Sleeping sickness : How to avoid infection: with an account of glossina palpalis and illustration of this and other biting flies. For the use of travellers and residents in Tropical Africa.

[REVISED EDITION.

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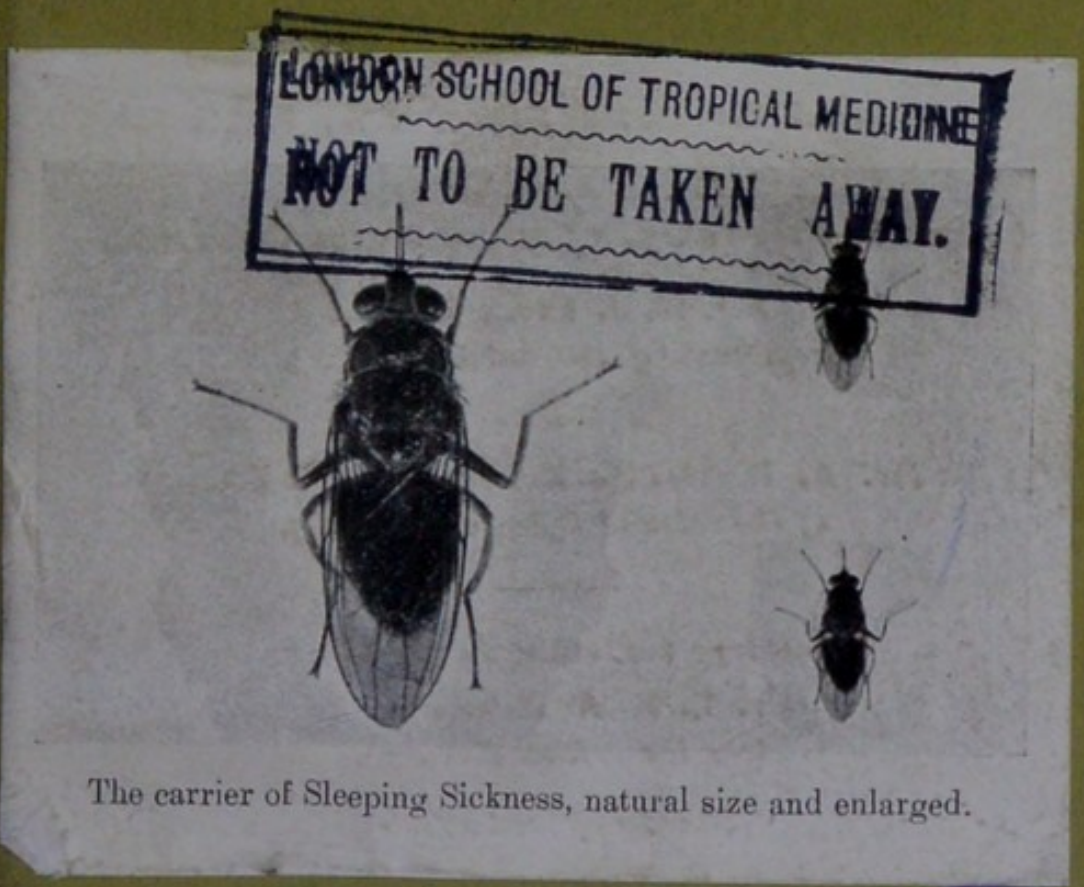
SLEEPING SICKNESS:

How to Avoid Infection.



The carrier of Sleeping Sickness, natural size and enlarged.

London:
Sleeping Sickness Bureau,
Royal Society, Burlington House, W.

1910.

MAY.

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Mr. E. E. Austen, F.Z.S.,
(for the British Museum).

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A. G. Bagshawe, M.B.
of the Uganda Medical Staff.

Application for copies of this Pamphlet should be addressed to the Director, SLEEPING SICKNESS BUREAU, Royal Society, Burlington House, LONDON, W.

