vaccinia, measles, varicella, and typhoid)—the occurrence in the central nervous system of perivascular zones of demyelination together with some degree of perivascular cuffing—that is, infiltration of the adventitial lymphatics with cells of the lymphocyte class. Moreover, should this same microscopical picture, so highly characteristic of the condition known as acute disseminated encephalomyelitis (Westphal), be constantly present in cases of paralytic accident, then antirabic treatment must necessarily be added to the somewhat heterogeneous group of factors (small-pox, vaccinia, measles, etc.) capable of producing that condition. Indeed, its inclusion within the group has already been suggested by Perdrau (1928), Greenfield (1930), and Marsden and Hurst (1932).

It is not our intention to give here any detailed account of the histology of the two fatal cases in our present series. For the sake of completeness, however, permission to include a summary of the principal findings has been secured from Professor S. Getzowa, formerly of the University of Bern, who has aided us in our recent investigations and in collaboration with whom we hope shortly to publish elsewhere a contribution to the histology of Landry's paralysis. In the nerve centres the brunt of the attack was borne by the ganglion cells, in which, varying with the region examined, all stages of degeneration were observed, from slight chromatolysis to nucleolysis and complete necrosis. Periganglionic and perivascular cell infiltrations did not occur, and perivascular zones of demyelination were wholly absent. Axis cylinders and myeline sheaths were everywhere unaffected. Neuroglia was not increased. Fat stains proved negative, but in Case II, in certain areas above the medulla, a fatty degeneration, strictly limited to the walls of the vessels, was not infrequently observed. The small vessels of the central nervous system showed little or no narrowing of lumen or thickening of the walls; they were, however, much congested, and haemorrhages were not infrequent. The condition was essentially an intoxication in contradistinction to an inflammation. In the spinal ganglia the capsule showed cellular proliferation; most of the nerve cells here had undergone necrosis, and several had been replaced, in whole or in part, by endothelial cells.

AETIOLOGY

Remlinger (1927) has already shown it to be unnecessary to seek an explanation of the occurrence of paralytic accidents in fixed virus, street virus, street virus modified by treatment, rabies toxin, enzyme or ferment action, bacterial infection, anaphylaxis, neurotropic virus, or *génie épidémique neurotrope*. Marinesco (1908) attributes these paralyzes to a poison of normal nervous tissue, and we (1928, 1930), in support of this cytotoxin theory of origin, have stated that "the cause lies in the antirabic injections themselves, and more specifically in some component of the nerve substance necessarily introduced during the process of immunization." To this view we still adhere although, admittedly, had the histology of our two recent cases proved to be identical with that of the four cases described by previous writers and therefore with that of acute disseminated encephalomyelitis (Westphal) or of acute perivascular myelinoclasia (Marsden and Hurst), we might have thought fit to revise our position and subscribe to arguments favouring an encephalomyelitic virus as *causa causans*.

SUMMARY

1. Paralytic accidents are a rare complication of antirabic treatment, but exhibit a certain periodicity in their occurrence.

2. Since 1928 the condition has been observed in Palestine on five occasions: three patients showing Landry's syndrome have died, two with dorso-myelitis have recovered.

3. Incidence is now, for the first time, recorded among members of the age group 0-5 years.

4. The proportion of cases to the number of treated persons varies according to method of vaccination employed. In this connexion, statistics have proved the superiority of carbolized vaccines over all others, but now the safeguards thereby afforded are shown to be far from absolute.

5. The histopathology now described does not agree with that previously published. In our cases the microscopical appearances of brain and spinal cord revealed little more than varying degrees of degenerative change in the nerve cells, together with considerable vascular congestion and occasional haemorrhage. Evidence of perivascular demyelination or of perivascular cuffing was altogether wanting and, therefore, the type of paralytic accident represented by the cases under review cannot, on histological grounds, be included among the group of diseases termed "acute disseminated encephalomyelitis" or "acute perivascular myelinoclasia." Further, the absence of Negri bodies and of perivascular and periganglionic infiltrations differentiates the condition from rabies.

