15 to 16. In boys the flattening starts at 10½ and continues to about 13½, but the rise to 15 to 16 is quite striking. In girls there is a flattening from 9½ to 10½, and again at 12½, but the late rise is not so marked, though sufficiently obvious. The influence of puberty on the slowing-down periods is, of course, purely inferential, but it is at least suggestive; while the continued rise—which appears to go on after the child leaves the school, since the number of successes exceeded expectation—may be due to a variety of causes. It may be that in the later years of training more attention is paid to manipulative work, and that this develops an inherent power for such performances, which has not previously been given a chance, and so gives more opportunity for the reception of stimuli and arousing of interest necessary to convert neuroblasts to neurones. It must be remembered, however, that the Terman tests are by no means purely intellectual in their scope, and should record capacity for manipulative and intellectual advance apart from achievement, though unless neuroblasts have been converted capacity will remain undiscoverable. On the other hand, the continuance of progress is in accordance with the finding of a previous investigation we made into children of slight degrees of backwardness. This showed that while many of these children failed to adjust to the requirements of life during the school period, they made remarkably good adjustments later on in late adolescence and early adult life. The 15 and 16 year olds may be approaching this period of more successful adjustment, and therefore make a better showing in their tests than might have been expected from the common supposition that mental defectives stop short in their development. The following tables show the findings at the various ages exclusive of the imbeciles.

TABLE I.—Boys and Girls together (82 Children).

Age Groups:	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15+
Highest I.Q. found	80	73	82	77	74	71	70	66	62
Average mental age	5	5½	6½	6½	6½	7½	7½	7½	8½
Average actual age	7½	8½	9½	10½	11½	12½	13½	14½	15½
Average I.Q. ...	66	63.9	65.2	61.9	59.4	58.0	55.2	55.5	53.4
Lowest I.Q. ...	46	45	50	47	48	44	42	42	41
No. of tests performed	31	32	39	47	42	44	41	43	47
No. of individuals	27	30	39	46	40	43	39	42	42

TABLE II.—Boys.

Age Groups:	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15+
Highest I.Q. found	78	78	82	77	74	71	70	65	61
Average mental age	4½	5½	6½	6½	6½	7½	7½	7½	8½
Average actual age	7½	8½	9½	10½	11½	12½	13½	14½	15½
Average I.Q. ...	64.0	66.6	64.9	63.1	58.7	56.6	55.6	55.5	53.7
Lowest I.Q. ...	46	45	50	47	48	44	42	42	41
No. of tests performed	21	21	25	23	23	22	20	21	22
No. of imbeciles ...	18	20	25	22	22	22	20	20	20

TABLE III.—Girls.

Age Groups:	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15+
Highest I.Q. found	80	72	75	70	70	67	62	66	62
Average mental age	5½	5½	6½	6½	6½	7½	7½	7½	8½
Average actual age	7½	8½	9½	10½	11½	12½	13½	14½	15½
Average I.Q. ...	67.7	67.6	66	61.1	60.1	58.6	54.9	54.6	53.1
Lowest I.Q. ...	57	64	60	52	50	47	46	45	41
No. of tests performed	10	11	14	18	19	22	21	22	25
No. of imbeciles ...	9	10	14	18	18	21	19	22	22

Certain points in addition to the continuance of progress stand out in relation to these tests. The early improvement in capacity after admission to the special school illustrates the necessity of removing backward children from

