below the division of the cord. See Dr. M. Foster's *Textbook of Physiology*, 5th edition, p. 329; Cohnheim's *Lectures on General Pathology*, New Sydenham Society's translation, vol. 1, p. 113; and Vulpian's *Leçons sur l'Appareil Vasomoteur*, Tome 1, p. 284. ⁷ *Op. cit.*, p. 608. ⁸ *Philosophical Transactions*, 1867; *Proc. Roy. Soc.*, 1867. ⁹ One of the aliases for curara or curare. ¹⁰ *Proc. Roy. Soc.*, 1867, p. 393. ¹¹ For an account of the influence of Professor Sanderson's teaching upon subsequent writers on the physiology of asphyxia see my *Essay on Asphyxia (Apnoea)*. ¹² When the chest of an animal is opened immediately after death caused by a sudden deprivation of air the proportion of blood on the right and left side of the heart respectively is about that of 8 to 1, or ounces to drachms. After a prolonged and complicated experiment ending in apnoea, the heart's walls and the arterioles are enfeebled, and the disproportion of blood on the two sides is consequently less. Care must be taken to avoid wounding a large vein in opening the chest. Such a wound would quickly reduce the amount of blood in the right side of the heart, and the previously distended cavities would be found nearly empty. ¹³ *Lancet*, February 17th, 1872, p. 213. ¹⁴ It has been shown in Ludwig's laboratory that the arteries of an organ that has been withdrawn from all nervous influence contract when venous blood flows through them. Cohnheim, *Op. cit.*, p. 112. ¹⁵ The difference between ordinary venous blood and the blood in the veins and the right side of the heart after death from apnoea is that the former contains some oxyhæmoglobin, as shown by the spectroscope, while the latter contains none. ¹⁶ *Op. cit.*, p. 626. ¹⁷ *Proc. Roy. Soc.*, vol. xlv, p. 389. ¹⁸ See Kussmaul and Tenner on Epileptic Convulsions from Hæmorrhage, New Sydenham Society's collected *Monographs and Essays*, p. 236.

A CASE OF "FILARIAL DISEASE" OF THE LYMPHATICS IN WHICH A NUMBER OF ADULT FILARIÆ WERE REMOVED FROM THE ARM.

BY SURGEON-MAJOR J. MAITLAND, M.D.,
General Hospital, Madras.

WITH A DESCRIPTION AND IDENTIFICATION OF THE FILARIÆ
BY PATRICK MANSON, M.D., M.R.C.P., LL.D.

THE following notes of a case of filarial disease are of much interest, and bring to light some new facts regarding the behaviour of these parasites.

T. L., aged 30, a Eurasian, and turner by trade, was admitted into hospital on September 11th, 1893, complaining of pain and swelling of the arm. The patient stated that he had always been in good health until four years previously, when he received a contusion of the left upper arm, which was followed by the formation of an abscess in that part. Since that time he had been subject to slight attacks of fever. The attacks used to come on at night, and last for about twelve hours, and were accompanied by pain running down the spine. They were not severe and never kept him away from work. A week before admission to hospital he received a blow on the left upper arm; not however a severe one. Six days afterwards the arm became swollen and painful.

He was found to be suffering from lymphangitis, affecting the lower part of the inner surface of the left upper arm. The blood examined at night was found to contain embryo filariæ. After suitable treatment the lymphangitis subsided, leaving some thickening extending along the inner side of the arm, from its middle to a point just below the elbow-joint.

As it was thought probable that the lymphangitis had been set up by the presence of filariæ, it was decided to explore the parts in the hopes of discovering and removing the parasite. Chloroform was therefore administered, an incision made and the whole of the thickened tissue removed. The wound healed by primary union, but some thickening formed at its lower extremity. The blood was examined after the operation, and found still to contain embryo filariæ. Eighteen days after the first operation another similar one was performed and the rest of the thickened tissue removed. The second wound supplicated slightly, and was followed by considerable thickening around the cicatrix. The blood still contained young filariæ. The patient was discharged on October 25th, as he was anxious to return to work.

