THE LOUSE PROBLEM AT THE WESTERN FRONT.

BY

LANCE-SERGEANT A. D. PEACOCK, M.Sc. (DUNELM.),
R.A.M.C. (T.F.);

FORMERLY ENTOMOLOGIST TO THE GOVERNMENT OF SOUTHERN
NIGERIA; LECTURER IN ZOOLOGY, UNIVERSITY
OF DURHAM.

The insect dealt with in this paper is the clothes or body louse—*Pediculus humanus*, Linnaeus; order *Anoplura* or *Siphunculata*.

ENTOMOLOGICAL. MORPHOLOGY.

Technique.—Microscopical preparations were made as follows:—the insects were chloroformed, fixed in formalin (10 per cent.) for a day, brought through the alcohols (50 per cent., 70 per cent., 90 per cent., absolute), cleared in xylol for a day or two, and mounted in Canada balsam. The drawings have been carefully prepared, and are as detailed and accurate as opportunity has permitted, but further work will, no doubt, reveal other features which may necessitate slight additions and modifications. The musculature and mouth parts, for instance, are not fully worked out.

The nomenclature of the parts may possibly need correction. As I am not aware of any other detailed drawings of this insect, it is hoped that these will be of utility.*

EXTERNAL CHARACTERS.

Only the most significant features are dealt with. The female is the larger, being about 4 mm. in length, while the male is about 3 mm. The proportion of the sexes is about equal. Soldiers speak of *black* and *grey* lice. With regard to the question whether these are different species, no distinctive features have been discovered which would necessitate separate classification. The black louse has a more dusky integument, the edges of the body are darkly pigmented and the dorsal regions of the segments darkly patched. Murray gives the information that the different coloured races of men have lice coloured to match. On the question whether the black variety exists peculiarly at the front, or more abundantly in proportion than in England, there is no evidence available. Eighteen hundred lice counted yielded 5.4 per cent. black. The bristles, of which there are two kinds, long and short, are placed all over the body, are somewhat sparse in number, and are roughly symmetrically arranged.

Head (see Figs. 3, 4, 5, and 6).

This bears the very simple sensory organs—the antennae and the black eyes. The entrance to the alimentary canal is at the anterior of the tubular chitinous mouth-part (5), which is nearly surrounded by a projecting sheath (1). This sheath rises from a thin chitinous diaphragm, which forms the greater portion of the anterior of the head. The dorsal margin overhangs and forms a blunt rostrum (2). Ventrally, are a pair of chitinous structures of unknown significance (3).

Thorax.

The three thoracic segments are fused and their boundaries are not sharply marked off. Mid-dorsally is an invagination. There are three pairs of strong legs which each end in sharp powerful grappels and spines.

Abdomen.

There are eight segments, the two posterior being fused. Each of the first six bears a breathing hole, the stigma, on either side. The male is pointed at the posterior, and the sharp tip of the penis may often be seen extruded. The female's posterior is bilobed and ventrally shows a pair of tooth-like appendages, the gonopods, which assist in copulation. In both sexes the anal region is fringed with numerous bristles.

* For bench room and facilities to finish certain microscopical and recording work I wish to acknowledge the kindness of Captain McNee, R.A.M.C.

INTERNAL CHARACTERS.

Mouth-parts.

The interesting question of the homologies of the mouth-parts the writer desires to leave till a more appropriate season, and, in the absence of knowledge on this point, it would be best to use non-technical terms. The chitinous mouth-parts are (1) an outer structure adapted for sucking and for supporting the first pharynx; (2) two inner structures adapted for stabbing.

The strong outer apparatus is tubular for a certain length at the mouth end. When the insect is not feeding the entrance is lined with sharp chitinous teeth, seated in tissue and pointing inwards. When feeding the outer structure is thrust forward a little so that the mouth region projects beyond the protective sheath. This action, in some way, appears to relax the tissue bearing the teeth, and these, instead of lining the mouth, come to fringe it and point outwards. The first half of the outer structure, dorsally, is an arch which forms the roof of the beginning of the gullet. Backwards from the arch run two limbs to which are attached the protractor muscles which out-thrust the structure. They also support the sides of the first pharynx. In the arch run two curved walls, which appear to have their origin just ventral to where the arch bifurcates, and in the floor of the pharynx. Within these two curved walls lie the anterior portions of the two stabbing organs.

