been raised against the *rationale* of the operation, practice has proved that it is often successful in relieving the patient from the distressing symptoms which so frequently accompany the disease—that is to say, the periodical attacks of fever and pain. The following brief notes of three cases speak for themselves in regard to this point:

CASE I.—Mr. —, a European, was attacked in the middle of February, 1897, with fever, accompanied by pain and swelling of the glands in the right groin, the attack lasting three or four days. Similar attacks followed about once every week, and in six weeks he had seven attacks. In consequence of these frequently-recurring seizures he was prevented from attending to his business, and begged urgently for something to be done to relieve him. The lymphatic glands in the right groin were found to be enlarged, forming a soft, collapsible mass having all the characters of a filarial lymphatic varix. An operation was performed, and the entire mass removed under chloroform. Since that time, a period of four years, the patient has never had any trouble of any kind.

CASE II.—A Hindu, aged 24, was admitted into hospital on February 19th, 1889, for a tumour in the right femoral region. The disease had been in existence for eight years, during which time he had suffered from periodical attacks of fever accompanied by pain and swelling in the femoral region. On examination he was found to have a large lymphatic varix in the right femoral region, and the blood contained large numbers of embryo filariae. The great frequency of the attacks, which sometimes recurred only after five days interval, rendered the patient's life miserable as well as useless, and he was ready to submit to any treatment that promised relief. A month after admission to hospital chloroform was administered and the tumour removed. The wound healed satisfactorily, and the patient was discharged from hospital a month after operation. Two years and a half later he wrote to me as follows: "It is beyond description to write of the benefits of the operation. Before this to draw a bucket of water, to walk a mile and return, to stand for more than fifteen minutes was impossible. The benefit of the operation is such as to make me undertake an enterprising life." This satisfactory result was maintained for nine years, during which time he was "healthy and active and able to earn his bread." At the expiry of this period of time he was unfortunately attacked with a disease of a similar nature in the left groin, and later on symptoms appeared which pointed to the site of lymphatic obstruction being seated high up in the intra-abdominal vessels. Putting aside this fresh attack of disease, there can be no question as to the benefit derived from operation in this case. Nine years of health and comfort were added to the patient's life, and during the whole of that time he was able to earn a livelihood.

CASE III.—A European, aged 16, was admitted into hospital on August 6th, 1894. The patient stated that he had noticed swellings in his groins for a month previous to the date of admission, and had suffered from attacks of fever. On examination a large lymphatic varix was found in the right groin, and a smaller one in the left groin. The blood was examined, and found to contain filariae. In addition to the inconvenience caused by the attacks of fever, the patient was suffering considerable mental anxiety owing to his knowledge of the nature of the disease, and he begged to have the swellings removed and the worms taken away if possible. Accordingly, a few days later chloroform was administered, and the varix in the right groin removed. On dissection of the tumour after removal it was found to contain one male and two female filariae. Healing of the wound was somewhat delayed by suppuration, but the patient was discharged quite well a month after the operation. Since the patient left hospital he has kept good health. The small varix in the left groin has not increased in size nor given rise to any trouble. During the month that the patient remained in hospital after operation no filariae could be found in the blood. Since that time there has been no opportunity of examining his blood.

These three cases in themselves furnish a complete answer to the first objection. A further answer lies in the fact that these varices are often quite local; the upper or more central portion of the lymphatic system not being implicated. This was the condition of things present in the first and third of the cases related above. In connexion with this question it is important to bear in mind that the object held in view in these operations is not so much the excision of the varix itself, as the removal along with it of the filarial worms themselves.

The second of the objections that have been raised against these operations is the probability of their being followed by lymphorrhagia or by the establishment of a lymphatic fistula. This is certainly not the experience of surgeons in Madras. I have never seen such a result myself, nor have I ever heard of its occurring in the practice of any of my colleagues.

The third objection raised against the operation is that such cases are prone to be attacked by septic inflammation or by erysipelas. Here again the experience of Madras is completely at variance with the dictum of the authors of the work alluded to above. I have never seen or heard of a fatality from one of these operations. In a few cases that I have seen, where a large number of ligatures were required, suppuration took place in the wound; but no further trouble ensued. If pressure is applied over the wound the lymphatic channels become rapidly sealed, and no more oozing of fluid takes place than would occur from any other wound. Therefore it is not evident, on theoretical grounds alone, why such wounds should be more liable to infection than others.

The point that I desire especially to emphasize is that the

object of these operations is, not to restore the circulation of lymph, but to relieve the patient from the sufferings entailed by the constantly recurring attacks of pain and serious constitutional disturbance. That this result is achieved in a number of cases has been proved by experience, and it is for this reason that I desire to press the advantages of the operation. No theoretical objections can carry any weight in the face of the favourable experience gained by those who have operated in these cases.

