enough in front. It is important to remember that the foot swells when heated and fatigued, and that a boot which fits perfectly over a thin sock, may be very uncomfortable over a thick one.

An ideal boot should protect the foot from cold, wet, and external injury, and support it when necessary without hindering any of its normal movements or causing any undue pressure upon any part of it. It should fit tightly round the heel and as far forward as the middle of the metatarsus, but should be roomy in front of this to allow for the spread of the foot, the adduction of the great toe, and the free use of the metatarso-phalangeal joints. The sole of the boot should have a good projecting welt, be straight on the inner edge, and be pliant so as to ease the toes and the tread when marching. If the front part of the sole is not pliant it bends up and forms a curve called the "spring" of the boot, and gets fixed in this position. Although some soldiers say that such a boot facilitates marching by enabling them to use their feet simply as rockers with minimum muscular effort, sooner or later troubles will arise, such as corns in the sole of the feet, with pain and inflammation around the metatarso-phalangeal joints. The vamp of the boot should be pliable, especially near the roots of the toes, so as to allow free movement to the "natural hinge" of the foot, and should be boxed up and rounded over the toes to prevent pressure or friction. The quarters should not interfere with the bending of the ankle, nor should they quite meet in front, otherwise it will be impossible to lace them so as to apply firm pressure. If the quarters are too high the soldier will be tempted to leave one or two of the upper holes of the lacing undone to give more movement to the ankle.

I would insist upon the following details being carried out in fitting a soldier with boots:

1. Fit the boot *after* a march, when the foot is fatigued and swollen.
2. Fit the boot over the thickest sock.
3. Have both boots properly laced, to see that the quarters are not too high and that the ankle-joint is free.
4. Fit each boot separately.
5. Make the soldier stand and walk in his boots before deciding which pair to give him.
6. If no ready-made pair fit, insist upon a special pair being made.
7. Give full instructions about the preparation and subsequent care of the boots.
8. Give a boot that is too large rather than one that is too small, for leather, when wet, shrinks.

On handing a recruit a new pair of boots he should be told to soften them *before* wearing them, and this is best done by well soaking them, inside and outside, with crude castor oil. It is important to keep the uppers supple by the constant use of oil or dubbing, and especially is this necessary when the boot is thoroughly wet. If this is not done regularly the leather becomes hard and brittle, and one of the commonest mistakes a soldier makes is to place his wet boots near a fire. It is on record that during the first winter in the Crimean war our soldiers suffered from their boots getting soaked through, and many were in the trenches without either boots or socks, as the leather of the boots shrank so much from the constant wetting that when once they were taken off it was impossible to get them on again.

In the Balkan war the result of the men being in wet trenches for twelve to twenty-four hours on end was seen in various forms. Many suffered from cholera and dysentery, but it is also stated that gangrene of the foot was not an uncommon occurrence, beginning in a painless way with mere discoloured blistering over one or two toes, to death *en masse* of the leg as high as the knee (Max Page). Depage considers that many of these cases were caused by the pressure of damp boots and putties shrinking as they dried. It is probable that a vasomotor disturbance very similar to this occurred in the Crimean war, and was classified in the statistics as frost-bite.

It is true that, *Cucullus non facit monachum*, but the boot *may* make the soldier, and no trouble can be considered too great which not only provides him with a sound and perfectly-fitting boot but also with the knowledge of how to keep it supple and in an efficient state for the hardship of war.

THE ARMY SOCKS.

The question of the soldiers' socks, although not so important as his boots, is one which requires most careful attention. Some years ago the Germans did away with socks, and kept the soldiers' feet well greased. It was reported to have been successful, not only from the point of view of economy, but it was maintained that the men marched more easily, and that the feet showed fewer blisters than when socks were worn. That this plan had its disadvantages is proved by the fact that the Germans are provided with socks at the present time. The socks should be properly shrunk before being worn, and should be a little on the large size. If too small, they will cramp the foot and compress the toes, and be liable to wear into holes very quickly. If too large, they are liable to cause blisters and sore feet from wrinkling. Unshrunk socks should be at least two or three sizes larger than the foot, otherwise, after several washings, the heels will be pulled down under the soles, and cause trouble. The army socks are made of grey absorbent worsted, and must be kept clean, or they become hard and non-absorbent, and cause sore and offensive feet. Each soldier should be taught to darn his socks evenly, so as to leave no ridges or imperfections, and on no account should he be permitted to wear socks with undarned holes. As thousands of socks are being made by patriotic ladies all over the country at the present time, the following particulars may be useful:

The socks are made with heels and toes of the usual kind, and should be woven or hand-knitted with No. 13 needles, and 4-ply superfine or wheeling in grey, Lovat's mixture, or natural colour. The lengths of foot asked for are 10 in., 10½ in., 11 in., and 11½ in.; the largest number required are those measuring 10½ in. and 11 in. in length. For sizes 1 and 2, 64 stitches should be cast on in the first instance, and for sizes 2 and 3, 68 stitches.

