considered by the umpires to have induced hesitation in disembarking.

Officer Commanding a Field Regiment and Anti-aircraft Battery (British Personnel).—No impairment of efficiency noted. In both these artillery units the experiment had been planned so as to include, in test and control groups alike, a number of individuals whose duties involved arduous physical labour or mental concentration.

The Commandant of the Training Centre stated that he personally did not consider that the remedies given interfered with the efficiency of the troops engaged. He stated that their performance compared very favourably with that of previous (and untreated) groups in training.

In considering the evidence it must be remembered that all the exercises in which excessive drowsiness was a source of complaint were carried out at night. Landings in general were at dawn, and the sea trips were made during the early hours of the morning after embarkation at or before midnight. Lack of sleep thus played a part in inducing drowsiness, as did the undoubted sleep-inducing effects of the motion of the craft. Further, such complaints as were received came from a relatively small section of the total subjects engaged, and the responsibility of the drug was not clearly established.

The balance of opinion, including that of senior officers observing the troops at work, was that untoward effects on military efficiency were not produced.

Summary

Experiments on the prevention of sea-sickness were carried out in the Tropics during the training of troops under conditions closely approximating those of battle. British (1,667) and Indian (3,673) troops were used for tests.

In all experiments, vomit-bags, sweets, biscuits, and chewing-gum were issued to all men taking part, and men were allowed to stand up in the craft if they so desired.

Assault craft of various types (L.C.A.s, L.C.M.s, L.C.T.s, L.C.I.(L)s) were used for all but a few experiments in which 170-ton dhows were employed.

In all experiments control groups receiving inert pills were observed under conditions identical to those of the test group(s). Usually control and test groups were each of approximately 100 men.

The drugs tested and the number of observations on each were: hyoscine (1,990); hyoscine plus amphetamine (625); hyoscine plus ergotamine (116); chlorbutol (619); ergotamine (116).

After rejection of 2,102 observations rendered valueless by calm seas, etc., 3,638 remained for analysis. The validity of the results has been statistically assessed. A high degree of reliability is shown for those for hyoscine, hyoscine plus amphetamine, and for some chlorbutol experiments.

Of the remedies tested, hyoscine 1/100 gr. proved most effective. The degree of protection was of the order of four-fifths of those susceptible. This degree of protection was observed in relatively calm seas, when the sickness rate in controls was 16%.

No case of heat-stroke or heat-exhaustion occurred among 2,731 men who were given hyoscine. The average maximum and minimum temperatures during the experiments were 91.9° and 82.1° F., with an average relative humidity of 80%. Considerable physical exertion was performed by 1,789 of the treated men on assault exercises; a further 424 carried out a very strenuous assault during an exercise in which one fatal case of heat-stroke and two cases of heat-exhaustion occurred among 5,000 untreated troops.

The conditions of the tests were such as to reveal any impairment of military efficiency. Drowsiness in landing-craft was general in all experiments, in untreated as well as treated groups. Only on two occasions (and these involving the same men) was there a possibility that one company might have been adversely affected by hyoscine. Executive officers did not attribute shortcomings of the troops during exercises to the effect of any drug.

We are indebted to Lieut.-Gen. Gordon Wilson, C.B.E., M.C., Director of Medical Services, General Headquarters, India, for permission to publish these results. It is a pleasure to record our appreciation of the co-operation and assistance so willingly given us by the Central Statistical Section of G.H.Q., India. Our thanks are also due to the officers commanding the training centre and the troops in training, as well as to their staffs, for the generous facilities afforded us and for the interest they displayed in the work.

REFERENCES

- Holling, H. E., McArdle, B., and Trotter, W. R. (1944). *Lancet*, 1, 127.
— and Trotter, W. R. (1944). B.P.C. Report 43/175, Abt. 18, Feb. 3.
Jowett, E. P. (1943). "Report on Sea-sickness Alleviation Trials," Part II, Dec. 4.
— and Thomson, C. S. (1943). "Second Interim Report on Sea-sickness Alleviation Trials (Indian and British Troops)," Nov. 4.

HUMAN CREEPING MYIASIS

REPORT OF A CASE

BY

R. G. TURNER, M.B., B.Ch.

Formerly House-physician, University College Hospital, London

Very few cases of human creeping myiasis have been reported and none described very fully, so that the following case may be of interest to both physicians and parasitologists.

Clinical History

The patient (K. C., W.857), a boy aged 14, was admitted on Jan. 21, 1944, to University College Hospital. He lived in South London, and had the normal activities of a boy of his age. He had never been abroad, and had left home only for holidays at Brighton or Shoreham, where he used to visit the harbour; but he had not done this during the previous two years. He often used to go on Epsom Downs to fly model aeroplanes. He had no allergic personal or family history, but was sometimes bitten by insects and he wheeled markedly as a result. His general health was good. Twelve months before admission he began having prickly pains over the shoulders and chest—"like a needle pricking the skin"—associated with aching pains in the shoulders and legs. These continued, without causing much inconvenience, in bouts about twice monthly for six months and then stopped. In July, 1943, he first noticed a swelling in the skin, not reddened, about 3 cm. in diameter, giving rise to a pricking pain on pressure but otherwise painless. It lasted two days and then disappeared. From then on he had many similar swellings, usually single, occurring at various sites (left calf, right popliteal area, left shoulder, back, and the back of the head and neck). They were 1 to 5 cm. in diameter and raised 0.5 to 1 cm. above the skin. They were red or skin-coloured, and caused a pricking pain on being touched, but did not throb. They usually remained for a few days and then disappeared, but the boy had from time to time the sensation of something moving beneath the skin, and he thought that the lumps sometimes moved, going down at one place and coming up near by at another.

