been converted into urobilin.² Albumose and indican were absent. There was

¹ This term, originally introduced by Leube, was intended to include those cases which could not be classified either under the head of leukæmia or pernicious anæmia.

no albuminuria or hæmoglobinuria throughout. The fæces showed no obvious abnormality.²

Blood cultures were negative and the patient's blood serum did not exert any hæmolytic action on the blood corpuscles of a healthy individual. The serum was very yellow, but the reason for this was not investigated.² Wassermann's reaction test was kindly tried by Dr. R. R. Elworthy, with a negative result. Von Pirquet's test was also negative.

May 24th: Basal and apical systolic murmurs were alone heard. An ophthalmoscopic examination revealed two small linear hæmorrhages, one on the periphery of each fundus; the discs were normal. An examination of the nose by Dr. H. J. Davis showed nothing beyond marked pallor of the mucous membrane and several stellate venules on the septum. 28th: Repeated epistaxis since the 24th. A dark purple ecchymosis had developed beneath the mucous membrane covering the upper jaw. A friction sound was audible to the right of the sternum, and there were increased resistance and impaired resonance for two fingerbreadths below the right costal margin.

June 4th: The boy looked, if possible, paler and the mucous membranes were still more blanched. Facial œdema had been noticed since June 1st and had steadily increased. The epithelium over the oral hæmorrhage had sloughed, and there was slight but persistent oozing from its periphery. 8th: The patient seemed weaker and could hardly open his eyes owing to œdema. The extremities were slightly swelled and free fluid was present in the scrotum and abdominal cavity; there were also indications of hydropericardium. 10th: Well-marked ascites and hydropericardium together with widespread slight œdema. The patient was semi-comatose and fretful when roused; previously his mental condition had been normal. 12th: Patient seemed brighter. The œdema was hardly noticeable, but breathing was difficult and the appetite very poor. 15th: Marked ascites and œdema, the scrotum being distended with fluid. The bases of both lungs were dull. 21st: Petechial hæmorrhages into tongue and mucous membrane of right cheek; purpuric spots on back and legs.

Death occurred on June 27th. For the preceding three days the boy was comatose most of the time. During this period the ascites and œdema diminished considerably, enabling the lower margin of the liver to be felt about an inch below the umbilicus. Slight bilateral enlargement of the cervical glands was also noticed for the first time. The temperature varied from 101° to 103° throughout, with the exception of the last day or two, when it was somewhat lower.

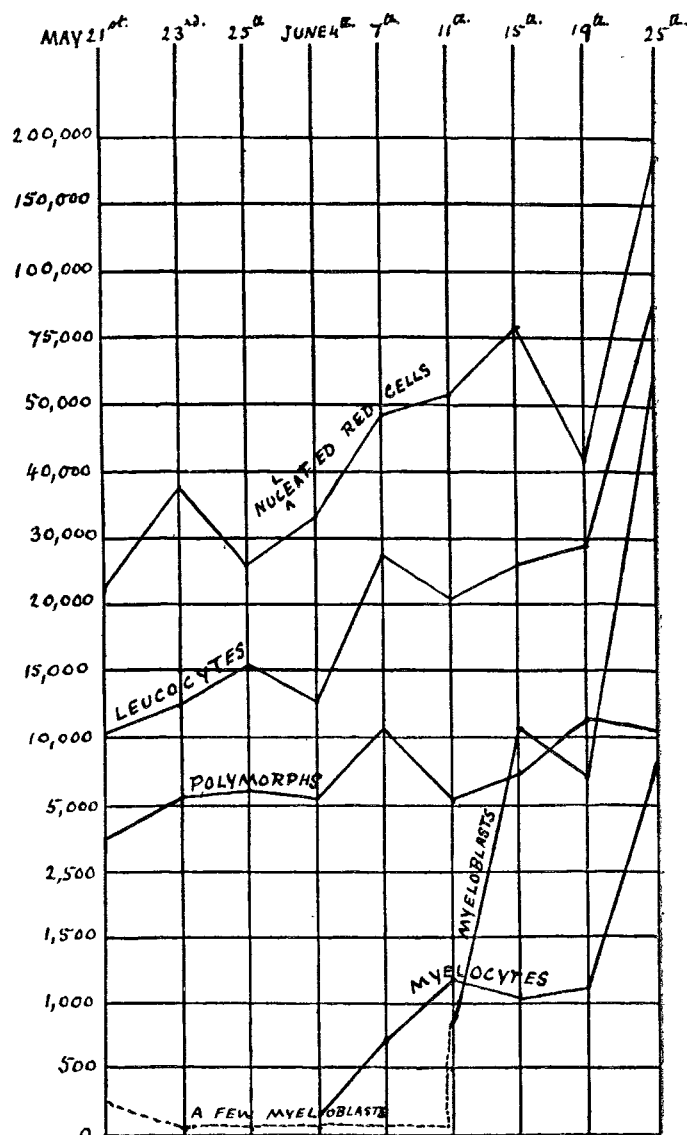
The treatment was chiefly symptomatic. Injections of soamin were given for a time but were afterwards abandoned. No beneficial effects were observed.