(TELEPHONE:—P.O., MAYFAIR. No. 4166.)

HAEMATOPOTA *torquens*, Austen.

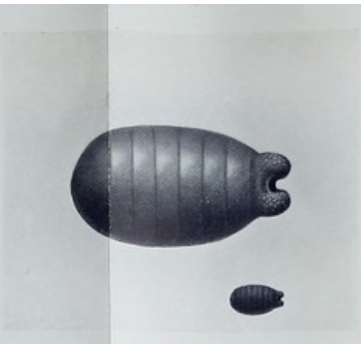
Enlarged **four** times.

Haematopota is a widely distributed genus of biting flies. The proboscis is directed downwards. The wings are mottled, and, in the closed position, meet at an angle which may be compared with the ridge of a roof; hence they are described as tectiform. (*Vide* figure *Hippocentrum*.)

HIPPOCENTRUM *trimaculatum*, Newst.

Enlarged **five** times.

The genus Hippocentrum is closely related to *Haematopota*. The figure is given to show the closed wings, which are arranged just as in *Haematopota*.

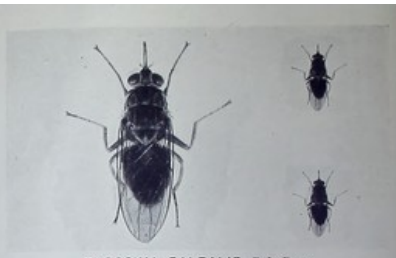


The chrysalis or pupa of Glossina palpalis, enlarged **twice** and **eight** times.

STOMOXYS *nigra*, Macq.

Enlarged **five** times.

The genus Stomoxys is widely distributed. The wing veining is different from that of *Glossina*. The wings when closed do not cover one another; they are arranged as in the house-fly, which Stomoxys resembles. The proboscis projects as in Tsetse flies; it is more slender.



GLOSSINA PALPALIS, Rob.-Desv.

THE CARRIER OF SLEEPING SICKNESS; in the resting position; natural size and enlarged **three and a third** times.

A good representation, but in life the proboscis appears solid, *i.e.*, the palpi completely hide the biting apparatus; and the outline of the abdomen is not seen through the wings as in the figure. Note the long proboscis in the line of the body and the superposition of the wings (like the blades of a pair of scissors). *The association of these two characters distinguishes all species of Glossina from all other similar biting flies; both characters must be present.*

GLOSSINA PALPALIS. Enlarged **four** times.

Note the dark coloration of the body; also the central pale patch on the abdomen, and the five black segments (tarsal joints) of the hindmost pair of legs. The abdomen is more rounded than it appears in the figure. The proboscis is bent downwards as in the act of sucking; it is the *palpi* that are visible.

The Illustrations of Flies are from Photographs by Dr. W. M. GRAHAM.

The enlargement in each case is from nature. The actual size is indicated in three instances by lines below the figure.

SLEEPING SICKNESS:

How to Avoid Infection:

WITH AN ACCOUNT OF GLOSSINA PALPALIS

and

Illustrations of this and other Biting Flies.

For the Use of Travellers and Residents in Tropical Africa.

ISSUED UNDER THE DIRECTION OF THE HONORARY MANAGING COMMITTEE.

