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ON FILARIA.

By Dr. Joseph Bancroft, Brisbane.

I am asked by my good friend Professor Allen to contribute to the history of filaria and allied diseases of a parasitic nature in Australia, and I put my hand to paper feeling how imperfect the investigations are, and how much is needed to be searched into, before the various bearings of blood-parasitism, as a cause of disease, can be in any small degree understood.

It will be much easier to indicate the standing timber that may fall as a harvest to the inquiring student, than to expatiate on the limited fields cleared by the pioneers in this branch of knowledge; but sufficient has been done by Lewis and Cobbold, now retired to their rest, by Manson and our South American investigators, still struggling with a difficult problem, to encourage our youthful naturalists to work at the subject of blood-parasitism, not merely as it afflicts the human race, but in the wide field of animal life, as there can be little doubt the more extensively the work is prosecuted, the clearer will be our views as to the measures necessary for human sanitation.

The subject after a time becomes an interesting study, more fascinating, if possible, than diatomes, and is intimately bound up with the welfare of ourselves and our animal friends.

Few things fill the mind with greater surprise than the discovery that the heart of our faithful dog is so filled with worms that his life cannot be expected to last long. On examining a drop of blood of a dog, we can ascertain by the presence of filariæ whether such is the case; and if we find it necessary to sacrifice our servant, we shall discover in the right side of the heart, and in the pulmonary artery, worms from four to ten inches long, more or less, interfering with the circulation of the blood, leading to dyspnœa, fatness and dropsy.

Filariæ, whose embryos float in the blood, may in all cases require the intervention of some blood-sucking creature to assist in their distribution, mosquito, sand-fly, louse, or flea, all of which will need to be examined.

With regard to the dog, the study of which is very convenient, as he is always at hand, much information has yet to be got. Some years ago, I found the louse of the dog with its meal of blood, and in the blood the embryos of Filaria immitis. This information was communicated to the Queckett Microscopic Club by Dr. Cobbold in February 1880. Dr. Prospero Sonsino, of Pisa, whose researches on blood-parasites in Egypt are so well known, in a recent letter reminds me of the communication, and is anxious to gain any further information obtainable in our country with regard to this filaria.

The dipteron Stomoxys calcitrans also absorbs with the dog's blood the embryo worms. Of these, I once counted fifty-nine in one insect.

The stomoxys-fly, distended with blood, it is not difficult to capture on sunny walls. It may be distinguished from the common house-fly by the set of its wings, more divergent posteriorly, and lying with their tips resting on the wall. When captured, the sharp penetrating beak at once confirms its generic title.

These flies are a great annoyance to horses in summer, gorging themselves with their blood, but I never found filariæ taken up, except in the instance referred to, and then I had seen the fly feed on the dog. Dogs clean themselves of fleas and lice by biting, and so probably acquire the parasite; they frequently also snap at flies. Feeding experiments with various insects, containing blood, are however wanting, to trace the life history of the parasite; and from careful scrutiny, knowledge may be gained that would be of the greatest help in understanding what is wanted to arrive at the history of the human filaria.

The embryo of F. immitis has no sheath, and is more active than the embryo of F. sanguinis hominis.

In dissecting dogs known to have embryos in their blood, the portal circulation should be searched, in case the parent worms, not being found in the heart, are obstructed in their progress by the capillaries of the liver. When F. immitis is extracted from the heart, and placed in a vessel of blood or blood-serum, it writhes about with a slow motion, and as the coils rise above the level of the liquid, they appear pure white, as if greasy. A dead or injured worm rapidly becomes stained red. The worms have much rigidity while alive, and at times cause the death of their bearer, by rupture of the ventricle when hunting. There is no history of the filaria of the dog living in the human subject.

I have examined the blood of many dogs belonging to the aborigines of this colony, but failed to find the parasite.* It has yet to be determined if the embryos of F. immitis observe the periodicity in activity, shown by Manson to obtain in F. sanguinis hominis.

In the sheaths of the tendons and bursæ, about the knee joint of the great kangaroo, there are often found worms as large as those in the dog, but not of such rigid texture. They are easily seen when the hind-quarters are skinned. The embryos of this worm never, so far as I have examined, enter the blood-vessels, but are plentiful in the synovial secretions of the bursæ inhabited. How the embryos are transferred from their resting place is not known ; but I would expect that the mosquito, probably the large grey sort, has the power of penetrating into the bursæ with its piercer. The ease with which the mosquito penetrates our trousers when tight over the knee, would indicate the possibility of this being the case, as the kangaroo sits with the integuments tense over the knee joint. The parasitic fly, that lives among the hair of the kangaroo, may play some part in the life history of this worm. None of the smaller species of kangaroo in this neighbourhood have any worms near the knee.