The inner mouth-parts, the two stabbing organs, are lodged in a tubular sac lying below the oesophagus and extending from the back of the head to the first pharynx. They are similar in so far as both are flexible, long (nearly the length of the head), enter the first pharynx together, and bifurcate posteriorly. They vary in detail. The uppermost resembles a thin, broad chisel, double-grooved along part (?) of its length. The lower is like a gouge bit, the tip being three-pointed. Protractor and retractor muscles bring the apparatus in and out of action.

Alimentary Canal.

The writer does not fully understand the relationships of the various structures composing the canal anterior to the first pharynx. It would seem, however, when human blood is being in-sucked, that a gutter or tube is formed, having for sides the curved structures of the outer mouth parts and for a floor the posterior length of the broad stabbing organ. It is possible, too, that the under-stabbing organ becomes closely apposed to the upper, so forming a narrow tube leading to the wound.

Following the feeding tube is the first pharynx, which has muscular walls and is lined with chitin. Its function as a pump is secured by the action of five pairs of muscles, which diverge from it dorsally. The second and smaller pharynx resembles the first. It leads to a narrow gullet which opens into the stomach.

For information concerning the salivary glands the writer is indebted to Major Sydney Rowland, R.A.M.C. The glands are situated far back in the thorax and consist of two on each side, one bifurcated and one globular. The duct from the bifurcated gland joins with that of the accessory gland to form a single duct, and this opens into the sac of the stabbing organs.

The stomach is of very large capacity and, anteriorly, has two pockets. A short, narrow, single-looped intestine follows and leads to a slight swelling, the beginning of the rectum. Into the intestine open eight excretory Malpighian tubules. A short rectum ends at the anus.

Circulatory System.

This is probably typical, a long tubular heart lying in a pericardial space dorsal to the gut, with few vessels and large blood sinuses.

Respiratory System.

The lateral stigmata lead to the tracheae which branch to smaller vessels to ramify the tissues.

Nervous System.

The brain lies behind the second pharynx, above the gullet, and is connected by lateral commissures to a sub-oesophageal portion. Backward from the sub-oesophageal ganglia runs the ventral nerve cord. An optic nerve runs

from the brain to the eye. The antennae are sensory. Apart from these, there is a marked absence of any structures denoting special sense.

Reproductive System.

With the exception of the penis the reproductive organs of the male have not been noted. Of the female only the eight (?) ovaries have been noticed. They are long tubes containing ova at various stages of development.

INSECTS, ETC., RESEMBLING LICE.

Many insects, etc., found in dug-outs, at first and casual glance may be easily mistaken for lice. The *woodlouse* or *slater*, a crustacean related to the crabs and lobsters, is regarded as an ancestral or originative type of louse. *Springtails*, primitive insects which move by leaping, resemble lice when at rest. Certain small beetles may be taken for adult lice, and small mites, relatives of the spiders, look like young lice. These mites are very common in food which has been trodden into empty sandbags and the floors of dug outs.

HABITS OF LICE.

Habitat.

For shelter the louse depends upon the clothing, particularly the garments worn next the body, and prefers the comfort of the seams. Soldiers express a habit of the insect graphically when they say "It digs itself in," and, for this purpose, the beautiful musculature and the strong claws and spines of the legs are admirably adapted. The shirt is preferred, but in many cases most eggs are found at the fork of the trousers. This is because the trousers are worn consecutively for a much longer period than the shirt. In order of importance the areas most favoured for egg laying are the fork of the trousers and the armpits, the triangles at the tail of the shirt; next are the trousers and the shirt seams, and then the neck, but under present conditions there is general distribution also. Eggs have even been found in the beads of rosaries. It will be noticed that the insect accumulates where there is plenty of warmth, plenty of humidity, and plenty of shelter.

The possibilities of infestation are instanced in a case examined at hospital. Apart from extreme lousiness of underclothing, the man actually had lice and eggs at the back of the neck of the tunic, the pocket seams inside the tunic, and the flap seams of the pockets. A walking distributing agent!

Alimentation.

The insect feeds by sucking human blood, and adult lice may suck for twenty minutes at one time. They feed voraciously and wastefully, their excreta often consisting of what appears to be undigested human blood. The peristalsis is violent, and the whole alimentary canal may move backwards and forwards while feeding is in progress. Young lice feed immediately on hatching. In consonance with Warburton's experiments, it was found that the young may be reared by feeding twice a day on the arm. They suck for any length of time between nine and twenty-two minutes, averaging twelve. If allowed to feed three times a day they do not suck so long at one time.