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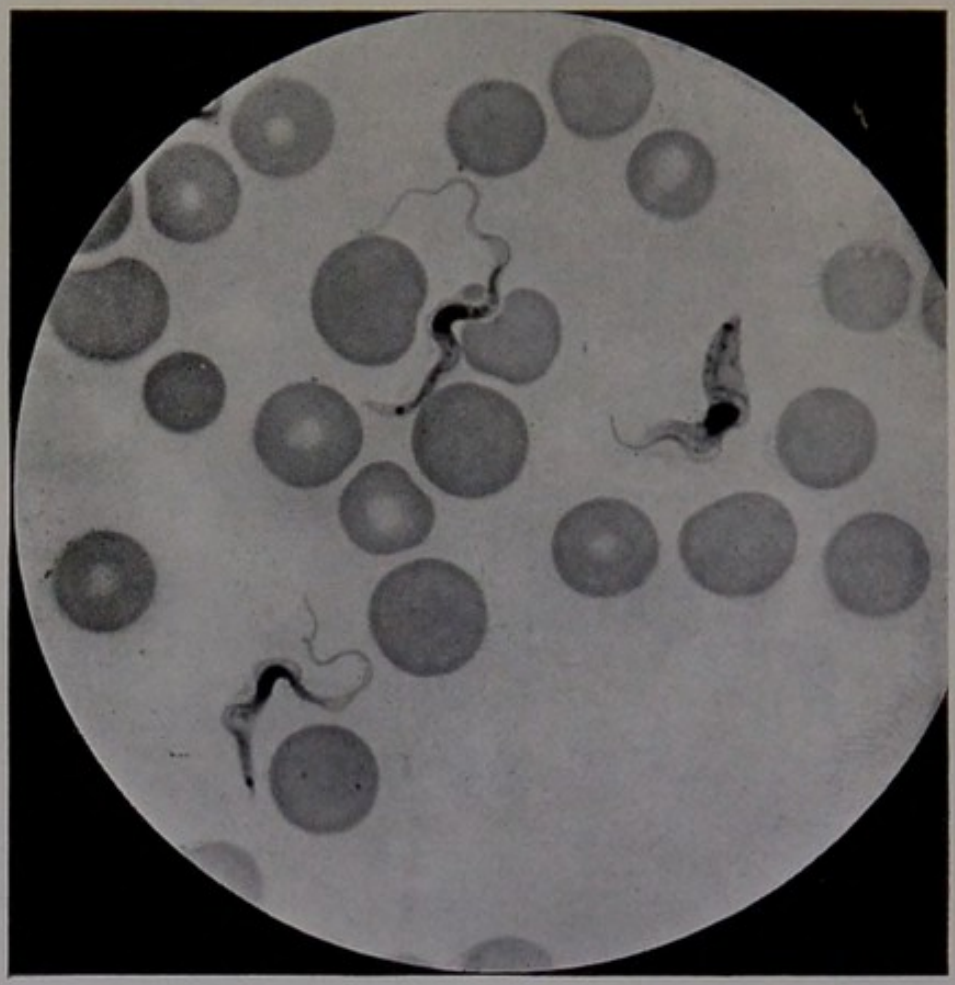

Trypanosoma gambiense, the cause of Sleeping Sickness (magnified 1,000 times). Three are here seen among the disc-like red blood corpuscles.

[Reproduced from a paper by Professor Minchin in *Parasitology*, by permission of the author and publisher.]

SLEEPING SICKNESS:

How to Avoid Infection.

Sleeping Sickness is caused by the presence in the system of a minute organism (*Trypanosoma*) allied to that which causes the fly disease of cattle. In each instance the organism is conveyed from the sick to the healthy by the bite of a species of *Glossina* (Tsetse), a genus of blood-sucking flies peculiar to South and Tropical Africa, and the south-west corner of Arabia.

The Transmitting Agent.

It is important to be able to recognise tsetse-flies and especially *Glossina palpalis*, the species which conveys Sleeping Sickness. They are not mere passive distributors of the infection; for the trypanosomes contained in blood which the fly has sucked up multiply and persist within the insect, and may be transmitted to every person on whom it feeds during a period measured by weeks, if not months.

The illustrations of biting flies are from photographs taken by Dr. W. M. Graham in the Gold Coast Colony.

How to recognise Tsetse-flies.