The blood.—The results of the various examinations are shown in the accompanying table. The absolute numbers per cubic millimetre of the more important cells are roughly depicted in the appended chart. The blood showed many interesting features from the commencement. At the first two or three examinations it did not flow very readily, but from June 4th onwards its coagulability was much diminished and towards the end blood flowed freely from the slightest possible puncture and the bleeding was difficult to stop. The colour index was at first above unity, but later fell below it. "Live films" showed rouleaux formation, though this was somewhat imperfect; they also showed poikilocytosis. Great difficulty was experienced in making accurate "white counts"; Toisson's fluid and various strengths of acetic acid with methyl violet, &c., were tried, but to no purpose. Although typical megaloblasts, lymphocytes, &c., could be easily distinguished, a residue remained which defied analysis, and the leucocytes could only be estimated by counting the total number of nucleated cells and apportioning them by means of a stained film. In such preparations, polychromasia and poikilocytosis were well marked. Basophilic stippling was noticed occasionally, but required a good deal of looking for. Macrocytes formed a large proportion of the red corpuscles and occasional microcytes were seen. Typical normoblasts were scanty in all the films, the predominating cell being a megaloblast with a varying quantity of polychromatophilic stroma and a

large nucleus rather deficient in chromatin; many were seen in process of division, and their nuclei were of the most varied shape. This feature was most marked from June 7th onwards. Gigantoblasts were also observed; a few showed a small dark nucleus and normal stroma, but there were usually marked polychromasia and well-defined spaces between the nuclear chromatin. Free nuclei and microblasts could always be found—in fact, all possible varieties of nucleated red cells were present. Their numbers, too, were altogether phenomenal, the last examination revealing nearly 184,000 to the cubic millimetre. Osler,³ in a series of 81 cases of Addisonian anæmia, gives 15,000 erythroblasts per cubic millimetre as the highest number observed by him. Gulland and Goodall⁴ record 52,000 in a case of chronic myelocythæmia, while 14,000 per cubic millimetre seems to be the highest figure recorded in leukanæmia.⁵

The white cells also showed marked abnormalities. Large lymphocytes and hyalines (large mononuclears of Ehrlich)

Chart showing the Absolute Numbers per Cubic Millimetre.