The tissues removed on these two occasions were macerated in a mixture of nitric acid and chlorate of potash, and examined by Dr. Bourne, of the Presidency College, who found

in the lump first removed seven specimens of the adult *filaria sanguinis hominis*, and in the second lump one filaria. Three of these were males and the remainder females. Those first discovered were coiled up together in a mass, and appeared as if lying in a lymphatic channel, but owing to the maceration of the tissues it was difficult to be certain of this.

The operations on this patient were undertaken with the express purpose of removing the parasite, and by this means getting rid of a probable source of further mischief. Although the result shows that all the worms have not been removed, yet the fact that it was possible to diagnose the presence of the parasite and remove a number of them should, I think, encourage us to undertake operations of a similar nature in other cases.

In the *Indian Medical Gazette* of October, 1891, I suggested that operations of a similar nature might be undertaken in cases of lymphangiectasis, and I published the notes of a case in which such an operation had been performed with great benefit to the patient. This patient was cured of the attacks of inflammation to which he had previously been subject, and the embryo filariæ disappeared from his blood. At the time that the case was published, two years and a-half had elapsed since the operation, and the patient remained well, but I have lately heard that although he still remains in comparatively good health, yet a new swelling has developed on the opposite side of his body, and filariæ are again to be found in the blood. Since 1889, ten operations for the removal of lymphangiectasis have been performed in the Madras General Hospital. In some of these cases filariæ were found in the blood, in some they were not found, but all the cases were considered to be of filarial origin. One of these patients returned to hospital two years and a-half after operation suffering from elephantiasis of the leg. In five of the cases the operation has been so recently performed that no opinion can yet be formed as to the result. Unfortunately none of the other cases have been heard of since the operation.

An interesting point in the case just related is the great number of the parasites that were found, and also the fact that they appeared all to be intimately associated with one another. So far as I know, such a large number of these parasites have never before been found in one individual, nor have they been found coiled up together in one mass as a number of these were. This arrangement is, however, found in the cases of other varieties of filariæ, and therefore it is probable that it is not an unusual one in the case of the parasite under discussion. Another point of interest in the case lies in the situation occupied by the worms. There is still some uncertainty as to the exact part of the lymphatic system usually selected by the parasites for their habitation, and whether they remain permanently located in such situation or not. There is, however, strong reason to believe that in the great majority of cases they lodge in the distal lymphatics of the limbs.

The case furnished another proof, if such were wanting, that the lesions produced by the adult parasites themselves are not such as result in elephantiasis and lymphangiectasis. Although this small colony of filariæ had managed to set up local irritation and inflammation of the lymphatics, yet the main circulation of lymph throughout the limb was in no way interfered with.

DESCRIPTION AND IDENTIFICATION OF THE PARASITE BY DR. MANSON.

[Along with the foregoing interesting and important communication, Surgeon-Major Maitland sent two slides containing specimens of the parasites referred to; these were handed to Dr. Manson, who reports as follows]:—

Of the two slides one contains the greater part of two female *filaria bancrofti*; unfortunately the tail end of both worms is missing. The other slide contains three complete male and one complete female *filariæ bancrofti* in a fair state of preservation. The parasites are mounted in balsam which has caused considerable contraction and, here and there, actual shrivelling of the structures; on the whole, however, and by supplementing what is invisible or obscure in one worm by what is distinct in the others, a fairly complete idea of the coarse anatomy of *filaria bancrofti* can be obtained.

A Tail end of male parasite; **B** showing constriction marking union of oesophagus and intestinal canal **C** head of male parasite; **D** from broadest part of female parasite showing double uterine tubes stuffed with ova; **E** tail of female parasite showing termination of intestine, convolutions of ovarian tubules, and position of anus.