Under the heading—General Characters of Tsetse: how to distinguish them from other flies—Mr. Austen (*Monograph of the Tsetse-flies*, 1903) writes as follows:—

"Tsetse may be described as ordinary-looking sombre brownish or greyish-brown flies, with a prominent proboscis. The hinder half of the body, or abdomen, in the best-known species, though not in all,* is of a paler colour and marked with sharply defined dark brown bands, which are interrupted on the middle line; the abdomen, however, is invisible when the insect is at rest, as it is then concealed by the wings. The sexes of Tsetse-flies can readily be distinguished when specimens can be examined, since in the male the external genitalia form a conspicuous knob-like protuberance (*hypopygium*) beneath the end of the abdomen, which is absent in the female.

"It is probable that only those who have suffered from the attacks of Tsetse can recognise them when on the wing, but *in the resting position* their identification is easy. In this attitude they can be distinguished from all other blood-sucking Diptera, especially from those belonging to the genera *Stomoxys* and *Haematopota*, which are most likely to be mistaken for them, by the fact that the brownish *wings lie closed flat over one another down the back*, like the blades of a pair of scissors, while *the proboscis* (i.e. the proboscis ensheathed in the palpi) *projects horizontally in front of the head.* As pointed out by Col. Bruce, the closed wings thus give the fly 'an elongated appearance' . . .

"Apart from the prominent proboscis and the mode of carrying the wings when at rest, there is nothing in any way remarkable or striking about the appearance of a †Tsetse."

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* *Glossina palpalis* is one of the exceptions.

† See figure of resting *Glossina palpalis*.

How to distinguish Tsetse from other biting flies.

"As already mentioned, species of *Stomoxys* and *Haematopota* are most likely to be mistaken for *Glossina*, and apart from these confusion can hardly take place. . . .

"Although *Stomoxys* also has a prominent proboscis, it is not ensheathed in the palpi, and is consequently much more slender than the proboscis of *Glossina*. The species of the former genus are little greyish flies with black markings*; they are much smaller than Tsetse-flies,* and since their wings when in the resting position, instead of closing one over the other, diverge at an angle, like those of *Musca domestica* (house-fly), it is easy to distinguish them. *Haematopota*, on the other hand, which is a genus of small horse-flies (Family *Tabanidæ*) often known as 'clegs' in various parts of Great Britain, resembles *Glossina* somewhat closely when at rest. The species of this genus, of which no less than twenty-two have been recorded from various parts of Africa,† are of much the same size as the larger Tsetse-flies, and are of the same brownish colour and elongate shape. In no case, however, is the abdomen marked with dark bands on a light ground, while the wings in the resting position do not close one over the other, but diverge slightly at the tips and are also somewhat *tectiform*, i.e. they meet together at the base like the roof of a house. The antennæ, too, afford a further means of distinction. While the antennæ of Tsetse-flies, as of all Muscidæ, are drooping, those of

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* This applies to *S. calcitrans*, L., and *S. nigra*, Macq., the two commonest and most widely distributed species of *Stomoxys* in Tropical Africa. *Stomoxys inornata*, Grünb., and *S. omega*, Newst., which have been discovered since the above statements were written, are almost black, and often quite as large as certain Tsetse-flies. [E.E.A.]

† At the end of the year 1909 the number of recognised African species of *Haematopota* amounted to eighty-two. [E.E.A.]

Haematopota project horizontally in front of the head, and being of some length are readily seen."*

How to recognise the species *palpalis*.

The species *palpalis* is rather less than half an inch long (excluding the proboscis and closed wings); its body is almost black, with the exception of a pale patch on the abdomen; the black segments (*tarsi*) of the hindmost pair of legs are characteristic. Persons familiar with Tsetse-flies recognise *palpalis* at once by its dark coloration.

The seven other species of *Glossina* differ in coloration or size.

Reproduction.

The Tsetse-flies do not lay eggs. One larva or maggot develops at a time in the body of the mother-fly. In the case of *Glossina palpalis* the larva, having reached maturity, is dropped in a shady place near water where the soil is loose and moderately dry, and often consists of crumbling vegetation. The larva creeps into the loose earth, its skin becomes dark in colour, and in a short time it enters on the pupal or chrysalis stage. This lasts from four to six weeks according to the season, after which the imago or perfect insect emerges. Pupæ have been found

* These points are shown in the figures.