(For the sake of clearness the lymphocytes, hyalines, and transitionals have been omitted.)

were present in considerable numbers in the earlier films. "Ghost" cells, which were also a feature, seemed to be largely derived from these hyalines as shown by the presence of intermediate forms. Between May 23rd and June 15th the majority of the polymorphs possessed few or no granules; before and after these dates nearly all of them were granulated—a curious fact which admits of no ready explanation. Owing to immaturity or degenerative change their nuclei were much less polymorphic than usual. From June 4th to 11th many of these cells were excessively small, and during this period the corresponding myelocytes were also very small. By June 15th the character of the films had altered considerably, and from that date onwards the predominating white cell was the agranular myelocyte or

² For the examination of the urine, fæces, and blood serum for Hb derivatives vide Parkes Weber and Dörner on Acholuric Jaundice, THE LANCET, Jan. 22nd, 1910, p. 227. This article includes many references.

³ Osler: The Principles and Practice of Medicine.

⁴ Gulland and Goodall: The Blood, 1912.

⁵ Hurter: Liverpool Medico-Chirurgical Journal, 1907, p. 105.

myeloblast. With eosin and methylene blue they showed a large, pale, and homogeneous nucleus surrounded by pale blue cytoplasm which frequently had the appearance of basophilic granulation. When stained by Leishman's or Giemsa's method the nucleus appeared darker and showed one or more pale nucleoli, while the protoplasm took on a greenish tinge at the periphery.⁶ Eosinophiles could always be found, but did not happen to appear in the differential counts. No basophile cells were seen throughout. From these remarks the differentiation of the various cells may appear to have been easy; this, however, was not the case.

Necropsy.

At the post-mortem examination (performed by Dr. Elworthy) emaciation was not excessive, even after discounting the widespread oedema. The gums were not thickened. There were small but palpable glands in the groins, axillæ, submaxillary regions, and posterior triangles of neck. The subcutaneous fat was yellower than normal, but the muscles were rather pale.

Thorax.—No remnants of the thymus were visible. Both pleuræ contained a considerable quantity of blood-stained fluid, and there were recent soft adhesions on the right side. There were many ecchymoses beneath the visceral layer of the pleura on both sides. The lungs together weighed 34 oz., both were congested at the bases and oedematous throughout. The pericardium contained a considerable quantity of bright

patches were inconspicuous, and no intestinal parasites were found.

Glands.—The glands were slightly enlarged in most parts of the body, the largest being about the size of almonds. They were dark red in colour, with the exception of a few in the mesentery, which were white.

Bones.—The marrow of all the bones examined—ribs, vertebræ, sternum, and femur—was of a deep red colour. The right femur was sawn longitudinally; its medullary cavity was entirely filled with soft red marrow.

Cultures.—A short streptococcus was grown from the heart's blood. The same organism was noticed in a stained section of the marrow.

Liver.—An analysis of the liver by Mr. J. H. Ryffel revealed the presence of iron to the extent of 0.273 per cent. of dried liver substance. In 12 cases of Addisonian anæmia recorded by Dudgeon⁷ the average was 0.325 per cent., so that the percentage of iron in the present case was not much below the average for Addisonian anæmia. Hæmoglobin only contains 0.33 per cent. of iron, while the normal liver contains 0.08 per cent. according to Stockman⁸; Ryffel, however, makes it rather higher—viz., 0.14 per cent.

Summary of Microscopical Appearances.

Leucocytic infiltration was everywhere slight, yet the red lymph glands and spleen showed myeloid change. The marrow was myeloblastic and showed few red cells.

Table showing the Results of the Various Examinations of the Blood.