competition with normal children of their age, since this always causes them to be discouraged and renders them sullen or mischievous. The low correlation with gross physical defect and conduct disorder is of interest in so far as it fits in with proved statistical records, which are, however, often looked on askance by the medical and lay public because they do not conform with certain preconceived ideas. The whole nature and development of mental defectives is interesting in relation to certain physiological experiments on rats. Mental defect is held to be due to a relative absence of the higher level cortical cells—an amentia. The failure is proved on post-mortem examination to be fairly general in distribution throughout the cortex, and is not localized in any one area. Although these cells are not there to develop, and no new cortical neuroblasts are ever laid down after the period of infancy, the capacity of the child does improve, though slowly, provided he rises to a level above the imbecile. The cells that are present must therefore to some extent assume the functions of those which are missing, for even the conversion of all the neuroblasts present is probably not enough. Professor Lashley and his colleagues have shown that it is comparatively easy to teach rats to find their way through a maze; that when various parts of the cortex are destroyed the rats can still be taught to run the maze, but with greater difficulty. They have, moreover, shown that the difficulty depends not on the localization, but on the extent of the injury, and that, so far as the function of maze learning is concerned, it is a property of the cortex as a whole rather than of any particular part, and that the remaining cells are capable of undertaking, at any rate to some extent, the functions of those which have been destroyed. The analogy between the history of mental defectives and the rats of Lashley's experiments is very striking.

The extent to which it is worth while expending money on the teaching and training of mental defectives is a question which is likely to give rise to a considerable amount of controversy, but the fact that 42 per cent. of the children trained in this particular special school were able to find work, and that only 23 per cent. had to be placed in institutions, is at least encouraging; but even so, there can be little doubt that the colony system on a large scale is the optimum method of dealing with certifiable mental defect in the bulk.

SEPTICAEMIA AND ENCEPHALITIS IN RELATION TO VACCINATION..

BY

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ANYONE who has followed at all closely the history of post-vaccinal fatalities must have been struck by the fact that, until recently, these patients, as a general rule, died from septicaemia, whereas now they die from encephalitis. Much more research than that which has been published is required to determine whether any causal relation exists between vaccination and the encephalitis reported as occurring in such cases, and, if so, what is the nature of such relation.

Of the sixty-two post-vaccinal cases of acute nervous diseases considered by the Ministry of Health Committee in 1925, only six were submitted to post-mortem examination and studied histologically. Meagre details were forthcoming in the majority of cases, and in no case was a blood culture performed either before or after death. It is not surprising, therefore, that the majority of the committee referred to hesitated to find proof of any direct causal relationship between vaccination and the deaths following shortly thereafter. In a minority report, however, the opinion was expressed that there was such a relationship. The medical profession would appear to have ignored the majority report and to have accepted the minority report, for this is the only explanation we can

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find of the curious fact that all such deaths are now reported as "post-vaccinal encephalitis."

Such a case came before us recently when one of us (T. G.) was asked by the coroner for East London (Dr. Guthrie) to make a post-mortem examination on a patient dying in the East London Hospital for Children after vaccination and reported to the medical officer of health as a case of "post-vaccinal encephalitis." The patient was under the immediate charge of the other of us (W. W.), and, in accordance with the usual clinical routine in any case presenting obscure generalized symptoms, a blood culture was made in two broth tubes and on an agar plate, *Staphylococcus aureus* being found in all media. The details are as follows.

A girl, aged 10, was admitted on July 27th, 1929, under Dr. Geoffrey Bourne with a temperature of 103°; she had been vaccinated on July 23rd by the public vaccinator, who used Government lymph, two insertions being made in the left deltoid region. Another child in the family was vaccinated at the same time. The girl seemed to be fit till the evening of July 26th, when she complained of pains in her head and abdomen, followed by two or three attacks of vomiting. She was feverish, but rested well at night. On the morning of July 27th she had a chill and was feverish; she became delirious and very drowsy. The drowsiness persisted all day, and she vomited again. There had been no fits or convulsions, nor any history of recent infectious diseases. She had had measles when 2 years old, and chorea at 5, but she was apparently in good health when vaccinated, and was well nourished.