A haunt of *Glossina palpalis*. Note the stream, the woody vegetation and the lightly clad natives.

[Reproduced by permission from *La Maladie du Sommeil au Congo Français*. Masson & Cie. Paris. 1909.]

in great numbers where the soil is sandy.* They are dark brown and barrel like (see figure). The female fly may live from three to four months and produce eight to ten larvæ; they are dropped at intervals of about ten days.

Fly areas.

Glossina palpalis is to be found close to water or to water courses where the banks are covered with vegetation (usually woody) which affords it shade. On Lake Tanganyika reeds give sufficient protection. On the Gold Coast it has been found on the open beach. It is not met with in papyrus swamps.

Habits of fly.

It is rarely found more than thirty yards from water, unless it has followed men or animals. It seldom bites except when the sun is up and the air still, and, as a rule, not through clothes.† It does not occur at a greater altitude than 4,000 feet; and is seldom found at such a high level. The prevalence of fly is influenced by the seasons: in the wet season they become numerous; in the dry they are few and may even disappear.

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* Pupæ have been found also in the forks of branches and elsewhere in trees, up to ten feet from the ground.

† Its habit in this respect seems to vary with locality. On the Lower Congo bites through clothes are frequent.

Notes by Dr. Graham.

* "*Glossina palpalis* is widely distributed in the Gold Coast and is found also in the town of Lagos and in its vicinity. In order to avoid being bitten travellers should be able to identify the fly, and should be watchful enough to drive it away before it has had time to bite.

"It is a difficult insect to catch, but with the help of the following information a little practice should enable anyone to recognise it on the wing.

"1. It appears upon the main roads in the morning as soon as there is sunshine, that is, usually between 10 and 11 a.m. in the rainy season and earlier in the dry season.

"2. It keeps on or near the ground.

"3. Its habit of flight is rapid, short, and furtive. Rising slightly from the ground as one advances, it flies forward a short distance keeping near the ground and is suddenly lost to view as it alights upon a small stone or projecting root in the roadway. And this it repeats each time it is disturbed until alarmed, when it takes cover under the leaves of a shrub on the side of the path.

"4. On being disturbed in a bush-path it usually flies swiftly several times past the intruder, making a peculiar buzzing noise which one soon learns to recognise.

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* For the account of the fly which follows acknowledgment is due to Dr. W. M. Graham, Director of the Medical Research Institute, Lagos.

"5. It alights by preference upon the feet or legs of its victim, more rarely upon the back or arms.

"6. When driven off it disappears, settling upon the ground or under a leaf in the immediate vicinity and renews the attack in a few minutes.

"7. It is alert and keeps out of view, changing its position from one side of the leg to the other when observed, but when it begins to draw blood it can be readily killed or caught.

"8. It attacks until sunset. It disappears after darkness sets in, and is not attracted by artificial light.

Places where one is liable to be bitten.

"Travellers are very liable to be bitten under the following circumstances; special vigilance is therefore demanded.

"1. In a railway carriage. The fly usually approaches the train while it is standing in a station. It perches first upon the window sill, but soon seeks the floor and gets under a seat. *Tabanidæ* on the contrary usually alight upon the walls or ceiling in sight. In a railway carriage women are the first to suffer; for the fly creeps along the floor under the skirt and bites the legs through the thin stocking. Therefore puttees or gaiters should be worn.

"2. In the tent. Outside, the fly perches on the guy-ropes; inside, behind the flaps, under the bed, or in any other concealed position.

"3. In a ferry boat. The fly usually settles upon the outside of the gunwale before flying into the boat.

"4. At cross-roads. Here natives sit to rest and talk.