Date.	Red corpuscles per c.mm.	Hæmoglobin percentage (Haldane's method).	Colour index.	Nucleated red cells (per c.mm.).	White cells (per c.mm.).	Differential count.							
						Poly- morphs.	Lymphocytes.		Hyalines.	Transi- tionals.	N. Myelo- cytes.	E. Myelo- cytes.	Myelo- blasts.
							Small.	Large.					
May 21st.	1,160,000	30%	1.3	22,800	10,200	{ 43% 4,386	30% 3060	12% 1224	12% 1224	3% 306	—	—	A few.
„ 23rd.	1,104,000	30%	1.3	37,100	12,500	{ 45% 5,625	28.5% 3560	13% 1625	11% 1375	2.5% 312	—	—	—
„ 25th.	1,360,000	30%	1.1	25,900	15,100	{ 46% 6,946	30% 4530	9% 1359	11% 1661	4% 604	—	—	—
June 4th.	1,192,000	18%	0.75	33,700	12,900	{ 43% 5,547	33% 4257	12% 1548	10% 1290	0.5% 65	1.5% 194	—	—
„ 7th.	946,000	15%	0.8	48,500	27,700	{ 42.2% 11,689	23% 6371	18.4% 5097	11.2% 3102	1.8% 498	2.6% 720	0.4% 111	—
„ 11th.	644,000	—	—	55,800	20,200	{ 26% 5,252	36% 7272	23% 4646	5% 1010	—	6% 1212	—	4% 808
„ 15th.	781,000	—	—	79,800	26,600	{ 29.8% 7,927	21.2% 5640	—	3% 798	—	4% 1064	—	42% 11,172
„ 19th.	722,000	—	—	42,600	28,400	{ 43% 12,202	20% 5680	7% 1988	1% 284	—	4% 1136	—	25% 7,100
„ 25th.	832,500	14%	0.85	183,700	87,500	{ 13% 11,375	9% 7875	—	—	—	9% 7875	—	69% 60,375

yellow fluid. The heart weighed 10 oz. Both ventricles were dilated, especially the right. There was no tabby cat striation of the cardiac muscle. The valves were healthy, but stained yellow. The large vessels showed nothing remarkable.

Abdomen.—The peritoneal cavity contained a fair amount of bright yellow ascitic fluid. The liver weighed 53 oz. It was considerably enlarged and rather hard. The cut surface showed a reddish-brown reticulated pattern enclosing pale pinhead areas. On treating with potassium ferrocyanide and hydrochloric acid the brown pattern was quickly transformed into a dark blue one. Siderosis was also very noticeable in the spleen and kidneys, and could even be demonstrated in the lungs and cardiac muscle. The spleen weighed 7 oz. The upper pole was adherent to the diaphragm, and several spleniculi were noticed in the gastro-splenic omentum. The organ contained several white wedge-shaped infarcts. The kidneys together weighed 13 oz. They were pale and much firmer than normal. Many small punctate hæmorrhages were seen in the renal pelvises. The ratio of cortex to medulla was unaltered. The stomach showed slight post-mortem digestion at the fundus, but otherwise no abnormality. The intestines were very pale and subperitoneal hæmorrhages were absent. Peyer's

Destruction of red corpuscles and storage of iron were the chief characteristics of the liver and spleen.

Detailed description.—Paraffin sections were treated with hæmatoxylin and eosin; blood stains were also employed, but differential staining with Mayer's acid hæmalum and eosin gave the best results. Marrow smears were stained by Jenner's method and by a combination of Jenner and Giemsa.⁹ Pieces of the liver, spleen, and kidney were treated in bulk with potassium ferrocyanide and hydrochloric acid; portions were afterwards hardened and cut in the usual way. Some of the sections were mounted direct; others were counterstained with hæmalum and eosin.

Pericardial fluid.—The deposit obtained by centrifuging the pericardial fluid showed fragmented red corpuscles and nucleated cells; the latter included more lymphocytes than were present in the blood, otherwise the proportions were similar.

Marrow.—Smears showed a great preponderance of myeloblasts.¹⁰ A differential count of 500 cells in a smear from the medullary marrow of the femur gave the following results: Myeloblasts, 72.2 per cent.; neutrophile myelocytes,

⁷ Dudgeon: THE LANCET, Dec. 17th, 1904, p. 1705.

⁸ Stockman, cited by Dudgeon.

⁹ A modification of Pappenheim's method gave good results. Cited by Gulland and Goodall, *The Blood*, 1912, p. 33.