The explanation of the pathology of the periodical attacks of pain and fever is still obscure. Manson's original theory that they were due to abortion on the part of the female parasite and consequent plugging of a number of lymph channels, is the most feasible explanation that has hitherto been put forward. Whether this be the correct explanation or not, there can be no doubt that the parasites themselves are, in some way or other, the cause of the inflammatory attacks. Hence the first principle of preventive treatment in such cases should be to endeavour, if possible, to remove the parasites. Judging from the fact that in some cases no parasites have been found in the mass of tissue removed at the operation, it is possible that the success of the latter may be due to other causes than the mere removal of the worms themselves. Assuming that the attacks of inflammation are coincident with, and due to, abortion of the female worm, the removal of those vessels by which the extruded ova are carried prevents further damage to the tissues beyond. Moreover, it is extremely probable that the stasis of lymph which follows ligation of the vessels results in the death of the parasites.

OBSERVATIONS ON HUMAN FILARIASIS IN TRINIDAD, W.I.

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FILARIASIS, on account of its interesting analogy to malaria and the recent additions to our knowledge of the life-history of the parasite, has become a subject of practical importance, attracting the attention of many observers in the tropics. The following is a record of the conditions associated with its prevalence in Trinidad. The population of the Colony is composed of a very heterogeneous group of people, more than a third of whom are East Indian immigrants, the remainder comprising the descendants of the original African slaves and Caribs, and representatives of almost every nationality. In addition there is constant immigration from the neighbouring Colonies, which makes it difficult to decide in what way filariasis was first introduced, whether originally by the African slaves or as a recent importation from the other West Indian islands.

INCIDENCE OF FILARIASIS AND FILARIAL DISEASES.

The following table gives the result of the examination of 500 cases taken indiscriminately from among the patients at the Colonial Hospital, Port of Spain, the St. Ann's Lunatic Asylum, and from private sources:

Race.	Number Examined.	Number with Filaria.	Percentage with Filaria.	Number with Elephantoid Disease.	Percentage with Elephantoid Disease.
Blacks ...	323	16	4.9	21	6.5
White ...	55	6	10.9	8	14.5
East Indians	122	3	2.4	4	3.2
—	500	(or 5 %)	—	(or 3.3 %)	—

In the above table the term "blacks" is meant to comprise all those of negro descent, and although the number of them infected (16) included two recent settlers from Barbadoes, it probably represents the true incidence of filariasis in the case of the black population. The percentage of infection in the case of the whites appears remarkably high, and is no doubt due to the fact that the majority of those examined were

natives of Barbadoes and Demarara, where it has been shown¹ that the white population is highly infected with filaria. It is, nevertheless, true that the whites in Trinidad are in no way exempt from the danger of infection, and with them the result (14.5 per cent. elephantoid disease) appears to be a very serious matter. The East Indians form the chief labourers on the sugar cane estates, and to a tendency on their part always to live by themselves in small villages away from the other classes must be attributed their slight infection with filaria.

The blood films were all collected between 8 P.M. and 11 P.M., and with one exception, in which filaria Demarquaii was found, all the infected cases proved to be filaria nocturna. The chief forms of filarial disease observed were (in the order of frequency) elephantiasis of the leg, elephantiasis of the vulva, chyluria, filarial lymphangitis, and elephantiasis of scrotum and penis. Of the 25 cases infected with filaria 3 (or 12 per cent.) were the subjects of well-marked elephantiasis, while of 475 uninfected cases 30 (or 6.3 per cent.) gave evidence of elephantoid disease.

METAMORPHOSIS OF FILARIA IN MOSQUITOS.

A number of experiments were undertaken to estimate to what extent the observations made in other tropical countries on the metamorphosis of filaria in mosquitos coincide with the conditions in Trinidad. The species of mosquitos employed were *Culex fatigans*, *Culex taeniatu*s, and *Anopheles albimanus*.