6. A cytotoxin, rather than a virus theory of origin, is again advanced. Thus, in the basic nerve substance of all antirabic vaccines there seems to exist some deleterious component which, though adversely affected by various physical and chemical agencies, is still capable, in peculiarly susceptible individuals, of producing neuro-paralytic disorders.

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THE WORKING CAPACITY OF THE CONSUMPTIVE

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It is not often that tuberculosis workers are in a position to correlate clinical findings, sociological environment, and precise economic status in patients under their care in the exact way in which this is possible in a village settlement for the tuberculous. At Preston Hall there are just over 150 settlers—all ex-patients—living in the village and employed in the different industries attached to the sanatorium section. From this number ten men have been selected for the purpose of this note. I believe that a detailed statement of the known working capacity of a selected group of patients with positive sputum may interest those who so frequently, and often with good cause, cast doubts on the ability of the patient with relatively advanced pulmonary tuberculosis to earn his livelihood.

CASE I

The patient, a male aged 36, left school at the age of 14, and served for seven years in the machine-tool trade. In 1917 he joined the Flying Corps, but after eleven

months was transferred to the infantry and sent to Ireland, where, after three months' residence, he had a haemoptysis and went to hospital for three weeks. Pulmonary tuberculosis was not diagnosed then, but the patient was transferred to the R.A.S.C., where he remained until demobilized in October, 1919. He then returned to his former work, and remained well until 1921, when cough and sputum developed; in August, 1921, there was a repetition of the haemoptysis, and tuberculosis was then diagnosed. The sputum was found to be positive.

He spent six weeks at Brompton Hospital and nine weeks at Frimley. His powers of resistance have from the beginning been good, for during the time he was under treatment at home he gained nearly 3 st. in weight. From October, 1923, to October, 1925, he worked as a mechanical inspector of aeroplane engines, but the strain of the work told on him, and in March, 1926, he was forced to return for sanatorium treatment. He was admitted to Preston Hall in March, 1926, and was sent to the printing department, where, after twelve months' training, he became an excellent compositor. In September, 1927, he was admitted to the village settlement and given a wage as a compositor. His general condition has remained excellent for the past five years, and except for a short period of two weeks in September, 1930, when he had an elevation of temperature accompanied by pain in the left side, he has kept regularly at work. The sputum was negative between 1927 and 1930, but it has been positive since. His weight is well maintained.

Socially this patient leads a steady, sober life, and is an ideal type of settler in every respect. Quite recently he lost his wife as the result of a fatal motor accident. He has had four children, one of whom died before the patient came here as a settler; a second died of acute bronchopneumonia during the summer of 1928; a third child—a baby of 1 year—was involved in the recent accident in which the patient lost his wife, but this child has recovered and is well. The fourth member of the family is a boy, aged 12, who is quite well.

Since September, 1927, the patient has earned £665 15s. 10d. in wages—that is, an average yearly income of £133 3s. 2d. The average number of days of absenteeism per annum is seven.

Physical Signs

There is tuberculous infiltration over the whole of the right upper lobe, with scattered deposits over the right middle and lower lobes. There is evidence of cavitation at the right apex, and some drawing of the trachea to the right. X-ray photograph showed focal deposits in the left lung, and these radiological signs are confirmed by physical examination of the chest, which shows definite dullness over the right side of the chest and moist sounds at the right apex posteriorly.

CASE II

This man, aged 47, was a clerk before joining the Army in 1916, when he was drafted to Salonica. In May, 1917, he developed cough, and showed evidences of haemoptysis: tuberculosis was diagnosed. He was sent home and ultimately discharged from the Army with pulmonary tuberculosis, with a 100 per cent. pension. On leaving the Army he received sanatorium treatment until September, 1918, when he took up an insurance agency and kept going for two years in this occupation. At the end of 1920, however, he broke down again, and between that date and September, 1930—that is, a period of nearly ten years—he had various short spells of sanatorium treatment, interspersed with casual work as a clerk with different organizations. In August, 1931, he was discharged from Preston Hall and admitted to the village settlement, where he has been working in the manufacture of travelling goods and acting as storekeeper. He is a 100 per cent. pensioner for life.

