admitted into the house drains and so is the roof water. The practice varies with regard to surface water—a separate set of drains is frequently provided for it, partly because they have in many cases been made before the water system for sewage came in. Where the dry systems are in vogue there must be a water system for surface water. Probably in the Tropics the whole of the surface water could not be admitted into the sewers; that is a question for engineers. As a matter of economy, it would seem desirable when inaugurating new works to admit all the water into one system. There are dangers in this, and in trying to do too much the whole plan may be spoilt—we may have sewage coming out of the drains if they are too full. In most tropical places some provision has had already to be made for waste water, and as previously said, it usually consists of house and street surface drains, open, flowing into main channels, which are in some places open water-courses and in others sewers. On the whole I am inclined to the opinion that such a system is the best for the Tropics—that the arrangements for excreta should be distinct.

(6) *Refuse Disposal.*—Solid refuse can never be admitted to sewers. Refuse is apt to be a grave nuisance in the Tropics owing to its rapid putrefaction in the high temperature. The best system of removal is to have an iron pail for each house put out in the street every morning to be emptied by the municipal scavengers into their carts. The refuse can then thrown into the sea if there be a suitable place, burned in destructors (a somewhat difficult matter on a large scale), or utilised in filling up selected hollow places, reclaiming land, &c. The pails ought to be supplied by the municipality, and should have lids which cannot be detached easily from the pail.

In reclamation work inland the position of the land with regard to sources of drinking water should be borne in mind. Reclaimed land often proves a valuable asset to the local government. It should not be covered by dwelling houses for about five years or more afterwards. The English law gives a minimum limit of three years; this is, however, often treated with little regard in towns where the latest Acts have not been adopted.

The ground on which refuse is emptied should, if possible, be prohibited to the public. In England it is customary to see a number of adults and children grovelling in the refuse for rags, bones and other valuable material which may exist in town rubbish.

The local sanitary authority is apt to be more to blame than the people for the accumulation of refuse. It is common in eastern towns to see the public refuse bins almost covered up with excess of refuse, either because the number of bins supplied is insufficient or because they are not emptied often enough, or from a combination of these two causes. Anyway, the bin is generally productive of a foul-smelling nuisance, inasmuch as the door at the ground level for emptying by permits escape of fluid and even if the people do not put fluids into the bin the rain enters and emerges saturated with organic matter.

The System Chosen.—After this somewhat lengthy exposition of our present knowledge of drainage and sewerage systems,[1] the good and the bad working thereof, we come to the chief portion of the article, viz., "The Choice of System Suitable for the Tropics."

(*To be continued.*)

A BREEDING PLACE OF CERTAIN FOREST MOSQUITOES IN MALAYA.

By G. F. Leicester.

Assistant to the Director of Institute of Medical Research, Kwala Lumpor, Federated Malay States.

With a few exceptions the mosquitoes which are found in towns and houses, and which breed in roadside puddles, artificial collections of water in the neighbourhood of houses, and open sheets of water such as small lakes and swamps, are not the mosquitoes found in the jungle. Neither are the jungle mosquitoes often seen in the house, nor are their larvæ taken in the places above mentioned. Search in such small pools as one finds in the jungle here yields but a few species of the genera *Uranotænia* and *Culex*, and always the larvæ of very small species of those genera. In the streams we find the larvæ of three Anopheles, *Anopheles leucophyrus*, *Anopheles Treacheri* (n. species), and one so far unidentified as the few larvæ obtained died. In rock pools beside the stream and only exceptionally flooded a species of *Stegomyia* (n. species) and a *Uranotænia* are found. Thus the breeding place of the large number of species of adults which were constantly found was yet unaccounted for. Further search showed that one of the most important breeding places in the jungle is the water which collects in the bamboo, either in the stumps of old bamboo or in the cavities of fallen bamboos which in some cases have cracked in drying and allowed water to accumulate in them, or even in standing living bamboos in which some insect has bored a hole in the stem and allowed water to enter. In almost every such collection larvæ were found. I have now collected from this source the larvæ of six new species of *Megarhinus*, five new species of *Uranotænæ*, two *Wyeomyiæ*, four undoubted species of *Stegomyia*, three of which are new species, and five species I have placed provisionally in this genus awaiting the decision of Mr. Theobald, two anopheles, *Anopheles leucophyrus*, and a new species with beautifully feathered hind legs like an *Ædeomyia*, and which I have named *Anopheles asiaticus*, three *Armigeres*, three *Culex* and other larvæ of one mosquito, which I cannot place in any genus yet given in Mr. Theobald's monograph.

Anopheles asiaticus I believe to be exclusively a bamboo breeder; the larvæ of *leucophyrus* were also found in a muddy pool in a cart track running through dense jungle and, but always in jungle, in many other situations. The only collections of water in bamboos in which I have taken it have invariably been that collected in the half of a bamboo which has been split longitudinally, and the water has therefore been open to the air, the conditions obtaining being quite different to water contained in the internodal cavity of a bamboo which has merely a crack in its upper surface to allow

[1] I have purposely left the pneumatic systems out of the discussion.

the admission of the water and the adult mosquito. In the one case the water can be, and almost always is, foul and stinking from the presence of decaying vegetable matter and even animal fæces, while in the other case the water is shielded from any such contamination, and is generally clear and not foul. That some species of Anopheles can breed both without direct sunlight and even practically without light, the presence of these larvæ in such situations definitely proves. In the JOURNAL OF TROPICAL MEDICINE, April 1, 1903, there is a review of an interesting paper by Adolph Lutz in which he mentions some of the curious breeding places of true jungle mosquitoes, as for instance the collections of water in the pitcher of pitcher plants, and at the bases of the leaves of certain bromelias. In such places he found the larvæ of *Anopheles lutzii*, certain species of *Megarhinus* and other mosquitoes. He says in this connection, "The author, after many years' observation, is confident that the typical forest mosquito without exception spends its larval condition in the water of the Bromeliacea." That this statement is too sweeping these observations show. More extended research may show that out here too the Bromeliacea often afford breeding places for mosquitoes, but at present I have not come across any except the various species of wild and cultivated banana.