¹⁰ Whether all the cells classed as myeloblasts were really such must remain a moot point. Large lymphocytes and hyalines were difficult to distinguish, but seemed to be present in small numbers.

⁶ For a full description of these cells vide Pantou and Tidy THE LANCET, May 18th, 1912, p. 1328.

7 per cent. ; eosinophile myelocytes, 1 per cent. ; lymphocytes, 0.2 per cent. ; macrocytes, 12 per cent. ; normocytes, 0.8 per cent. ; microcytes, 0.2 per cent. ; giantoblasts and megaloblasts, 6.4 per cent. ; and microblasts, 0.2 per cent. Neutrophile and eosinophile leucocytes were seen, but were very scanty. Smears from the head of the femur and from the other bones gave similar results. Sections of the medullary marrow showed a very cellular structure with few fat vesicles. The red corpuscles had broken down into granular débris, and there seemed to be more nucleated red cells than the smears had indicated. Myelocytes were numerous, and in other respects the smears were confirmed. No giant cells were seen.

Liver.—The central portions of the lobules showed fatty necrosis, the peripheral and intermediate zones cloudy swelling only. There was little infiltration, but slight sclerosis in the portal canals. The bulk of the organ consisted of columns of liver cells separated from one another by red corpuscles in various stages of disintegration; amongst them were many nucleated red cells, some myelocytes, chiefly eosinophile, eosinophile leucocytes, and myeloblasts. The red corpuscles were best preserved towards the centre of the lobule, becoming more and more fragmented towards the periphery; at the extreme periphery they had disappeared, but the liver cells in this situation contained much golden-brown pigment. This pigment was less marked in the intermediate zone and absent in the centre of the lobule. Appropriately treated sections confirmed this distribution and showed the corresponding liver cells to be crowded with dark blue granules. The blood-vessels showed the usual degenerative change, and there were frequently small extravasations in their vicinity; the capillaries, when visible, were distended with blood cells. Actual phagocytosis of red corpuscles was not observed, but phagocytic cells containing pigment which gave the iron reaction were fairly plentiful both inside and outside the capillaries.

Spleen.—The organ was crowded with red corpuscles and their débris. The myeloid element predominated amongst the white cells, but in spite of this the Malpighian bodies were fairly well marked. Pigment giving the Prussian blue reaction was rather unequally distributed, but some of it was visible in every field; its situation was extra- as well as intra-cellular. No giant endothelial or marrow cells were seen either in the liver or spleen.

Glands.—The red cervical and prevertebral glands were markedly myeloid and their cell content closely resembled that of the marrow itself. A white mesenteric gland approximated much more closely to the normal, but contained numerous eosinophiles, chiefly mononuclear.

Kidney.—The tubules showed marked cloudy swelling and degeneration; the glomeruli were much less affected. Infiltration was not at all marked. The Prussian-blue reaction was best shown in the débris filling the convoluted tubules, although blue granules were visible in some of the corresponding renal cells. Blue granular detritus was also noticed in many of the Malpighian bodies between the glomerulus and its capsule.

Lung.—Some of the alveoli were filled with transudate, many with red corpuscles and other blood cells, while the residue contained both transudate and blood cells. No normal alveoli were seen. The pancreas and suprarenal showed cloudy swelling and a few small hæmorrhagic extravasations; the section of cardiac muscle examined showed cloudy swelling only.

Remarks.—The diagnosis of leukanæmia was primarily made, so that a few remarks on this subject will not be out of place. Drysdale¹¹ regards the majority reported under this heading as atypical leukæmias, and a small minority, including Leube's, as cases of Addisonian or of secondary anæmia. Melland,¹² who has reported a case more recently, is in substantial agreement with him, and the one under consideration confirms the correctness of their views. On the other hand, Bushnell¹³ is of the opinion that the term "leukæmia" is not sufficiently comprehensive in that the anæmia is markedly of the pernicious type, while the leukæmia *per se* is minimal. Against this it may be urged that in most cases of leukæmia the presence of nucleated red cells in the peripheral blood is an integral part of the disease, and the

present atypical case serves to emphasise this fact and to show that the "red cell series" may be definitely and perhaps even primarily involved in the processes which underlie the production of the leukæmic state. In the absence of any definite etiological knowledge it would therefore seem better to try and maintain a rigid distinction between atypical leukæmia and Addisonian anæmia. The word "leukanæmia" might perhaps be retained in so far as it facilitates reference to the literature of these seemingly borderland cases, but on no other grounds.