A substitute has been tried for socks in the shape of foot-cloths, which can be more easily washed and dried, as they are simply wrapped round the feet. It is a matter of small consequence if they shrink, but, even with these advantages, good, well-fitting woollen socks have proved to be more efficacious.

(To be continued.)

INSECTS AND WAR:

VI.—FLIES (PART II).

By A. E. SHIPLEY, Sc.D., F.R.S.,
MASTER OF CHRIST'S COLLEGE, CAMBRIDGE.

Who fills our butchers' shops with large blue flies?
Rejected Addresses.

BUT there are other flies, first amongst which may be mentioned *Fannia canicularis* and *F. scalaris*. These belong to the family known as Anthomyiidae, and are distinguished from the house-fly by being smaller in size and by many other small details in the imago stage hardly to be appreciated except by trained dipterologists. For a short time at the beginning of the summer during May and June *F. canicularis* is more abundant than *M. domestica*, and, as watched on the window panes of our living rooms, are apt to be thought by the uninformed to be young specimens of the latter. But, as has been said in a previous article, flies when they are once flies do not grow; all the growing they do is done in the larval stage. But as the days lengthen the common house-fly becomes vastly more common than *F. canicularis*, the "lesser house-fly," and the latter now tend to aggregate in those rooms of our houses not devoted to cooking, and may frequently be noticed flying in a jerky and disconcerting manner around the chandeliers or bedposts in unfrequented living- or bed-rooms. The relative proportion of these two genera now varies in different localities. Roughly speaking, out of 100 flies collected in a house there is something between 90 and 99 per cent. of *M. domestica*, but the numbers not only vary with locality but with temperature.

On the other hand, there is a curious disproportion between the number of the sexes found "at home" in the lesser house-fly. For every 100 *F. canicularis* taken indoors 70 to 75 are males, the numbers being evened by an equal preponderance of females who have remained out of doors. The larva of *Fannia* is a flattened-looking

grub with distinct segments, decorated by numerous feathery processes. It lives amongst decaying vegetation and fruit, and also amongst fermenting animal matter

Fig. 1.—Latrine fly, *Fannia scalaris*, male ($\times 3$). Antenna. Head of female, dorsal view. Natural size, resting position.

and dejecta. Sometimes they are found in rotting grass. As we shall see later, they frequently pass into the human alimentary canal. *F. scalaris*, usually known as the "latrine fly," is even commoner than its congener, and the external structural differences are minute. As its name indicates, it is found as a rule breeding in human dejecta, and is therefore, as a

typhoid carrier, much more dangerous than *P. canicularis*. Its larva is also more commonly found in the human intestine.

Then there are two species of large flies known as blue-bottles or blow-flies—*Calliphora erythrocephala* and *C. vomitoria*. The former of these is the more common. The sides of its face are golden yellow, set with black hair; whereas in *C. vomitoria* the sides of the face are

Fig. 2.—Blow-fly or blue-bottle, *Calliphora erythrocephala*, female ($\times 3$). Antenna. Male head, dorsal view. Side view of head. Natural size, resting position.

black, but the hair is golden. Both are handsome, sturdy looking diptera, with bluish-black thoraces and abdomens of a dark metallic, gun-metal sort of colour.

Blow-flies deposit their eggs on fresh or decaying meat, and this is one of the great sources of trouble to the officers of the Army Service Corps. But they are not content with killed flesh. They will lay their eggs on any living flesh which is exposed, or in sores or tumours, and here their larvae will thrive. Dr. Graham-Smith tells us he once found the exposed muscles of the broken leg of a living rabbit seething with a mass of small blow-fly larvae, which were nourishing themselves upon the living flesh. The eggs of the blow-fly hatch out in from ten to twenty hours in normal British temperatures; the larval life, in its three stages, lasts from seven to eight and a half days; the pupa state lasts a fortnight, so that the total development extends a day or two over three weeks. These maggots are unusually voracious, and Linnaeus used to say that the progeny of three blow-flies will dispose of a dead horse as quickly as three lions.

