weak spot. Great stupidity in attempts to conceal the crime, and absence of motive, are important clues; the man who steals a loaf of bread to give to his starving family is probably normal; the poor boy who robs his sister's money-box, and then scatters the coins among a crowd of children in the street, is probably defective.

INSECTS AND WAR:

XI.—THE MOSQUITO (*Anopheles maculipennis*).

BY

A. E. SHIPLEY, Sc.D., F.R.S.,

MASTER OF CHRIST'S COLLEGE, CAMBRIDGE.

(Continued from p. 106.)

There in a wailful choir the small gnats mourn
Among the river shallows, borne aloft.
Or sinking as the light wind lives or dies.

JOHN KEATS, "To Autumn."

THE female imago hibernates. Finsch made observations and found it hibernating on the frozen Siberia Tundras, beneath the moss and snow. Sterling found them in North America when the snow was melting, in great numbers, and he and his party were terribly bitten. There is no doubt that female imagines live throughout the winter, and they can be found in England as a rule hibernating in cellars, old out-houses, chicken-houses, or disused farm buildings. These hibernating females disappear early in May, presumably having laid their eggs. Dr. Thayer of Baltimore describes these creatures, having found them on the roofs and walls of barns near New Orleans, and although some may pass through the winter months in the egg state, probably the great majority of them hibernate as imagines. Whether the male also hibernates is doubtful. Grassi says he never found the male of *A. maculipennis* in the winter, only fertilized females. But as the warm weather sets in the female generally becomes active and bites, and the native Indians consider these elderly and famished females to give more annoyance than any other stage in the life-cycle. In the warmer climate of Southern Italy they not infrequently hibernate in grottos and caves. At times they occur in such numbers that they can be swept up. After depositing her eggs the hibernating female probably dies. This usually happens in May.

In the old days we used to collect gnats, keep them in a receptacle unprovided with any food, and when they died of starvation after a couple of days, we wrote poems or essays on the "Transitoriness of Life" and the "Evanescence of Time."

The thin-winged gnats their transient time employ,
Reeling through sunbeams in a dance of joy.

MRS. NORTON.

Nowadays we feed them. Bananas, sweetened milk, pine-apple, or almost any other vegetable juice is their diet, and they live in captivity for weeks. At Cambridge in 1900 (July to August) Professor Nuttall was successful in keeping females alive on a diet of bananas and water from two to eight weeks, but it was found essential to keep the atmosphere fairly moist and the food fresh. Grassi found that he could only keep *Anopheles* alive in his laboratory in Rome for a month.

Both *Anopheles* and *Culex*, at any rate in captivity, lay their eggs early in the morning. Apparently the nature of the food has some effect upon their fertility, certain observers stating that when male and female are fed on vegetable food alone there is no fertilization and no oviposition. A diet of blood evidently assists the female to lay her eggs, and perhaps to get them fertilized. One female *Anopheles* laid a batch of 146 eggs, and subsequently laid six more. But, as a rule, a fertilized female does not lay a second batch unless she receives a second meal of blood. The eggs are laid two or three days after the meal. There is also some evidence that a meal of blood is necessary if fertilization is to be effected. As Austen says in the report of the Sierra Leone Expedition of the Liverpool School of Tropical Medicine, "the following law is likely to hold good for the *Culicidae* which feed on man—at least for the common species; although these gnats can live indefinitely on

fruit, the female requires a meal of blood both for fertilization and for the development of the ova. In other words, the insects need blood for the propagation of their species." Undoubtedly, if mosquitos ever talk, they would talk like Mr. Waterbrook, Hamlet's aunt, and the "simpering fellow with weak eyes" talked when David Copperfield dined with the first-named at Ely Place, Holborn. The burden of their song was: "Give us blood."

But a word of caution must be given here. Most of these deductions are based upon mosquitos in captivity; whether the same is true of them in natural conditions is not quite certain. If it be so it is difficult to see how these countless millions of gnats and mosquitos which dwell in the barren regions around the Polar circle ever keep going.