On examination she was found to be prostrated and semi-conscious, being aroused with difficulty; there was no rash or eruption, except a small, reddened, indurated area over the right tibia. Her colour was good; the respiratory rate was somewhat increased, but there were no rhonchi. The breath was foul, with no odour of acetone; there was marked trismus, and the pharynx was seen with difficulty. The air entry was slightly lessened over the right side of the chest; the percussion note was somewhat flattened, but there were no added sounds. On percussion the cardiac area was found to be normal, and the pulse was thready, 150 to the minute; there was no murmur and no friction rub. The abdomen was soft, and the spleen and liver were not felt. There was no oedema of the extremities, or evidence of paralyses or spasticity. The ear drums were normal, but the pupils were widely dilated, the right reacting to light and accommodation, while the left was fixed; no ptosis was noted, and no facial paralysis, but there was intense papilloedema of the fundi, the disc outlines being very blurred and the vessels greatly engorged. The corneal reflex was intact on both sides. The arm reflexes were normal, but the abdominal reflexes were absent; the knee-jerks were sluggish, there was no ankle clonus, the plantar reflexes were flexor, and the Brudzinski sign was present.

The laboratory findings were as follows:

Blood count: Leucocytes 33,400 per c.mm.; polymorphs 90 per cent.; lymphocytes 9 per cent.; and myelocytes 1 per cent. There were many young polymorphs of the single-lobed variety, with a definite shift to the left in the Arneeth count.

Catheterized urine: Acid reaction; protein 0.5 per cent.; no glucose; trace of ketones; no blood; no deposit.

Lumbar puncture: 10 c.cm. of slightly hazy fluid was withdrawn, and no coagulum formed in incubating; the count was 75 cells per c.mm., 90 per cent. of which were lymphocytes; smears showed no tubercle bacilli or other organisms; there was no growth on culture; the protein content was 0.06 per cent., and the chloride content estimated as sodium chloride was 0.64 per cent.

Blood culture: *Staphylococcus aureus* was recovered. The blood urea figure was 80 mg. per 100 c.cm.

The child remained comatose, but the temperature rose to 104–105° F.; the pulse was hardly perceptible, and the reflexes remained unaltered. Milk and sugar solutions given by the nasal tube were all vomited. Clonic convulsions of the arms and legs developed, with considerable opisthotonos and cyanosis, and the child died on July 28th.

At the post-mortem examination the signs of recent vaccination were apparent as two raised papules over the left deltoid; the lesions were clean. The face and neck were flushed, the tongue was furred, and there was early green discoloration of the abdomen. The middle and lowest lobes of the right lung were adherent posteriorly and to the diaphragm; all lobes were congested except the upper left one. The heart muscle, liver, and kidneys showed cloudy swelling; and there were numerous vegetations of the mitral valve. A Giemsa-stained film of the heart blood revealed numerous staphylococci. The spleen, which was large and firm, contained several infarcts, and the pancreas was injected. The appendix was bound down behind the caecum, and kinked. The stomach contained a small amount of material indistinguishable from intestinal contents; there had been some retroperistalsis, and a small amount of this material was present in the oesophagus and right bronchus.

The brain surface, which was much engorged, was dotted with

multiple pyaemic abscesses from which staphylococci were isolated. The meninges of the brain and cord were injected, and the cord was somewhat soft. No macroscopic lesions of the brain or cord substance were detected, and there was no disease of the middle or inner ear.

Death in this case was due, then, to septicaemia and pyaemia. It will be seen that the scepticism with which the fashionable diagnosis of "post-vaccinal encephalitis" was approached was amply justified, and but for the inquiry this case would have found its way into the statistics as one of "post-vaccinal encephalitis."

Another case, attributed by the friends and neighbours (but not by any medical practitioner) to vaccination eighty-six days before death, was investigated by one of us (F. G.) for the North-Eastern district coroner (Dr. Edwin Smith). The details are as follows:

A man, aged 20, was vaccinated on May 18th, 1929. He was treated in May and June for a febrile condition beginning two days after vaccination. He was examined by another doctor on July 16th, two teeth having been extracted the previous day; he was diagnosed as having influenza, and was seen frequently till July 30th, when he was admitted to a municipal hospital with a temperature of 101.4°. Swelling and ulceration of the gums was then present, with suppuration round all the teeth; there were enlarged tender glands on both sides of the neck and in both groins. The spleen was large and tender. The temperature fluctuated between 102° and 104°, and no improvement in the mouth condition resulted from conservative treatment. Complete dental extraction was performed under general anaesthesia on August 1st, but no improvement followed, and the patient died on August 12th.