He is living in the village as a single settler, and socially has looked after himself fairly well. His total earnings over a period of fourteen months have been £126 9s. 4d.—that is, at the rate of £117 2s. a year; and his average yearly absenteeism works out at eighteen days.

Physical Signs

There is definite pulmonary infiltration over both upper lobes, with heavy root shadows. There are some scattered nodules in the right lower lobe, shown by x-ray examination. On auscultation some crepitations are to be heard over both apices and between the scapulae posteriorly. Neither the physical signs nor the x-ray picture have varied much during the past two years. The sputum has been positive at intervals since his coming here, and there has been no substantial reduction in weight, the maximum being 8 st. 9 lb., and the lowest recorded weight 8 st. 4 lb.

CASE III

This patient, aged 37, served in the Navy and had a good athletic record. In 1920 he complained of frequent colds, accompanied by cough and sputum, and in April, 1921, sputum was bloodstained for the first time. Pulmonary tuberculosis was diagnosed in May, 1921, and the sputum was then positive. He was discharged from the Navy with a 100 per cent. pension for pulmonary tuberculosis. In May, 1922, he came to Preston Hall, and received some training in horticulture. In December, 1922, he coughed up about two pints of blood. At intervals between January, 1923, and August, 1925, he had three relapses, with periods of incapacity ranging from one to two months at a time.

Towards the end of 1926 he was introduced into the printing department at Preston Hall, and was so apt that he became in charge of the machine-room and the warehouse section of that department. Despite the relative frequency of relapses, the patient's weight has not varied more than 12 lb. in eleven years. The sputum has been consistently positive. The man is married and has one child—a healthy girl of 16 years. His social life is limited to the confines of his own house almost entirely. He is a keen student of his work, and takes the greatest care of his physical condition.

Since April 1st, 1925, this man has earned £738 11s. 9d. in wages—that is, an average of £98 9s. 9d. a year. In addition to this, of course, he has his pension. The average number of days per annum which he has lost from employment as a result of ill-health is ninety-nine. This patient represents, physically, one of the most seriously handicapped settlers in the village.

Physical Signs

The disease is apparently only very slowly progressive. The chest is flat, but moderately well covered. There is hollowing and flattening below both clavicles, especially in the right side, with marked winging of the right scapula. The air entry over the left upper lobe is deficient in volume, and fine crepitations are heard over the right upper lobe in front. There is distinct bronchial breathing and whispering pectoriloquy at the right apex posteriorly, and at both bases some crepitations are heard from time to time. The most recent development has been an extension of the lesion in the right lower lobe.

CASE IV

The patient, aged 34, worked as a warehouseman until joining the Army in 1916. He served in France and was wounded behind the left ear, but not seriously. In 1919 he was discharged under category B3. Early in 1920 he developed pneumonia and pleurisy, and this illness was the beginning of chest symptoms which continued until 1928, during which time he had been working fairly regularly as a carman. Tubercle bacilli were then found in the sputum, and he was sent to a sanatorium for seven months. The history between 1928 and August, 1929, shows that various attempts were made to resume work, but in each case his health broke down, and he was admitted to Preston Hall in August, 1929. Sputum has been consistently positive until January, 1931, when it became negative for the first time. The two most recent examinations have shown a negative sputum.

He has earned altogether £131 6s. in wages, being one of the lowest-paid men in the industries—that is, an average of £75 0s. 8d. a year. He has lived rent-free,

on account of his poor earning capacity. Absenteeism has been seventy-eight days per annum.

There are four children in the family, and all are badly nourished and share in the domestic difficulties. One child has a definite and persistent deposit in one lung, but she is symptomless, although the Mantoux test is consistently positive.