I have to thank Dr. Seymour Taylor for permission to report the case. I am also indebted to Dr. C. Clarke, Dr. R. Elworthy, Dr. R. Hutchison, Dr. A. C. Inman, Dr. P. N. Panton, and Dr. F. Parkes Weber for assistance on various points.

ON THE ALLEGED DIAGNOSTIC VALUE OF THE PROVOCATIVE INJECTION OF OLD TUBERCULIN IN SUSPECTED "CLOSED PULMONARY TUBERCULOSIS."

BY E. E. A. T. RIGG, M.B., B.S. LOND., M.R.C.S. ENG.,
L.R.C.P. LOND.,

LATE HOUSE PHYSICIAN TO THE BROMPTON HOSPITAL FOR CONSUMPTION AND DISEASES OF THE CHEST.

THIS investigation was carried out because so many cases are admitted to the hospital who present some symptoms or signs which have been deemed to be suspiciously like those met with in "early" cases of pulmonary tuberculosis. There was no point in submitting to the test those cases who expectorated tubercle bacilli except as a means of control. Though it is a matter of great doubt that cases should be called "early" so far as the term means the "early" stage of the deposit of tubercles in the lungs as opposed to what is more probable, the "early" manifestations of pulmonary disease which has been present for, may be, years in the lungs, in deference to the prevalent view, that when cases present slight signs of disease they are more likely to be "cured," evidence has been sought to establish the value or the reverse of an appeal to the use of provocative doses of old tuberculin. Up to the present time doubtful cases have been kept in the wards until repeated examinations of the sputum, provoked or not by means of potassium iodide, failed to establish evidence of pulmonary tuberculosis. If tubercle bacilli were never shown to be present in the sputum, time was allowed to elapse during which signs or symptoms disappeared, and then the patients were discharged as "unproven" so far as the existence of pulmonary tuberculosis was concerned. This has entailed a considerable drain on the beds available in the hospital for the treatment of established tuberculous disease.

Mechanism of the reaction.—Before entering upon the details of the tests, &c., it is necessary to express in terms which are familiar to the students of immunity and anaphylactic reactions the processes by which presumably any positive results could be brought about. This involves a consideration of the three forms of receptors which have been invoked by Ehrlich and his school. The receptors involved in the test belong to what Ehrlich speaks of as receptors of the third order—i.e., amboceptors which, on the one hand, are capable of attaching to themselves complement, and, on the other, tuberculin. These amboceptors are supposed to possess a special "ferment" action which brings them somewhat into line with Ehrlich's second order of receptors which include agglutinins and precipitins. Ehrlich's simple or first order of receptors do not in any way enter into the reaction. It must further be supposed that the amboceptors entering into this test remain "sessile," that is, remain attached to the cells from which they develop; they may also become "free," a supposition which must be accepted in order to explain some anomalies to which attention will be called later. The cells in the immediate neighbourhood of a tuberculous focus, say in the lungs, must be looked upon as being the ones which are most richly endowed with the above "sessile" receptors, and the theory of a tuberculin reaction requires the belief that when tuberculin is injected into the

¹¹ Drysdale: Quarterly Journal of Medicine, Oxford, 1907, vol. i. p. 89.

¹² Melland: Ibid., 1909, vol. iii., p. 1.

¹³ Bushnell: Liverpool Medico-Chirurgical Journal, 1908, vol. xxviii., p. 415.