C. erythrocephala is essentially an outdoor fly and enters houses only in search of a nidus on which to deposit its eggs. *C. vomitoria* resembles its congener in size and habits, but it is not so abundant. Occasionally its eggs have been known to be deposited in the nostrils of animals and men.

But there are:

All species of resplendent flies,
Some with green bodies and green eyes,
Pricking like pins' heads from their holes
Like tiny incandescent coals.—Anon.

One of these, *Lucilia caesar*, is a marked nuisance to those responsible for victualling a camp. This green-bottle fly, like the *Calliphora* and the house-fly, belongs

Fig. 3.—Green-bottle, *Lucilia caesar*, male ($\times 3$). Antenna. Female head, dorsal view. Natural size, resting position.

to the family Muscidae, and its larvae are said to be indistinguishable from those of blue-bottles. Some species of *Lucilia* deposit their eggs in great quantities amongst the wool of sheep when the sheep are ill-kept, and they do much damage. But as far as war is concerned the harm that *Lucilia* does is laying its eggs upon dead animals. It does this on all sorts of meat stores, but in times of peace it especially infests stale fish, which the issuing larva very soon eat clean to the bone. When feeding upon a dead fish lying upon the beach they burrow down in the sand below their food. They descend some 2 to 6 in., and for the most part remain deep in the sand during the daytime, coming up to feed at night. They also have a habit of migrating from one fish to another. This fly has also been known to lay its eggs in the neglected wounds of human beings.

Sarcophaga carnaria is another species which occasionally infests human sores, and which enters houses in search of filth or carrion on which to lay its eggs; it is viviparous and produces not eggs but live larvae. One female can give birth to 20,000 young, and Redi states that the larvae of flesh-flies will in twenty-four hours devour so much food and grow so quickly that they increase their weight two-hundred fold.

Finally, there is a group of flies whose larvae penetrate under the skin of human beings and give rise to definite subcutaneous troubles. But fortunately these are with few exceptions confined to the warmer regions of the earth, and there is very little risk of their causing real trouble in Northern or Central Europe.

The troubles or diseases caused by the presence of fly larvae in the body are grouped in medical language

Fig. 4.—Flesh-fly, *Sarcophaga carnaria*, female ($\times 3$). Antenna. Natural size, resting position.

under the term "myiasis," which Graham-Smith defines as follows:

The term "myiasis" signifies the presence of dipterous larvae in the living body, whether of man or animals, as

well as the disorders, whether accompanied or not by the destruction of tissue, caused thereby. Though not strictly coming within this definition the sucking of blood by larvae through punctures of the skin, which they themselves

Fig. 5.—Side view of blow-fly (*Calliphora erythrocephala*) (x 5). A, Cheek (jowl); B, squama; C, halter.

produce, may be included for the sake of convenience in classification.

Myiasis in man may be produced by dipterous larvae—

- (a) Sucking blood through punctures in the skin (*Auchmeromyia luteola*).
- (b) Deposited in natural cavities of the body (*Chrysomyia*, *Lucilia*, *Sarcophaga*, *Calliphora*, *Oestrus*).
- (c) Deposited in neglected wounds (*Chrysomyia*, *Lucilia*, *Sarcophaga*, *Calliphora*).
- (d) Living in subcutaneous tissue (*Cordylobia*, *Dermatobia*, *Bengalia* (?), *Hypoderma*).
- (e) Passing through the alimentary canal (*Fannia*, *Musca*, *Eristalis*, *Syrphus*, *Gastrophilus*).

In the above list only the more common genera producing myiasis are mentioned. In England Type (c) is fairly common, and Types (b) and (e) are occasionally observed.

We may now consider in detail, but very shortly, the categories set forth by Dr. Graham-Smith:

(a) The very peculiar blood-sucking maggot known as the Congo floor maggot, the larva of *Auchmeromyia luteola*, fortunately does not spread beyond tropical and sub-tropical Africa. It chiefly affects the natives who sleep on mats.

(b) The flies which deposit their ova and larvae in the cavities of the body are again mostly foreign. The worst of all is the screw-worm, *Chrysomya macellaria*, of the Southern States, Central and South America. Although it extends to Canada it is not troublesome north of Texas.