At the post-mortem examination four recent scars were observable in the left deltoid region, presumably due to vaccination. The inguinal glands were enlarged. The mouth was in a septic condition, and the tongue was covered with sordes; the jaws were edentulous (recent extractions), and osteomyelitis was present. Bacteriological examination revealed large numbers of staphylococci and streptococci, besides a few saprophytes. There was an enlarged gland in the right anterior triangle of the neck. Four ounces of blood-stained fluid was found in the peritoneal cavity. The spleen was much enlarged (24 oz.), as were the mediastinal glands; 8 oz. of blood-stained fluid occupied the left pleural sac, and there was 10 oz. in the right, but no pleurisy or chronic pathological process (macroscopic) was detected in the lungs. Some broncho-pneumonia was present, but no oedema of the glottis.

The kidneys showed macroscopic changes suggestive of leukaemia; sections revealed lymphatic leukaemia, as did sections of the spleen, liver, and brain. There was 4 oz. of blood-stained fluid in the pericardial sac; the heart was flabby, and some myocarditis was present; the vessels were healthy except for scattered atheromatous patches about the aortic valves. Microscopic examination of the blood films showed a lymphatic leukaemia and the presence of staphylococci.

Death was apparently due to septicaemia and osteomyelitis in a case of lymphatic leukaemia.

Since by hypothesis septicaemia and pyaemia can hardly be without effect on any and every tissue of the body, it is an extraordinary thing that the histologist has, with rare exceptions, so little to tell us about the state of the brain and spinal cord in these conditions. Diamond¹ stressed the point that in septicaemia one finds no organism in the brain, although histological examination reveals multiple areas of softening due to a toxin reaction, and not to any definite infiltration of the brain by organisms. These changes he likened to those of disseminated sclerosis. But the changes in post-vaccinal encephalitis have been compared with those in disseminated sclerosis (Turnbull and McIntosh²).

On the other hand, although the histology of encephalomyelitis, with its characteristic areas of demyelination, is now on a satisfactory basis, it must constantly be borne in mind that these changes can occur apart altogether from vaccination.³

Conclusions.

1. No condition can be fairly described as encephalitis pure and simple unless septicaemia has been excluded as a possible cause by appropriate bacteriological examinations.

2. All cases of severe illness within three weeks after vaccination should be under hospital treatment, in order that the necessary special examinations may be performed; should death occur, the necropsy should include bacteriological and histological investigation of the other tissues as well as those of the central nervous system.

3. Only when a larger number of cases have been examined in a uniform and careful manner can any conclusions be

safely adopted. Meanwhile, it may be fair to suppose that vaccination can light up a dormant infection such as low grade septicaemia.

4. The comparative immunity of infants to complications after vaccination would appear to be due to the fact that they are hardly likely to be harbouring such an infection. As for the still not uncommon gross infection of the vaccination site, young infants are obviously unable to set up such a condition, since they cannot scratch their own arms.

REFERENCES.

¹ Diamond: *Arch. Neurol. and Psych.*, vol. xx, 111, p. 524; Grinker and Stone: *Ibid.*, p. 244.

² Turnbull and McIntosh: *Journ. Exper. Path.*, 1926, vol. vii, p. 181.

³ Troup and Weston Hurst: *Lancet*, 1930, i, 566.

PRIMARY CARCINOMA OF THE APPENDIX.

BY

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MALIGNANT disease of the appendix is of some special interest, not only by reason of the popular idea as to its rarity, but also because of the histological and other

FIG. 1.—Growth in the appendix.

problems which are concerned. It may therefore be worth while recording a case which illustrates some points of importance in these respects.