Physical Signs

Clinical and x-ray examination indicates widespread tuberculous disease over both sides of the chest, more marked on the right. The patient's physical condition is poor. He is working as handyman in the portable building section of Preston Hall Industries, and is able to undertake a number of jobs more suitable to the unskilled workman. Socially he is from a lower category, and his domestic sphere is badly administered. He appears to be losing ground, for the lesion on the right side especially is more marked than on admission, but the patient's weight has dropped only 2 lb. in three years and three months.

CASE V

The patient, aged 44, served in the Army as a Regular and became a warrant officer. He had an excellent athletic record. He was stationed at Malta at the outbreak of the war, and contracted malaria in 1917, when he was transferred to Egypt. Chest symptoms were suspected in 1918, but the sputum was negative. Between that time and the summer of 1920 there were recurrent attacks of night sweats, cough, and elevation of temperature. In March, 1922, the sputum was again examined and found positive, and he was discharged from the Army with pulmonary tuberculosis, receiving a pension of 100 per cent.

Between 1922 and February, 1928, he had four periods of sanatorium treatment, but no permanent benefit accrued. He was admitted to Preston Hall in February, 1928, and was given light clerical work as occupational therapy. His previous Army experience benefited him considerably, and he was admitted to the settlement on the clerical staff in October, 1929. Apart from slight attacks of haemoptysis he remained fairly fit until September, 1931, when he had a haemoptysis of about one pint. An emergency artificial pneumothorax was induced, and he was off work resting for the greater part of that winter. Since admission to Preston Hall the patient's weight has not varied more than 7 lb.

Socially this patient lives in an excellent environment, and has benefited considerably from both the occupational and the social aspects of settlement life. His total income, apart from his pension, during the time he has been here comes to £324 16s. 4d.—that is, an average of £108 5s. 5d. a year. The average number of days per annum he has been off work is seventy.

Physical Signs

The signs noted in 1928 have not been materially altered. The sputum has, however, always been positive. The left upper lobe bears the brunt of the lesion, which is, however, not confined to the left side, there being considerable fibrosis on the right. Moist sounds are audible at both apices.

CASE VI

The patient, aged 30, joined the Navy as a boy, and served regularly until 1918, when he developed pneumonia and pleurisy. He was discharged in 1918 with pulmonary fibrosis, and returned to his home and began work as a farm labourer. During this time, however, he was troubled constantly with cough and sputum, and pulmonary tuberculosis was diagnosed definitely in 1923. In July, 1926, he came to Preston Hall, and became interested in the printing department, where he took up work in the composing room. So satisfactory was his progress in this direction, both medical and technical, that he was drafted into the village settlement in June, 1927. His sputum was then negative. In December, 1929, he had a haemoptysis amounting to some four or five ounces, and was given sanatorium treatment at Preston Hall until March, 1930. In the spring of 1931

he had a recurrence of the haemoptysis, but this subsided after some eight weeks' rest in bed. On admission to Preston Hall in 1926 the patient's weight was 10 st. 12 lb.; he now scales 11 st. 4½ lb.

This man is married and has one child, who is in excellent health. His wife had pulmonary tuberculosis and was notified in 1925, before coming to Preston Hall. Her sputum has been positive. Under the conditions at Preston Hall she has remained in reasonably good health for five years. The daughter, aged 11, has a positive Mantoux reaction, but no abnormal radiological signs in the chest are to be observed. Socially this man is well-behaved and has high ideals.

During the past two and a half years he has earned £300 13s. 9d. in wages—that is, an average of £120 5s. 6d. a year—and the average number of days per annum absent from duty is 60.8.

Physical Signs

The lesion involves the greater part of the left lung with cavity formation, and there is definite infiltration at the left apex.

CASE VII

The patient, aged 34, worked as an engineer until he joined the Army in 1914. He developed pleurisy with effusion in 1916, and following that had a persistent cough. Despite this, however, he served over-seas until the time of his discharge in March, 1919. In July of the same year he had a haemoptysis of about four ounces, and was treated at Brompton Hospital and later in a sanatorium. He was given a pension for pulmonary tuberculosis and did no work until 1922, when he started farm work. This he continued for three months only, when he had a recurrence of haemoptysis, and further sanatorium treatment was given at Preston Hall in 1922.