Culex Fatigans.—A small brown mosquito described by Giles² as closely resembling *Culex pipiens*, and by Low³ as occurring in St. Lucia and Barbadoes, is the common house pest here during the rainy season. It breeds freely in all collections of water about the dwelling house, and bites voraciously at night. Specimens were bred out and fed on a highly-filariated patient. In about 9 per cent. of those fed, the metamorphosis of the filaria embryo took place in the muscle of the thorax in the manner described by Bancroft, James, Low, and others, working with *Culex ciliaris* and other species. About the tenth day the embryos were fully one-twentieth of an inch in length, and when teased out of the thoracic muscles exhibited active wriggling movements. The final stage of the metamorphosis was reached between the sixteenth and the nineteenth day, the fully-developed embryo appearing shortly after in the tissues of the head and proboscis. Although special attention was devoted to the point, in no case was the final stage reached earlier than the sixteenth day, in spite of the fact that the mosquitos were kept in a room, the temperature of which was never lower than 76° F., and often for the greater part of the day, was about 85° F. (August). It would appear, therefore, that a high temperature alone is not sufficient to accelerate the metamorphosis to such an extent that the final stage can be reached in seven or eight days, as Manson first announced, though a lowering of temperature may considerably retard the process. One must look to other factors for the explanation of the variability in the time taken by different species, and it will possibly be found in the fact that some species in highly filariated localities have acquired in an exceptional degree the capacity for acting as intermediary hosts. By storing the mosquitos in dry mosquito-net cages, and feeding them on ripe bananas, it was possible to keep some of them alive as long as seventy days. Many examined on the fortieth and forty-fifth days after infection with filaria still contained numerous fully-developed embryos in the proboscis and head tissues, and it is evident that Grassi's and Noë's⁴ statements that *Anopheles* rid themselves of the fully developed embryos when made to feed on fruit cannot hold good for *Culex fatigans*, for by this time most, if not all, of the embryos would have been voided.

*Culex taeniatu*s, a smaller blackish mosquito with silvery spots on the body and striped legs, is very common all the year round, is a rapid breeder and a nocturnal and diurnal feeder. Many specimens were bred out and fed on a filariated subject, but investigation soon proved that either this species of *Culex* is not an efficient host for filaria, or that it is impossible to supply them, while in captivity, with the conditions essential to the complete metamorphosis. The metamorphosis took place more slowly than with *Culex fatigans*, and although fed on the same patient, a much smaller number

of embryos migrated from the stomach to the thorax. Of those that reached the thoracic muscle several became sessile and underwent no further change; others developed slowly up to the sixth day, after which no further changes took place, and by the eighth day disintegration and absorption began, while many specimens examined from the tenth to twelfth day showed no signs of embryos. The plan was tried of giving a second, and in some cases a third, feed of filariated blood on the third or fourth day, but the result did not appear to be affected in any way, no filaria embryos reaching the final stage.

Anopheles albimanus, a large black insect with snow-white rings on legs, occurs in the highly malarious districts and in swampy localities outside of the city of Port of Spain. In these localities it sometimes greatly outnumbered the commoner species of *Culex*, and as it proved to be an efficient host for filaria it probably forms an important factor in the spread of filariasis in these districts. Great difficulty was experienced in getting them to breed in captivity and it was found impossible to keep them alive more than fourteen days. The specimens bred out and fed on a filariated subject showed the metamorphosis taking place more rapidly than in *Culex fatigans*, the stage reached by the tenth day corresponding to that of the twelfth day with *Culex*. As none lived beyond the twelfth day after feeding it is not possible to say definitely when the final stage is reached, but judging from the size of the embryo and its active movements it is likely that the fully metamorphosed filaria reaches the proboscis shortly after the twelfth day. A second feed of filariated blood did not seem to improve the condition of the *Anopheles*, those receiving it dying about the same time as the others.

PROPHYLAXIS.

That filariasis is transmitted through mosquito bites admits of little doubt, whatever may be the other means by which infection may be carried, and protection from infection practically means protection from mosquitos. It may be possible to rid a locality of *Anopheles*, which require special conditions for breeding, but this is not so easy a matter in the case of the *Culices*, which breed readily in any collection of water. Much may be done even in the case of *Culex* by protecting all stored water and frequently emptying all collections of water so as not to allow sufficient time for the larvae to mature.

Meanwhile the only safeguard is to be found in the habitual use of mosquito nets, especially when in the neighbourhood of known filariated individuals. If a malarial subject is a source of danger to those around him, a filariated individual is doubly so, for in his case the carriers of infection are drawn from the ranks of a very common species of mosquito, as well as from the rarer species to which we owe malaria.

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ON THE CAUSAL RELATIONSHIP BETWEEN "GROUND-ITCH," OR "PANI-GHAO," AND THE PRESENCE OF THE LARVAE OF THE ANKYLOSTOMA DUODENALE IN THE SOIL.

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In the *Journal of Tropical Medicine* for March 1st, 1901, an article appeared under the heading "Water-itch; or Sore feet of Coolies," describing a disease with which all tea garden medical officers in Assam, Cachar and Sylhet, are familiar. Apparently a similar affection is very prevalent on the sugar plantations of the West Indies; for in the annual report, by the Surgeon-General of Trinidad, for the year 1900, it is mentioned that "ground-itch is very prevalent during the rainy season on the sugar plantations, amongst the East Indian labourers." It is further remarked in this report, that although the disease is not a serious one, it is a matter of great