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* Since found in the blood of blackfellows' dogs, June 1889.

I have often heard it mentioned that fishes in some parts of Australia have worms in their flesh, and that after cutting a fish in pieces, and leaving them on a plate all night, the worms may be found crept out of the muscles in the morning. I have not seen an instance of this parasite, but am told that fresh-water fishes near Melbourne are so affected. Some student at your University might undertake the inquiry.

The resting place of the mature filaria in the human body is hard to determine. It is found in the lymphatics of the arm; there, dying probably from bruises or the excessive muscular action of the labourer, it forms an abscess, the structure involved becoming brawny and tumid. Rigors mostly occur. If the abscess is opened early, the parasite may be perceived, more or less broken and undergoing disintegration; the embryos, also dead, escaping from the ruptured ovarian tubes.

The particulars of the discovery of the first parent filaria sanguinis hominis, were published in the Proceedings of the Pathological Society of London, in Vol. 29, A.D. 1878, but as access to this work is not easy, I will repeat briefly some of the circumstances.

In this colony, the embryo worms in the blood were first found in Ipswich by the late Dr. Thomas Rowlands, by following the researches of Lewis, of Calcutta. Dr. Jno. Mullen was the first practitioner to discover a case of chyluria in Brisbane. A case of chyluria happened to be under my care when Dr. Rowlands informed me of the observations of Lewis. This was in December 1874. A few days later I observed the parasite in my patient's blood. Specimens in blood and in glycerine were sent to Dr. William Roberts of Manchester, in 1874, and subsequently in 1875, with a request to interest Dr. Cobbold in the inquiry. Dr. Cobbold examined the tubes of blood in May 1876, and published this statement:—"There cannot, I think, be much doubt as to the identity of all these sexually immature nematoids."—See *British Medical Journal*, June 24, 1876.

I received this on September 28th, 1876.

Then there must be a parent worm to be found, but where? Reading up the history of filaria medinensis, of which I had no practical acquaintance, it is recorded that Guinea-worms, when not extracted with care, form abscesses. I had by this time found several cases of filaria disease, and had gathered some record of those patients suffering from abscesses. I resolved therefore, on receipt of Dr. Cobbold's communication, to carefully examine all abscesses my patients might have. This I did, without finding anything until December 21, 1876, when I opened an abscess in the arm of a youth employed as a butcher. I collected the matter as usual in a small vessel. As a preliminary inquiry, the blood had to be inspected for embryonic filariæ. This was the second case in which the blood contained the parasite

in question, but in the former the abscess, which was an old steatoma, gave negative results. On examining the matter in the present case, a thread-like body came in view. Under the microscope it was without doubt a worm, and embryos were seen coming out of its body.

On March 21, the following year, I tapped a hydrocele, in an elderly patient, with a trochar and canula combined, which I had made by McLennan, our surgical instrument maker. On withdrawing, a lash of hair-like bodies was caught in the eyes of the instrument. At once suspecting their real nature, I put them in the hydrocele fluid, when they began to move about with great activity. Embryos in abundance were found in the hydrocele fluid, and in the patient's blood. My friend, Dr. Mullen, I sent for to see the live worms. I kept them for over a day, during which time they remained entangled. On immersing them in pure water they stretched out and became quiet, on restoring them to the hydrocele fluid they recovered their activity. Uncoiling them in fresh water occupied me over an hour. The specimens were now transmitted to Dr. Cobbold, with a communication, which appeared in the *Lancet* of July 14, 1877, p. 70.

In the *Lancet* of September 29, 1877, Dr. Timothy Lewis records dissecting an elephantoid tumour, removed by Dr. Gayer, on August 7 of the same year, from a young Bengalee in Calcutta, and after eight hours' search discovering in a blood-clot the adult filaria, thus verifying my belief, previously published, that the filaria would prove to be the cause of such growths.

In the *Lancet* of October 6, 1877, Dr. Cobbold's drawings of the parasites transmitted from Australia appeared, showing the sexual organ of the female parasite.