It is unnecessary to repeat the description of those points already made out by Cobbold, Lewis, Sibthorpe, and myself; I shall therefore confine myself to supplementing, as far as the specimens permit, these descriptions where defective, or correcting them where they appear to me to be wrong.

resembling a coil of rope in the case of one of the worms, and is provided with two spicules, a long (*a*) and a short (*b*); in all three specimens the spicules do not protrude, but are retracted just inside the cloaca (*c*). Both spicules, but particularly the longer, are divisible into two parts—a basal and

Coils of male *a* *d* male, the former showing the tail. $\times 40$.

The most important feature ascertained by the examination of Dr. Maitland's filariæ is the structure of the caudal end of the male worm (*A*). This, hitherto, has never been seen quite intact. The tail of the male is strongly curved re-

The heads of two males. $\times 40$.

a terminal; the basal portion is manifestly rigid, chitinous in character, reddish-brown in colour, and is thinly dotted over with minute, ill-defined, short, broad-based spines. In the case of the long spicule, and springing abruptly from the

pen-shaped distal end of the broader, darker, coarser base, the organ can be traced backwards as a long, colourless, cylindrical, slightly wavy filament, the free end of which, lying just inside the cloaca, is turned backwards in the case of one of the worms, forming a sort of crook like the handle of a walking stick. The shorter spicule is about the same size at the base as the longer, but its free end is slightly thicker and coarser, and can with difficulty be distinguished from the sheath in which it lies. In the case of the short spicule the chitinous character of the base seems to be extended along the dorsal aspect of the sheath as far as the free end of the organ, which is somewhat sharply turned towards the cloacal orifice by impinging on a sort of chitinous flange or projection. The cloaca terminates in two somewhat protuberant lips, an anterior and a posterior; but I failed to make out distinctly any preanal papillæ. Faint traces of the remains of three pairs of postanal papillæ, which the maceration the specimens were subjected to has rendered indistinct, are possibly faintly discernible. I was able, I thought, to make out in one of the male worms that the junction of œsophagus with intestine is marked by a slight yet distinct constriction (B); possibly this is artificial. In the case of two of the female worms the uterine tubes could be traced forward past the vulva for a considerable distance; the vagina, formed by the union of the uterine tubes, therefore courses backwards to the vulva. I also remarked that although the male worms were quite colourless, the females in all three instances had a distinct brownish tinge.

Owing to the manifest longitudinal shrinkage and inextricable coils of the male worms, it is impossible to give even an approximate estimate of the length of these particular parasites. Allowing for this shrinkage, the following measurements of some of the details may be relied on as being fairly accurate.

	Male. mm.	Female. mm.
Diameter of head (c)	0.035	0.030
Diameter of neck... ..	0.030	0.025
Diameter of body (greatest)	0.100	0.185 (D)
Diameter of body 0.05 mm. from tip of tail	0.030	—
Diameter of body at base of short spicule	0.080	—
Distance from anus to tip of tail, following curve	0.130	0.170 (E)
Distance of vulva from mouth	—	1.200
Length of œsophagus ?	1.000	—
Length of short spicule, following curve	0.200	—
Length of long spicule, following curve... ..	0.600	—
Length of chitinous base of short spicule	0.120	—
Length of chitinous base of long spicule	0.170	—

It is of the utmost importance that the zoological features of these and similar parasites should be accurately made out, as great confusion is apt to arise in so complicated a subject from careless or vague statements. Some time ago Magalhaes gave a very complete and careful description of two mature filariæ—male and female—which had been found in the left ventricle of a child in Rio de Janeiro. Until I examined Dr. Maitland's filariæ I was inclined to believe that the parasites Magalhaes described were the mature *filaria bancrofti*. Now, however, on comparing Maitland's filariæ with the drawings and measurements of Magalhaes's filariæ, I am convinced that the worms are not the same, and that they belong to different species, that of Maitland being *filaria bancrofti*, and that of Magalhaes being quite a new species. In this connection I may mention a circumstance with which I have lately become acquainted, and which may throw some light on Magalhaes's filariæ. In slides of blood which Dr. Newsam, of St. Vincent, West Indies, sent to me some time ago I have in two instances found a number of very minute, sharp-tailed, sheathed, embryo filariæ, which are present in the general circulation both by day and by night, and which, judging from their size and absence of periodicity, are certainly not *filaria nocturna*—the free embryo of *filaria bancrofti*. Considering the geographical proximity of St. Vincent to Rio de Janeiro and the hæmatozoal character of Magalhaes's filaria, it seems not unreasonable to suppose that the latter may be the parental form of these minute St. Vincent filariæ.

