

likely to be punctuated by the occurrence of infection than would otherwise have been the case. I regard the sanatorium training of consumptive patients, as distinguished from any pretension to cure, as the most important preventive measure which has hitherto evolved from our system of voluntary notification of phthisis in Brighton.

I do not propose to discuss the subject of compulsory notification of phthisis. It is certain to come, but there are strong reasons against "forcing the pace." The surest progress is gradual and preventive measures must be organised and elaborated before we can in most districts obtain much good from universal notification of cases. The Local Government Board has recently supported an enactment providing for the compulsory notification of phthisis in Sheffield on the understanding that the powers are confined to the enforcement of notification and of cleansing and disinfection. No powers of compulsory isolation of phthisical patients are conferred and no responsible person has so far as I am aware ever suggested or is likely to suggest that the granting of such powers is desirable.

I have endeavoured in the preceding remarks to indicate the ideal position of the medical practitioner in relation to tuberculosis. If my contention be correct it is equally true that therapeutical measures are in the widest sense measures of prophylaxis, and that the aid of measures of public and private hygiene is as indispensable to cure as are therapeutical measures. But the practitioner in the majority of cases—i.e., those of the working classes—can scarcely be said to be the "family" practitioner. Even in the higher social strata his efforts at prophylaxis may be hampered by prudential and other considerations and he cannot undertake those wider inquiries which are required in order most completely to stop the sources of infection. Clearly, then, everything indicates the necessity of coöperation between medical practitioner and medical officer of health, and the more complete is this coöperation the greater is the benefit to the consumptive patient and to every member of the public.

APPENDIX I.

PRECAUTIONS FOR CONSUMPTIVE PERSONS.

Consumption is, to a limited extent, an infectious disease. It is spread chiefly by inhaling the expectoration (spit) of patients which has been allowed to become dry and float about the room as dust, or by directly inhaling the spray which may be produced when a patient coughs.

Do not spit except into receptacles, the contents of which are to be destroyed before they become dry. If this simple precaution is taken there is practically no danger of infection. The breath of consumptive persons is free from infection except when coughing.

The following detailed rules will be found useful both to the consumptive and to his friends:—

1. Expectoration indoors should be received into small paper bags and burnt immediately; or into a receptacle which is emptied down the drain daily and then washed with boiling water.

2. Expectoration out of doors should be received into a suitable bottle, to be afterwards washed out with boiling water. If a paper handkerchief is used this must at once be placed in a waterproof bag, the contents subsequently burnt and the bag washed daily.

3. Ordinary handkerchiefs, if ever used for expectoration, should be put into boiling water before they have time to become dry, or into a solution of a disinfectant, as directed by the doctor.

4. Wet cleansing of rooms, particularly of bedrooms occupied by sick persons, should be substituted for "dusting" and sweeping.

5. Sunlight and fresh air are the greatest enemies of infection. Every patient should sleep with his bedroom window open top and bottom, a screen being arranged, if necessary, to prevent direct draught and the patient should occupy a separate bedroom.

N.B.—The patient himself is the greatest gainer by the above precautions, as his recovery is retarded and frequently prevented by renewed infection derived from his own expectoration.

6. Persons in good health have little reason to fear the infection of consumption. Over-fatigue, intemperance, bad air, dusty occupations and dirty rooms favour consumption.

APPENDIX II.

DEAR SIR,—I beg to inform you that of
was admitted to the phthisis ward of the sanatorium on and
discharged on

The following is a report of condition:—

	On admission.	When discharged.
Weight... ..	—	—
Expectoration—		
(a) Amount	—	—
(b) Microscopically	—	—
Temperature	—	—
General condition	—	—
Remarks	—	—

The patient has been instructed to resume attendance under you.

Yours faithfully,

Medical Officer of Health.

NOTE ON THE PROBABLE MODE OF INFECTION BY THE SO-CALLED FILARIA PERSTANS, AND ON THE PROBABILITY THAT THIS ORGANISM REALLY BELONGS TO THE GENUS TYLENCHUS (BASTIAN).

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IN the reports of the Sleeping Sickness Commission, No. 3, recently issued by the Royal Society, Dr. Cuthbert Christy calls attention to, and illustrates by maps, the distribution of *Filaria perstans* in East Equatorial Africa so far as it was known up to Oct. 23rd, 1902, and shows how that area corresponds almost exactly with the area of "distribution of the banana cultivation and clothed people." The attire of the natives in these regions, as described by him, is so scanty and of such a kind as to make it difficult to suppose that the fact of its existence could favour infection of the natives by the nematoids in question. But great importance undoubtedly attaches to the striking similarity between the area of cultivation of the banana and that of the prevalence of *Filaria perstans* in East Equatorial Africa. The fact of this coincidence in area is all the more significant, seeing that the information supplied by Dr. Christy does not, as he says, favour the notion that mosquitoes are agents concerned with the causation and distribution of this disease. Dr. Christy says: "Wherever the banana is growing in the districts I have examined there is found the *F. perstans*. What is more, it would seem that where the banana is most luxuriant (on Mount Elgon) there the inhabitants are most infected (60 to 70 per cent. and the blood crowded). The converse of this is also clearly correct, as will be seen by the map—viz., where the banana is scarce (in Southern Bukedi and Northern Kavirondo, in which latter place it is only grown within the mud walls of the small villages) there the percentage of *F. perstans* is small; and where there is no banana there is no *F. perstans*." The uses to which the banana is put are thus referred to: "The banana when fully grown is peeled and boiled or steamed in an earthenware pot. The leaves are used for plates and dishes, for thatching houses, for clothing, for mattresses to sleep upon, for pipe stems, and many other things. The skins of the fruit are used for making soap, and the stems for rope, &c."