"5. At fords. Here natives sit before or after crossing.

"6. In the narrow path leading from the main road to a native village.

"7. Under the shade trees in a native village.

"8. In the open courtyard of native huts when cooking is in progress.

"9. In the path to the village water supply.

"10. When passing a troop of native carriers upon the road, or the natives bringing in palm wine in the morning. Some of the flies accompanying the troop leave it and attach themselves to the new party.

"When a fly is caught and an attempt is made to identify it, too much attention should not be paid to the mere crossing of the wings. The crossing of the wings is a characteristic of many other flies, and is not distinctive of the tsetse unless accompanied by a long proboscis projecting in front of the head almost in the line of the body.

"Inattention to this point has caused flies belonging to the following families to be mistaken for tsetse:—

(a.) *Ephydridae.*—Dusky flies with crossed wings found upon mud.

(a.) *Stratiomyidae.*—Dark flies with crossed wings found upon leaves, etc."

The Disease.

Recognition of cases of Sleeping Sickness.

Sleeping Sickness is easily recognised in its later stage, but it must be remembered that the micro-organism which causes the disease has been found in natives apparently healthy.

Symptoms: Enlargement of glands, &c.

A native who is suffering from Sleeping Sickness in its early stages may show physical and perhaps mental languor; he is apt to suffer from attacks of fever which may or may not interfere with the performance of his work; his eye-lids may become puffy; glands on one or both sides of his neck may be swollen, but give him, as a rule, no pain. His character or disposition may change. Mania, epileptiform seizures, or tremor may occur.*

* Sleeping Sickness may run its course without the symptom to which it owes its name; in any case somnolence or lethargy does not occur till the disease is far advanced.

In the majority of cases swelling of the glands in the neck is an early sign, but this may be slight, and enlargement of glands may be due to other causes.

The red rash which is a striking feature in early cases in whites is not noticed on the black skin.

It is not possible here to do more than indicate such symptoms as should warn the European. If he has reason to suspect the existence of the disease in natives about him, he should if possible get a medical opinion.

Prevention.

Clearing.

If *Glossina palpalis* is found at the watering place or landing for canoes, the vegetation must be removed so as to deprive the fly of shelter. It is not possible to state precisely how much should be cleared. As a rough guide a strip along the bank 50 yards broad and extending 100 yards on each side of the landing or watering place may be suggested. In some instances this will not be enough; in a few it will be unnecessarily large.* In the case of rivers both banks, as a rule, need clearing. Trees need not be cut down if they are clean stemmed and do not branch near the ground. When such clearings are made the flies as a rule disappear (except those which may be conveyed by boats from neighbouring fly areas).

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* The larger clearings should be undertaken by the European Government, acting under the advice of a medical officer.

If, however, this measure fails it is necessary to search for and find the pupæ, and to remove the vegetation which shelters them. The scrub which is cut down should, if possible, be burnt on the spot.

To prevent rank vegetation springing up it is necessary to plant some crop which owing to its low height will not shelter the fly, *e.g.* sweet potato or ground nut. Good results have been obtained in Uganda from the cultivation of lemon grass, *Citronella* (*Andropogon citratus*, D.C.).* At fords or ferries far from human habitation, where crops cannot have the necessary attention, it has been suggested that the members of each caravan should, as they pass, beat flat the growing weeds or scrub.

It should be remembered that whether Sleeping Sickness is present or not in any locality the existence of *Glossina palpalis* in places visited by man is dangerous; for it needs only the presence of one infected person to infect the flies.

Trapping of flies.

If it is not possible to clear, or if such clearing as can be done is ineffective, the method devised by a Portuguese planter may be tried. This consists in providing a man or animal

* This grass is not deterrent owing to its smell as was at first supposed. It is effective because it holds the ground against other vegetation, and does not afford conditions suitable for the deposit of pupæ. Bahamas (Bermuda) grass, *Cynodon Dactylon*, Pers., has also been suggested.

with a black garment coated on the outside with birdlime or some other sticky and tenacious substance.* The tsetse flies, it is said, settle on the black surface and become entangled.