It is evident that much work has yet to be devoted to the study of the bloodworms of man before the subject is thoroughly worked out and understood. Already we are partially acquainted with at least four species, possibly five;

observers must therefore exercise great care in arriving at a diagnosis of any bloodworm they may encounter, and must always be alive to the possibility of its being a species other than the common *filaria nocturna*.

ON INFLUENZA, 1893-94.

By SIR PETER EADE, M.D., F.R.C.P.,
Consulting Physician to the Norfolk and Norwich Hospital, etc.

MORTALITY.

DURING the three months ending mid-February, 1894, influenza was again exceedingly prevalent in Norwich and the surrounding districts. After the blizzard of the first week of January, with its attendant and consequent very low temperature, the fatality of the disease suddenly increased, so that in the week following this storm the mortality of Norwich from chest diseases registered as influenza, bronchitis, etc., and, excluding eight cases of ordinary phthisis, amounted to 47 cases. This was at about the ratio of 27 per 1,000, due to this cause. It is notable that these deaths were almost exclusively of either very young, or of elderly or aged persons. The total mortality of Norwich in this week rose to 60 per 1,000; whilst in the following week it amounted to the lesser but still very high number of 42 per 1,000. In the week next succeeding, the mortality fell to the more normal rate of 21 per 1,000.

Our experience of this disease, both in its uncomplicated and complicated forms, has consequently again been very large. And it seems worth while to inquire whether any fresh light has been recently thrown upon it, and also whether we have obtained any fresh information as to the best method of treating or managing it.

SYMPTOMS.

Continued observation has added little to our knowledge of the symptoms. They still are, briefly, sudden sharp fevers, terminating in the simple cases almost abruptly at the end of three or four days, and then a reduction of the temperature to normal, or something below this. But close observation of the thermometric register in acute and especially in prolonged and complicated cases has shown how constantly this temperature runs a very definite cyclical course; how usually it steadily rises after about 8 A.M., and reaches its highest point (varying from two to five degrees above normal) in the afternoon or late evening. It will then constantly remain nearly stationary until about 12 P.M., after which time it begins steadily to fall, reaching its lowest point at 6 or 8 A.M.; in some cases almost punctually at 6; after which it again begins to rise; and it is remarkable that the temperature registered at this early hour will often be 99° to 98°, or even less, even when a rise to 101° to 102°, or more will again take place during the ensuing day or evening. May it not be fairly asked whether this cyclical course does not indicate a fresh multiplication or swarming of the micro-organisms of the disease during the period of the higher temperatures, and a corresponding diminution of the activity of the germ life in the six or eight hours after midnight?

The peculiar brightness of the eyes without suffusion of the conjunctivæ has been constantly present at first in the severer cases; so also has a red suffused condition of the fauces; and very frequently, as observed by Dr. Shelly, a vesicular eruption has been present on the soft palate, followed often by a soft follicular exudation—more often observed on the left side of the palate—and then later on occasionally by a dry desquamation or peeling of the mucous membrane of this part. The tongue in severe cases, and especially in old persons, has often been brown, dry, or almost horny for several days. Eruptions on the skin, erythematous or papular, have been not uncommon; and, as in other years, there has constantly been much general relaxation of the skin, shown by a warm, soft, perspiring (in every degree) condition of this membrane. Albuminuria has also been present in a considerable proportion even of the simple cases, but it appears to have passed away without causing serious special symptoms.

Constipation has often been very marked and troublesome from the first, even in those whose bowels were previously in