Many adult filariæ have since been found, but recently Dr. Pedro S. de Magalhaes has kindly sent me an account of two parasites having been found by Dr. Saboia in the right side of the heart of a boy who died in the Hospital Misericordia of Bahia. The disease from which the patient died is not mentioned. The worms are very ably figured, after comparison with the drawings of Lewis and Cobbold; one is a female, the other a male, the latter having a spiral tail similar to that of Filaria immitis. This is the first time the male parasite has been described. Dr. Magalhaes also draws a peculiar band running along the body of the female, an appearance recorded in my first unpublished drawings. I have also among them the sexual organ of the female, near the head, the significance of which was not apparent to me when the drawing was first made. I have to thank Mr. Birkbeck of the Railway department for aid in translating the Portugese—*Gazeta Medica da Bahia*, No. 3 de Setembro de 1886; also paper on the same by the Faculty of Medicine of Rio de Janeiro, No. 3, 1886.

The pathological conditions produced in the human subject by filariæ are numerous. The movements of the embryos in the blood do not

appear to inflict injury. Dr. Manson has studied this subject with great care, and showed the further development of the embryos in the intestines of mosquitos—see *Linnæan Society's Transactions*, March 1884, and in previous papers in 1877 and 1878—also the greater activity of the embryos in the evening.

Dr. W. W. Myers, of Shanghai, shows that the normal evening rise of temperature of the human body may account for the greater activity of the nematoids. How the parasite passes from the mosquito to the human subject has not been satisfactorily traced, though it is likely that it is drunk in water.

The fact that few cases of youth suffering from filaria in Brisbane are now to be found, seems to show that the city water-supply is purer than the well and tank water formerly used. The new cases presenting themselves in Brisbane are from country towns, where there is no public supply of drinking-water.

The adult parasite probably, by its presence in the lymphatics, blocks them up, either by its own bulk, or by the inflammation it may cause. If located in the heart and blood-vessels, as in the Bahia case, thrombosis and embolism may happen. Little information is to hand on this point. When the parasites live in a hydrocele, no harm can follow. My patient, whose hydrocele contained four worms, was not free from embryos in his blood for years after, showing that all the adult worms were not removed from his body. Suppose the parent worms are in the structures of the arm, a common occurrence, the disease manifests itself, and is recognisable, by rigors and abscesses. Cases that suffered in this way are now in fair health, others are weakly, but able to work with feeble circulation.

Elephantoid growths and limbs do not develope in Brisbane. It is not easy to account for this. People are better fed here than in India, and the climate may be more salubrious. One patient here has intense scleroderma of the head, arms, and upper part of the body; but now, after some years, the skin is becoming softer, and embryos are no longer to be found in the blood. How could the lymphatics be blocked with adult parasites, so as to cause this hardness of the integuments of the head and shoulders?

Chyluria and elastic tumours in the groin are associated. When the tumours are evacuated, an operation not easy of execution, as the sac is very difficult to pierce by trochar, they yield chyle, containing a very small amount of blood, which deposits itself in the bottom of the receiver after some hours. The blood is very bright, and seems to differ from ordinary blood. May it be blood in a state of development? When urine becomes chylous, the elastic tumours, if present, lose their tension. These elastic chyle-sacs, emptied of their contents and injected with iodine, will solidify and close up. It is rather a perilous operation, as the sac is partly intra-abdominal, and there is danger of peritonitis. A patient, cured of these tumours by injection, afterwards suffered from

chyluria. A better course is to use a double truss, with concave pads. A case so treated is now cured, and no embryos have been seen in the blood for two years.

Chyluria is sometimes so severe as to threaten death from exhaustion. A chyluric patient was confined of a living child, the chyle and blood discharged from the bladder was in great abundance. She became so weak as to faint on the head being raised. Hæmostatic remedies did no good. A fatal issue being anticipated, I injected the bladder with tartrate of iron and port wine. After two injections, the discharge ceased and the patient recovered.

Lymph vesicle on the skin of the leg or scrotum seems related to chyluria. The lymph discharge is intermittent, so is the chyluria. At times it is scarcely possible to find the minute aperture on the scrotum which discharges the lymph. From this I had one patient die, with epistaxis and frequently recurring rigors. It seems to me that in chyluria the aperture which gives out the chyle is a lymph vesicle on the walls of the bladder. It would be difficult to verify this conclusion, even post mortem, and the presence of parent worms among the pelvic lymphatics would be hard to find.

At the Medical Schools of India it ought to be possible to obtain bodies of patients, known to suffer from filaria diseases, for their dissecting rooms. Preparations, showing the enlargements and varicosities of the lymphatic system, could thus be made, tracing to their true cause these abnormal conditions.