Caravans.

It is important to avoid camping at the edge of a fly area. Camp should be pitched at such a distance as to minimise the risk of flies reaching it. The distance will depend on the nature of the vegetation; if this is composed of short grass it will be less than if a shady path leads from camp to water. A safe distance will seldom be less than half a mile.† Fords infested with flies should be crossed if possible in the early morning or the evening, or at night.

Removal of Houses from vicinity of fly areas.

Native huts or European houses which are situated close to fly areas should be moved out of the fly range, that is to say, at least half a mile from the water, and if possible on to higher ground. (It is

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* In Tropical Africa a serviceable birdlime may be made from one of the rubber-yielding plants, as *Landolphia*, or by boiling *Loranthus* berries. *Loranthus* is a parasite closely allied to mistletoe, with tubular red flowers.

† This does not apply to camps occupied only from the evening of one day to the morning of the next.

preferable and sometimes necessary to move them much further.)

Removal of sick from fly areas.

It is clearly important that the flies which convey the infection should have no opportunity of sucking the blood of the sick. Infected persons must therefore be moved well out of the fly range to places where there is no risk of *Glossina palpalis* reaching them. Owing to the habitat of the fly (edge of water) this would not usually involve difficulty or hardship.* As however it is possible that other species of Tsetse-fly may occasionally carry the disease, a spot should be chosen free from all Tsetses.

One infected person within a fly area may cause the infection and destruction of a whole village.

Education of Natives.

These proved facts should be explained to native chiefs and the more intelligent natives. They should be told that the *bites of these flies mean Sleeping Sickness*, and stress should be laid on the protection afforded by clothes. If they are obliged to visit fly areas for the purpose of drawing water, the visits should be made early or late in the day when the flies are not active.

Fishing, if carried on throughout the day in places where flies are present, is a fatal occupation.

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* In parts of West Africa it is almost or quite impossible to find a site which is certainly free from *palpalis*.

Protection of European Residents.

If it is necessary that European houses remain within the fly range they should be protected by wire gauze, which need not be of fine mesh. Native water carriers should not be allowed to enter, for the flies are known to accompany them for long distances. Steamers which ply on fly-infected rivers should be provided with wire-gauze cages into which Europeans can retire. Gloves, veils, etc., may be worn, and are sometimes necessary. To go about with bare arms and legs is to invite infection. It is found that the fly is prone to creep under a skirt; women, therefore, must wear puttees or other form of legging. Stockings are an insufficient defence. The wearing of white clothes gives some protection; for the fly prefers dark to light colours.

Europeans should be on the look out for the disease in their servants, as the constant presence of an infected person is a danger; biting insects exist everywhere in Tropical Africa, and in rare instances the disease may be conveyed by insects other than Tsetse-flies.

How Missionaries and others can assist.

Through their knowledge of the native languages and customs missionaries may be of great service to natives who are exposed to infection. Moreover, they and other residents in Tropical Africa can assist those engaged in the study of Sleeping Sickness by the collection of

data and specimens of biting flies.* Accounts of native remedies or native means of keeping Tsetse-flies from animals may be valuable; they should be accompanied by a supply as well as a description of the substance used.

Any authenticated information will be welcomed at the Sleeping Sickness Bureau. Specimens received will be referred to the British Museum for diagnosis; they should be accompanied by notes giving site and date of capture, habits, etc. No observation is too small to be recorded. Our knowledge of the life history of the fly is still very imperfect.

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* Copies of *Instructions for Collectors of Blood-Sucking Flies*, published by the British Museum (Natural History), will be forwarded to applicants.

Persons who wish for further information on the subjects of this pamphlet should communicate with the Director, Sleeping Sickness Bureau, Royal Society, Burlington House, London, W.

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