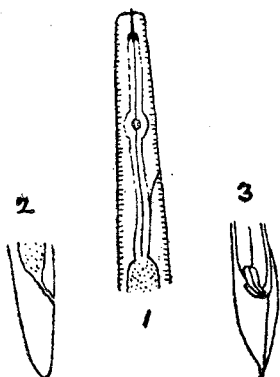
The author makes no allusion to, and perhaps may not be aware of, the fact that free nematoids are frequently to be found in the roots, stems, and leaves of plants, and that they are known to be found in the roots at least of the banana as it grows in Eastern Australia. The best known of the plants to be affected in this way are wheat, the common teasel, the feverfew, the cucumber, and the banana. In my "Monograph on the Anguillulidæ or Free Nematoids"¹ after referring to the mode of infection by wheat owing to the young nematoids passing from the earth in which wheat is growing, getting between the sheaths of its leaves and proceeding thence onwards to the immature germens, I say: "In several grasses I have found different species of these free nematoids lying between the inner sheaths of the leaves near the bottom of the culm. In *Festuca elatior* I met with no less than five species in this situation belonging to the genera *Dorylaimus*, *Mononchus*, and *Plectus*; and in the stalks of wheat and oats removed from stubble fields I have frequently found specimens either of these genera or of *Rhabditis*, *Aphelenchus*, or *Cephalobus*."

Many years since I ascertained that the nematoids which were to be found in the nodosities on the roots of certain cucumber plants in this country belonged to the genus *Tylenchus* and some years later (in 1879) I received an interesting pamphlet from Dr. Bancroft of Brisbane on certain "Diseases of Animals and Plants" from which I found that a very similar disease was common in Queensland among the bananas. From the merely rough figures there given of the worms it seemed to me evident that these nodose roots of the banana are also infested by nematoids of the genus *Tylenchus*. The females become so enormously distended with embryos that they assume somewhat the shape of a

¹ Transactions of the Linnæan Society, vol. xxv., 1865, p. 88.

Florence oil-flask, so that Dr. Bancroft spoke of them as "flask-worms." I have found the mature worms, also assuming the same kind of shape in cucumber roots and from the same cause. Dr. Bancroft makes the following statements in regard to the occurrence of such worms in the roots of bananas: "The root of *Musa maculata* breaks off where the worm colony has been located; the sugar banana is more tolerant of the parasite and does not break off. This latter is the species of *Musa* which produces the fruit now sold in Brisbane." He found nematoids also in vine roots, in the roots of many culinary vegetables, and likewise in various weeds, particularly *Sida retusa*.

Sir Patrick Manson in his description of the embryo of *Filaria perstans* in Quain's "Dictionary of Medicine" says, in regard to one of its distinguishing characters: "From time to time a minute tongue-like organ is rapidly protruded and withdrawn at the extremity of the cephalic end." A reference to Plate X., Figs. 109, 112, 115 and 117 of my "Monograph on the Anguillulidæ" will show in each of the four species of the genus *Tylenchus* there represented a short spear-like body of the kind referred to,³ and the only other genera of free nematoids in which bodies at all like this are met with are *Aphelenchus* and *Dorylaimus*. I reproduce drawings of the anterior and posterior extremities of one of these species of *Tylenchus* which was many years ago discovered by me in "sandy soil, about the rootlets of oats." This species has a blunt posterior extremity, such as is found in *Filaria perstans*, but in others it is sharp and pointed, as in the closely allied *Filaria demarquayi*.



Tylenchus obtusus. 1, Anterior extremity of worm. 2, Posterior extremity of female. 3, Posterior extremity of male. $\times 150$ diameters.

The probability seems great, therefore, that the embryos found in the blood of human beings and known as *Filaria perstans* are really embryos of some species of *Tylenchus*; and further, as a species of *Tylenchus* has been found in Queensland by Dr. Bancroft infesting the roots of bananas, it seems quite possible, looking to the facts revealed by Dr. Christy, that a nematoid belonging to the same genus may infest the roots and perhaps different parts of the bananas in Equatorial Africa.