Between that time and Christmas, 1925, he worked intermittently at pig farming and as a carman. In August, 1926, however, he fell ill again, and was readmitted to Preston Hall, where his sputum was found to be positive. He did well under treatment, and in January, 1928, was admitted to the settlement, where he has worked on the rabbit farm and in the fibre department, and latterly as assistant in the laboratory. The sputum has been positive at intervals since he came to Preston Hall.

Socially he leads a good life, and takes great care of himself. His total earnings since coming here are £557 16s. 6d.—a yearly average of £117 18s. 6d. He has been off duty, on an average, only 3.6 days a year.

Physical Signs

There is tuberculous infiltration over both upper lobes, with evidence of fibrosis most marked on the right side. There are several calcareous nodules to be found on both sides of the chest, particularly the right. His chest condition is well maintained, and his weight has not altered more than 2½ lb. in five years. Apart from some morning cough he complains of very little. No moist sounds are to be heard in the chest. His progress is in every way satisfactory.

CASE VIII

This man, aged 28, is a post-war case of pulmonary tuberculosis. As a youth he was a machine minder in a printing shop in London, but in 1921 he joined the Army, and after serving for five years developed symptoms of pulmonary tuberculosis; tubercle bacilli were found in the sputum, and he was discharged from the Army.

After a period of six weeks at a sanatorium on the South Coast he resumed work in the printing industry, and carried on until 1929, when he was readmitted to an institution under the London County Council for three months. From the time of his discharge until April, 1931, he worked fairly regularly, but was then sent to Preston Hall, when the sputum was found to be still positive. He made immediate improvement, and it was found possible to admit him to the village settlement in July of the same year on account of his high technical abilities. He is now working in the printing department, at his old trade, but, of course, under entirely different hygienic conditions.

An interesting point in this case is that the two most recent examinations of the sputum have shown negative results.

He is a good type of settler, well-behaved, and a conscientious worker. His earnings since coming on the staff amount to £143 4s. 10d.—that is, at the rate of £115 a year. He has been off, on an average, 25.6 days per annum.

Physical Signs

There is pulmonary infiltration over both apices, with scattered patches over both lungs and some calcareous nodules on either side. The radiological examination shows good movement of the diaphragm on both sides. The patient's weight has varied by only 3 lb. in eighteen months.

CASE IX

This man, aged 39, was a miner in Lancashire, and served four and a half years in the Army during the war. Prior to coming to Preston Hall in October, 1929, he received treatment at two institutions in the North-West of England for a period of eight months in all. There is a strong history of tuberculosis in the family, and the patient has always been subject to so-called bronchitis. During an attack of "influenza" in 1926 tuberculosis was diagnosed and tubercle bacilli were found in the sputum. On discharge from a sanatorium in the North he was unable to find employment suitable to his physical condition, but some weeks after coming as a patient to Preston Hall he was sent to the printing department, where he made excellent progress. In July, 1930, he was admitted to the village settlement, and has become an apt compositor in the printing department. During the winter months he loses some ground, but in the better weather of the summer he makes substantial improvement. The sputum has been consistently positive for five years at least.

His total earnings since admission to the village settlement have been £165 4s. 6d.—that is, an average of £76 5s. 2d. a year—and the average number of days absent from work per annum is thirty-six.

Physical Signs

There is a dullness over the left upper lobe, and impaired resonance at the right apex. Pectoriloquy is heard over the left upper lobe, and fine moist sounds are audible over both apices from time to time. The x-ray picture showed that the lesion was most marked in the left upper lobe; there were diffuse calcareous deposits over the right lung. The patient's weight has not fluctuated more than 3 lb. in five years.