A multipara, aged 56, who had lost one sister from carcinoma of the cervix, but whose personal and family history was devoid of tubercle, sought belated advice for colicky pains and distension, variable in relation to meals; the condition was becoming more constant, and never exhibited periodicity. She gave a history of previous indigestion over a period of some years, sometimes interspersed with fairly severe and prolonged colic. Medical advice she eschewed on the representations of officious friends, who feared for her the "way of the knife." Her symptoms gradually became more severe, and the supervention of some wasting and occasional bouts of vomiting made a consultation imperative. She was constipated; she never at any time suffered from alternating diarrhoea, nor was there ever any declared blood in her stools.

Physical Examination.—The woman was pale and cachectic, and there was loss of dermal elasticity. Her regular pulse of 90 was of a sinister softness in quality. No chest lesion was detectable. The upper abdomen showed a little fullness, and peristalsis could just faintly be discerned. Liver dullness was normal, and no splenic enlargement could be made out. It was observed that while no caput medusae was in evidence, the protruding umbilicus, quite small, had a nodular cartilaginous feel. In the right iliac fossa there was an indefinite hard mass, freely movable through a small arc of a circle centred at the umbilicus, though not along its radius. The swelling, about the size of an orange, presented

no graded upward margin, as in ileo-caecal tuberculosis, and it appeared to be of uniform consistency. Pelvic examination shed no further light, nor was there any enlargement of the ovaries. Owing to temporary disorganization of plant, and the comparative urgency of the case, radiography was dispensed with. The diagnosis, indeed, seemed clearly to be adeno-carcinoma of the caecum, or possibly the formative type of ileo-caecal tuberculosis, either alternative offering a reasonable hope from surgical intervention.

Operation.—A low paramedian coeliotomy was performed, and a little free fluid escaped. The most striking feature was a hardened nodular cake-like mass, consisting of omentum, obviously infiltrated with growth, and receiving at the umbilicus a small but firm attachment to the anterior abdominal wall. From this region it was carried downwards to adhere to, to cross superficially, and to kink, almost to the occlusion of its lumen, the lower four inches of the ileum. From here it proceeded to the appendix, which in part it clothed, and to which it firmly, but sparingly adhered. The appendix, twisted upon itself, presented three ovoid swellings, cartilaginous to the feel, measuring 1 by 1.5 cm., serially arranged in apposition like a string of beads. The mesentery of the appendix was short, thick, and infiltrated with excess of fat. The appendicular lymph nodes were not enlarged, nor indeed was there any evidence anywhere in the abdomen of glandular involvement, save in the portal fissure, and here it formed a noteworthy feature. The serous coat of the appendix was much thickened, but retained its sheen, and was typically pearly. Macroscopically there was no involvement of the caecum, which was connected to the oval masses by a short length of apparently normal appendix. Systematic and meticulous

FIG. 2.—Growth in the great omentum.

scrutiny excluded all other of the abdominal contents than the appendix as the *fons et origo* of the primary neoplasm. The precarious state of the patient, no less than the infiltration of the whole of the great omentum and the involvement of the lymph nodes in the portal fissure (a seeming anomaly), precluded further surgical procedure than the removal, *secundum artem*, of the appendix and the freeing from its omental embarrassment of the involved segment of the ileum.

Morbid Histology.—For the following pathological report on the condition of the appendix and the omentum we are indebted to Dr. Arthur Sladden, director of pathology at Swansea Hospital: "Sections of the appendix show the presence of a growth of the adeno-carcinomatous type infiltrating the whole of the submucous coat. The cells are regular, uniform, and cubical. The portion of omentum submitted for examination exhibits diffuse infiltration with a neoplasm whose cells are of the same general type."

The appendicular neoplasm is generally looked upon as a rare condition. The Mayo Clinic papers, however, place its incidence at 1 in 225 of all cases of appendicitis necessitating operation. Although this figure would seem a little pessimistic, and perhaps not quite in accord with common experience, the growth cannot be so uncommon as one might suppose. Many more examples would undoubtedly be revealed if all appendices removed were submitted to histological investigation.

Much controversy has centred in the phylogeny of the yellow tumour of the appendix, with its characteristic ring