The process seems to be—the stabbing organs are out-thrust, pierce deeply, and the sucking tube is anchored by the circumoral teeth to the skin; by means of muscular action on each pharynx the blood is drawn in; leakage into the sac of the stabbing organs is prevented by the upper stabber; the saliva pours into the sac, and, possibly via a tube formed by the upper and lower stabbers, reaches the wound and prevents the coagulation of blood; the blood is digested in the stomach and intestine; the waste

products from the gut and Malpighian tubules pass through the rectum and anus.

Life-History.

Concerning this it has not been possible to conduct many experiments. In copulation the male lies below the female, the penis is extruded, up-curved, and is retained in position by the gonopods of the female.

The eggs are about 0.8 mm. long and 0.3 mm. in diameter, and, according to Warburton, one female lays five at one sitting, and may produce a total of 125. They are clear and glistening when new, but towards the time of hatching appear a yellowish-brown, due to the colour of the developing insect inside. The experimental method of incubation was as follows:—small pieces of shirt seam bearing undisturbed eggs were placed in calico bags; these were tightly fastened with string to prevent the escape of any newly-hatched young; the bags were slung next the body under the armpits and examined twice a day, morning and evening. The conditions, therefore, were almost natural.

One exact result is of importance. A fortunate chance gave six newly-laid eggs. One young hatched out in six days, three in about seven days, one in seven days and a half, and one in eight days.

A total of 291 eggs, of unknown age, taken *in situ* on eight pieces of shirt which had been discarded for about one day, yielded, after two days' incubation, the following:

1. A constant succession of hatchings each day of 9, 23, 33, 24, 10, 11, 20, 7, 72, 5.
2. Total percentage hatched—82 per cent.
3. The greatest number took at least ten days to hatch. (Perhaps the one day's separation of the shirt from the body inhibited development.)
4. Incubation may often take at least twelve days.

The attempts to rear the young in calico bags carried at the armpits and by freeing to feed twice a day were not very successful. The results differ in certain respects from those of Warburton. The first moult took place at various periods—for example, about two days in one case, after three days in one case, five days in one case, and seven days in one case. One specimen lived fifteen days and moulted twice, the first time on the fifth day and the second time on the seventh. It looked only half-grown at the end of the time which Warburton suggests to be the limit of growth. The conditions of the experiments were almost natural, and the heavy mortality of the young is rather baffling and disappointing. It may be that the young are especially susceptible to even the slightest confinement.

Vitality.

The duration of life on the body is not known. Warburton kept a mature female alive for thirty days. This would make the total length of life about seven to eight weeks. The duration is said to be dependent upon three factors:—abundance of food, the normal body temperature, and body emanations. Kept at 37° C. dry heat in a bacteriological incubator, lice die in about three days. Specimens were fed twice a day and kept on a piece of clean shirt in a cardboard cylinder. This was carried under the armpit, so ensuring body temperature without body moisture. The insects died in about five days. Body moisture, therefore, seems necessary to the insects, but what is the more essential, the humidity only or the chemical quality, is not known to the writer. To these factors it is proposed to add freedom. Even under the very slight restraints imposed during experiments the adult insects died quickly, that is, in two or three days.

As a result of many experiments it was found that the longest period during which lice survived separation from

FIG. 2 (key to Fig. 1).

the human body was nearly nine days. The following results were noted:

On an infested shirt, newly discarded and exposed to the open, during which the temperature varied between 40° F. and 45° F., two days being raw and wet, lice lived as long as five days.

On infested shirts, taken singly and stored in large army biscuit tins, or in brown paper parcels, they may live about seven days; on shirts stored in bulk, eight days.

Placed upon freshly won soil, they lived seven days. On a piece of shirt which was placed upon soil in a large biscuit tin they lived eight days. Dry soil to the depth of 2 in. was placed at the bottom of a box 2 ft. x 1½ ft. x 1½ ft., and covering the soil were laid pieces of wood, so imitating in miniature the conditions of a dug-out. A lousy shirt was placed in the box. The lice congregated upon the uppermost part of the shirt and remained there alive for eight days.