The modes in which the natives use the different parts of the banana would make it possible for them to be infected either (1) through the skin or (2) through the alimentary canal. The fact that free nematoids can penetrate in some way through the skin—perhaps through the perspiratory ducts—is, I think, clearly shown by what is known concerning the parts of the body principally infested by *Dracunculus*. The evidence seems overwhelmingly in favour of this mode of infection, as originally suggested by H. J. Carter, and against a now commonly received view that the nematoids, through the intermediation of a cyclops, are taken into the alimentary canal with unfiltered water that has been drunk. It is quite possible that in some experimental investigations in which the young of the guinea worm were associated with these entomostraca, Fedchenko, the author of this latter view, may have seen young nematoids bore their way into the abdominal cavity of a cyclops, and yet his hypothesis as to the manner in which human beings become infected with guinea-worms may be wholly incorrect. As I long ago pointed out in a memoir on the guinea-worm⁴ infection through the alimentary canal cannot

reasonably account for the well-attested fact that in four-fifths or more of the whole number of recorded cases of guinea-worm the worms have been situated in the subcutaneous tissue of the lower extremities, and mostly below the knees, of persons who are in the habit of going about with bare legs and feet. The exceptions, too, are of a kind to prove the rule of external contamination, seeing that the Indian water-carriers, who bear on their backs water in eather bags or in skins, are not infrequently affected with guinea-worms in such exceptional situations as the back and the loins. Major Harrington of the Indian Medical Service, who has seen more than 200 cases of guinea-worm disease, is also firmly convinced that the views now commonly received are erroneous, and he has added further evidence in support of Carter's original view and direct external contamination.⁵

Although, therefore, I freely grant the possibility of such direct infection through the skin I think the evidence in regard to *Filaria perstans* points strongly to infection through the alimentary canal. The use by the natives of the banana leaves for "plates and dishes" would probably be one means by which infection could be thus brought about.⁶ There is the further fact that in the cases where mature specimens of the so called *Filaria perstans* have been found, they have been situated not in the subcutaneous tissue in any part of the body but, as Dr. G. C. Low says,⁷ within the abdomen and "in the connective tissues of the mesentery." Without much difficulty we may imagine some of the young worms, taken into the stomach with food, boring their way through the intestinal canal after the fashion of embryo trichinæ and then, instead of wandering far, settling in the mesentery or in adjacent parts and there undergoing development. From such a situation it would be very easy for the young worms to pass into the lymph stream and thence into the blood.

I have thought it well to direct attention to the possible mode of infection and to the real nature of the organism hitherto known as *Filaria perstans* in order that those who have the opportunity may search for worms in connexion with the banana having the characters of *Tylenchus*, may ascertain whether they are to be found in the fæces, and may also look to the characters of the oesophagus and pharynx in any of the adult specimens of the so-called *Filaria perstans* that may be found in the mesentery.

My observations, as well as those of others, on the free nematoids have made it perfectly clear that a parasitic stage forms no necessary part of their life-history, though many of the forms may and do become parasitic in a more or less accidental manner—partly infecting various portions of plants and partly different tissues or organs of various animals. As facultative parasites, whether in animals or in plants, they commonly attain a very much larger size than that which characterises them in the free state, and instead of producing a small number of ova or embryos they commonly give birth to these in prodigious quantities. The most notable example of both these peculiarities is to be found in the guinea-worm.

Manchester-square, W.

⁵ Brit. Med. Jour., vol. i., 1899, p. 146.

⁶ Of course, leaves of young plants or leaves proceeding from the stem at no great distance from the root would be most likely to be contaminated with the nematoids. The chance of infection in the manner I have indicated is also distinctly favoured by the fact that *Tylenchus* is one of the only four genera of nematoids in which a power of resisting prolonged desiccation exists. This subject I considered pretty fully in a memoir "On the Anatomy and Physiology of the Nematoids, Parasitic and Free" (Philosophical Transactions, 1866, pp. 613-619).

⁷ Reports of the Sleeping Sickness Commission, No. 2, p. 69.

NEW WORKHOUSE INFIRMARY.—The new workhouse infirmary for Swansea was formally opened on Jan. 18th in the presence of a large gathering. The building, which has taken about two years in construction, has been erected at a cost of £17,730.

THE OSIRIS PRIZE.—The *Electrical Engineer* of Jan. 22nd states that this valuable prize has just been divided between Madame Curie (in recognition of her part in the discovery of radium) and Professor Branly (inventor of the system of wireless telegraphy which bears his name). The prize is worth £4000 and was offered by M. Osiris in 1900 for any work which should be deemed useful for mankind by the members of the Syndicate of the Paris Press. The prize remained undistributed until it was recently suggested by the founder that the claims of the Curie family should be considered. It was then decided that Madame Curie should receive £2400 and that the remaining £1600 should go to Professor Branly.

² Article: *Filaria Sanguinis Hominis*.

³ This is described by me (loc. cit., p. 125) as "an exertile spear with a trilobed base."

⁴ Transactions of the Linnæan Society, vol. xxiv., 1864, pp. 102 and 106.