Many other aquatic larvæ of insects are found associated with the mosquito larvæ, some of which as natural enemies play their part in keeping down the numbers of mosquitoes by destruction of their larvæ. Probably the most important of these natural enemies are the larvæ of the various species of *Megarhinus*. These larvæ are entirely carnivorous. My observations so far tend to show that in each collection of water the adult female deposits but very few eggs, possibly not more than two. Of one species I have never found more than one larva in any one collection of water if the larva is more than a few days old. I have on one or two occasions found two larvæ of this species together when very young, but I am convinced that if more eggs than one are laid and hatched in a short time all but one disappear, having been eaten by the survivor. That they eat one another even when nearly full grown I have proved again and again, even though other larvæ are present. This cannibal tendency is specially marked in one species. I have not succeeded in obtaining eggs of any of these *Megarhinina*, and therefore cannot speak absolutely as to the length of the larval stage, but I know it covers a period of more than fifteen days even when plentifully supplied with food and at the temperature of the air, 80°-90°. The pupal stage is almost exactly six full days. My belief is that about three weeks is the duration of the larval stage of a Megarhinus with plentiful food supply. During this time they must consume an enormous number of larvæ, as they are very voracious. Scarcely any collection of water in a bamboo containing larvæ is without its Megarhinus larva lurking in its darkest depths. Other natural enemies are the larvæ of certain species of *Agrionidæ*, *Libellulidæ* and *Chironomidæ*.

Besides these the larvæ of certain *Tipulidæ* and *Syrphidæ* are to be found, and in water in the more open bamboos numerous species of tadpoles and the closed or open joints not containing water are favourite breeding places for larvæ of many insects—*Coleoptera*, *Orthoptera*, *Hemiptera*, *Hymenoptera*, &c.

The full study of the bamboo as a breeding place for insects would, I feel sure, well repay careful and prolonged work.

THE ETIOLOGY OF SLEEPING SICKNESS.—The second commission sent to Uganda, consisting of Lieut.-Col. David Bruce, F.R.S., R.A.M.C., and Dr. David W. Nabarro, to investigate sleeping sickness, have in their report dated from Entebbe, May 29th, 1903, confirmed Dr. Castellani's discovery of the trypanosome in connection with sleeping sickness. They have found the parasite not only in the cerebro-spinal fluid but in the blood of all cases examined. They have examined a large number of persons in the sleeping sickness area, but free from sleeping sickness itself and in no instance have they found the trypanosome in the cerebro-spinal fluid. An experiment made to test the possibility of the tsetse fly being the carrier of the sleeping sickness trypanosome (Castellani), proved successful in the case of an animal—in this case a monkey. These are important results and go far to show the correctness of the suggestions advanced by Dr. L. Sambon, in the JOURNAL OF TROPICAL MEDICINE, July 1st, 1903.

CARBOLIC ACID TREATMENT OF PLAGUE.—J. Mitford Atkinson, M.B.Lond., Principal Civil Medical Officer, Hong Kong, gives details of the treatment of six cases of plague treated by carbolic acid given internally (*Lancet*, September 12th, 1903). The general plan of treatment was as follows: carbolic acid was given in twelve grain doses every two hours for sixty hours; after this the dose was reduced to six grains every four hours. If untoward symptoms, such as carboluria, appeared, the dose was further reduced to two grains twice daily, and was continued for fourteen days.

A NOTE ON ANOPHELES FULIGINOSUS AND SPOROZOITES, by J. R. Adie. *Ind. Med. Gaz.*, July, 1903.—During his stay in the Punjab, Adie, while examining an *Anopheles fuliginosus*, discovered that it harboured the crescent germs of malarial parasites. The observation is of importance from the fact that the crescents in India have hitherto only been found in *Anopheles fluviatilis* = *Anopheles Christophersi* (Theob.) = *Anopheles Listoni* (Liston). Moreover these varieties are never found in the Punjab during the winter (February, March and April), but the *Anopheles fuliginosus* is present during that period, and the author, therefore, is convinced that it is this mosquito that originates the attacks of fever during the winter months.

TO ADMINISTER QUININE TO CHILDREN.—A French pharmacist states that a good way to administer quinine to children is to mix 1 gramme (15 grains) of the sulphate in a mortar with 8 grammes (2 drachms) of olive oil. Twenty drops of this mixture will contain 5 centigrammes ($\frac{3}{4}$ grain) of quinine. The mixture is poured into a tablespoonful of sugared milk, and will be easily swallowed.

The article on "The Condition of the Blood in Filariasis," published in the JOURNAL OF TROPICAL MEDICINE, September 1, 1903, was reprinted from the *British Medical Journal*.