A constant feature is the moribund condition into which the insects sink after two days' separation from the body. This condition lasts till death. On taking a moribund louse, and placing it on the arm, there is evinced a quick response. The insect begins to take a distinct interest in life and shows it by perambulation and feeding. In connexion with this "warmth test" it is important to note that it may need to last quite five minutes at times.

With regard to vitality when subjected to various insecticides, the following results were noted:

Infested shirts dusted with a white mercury powder advertised as a vermicide, still held live lice at the end of four days. A similar test, using a powder of heavy oil residue (sulphonated), talc, and aloes, gave the result that the lice lived nearly nine days. The insects crawled regardlessly through both powders. Placed upon a small piece of shirt in a pill-box, the bottom of which was smeared with Vermijelli, they died in two hours, not having sense enough to keep away from the insecticide. They were killed by suffocation, their bodies becoming sticky with the preparation, and the stigmata choked. Similarly placed above N.C.I. powder they died in half an hour. A single infested shirt dusted with N.C.I. did not hold a live louse in ten hours. Shirts, each dusted with N.C.I. and stored in bundles of ten, each bundle being dusted above and below, did not contain live lice after three days. An infested shirt was immersed for half an hour in an emulsion of soapy water and crude paraffin oil (0.75 per cent. of emulsion being oil). The lice revived, and lived in pill-boxes for seven days.

The maximum time during which eggs away from the body may remain dormant has been found by Warburton to be about forty days. This was under laboratory conditions in England, and the temperature fell at times below freezing point. Similar experiments were carried out here, shirts holding eggs being exposed to weather conditions. Samples taken from one shirt which had been exposed for eight days hatched after four or five days' incubation on the body. During the time of exposure the temperature fell twice to freezing point, and two days were raw and wet. Samples taken from a shirt exposed thirteen days did not hatch after twenty eight days' incubation.

In applying this knowledge the important fact is that

eggs on the clothing, particularly the outer garments, if not treated regularly by ironing or disinfection, are a possible source of infestation for as long as a month after laying. Also, the removal of the clothing from the body for a few days in order to kill the eggs and lice by exposure, is not a practicable scheme.

The scanty existing information on the parasite's powers of endurance indicates them to be small. The examples cited, however, point to the conclusion that these powers are by no means inconsiderable.

The louse, therefore, is a parasite which is utterly dependent upon man's blood for sustenance and man's body and clothing for prolonged, prosperous longevity and reproduction.

INSTINCTS.

Migration.

To discover the capabilities of the louse with regard to its powers of locomotion and distribution the following simple experiments were made. On four occasions, for a period of at least one hour, the tracks of four lice were charted. The diagrams (Fig. 8) illustrate two typical results.

The distance between the two lice farthest apart was 9 ft., two covering a distance, measured in a straight line, of 5 ft. The routes pursued were decidedly devious and exploratory. There was no desire evinced to make for a recently discarded shirt, which was laid as bait 6 and 12 in. from the insects. These charts demonstrate how, under certain conditions, the louse may go far afield to find a local habitation and a means of livelihood. It has been observed that the insects may climb the wall of a room to a height of 3 ft.

A box was made into a miniature dug-out; twenty lice were placed in it, and watched with very short breaks for eight hours. The insects scattered quickly, roamed round, and twelve in all left the box within half an hour. The remainder were lost. In another case, in which straw was placed in the box, only two migrated after two hours. After twenty-four hours two were found on the straw and six on the boards. The remaining ten were lost.

Such migratory powers are most probably only fully exerted in times of stress. This is borne out by their curious habits of "congregating." Whenever lice upon discarded clothing were the subject of experiment most of them invariably made for the uppermost portion of the material, and showed no desire to forsake it. There is therefore a decided preference for warm material. On a shirt in a condition generally termed "walking" were computed 10,000 live lice. This would indicate gregarious habit and comfortable inertia and that competition is no incentive to migration. Experiment also shows that light is not the stimulus to congregating.

