PRELIMINARY ACCOUNT OF THE INFLUENCE OF FATIGUE ON THE STRUCTURE OF THE NERVE-CELLS.¹

BY GUIDO GUERRINI.

THE general symptoms by which fatigue manifests itself are principally of a nervous nature and have been compared by Tissé to a state of hypnotic sub-consciousness. But if we reflect that disorder or alteration of the functional activity of an organ is often the result of an anatomical modification of the substratum we are compelled to suspect that in consequence of fatigue the nervous centres may also show some alteration in their morphological structure. The naked-eye examination of a fatigued brain does not reveal, for the most part, anything remarkable except a certain amount of hyperæmia; microscopical examination has not yet been made, as far as I know, at least by the more recent technical methods. The only researches that have been made relate to the influence of fatigue on the structure of individual ganglia, and of these the most remarkable are those of Hodge,² who observed that the nerve-cells of several ganglia in sparrows, swallows, pigeons, bees, &c., show in the evening, subsequently to the day's work, the following morphological characteristics: diminution of the size of the cells; increase of the pericellular lymphatic space; vacuolisation and chromophobia of the protoplasmic mass; and diminution of the nucleus, which loses its reticulated aspect and displays a conspicuous chromophilia and a dentellated circumference. Hodge is the only investigator who has studied nerve-cells that have been subjected to really physiological fatigue. Other investigators, and they are not few, have on the other hand conducted their observations on cells fatigued by an artificial and especially by an electrical stimulus. In the following researches only a physiological cause of fatigue was employed. I made 12 dogs run, within an apparatus resembling that used by Grandis,³ until they evinced symptoms of very evident fatigue. Afterwards I killed the animals with numerous special precautions and sought for the alterations caused by the excessive work in the structure of the nerve-cells of the cerebral and cerebellar cortex. This method of research enabled me to ascertain the distance covered by each of the dogs before they manifested the above-mentioned symptoms of complete fatigue. This distance was ordinarily between 35 and 98 kilometres—i.e., between 22 and 61 miles. The alterations found in the nerve-cells were as follows: (1) an increase of the pericellular lymphatic space; (2) the presence of leucocytes upon the cell in the pericellular lymphatic space; (3) disorder of the rete achromaticum; (4) decomposition of the pigment masses which were sometimes reduced to an accumulation of small fragments; (5) the presence of vacuoles in the protoplasmic mass; (6) irregularity of the margins of the nucleus; and (7) the presence of vacuoles in the nucleus. These modifications, although they may sometimes show themselves in the normal nerve-cells, were in the above-mentioned fatigued cells undoubtedly a consequence of excessive work. In fact, the more the dog had been fatigued the more profoundly altered the nerve-cells of its cerebral or cerebellar cortex were found to be.

Moreover, all the above-mentioned alterations do not appear simultaneously in the nerve-cells. The two modifications which are the first to show themselves have always been (1) the increase of the pericellular lymphatic space; and (2) the decomposition of the pigment masses. This process of destruction was not always of constant type, because it sometimes began at the circumference, sometimes at the centre of the protoplasmic mass, and sometimes immediately on the nucleus. The first case, however, was always the most frequent.

These are, briefly, the modifications which fatigue produces on the microscopic structure of the nerve-cell, and more evidently in that of the cerebral than in that of the cerebellar

cortex, and most of all in the structure of those nerve-cells which correspond to the motor zones. I will return to this subject as soon as I can publish the results of other and more complete researches which I have recently terminated, and in the meantime I give in this preliminary note the results which I have already obtained.

Pathological Institute of the University of Bologna.

THE CLINICAL CHARACTERS OF THE PLAGUE EPIDEMIC IN INDIA.

BY HAROLD W. BRUCE, M.B., B.S. LOND.,

LATE MEDICAL OFFICER ON PLAGUE DUTY, BOMBAY.

IN view of the invasion of Europe by plague the following account of the clinical aspects of the disease as manifested in the epidemic in India may be of interest.

The most remarkable feature of the epidemic has been the appearance of a variety of plague which has apparently never before been fully recognised. I refer to those cases in which the primary seat of disease is in the lung. Pneumonic plague has constituted about 7 per cent. of the total number of cases and possesses the interest of being an almost invariably fatal disease. While an ordinary case of plague is quite characteristic and could hardly be confounded with any other affection yet the general course of the disease resembles that of other acute fevers which are the result of an intoxication by the poisonous products of micro-organisms. A case of typhus fever or malignant scarlet fever resembles, as far as the general condition of the patient goes, a case of plague. There is the same severe depression of the vital centres with fever and its accompanying symptoms, while each disease has its characteristic features in addition. No doubt in all there is a similar causation—a specific micro-organism. Plague is characterised by the extreme severity of the intoxication. In the present epidemic the mortality has been between 70 and 80 per cent. of all the cases. With regard to the length of the incubation period there is not much certain evidence, except as regards its limit. A detention in quarantine for ten days has been practically always successful in eliminating the infected cases, and that may be regarded as the maximum period. It may be as short as two days. Five or six days is probably the most frequent duration of the period. While no age has been quite exempt, yet the disease has principally attacked young adults. Out of 3570 cases no fewer than 1350, or almost 38 per cent., of the patients were between 20 and 30 years old. From 10 to 20 years and from 30 to 40 years were the periods during which there was the next greatest number of attacks, and, indeed, 80 per cent. of the total cases occurred between the ages of 10 years and 40 years. Little children seldom contracted the disease; only 56 patients were below five years of age, while patients over 50 years of age made up but a little more than 4 per cent. of all the cases.

Bubonic plague.—The onset of the disease is generally rapid, but now and then malaise for a day or two precedes the appearance of severe symptoms. Vomiting is the most common premonitory symptom, a rigor occasionally occurs, and diarrhoea rarely ushers in the disease; but none of these are at all frequent. Headache, sometimes exceedingly severe, is almost constantly present from the outset. There are, however, a few more characteristic symptoms which often first appear at an early stage before the temperature has risen much or before the appearance of a bubo, and the study of these is of the greatest importance, since the earliest possible detection of cases is essential in the treatment of an epidemic the spread of which is effected almost entirely by human agency. Some of these symptoms are very characteristic and their detection, even when little marked, as they generally are during the first few hours of the disease, has often led to a correct diagnosis at this early stage. The facial aspect of the patient and his speech are the most important. The former loses all expression and becomes dull and emotionless; the eyes become listless and the eyelids droop a little. The appearance of the sick man is very like that of a person dulled with alcohol. A look of dread and anxiety has been described, but it is not so common or characteristic. With the change in the patient's expression is often combined an

¹ Vide La Riforma Medica, year xv., No. 101. Palermo, 1899.

² A Microscopical Study of Changes due to Functional Activity in Nerve-cells, Journal of Morphology, vol. vii., p. 15. Boston, 1892.

³ Influenza del lavoro muscolare, del digiuno e della temperatura sulla produzione di acido carbonico e sulla diminuzione in peso dell'organismo, Memorie della Regia Accademia dei Lincei, anno 1888, &c.