Occasionally blow-flies in Great Britain deposit their ova in the human nose or ear. They very rapidly hatch and cause great inflammation and necrosis until they can be discharged or removed. They have even been found in the anterior chamber of the eye, and I have some microscopic sections showing the presence of these larvae in that chamber, whither they had probably proceeded from the nasal sinuses. But on the whole, cases

of this sort are comparatively rare, and cause but little trouble.

(c) The real difficulty, and one which has already proved a serious trouble to our army in the field, are the cases in which maggots are found in neglected wounds. Here, however, we may take some comfort in the fact that the trouble is fortunately much greater in the tropical and sub-tropical regions than in more temperate climates, and is likely to diminish as the cold weather draws on. Still, during the hot

Fig. 6.—Abdomen of female house-fly, showing the extended ovipositor.

weeks of August there were cases of wounded soldiers left lying on the fields for two or three days who were found to be suffering in this way. One almost hesitates to offer suggestions to our heroes in such cruel conditions, but whenever and wherever it can be

done wounds should as far as possible be kept covered. Not only are neglected wounds affected, but tumours and ulcers are often attacked. But, as I have said, the danger is much greater in warmer climates. We know that Herod Agrippa "was eaten of worms, and gave up the ghost"; a fact which recalls the translation given by an unhappy undergraduate who when in difficulties with the Acts of the Apostles in the "Little-Go" translated *καὶ γενόμενος σκωληκόβρωτος ἐξέψυξε* "He became a skolekobrote, and died in the enjoyment of that Office."

(d) Flies burrowing in the subcutaneous tissues are again very much commoner in tropical climates than in Northern Europe, and the cases quoted in our country are comparatively rare.

(e) The presence of larvae in the alimentary canal of man is by no means uncommon. Both the larvae of *Musca* and *Fannia* are not infrequently found, and over a thousand of the latter have been passed by a highly infected individual at one time. They probably make their way into the body with over-ripe fruit. In some cases they give rise to no symptoms, but in others violent pains are felt and a certain dizziness, and the digestive functions are interfered with. The presence of these larvae in the urinary passages are even more difficult to explain, but they undoubtedly are at times found in these channels.

A few years ago an elaborate investigation was carried on by Mr. W. Nicol, for the Local Government Board, on the part played by flies in the dispersal of the eggs of parasitic worms. He showed quite definitely that the ova of certain human parasites are taken into the fly and pass through its body undigested. Should these be deposited on the food of man, there is great risk of his becoming infected. As I have said before, flies take only liquid food, and it is only when the ova of the parasites are very small that they can pass into the alimentary canal. Some eggs are too large for the fly to swallow. Eggs of parasitic worms have also been shown to be carried on the legs and proboscides of flies, and these are deposited on the spot where the fly next cleans itself. Probably, however, in the end little harm is really done by flies in disseminating parasitic worms, but it is a possibility which must not be disregarded.

The remedial measures for the control of flies are fully dealt with in Graham-Smith's admirable book, *Flies in Relation to Disease*, from which I have ventured to borrow many figures; and again by Dr. Gordon Hewitt, in his work on *House-flies*, which has had such a wonderful success in stimulating our North American cousins to decrease one of the gravest enemies to mankind.

It has been shown over and over again that we can control the mosquito; the building of the Panama Canal alone proves this. We could equally control the "Infinite Torment of Flies." The Canadians and Americans are doing their best, but are we? The knowledgeable world has at least discovered the reason why Beelzebub was called "the lord of flies."

Fig. 7.—Larva of *F. canicularis*. (From Hewitt, Report to Local Government Board, 1912; reduced by one-half.)

A COURSE of lectures on infant care for voluntary health workers, mothers, nurses, etc., has been arranged by the Association for the Prevention of Infant Mortality and for the Welfare of Infancy. The lectures began on October 19th. Further particulars can be obtained on application to the Secretary, 4, Tavistock Square, W.C.

SOON after the war broke out the Lancaster Medical Book Club, one of the oldest medical societies in the country, which now includes every medical man in the town, held a special meeting at which arrangements were made to undertake the work of every medical man called up or volunteering for military service, and to safeguard the integrity of their practices. The balance of funds in hand, amounting to between £30 and £40, was voted to the Prince of Wales's Relief Fund.