Lice certainly do wander from the host. Although no experiments have been performed with the definite aim of ascertaining the stimulus of wandering, five months' experience with the insects suggests, that if the

FIG. 1.—The Clothes Louse—*Pediculus humanus*, Linnaeus (synonym, *P. vestimenti*). Male; black variety; enlarged about sixty times. Drawing made from cleared specimen, viewed dorsally, and seen by transmitted light.

surroundings of the host be warm and comfortable, lice are tempted to wander about. Such conditions exist in a warm bed or when soldiers are packed closely together. The insect, though moving about, is in its native air all the time, and there is not the adventure of changing an environment. In such circumstances a bed may be infected through the louse not being fortunate enough to return to

to wandering; (2) contact of the lice and the body; (3) the insect "scenting" the host. Which is the most important factor is not known. A deliberate effort to reach the human body or recently discarded and sweat-impregnated clothing has never been observed. The instincts of detecting and pursuing the host seem, therefore, to be very feeble, if not absent.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

FIG. 3.—Diagram showing anatomy of head; dorsal aspect. Drawn from sections and cleared specimens; sections cut by Lieutenant J. Shaw Dunn, R.A.M.C. (1) Protective sheath—incomplete tube; (2) projecting anterior dorsal margin of head; (3) paired anterior ventral structures; (4) anterior ventral margin of head; (5) chitinous outer mouth-part, with (6) its tube running forward (7), and terminal teeth (8); (9) protractor muscles of outer mouth-part, and (10) retractor muscles (?); (11) first pharynx, and (12) muscles; (13) second pharynx, and (14) muscles; (15) the two structures of the inner mouth-parts, the dorsal being thin and broad, the ventral narrower and thicker, with three (?) terminal points; (16) ventral sac lodging the inner mouth-parts; (17) bifurcated posterior ends of inner mouth-parts; (18) protractor muscles (?); (19) retractor muscles (?); (20) oesophagus—dorsal; (21) supra-oesophageal brain, and (22) sub-oesophageal portion; (23) optic nerve; (24) eye.

FIG. 4.—Transverse section through head at region 5 of Fig. 3.

FIG. 5.—Transverse section through head at region 6 of Fig. 3.

FIG. 6.—Diagram to illustrate mouth-parts in action.

the host before he leaves the bed, and other men, clean or otherwise, may become infected.

Selection and Preference.

Lice soon find the body if the host sleeps on any infected bedding. The discovery of the host may be due to three causes: (1) The warming of the bed giving the incentive

FIG. 7.—Diagram showing internal anatomy of female; ventral aspect. Drawn from dissections and cleared specimens.

These instincts being at best so feeble it seems still more improbable that the parasite has any instinct of preference—that is, as popularly expressed, "choosing one person rather than another." Three types suffer most from lice—the person badly infested, the person with a very sensitive skin, and the person who has never been verminous before. The first type may be an unfortunate soldier, physically unclean through campaigner's luck, or may be a man of unclean habits, in both cases the parasites having every

FIG. 8.—Tracks of lice; the breadth of the diagram represents 9 ft.

opportunity for success. In the other two types it is a matter of susceptibility to the touch and stab of the insects.

MEDICAL AND MILITARY SIGNIFICANCE.

Scratching, such as louse irritation induces, renders the skin prone to sepsis. "Louse rash," if it may be termed so, has been found distressingly common, and has frequently been mistaken for scabies.

Lotusiness is felt mostly at night. This is in spite of

the fact that practically the same number of lice is present on the body during the day. Probably the distractions of the day keep the mind away from the pest, but at night, when everything is conducive to the desire for rest and comfort, the mind is most sensitive to the slightest irritation. Then the crawling of the insects, their sharp stabs, the itchiness of each tiny wound, and the fierce desire to scratch become intolerable. As one man said, "You feel as if you could rive yourself to pieces." Sleep, at best, is broken and uneasy, but is usually impossible. Consequent upon loss of sleep, impaired vitality and mental weariness become very real miseries to the soldier, the value of whom depends upon a high pitch of bodily well-being.

These are the soldier's most acute troubles, primarily due to lice at this front, but it must never be lost sight of that the menace of typhus, possibly more imminent at the Eastern fronts, is still present at the Western.

(To be continued.)

Notes on Military Orthopaedics.

III. THE SOLDIER'S FOOT AND THE TREATMENT OF COMMON DEFORMITIES OF THE FOOT.

BY

LIEUTENANT-COLONEL ROBERT JONES, CH.M.,
F.R.C.S.I. (HON.),

INSPECTOR OF MILITARY ORTHOPAEDICS, ARMY MEDICAL SERVICE.

(Continued from page 711.)

PART II.

CLAW-FOOT.