CASE X

This patient, aged 41, had good health as a boy. He joined the Royal Irish Fusiliers in 1899. He was sent to Ostend at the outbreak of the war in 1914, and to the Dardanelles in 1917. He kept fairly well until the latter part of 1917, when he developed pains in the chest and lassitude. While at home in 1918 he reported sick at Chatham, and pulmonary tuberculosis was diagnosed. He was discharged immediately, with a pension for pulmonary tuberculosis due to war service.

Following upon a period of treatment at Brompton Hospital for three months and at Frimley Sanatorium for a further thirteen weeks, he worked in Suffolk as a gardener until 1920, when he had a breakdown and was readmitted to Brompton Hospital prior to coming to Preston Hall in December, 1920. The sputum was then positive. At Preston Hall he was trained in the boot department under the Industrial Settlements Incorporated, but when the British Legion took over in 1925 he was transferred to the appliance department. In 1927 and again in 1930 it was necessary to admit him to hospital, for eight and three weeks respectively, owing to temporary incapacity. Since then, however, he has remained fairly well. His weight has been stationary for five years.

Socially this man leads a quiet and well-ordered life. He has three children, all of whom are well. His total wages since April 1st, 1925, come to £772 5s. 10d., the average earnings being £102 17s. 3d. a year. The rate of absenteeism is forty-nine days a year.

Physical Signs

The lesion in this case is confined to the right upper lobe, with a small patch at the left apex. The right middle and lower lobes and the left lower lobe are comparatively clear, and all the evidence tends to show that the disease in this case is completely arrested.

SUMMARY

Short histories with notes on the physical signs of ten relatively advanced cases of pulmonary tuberculosis are given. The total period of sojourn of all ten cases in the village settlement at Preston Hall is thirty-nine years and two months. The sputum has been positive in all cases, and is still positive in seven.

During the five-year period prior to their admission to the settlement at Preston Hall these men have had, in all, at least 198 months of sanatorium treatment—that is, an average of 120 days per man per annum. Since being admitted to the settlement at the British Legion Village they have earned collectively £3,926 4s. 8d. in wages, or an average of £106 8s. 6d. a year. The average number of days per annum absent from duty from all causes, including tuberculosis, is 44.8. Only two men—Cases V and VIII—are doing work in which they had training before coming to the village settlement.

The cost of treatment, on the basis of 45s. per patient per week, to local authorities for this group during the five-year period prior to their coming to the village settlement is altogether £1,935. During the period under review, however, these ten cases have cost local authorities in sanatorium treatment only £144.

It is submitted, in conclusion, that the results, medical and economic, in these cases are a definite improvement on those which could be obtained in a similar group of patients for whom the special conditions prevailing in a village settlement are not available.

PROGNOSIS IN PULMONARY TUBERCULOSIS

BY

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Prognosis in tuberculosis is fraught with difficulty. One patient, diagnosed early and treated promptly and skilfully under the best conditions, may go steadily downhill, while another makes uninterrupted improvement, despite every unfavourable circumstance. Why does this difference exist? Let us consider the common or ulcerative type of pulmonary tuberculosis, selecting those cases in which the sputum has been found positive—the only unequivocal evidence of the presence of the disease.

In diagnosis, physical examination and x-ray investigation are not enough, valuable as they are. Specific therapy and sanatorium treatment produce the best results in cases of "primary" infection (where natural cure can be expected). The healed lesions of the lungs found at necropsy after death from non-tuberculous causes are attributed to infection of this nature. It will be necessary to define a standard of cure and to describe the results of treatment. The Ministry of Health advises the use of the following terms:

Quiescent.—Cases in which there are no symptoms of tuberculosis and no signs of tuberculous disease except such as are compatible with a completely healed lesion, and in which sputum, if present, is free from tubercle bacilli.

Arrested.—Cases in which the disease has been "quiescent" for a period of at least two years; in non-pulmonary cases if the disease is "quiescent" and there is reason to believe that it is unlikely to recur.

Recovered.—Cases in which arrest of the disease has been maintained for at least three years.