It very frequently happens in the animal kingdom that females are much more numerous as well as much larger than the males. As Kipling tells us: "The female of the species is more deadly than the male." Professor Nuttall and I did not notice that this was the case with *Anopheles*. There is some evidence that the male hatches out earlier than the female, and that in Southern Europe there may be three or four generations in the course of the season, the first beginning in April and the fourth taking place between the middle of September and the middle of October. After that date no larvae were found. About four generations also occurred in the neighbourhood of Cambridge, according to observations of Professor Nuttall. Kerschbaumer has calculated that if the average number of eggs laid by a female be 150, the number of the descendants by the fourth generation would amount to 31 millions. This readily accounts for the fact that in certain parts of the world they occur in perfectly enormous numbers, and if it be true that blood is essential for fertilization and oviposition, very few of these potential mothers can breed. In nature they will feed on a great variety of vegetable juices—melons, wild cherry blossom, bananas, oranges, over-ripe mangoes; they suck the "juices" of allied species of insects just when the imago is issuing from the pupa case and before their integument is hardened, or they pierce the soft skin of the cicada, and occasionally attack the chrysalids of a butterfly. One of the most curious sources of food is very young trout. The adult insect attacks the *petit poissons filiformes*, "literally sucking out their unsuspecting little brains before they could escape." Grassi is doubtful whether the adult males feed at all. He states that he never found any food in their stomach, nor has he ever seen a male feed. But Professor Nuttall's experiments in Cambridge prove that males were seen repeatedly to feed, and to feed hungrily, on cherries, dried fruits, dates, and bananas.

Anopheles maculipennis (female) sucking my arm.

As mentioned before, the proboscis of the male is too weak to pierce the human integument, but Howard notes that it will suck up water, molasses, and beer; and Gray, at Santa Lucia, mentions that in that island *Culex* had developed a great fondness for port wine. One particularly favourite food is rose-buds covered with aphides, probably due to the sweetened secretion which these insects exude. The feeding is sometimes very ravenous, so that the insects become distended, the bright colour of the blood readily shines through the joints of their chitinous armour, and sometimes, like Baron Munchausen's horse after the adventure with the portcullis, what goes in at one end comes out at the other. In fact, as Dr. Johnson said of the children at a school "where discipline was maintained without recourse to corporal punishment," "But, sir, what they gain at one end they lose at the other!"

The reaction to heat and cold is that common to many insects. During the winter the imagines become torpid, quiescent, and cease to worry one. With returning warmth they become lively again, and generally wake from their winter sleep in a state of considerable hunger. They are insects which prefer darkness to light, and during the day-time congregate in caverns and grottos, under the shade of trees and bushes, beneath bridges, in barns, and so on. As the sun sinks they emerge from their hiding places and fly during the night.

Cambon, writing on *Anopheles maculipennis* in the Roman Campagna, says that imagines "appear a few minutes after sunset and disappear a few minutes before sunrise." We were able to confirm this at Cambridge. The insects retired into the shadiest parts of the boxes in which they were living until the time of sunset, when a loud buzzing was heard, and the insects promptly fed on the food which they had neglected during the day. We kept our tame mosquitos in a huge gauze tent, and at night they invariably accumulated on the side which was illuminated by a lamp. Such mosquitos as were kept in a glass lamp chimney, closed with gauze at each end, invariably flew towards the end which was held towards the light. People who are experienced with mosquitos sometimes keep the room in which they are sleeping dark and place a light in an adjoining room, leaving the door ajar and thus lure them away. It seems a curious thing that, while these insects are repelled by the diffused light of the sun, they are attracted by the more concentrated light of a lamp or candle, but such is the psychology of *Anopheles*.

It is not perhaps solely the influence of light; it may be the influence of colour, for light is very rarely entirely colourless. In the many experiments carried on in Cambridge in the natural history of the mosquito, *A. maculipennis*, not the least interesting were those directed to ascertaining the insect's preference for colour. It had been noticed by many observers that they frequented dark-coloured areas rather than light. Austen had pointed out that in a room with a dark dado it was on the dado that the mosquitos were found rather than on the whitened walls above. Buchanan noted that the men when collecting *Anopheles* in an Indian hospital found they were to be most easily got by hanging up a dark coat or two upon the walls. A white coat they always avoided. The proverbial yellow dog in the West is much less bitten than the Newfoundland, and persons wearing dark socks and black shoes are more bitten than those who wear light ones. Natives, although they suffer less in health, having acquired a certain immunity, are undoubtedly more bitten than the Europeans.