ONE of the surprises the military surgeon meets is the number of men with claw-feet who have been passed into the army; but still more surprising is the fact that many such cases have found their way to the front after the vigorous initial training which the recruit undergoes. Sooner or later, however, these men gravitate to hospital, and very few of them return to the ranks as efficient. A patient with this condition of the foot is quite unfit for military service, and should never be accepted as a recruit. The affection usually begins in early life, and is often not recognized until it has reached what I have termed its second stage; until then serious trouble hardly ever arises.

The etiology of "claw" or "hollow" foot is still uncertain. It is very often associated with a slight contraction of the Achilles tendon in childhood, and in some cases is due to a transitory paralysis of the extensor group of muscles. The short boot also stands in some causal relation to it. The whole question is, however, too vexed to be discussed here.

Clinically the condition presents five degrees or stages. The progress of the development of the deformity from one degree to another, though often continuous, is frequently arrested in one of the early stages; or perhaps the facts may be better stated by saying that progress from the first two stages to the later more severe stages is very slow, and sometimes does not take place.

1. The First Degree of Claw-foot.

The first degree occurs in childhood, and is easily overlooked. There is no visible increase in the height of the arch—in fact, the foot looks normal. The complaint made is that the child is clumsy, especially when running, and frequently stumbles or trips without obvious cause.

It will be found in such a case that the foot cannot be dorsiflexed beyond a right angle with the leg, and that there is commencing contraction of the Achilles tendon and the structures in the sole. The child's tendency to stumble is thus explained, for the fore part of his foot gets in his way as he tries to run.

The treatment in this stage is obviously to stretch the Achilles tendon and the plantar structures and so restore the power of dorsiflexion of the foot at the ankle. This can usually be effected by manipulation, after which the boot in which the patient walks should have no

heel to it, but a bar half an inch thick placed transversely under the tread. In some cases it may be necessary to lengthen the Achilles tendon. This is best done subcutaneously by the following procedure (Fig. 1).

The tenotome is entered on one side near the heel, and one-half only of the tendon is divided. The tenotome is next entered one and a half to two inches further up on the other side, and the other half of the tendon is divided. Now, by forcible dorsiflexion of the foot, the two halves of the tendon are made to slide on one another until the required lengthening is obtained. A rectangular splint is then applied so as to keep the Achilles tendon at rest in the corrected position and to maintain tension on the sole of the foot. This method is always preferable to the other method of complete division of the tendon at one level as the period of convalescence is shortened, and functional power in the calf muscles is more speedily restored.

FIG. 1.—Anatomical diagram to illustrate the two stages of the operation for the lengthening of the Achilles tendon by subcutaneous tenotomy.

2. Degree of Claw-foot.

In the second degree there is definite contraction of the plantar fascia, and the characteristic deformity of the foot is easily observed (Fig. 2). The fore part of the foot is dropped—that is to say, there is flexion at the mid-tarsal joint or exaggeration of the arch of the foot. At the same time the great toe is dorsiflexed at the metatarso-phalangeal joint, and the tendon of the extensor proprius hallucis stands out prominently. Further, if the surgeon places his finger under the ball of the great toe he easily lifts it, and

FIG. 2.—Claw-foot, second degree.

the toe automatically straightens out (Fig. 3). The other toes do not present a similar deformity at this stage, but the Achilles tendon is shortened. Even in this condition the patient may not complain of pain or disability; especially is this the case in the very young. In older folk, such as the recruit, complaints may begin whenever long marches are repeated. The men have to fall out because of pain and fatigue. They have frequently been suspected unjustly, for even at this stage there are no very obvious objective signs. The arch of the foot is not collapsed, but, on the contrary, slightly exaggerated. But if the surgeon makes a careful examination he will

FIG. 3.—Claw-foot, second degree. The surgeon's finger easily replaces the dropped head of the metatarsal bone of the great toe; a case in this stage is suitable for tendon transplantation.

note tenderness beneath the metatarso-phalangeal range, and when the patient is asked to extend his toes the big toe responds to a disproportionate extent.

Treatment at this stage must be drastic. If the patient is to be rendered able to get about with ease and comfort, nothing less than operation will suffice. A radical attack may save the situation, and in a few weeks the soldier may return to duty. The operation consists in dividing and stretching the plantar fascia and then in making an incision over the tendon of the extensor of the great toe (extensor proprius hallucis), and the tendon is severed from its attachment. Two holes are drilled close to each other behind the metatarsal head, forming a tunnel through which the tendon is drawn by means of a catgut