The experiments we carried on at Cambridge were as follows: In the large gauze cubical tent in which the mosquitos were bred and kept a number of paste-board boxes without lids, measuring 20 by 16 by 10 cm., were piled up. The boxes were lined with seventeen different coloured cloths, and were placed in rows one above another, and the order was changed each day, so that no question of height from the floor or better illumination entered into the problem. Counts were made of the inhabitants of each box on each of seventeen consecutive days, with the following results:

Colour of Box.	No. of Mosquitos in each Box.
Navy blue	108
Dark red	90
Brown (reddish)	81
Scarlet	59
Black	49
Slate grey	31
Dark green (olive)	24
Violet	18
Leaf green	17
Blue	14
Pearl grey	9
Pale green	4
Light blue (forget-me-not)	3
Ochre	2
White	2
Orange	1
Yellow	0
Total	512

It will be noted that about the level of the pearl grey there was a marked drop. Pale green and pale light blue, ochre, white, orange, and yellow, especially the last two

colours, seem positively to repel the insect. Our khaki clothed soldiers have other advantages than invisibility to the foe. This matter is worth pursuing further, and it might be possible to design mosquito traps lined with navy blue; by periodically sweeping out the contents considerable numbers of mosquitos might be destroyed. A dark blue sticky solution might be even more effective. Some of these results were published in this JOURNAL on September 14th, 1901, and on September 17th, Mr. J. Cropper of Chepstow wrote in it as follows:

Seeing your article on Colour Selection by *Anopheles* reminds me that I found the dark navy-blue lining of my tent this summer (in Palestine) extremely attractive to mosquitos, almost entirely *Anopheles*—and when the sun got hot I always noticed an increase in their numbers, presumably as they came from the herbage and trees near by. No one ever slept in the tent, and I never found *Anopheles* bite in the daytime.

SURGICAL EXPERIENCES AT THE ANGLO-AMERICAN HOSPITAL, WIMEREUX, FRANCE.

BY

HUGH LETT, M.B., F.R.C.S.,

SURGEON TO THE LONDON HOSPITAL, WITH CHARGE OF OUT-PATIENTS,
AND

J. H. MORRIS-JONES, L.R.C.P., L.R.C.S.E.,

COLWYN BAY, NORTH WALES.

THE following notes refer to cases that have been admitted to the Anglo-American Hospital (Lady Hadfield's), Wimereux, and treated by us during the last two months.

In addition to the patients suffering from bullet, shrapnel, or shell wounds, several cases of appendicitis were admitted, and one of acute intestinal obstruction due to a Meckel's diverticulum. This last case will be referred to in detail later.

Nature of Wounds.

The great majority of the wounds were in a more or less septic condition, especially when they had been caused by shrapnel or shell, and where there was extensive laceration of the tissues at the wound of exit.

Tetanus.

We were fortunate in not having any case of tetanus, in spite of the fact that many of the wounds were lacerated and soiled with mud and clay. The absence of tetanus was no doubt accounted for by the prophylactic injection which had been administered at the field ambulance. Inquiry was invariably made in every case, and an injection of 30 c.cm. was given to any patient who had not been previously inoculated, as well as to those about whom there was doubt.

Antisepsis Vaccine.

We made use of Sir Almroth Wright's vaccine in a few cases. Though their number is not sufficiently large to enable us to draw any positive conclusions, our experience leads us to the belief that in the majority of cases it is unnecessary, and that where used as a curative agent the cases should be chosen with discrimination. As a prophylactic, however, the progress of the cases in which we have employed it has been such as to encourage us to continue its use, especially in those cases in which there is extensive laceration of the soft parts, with a large open wound. But it is in the highest degree important to regard the vaccine merely as an adjuvant to ordinary clinical treatment, and to realize that it cannot in any way replace it.

General Treatment.

Simple bullet wounds of the soft parts, if the bullet had passed out, rapidly healed. The wounds of entry and exit were painted with iodine, a dry dressing applied, and the part kept at rest. In those cases in which a bullet remained, as shown by the x rays and by the absence of a wound of exit, provided that there was no injury to important blood vessels and no evidence of reaction as shown by inflammation, pain, and rise of temperature, no