On Dec. 30, 1943, one of these swellings came up on the right thigh, and in a short time showed a black spot in the centre. It was fomented, and on Jan. 2 burst, discharging sero-sanguineous fluid. The cavity was syringed by a doctor, and a white maggot emerged. At that time the boy had a severe sore throat, which subsided uneventfully. He was shortly afterwards seen at the Hospital for Tropical Diseases and found to have an eosinophilia of 54%. He was then referred to U.C.H., where his course was as follows:

Jan. 21, 1944.—On admission there were no swellings and the skin was normal. The patient was a sensible uncomplaining boy in apparently good general health. T. 98.6°, P. 104, R. 20, B.P. 115/80. Blood count: R.B.C. 4,800,000, Hb 100%, W.B.C. 22,000 (neutrophils 35%, lymphocytes 19%, monocytes 2%, eosinophils 44%).

Jan. 24.—Left temporal region painful (throbbing, worse on palpation), no swelling visible. During the night a swelling developed, and next day it involved all the left circumorbital tissues and the frontal region to the roots of the hair, extending just over the mid-line; it was tender, showed capillary pulsation, was oedematous, and pitted readily on pressure. The skin was reddened, with no circumscribed margin. The palatal fauces were reddened. Soft glands were palpable in left axilla and on right side of neck. Attempts to obtain fluid from the swelling were unsuccessful. T. 103.6°, P. 108, R. 24, in the evening. Blood culture negative. Radiograph of chest negative.

Jan. 27.—Oedema spreading; left eye practically closed. Adrenaline (0.25 c.cm. of 1:1,000) given subcutaneously with doubtful effect. The oedema then gradually subsided and was gone by Feb. 1, as was also an irregular spiking temperature, present since admission. Urine normal. Stools negative for ova and parasites.

Feb. 6.—In the night the patient developed tenderness over the 7th left rib in the mid-axillary line. At 7 a.m. there was in this situation a small red non-indurated slightly tender raised area, 2 by 1 cm., with a central clear yellowish linear bleb. This was incised, and from immediately below the skin a white segmented maggot, very slightly motile, 1 by 0.3 cm. in size, was shelled out. Temperature 97.4°. The maggot was taken to the London School of Hygiene and Tropical Medicine, and identified by Dr. John Smart of the British Museum (Natural History) as the larva of the warble-fly (*Hypoderma bovis*) in the spineless stage (first instar, according to Knipling's (1935) description).

Feb. 8.—A similar swelling, but with a small dark spot in the centre, was present on the right medial malleolus. It was fomented; but by 8 p.m. the dark spot had disappeared, the swelling being otherwise unchanged. During the day four pink papules, 4 by 1 mm. in size, appeared in a straight line on the front of the left side of the chest, as though distributed along the 4th intercostal space. One

of them was opened, but no maggot was found. Blood count: W.B.C. 20,800 (N. 30%, L. 24%, M. 2%, E. 44%). Erythrocyte sedimentation rate, 12 mm. in 1 hour. During the next five days the papules disappeared.

Feb. 13.—A reddish smooth swelling developed over the medial edge of the right scapula. The patient thought it was one of the papules that had migrated. Next day this swelling had disappeared, but one had come up in the right lumbar region, and the patient thought this also was a migration of the same swelling. *Feb. 15.*—No swellings present.

In the next three weeks, except for a spike to 101.2° on Feb. 16, the patient was afebrile and asymptomatic. Several swellings, similar to that of Feb. 6, developed, and three more specimens were obtained from the left buttock and the right lower leg—one excised and two forced out with ease by squeezing. The small central bleb noted on Feb. 6 was not again seen, but a few swellings showed the dark central spot observed on Feb. 8. Some of them were not touched, and it was noticed that the dark spot would spontaneously disappear in a few hours, though the surrounding swelling generally lasted for one or two days. *Feb. 24.*—Blood count: W.B.C. 20,000 (N. 24%, L. 17%, M. 2%, B. 1%, E. 56%).

No swellings or oedema developed after March 1. On March 7 the patient had a sore throat, which was reddened, and the right anterior cervical glands were swollen. There was no fever and the throat culture contained no pathogens. Symptoms subsided in a few days, and the patient was discharged on March 10. He has had no symptoms or signs since; he was last heard from on Feb. 22, 1945.

Commentary

Cattle are the usual hosts of *Hypoderma* flies, which are usually one of two species—*H. bovis* and *H. lineata*. Great economic loss results, on account of the damage caused to the hides by the emerging larvae. The flies are said (Hermes, 1939) to occur throughout the U.S.A., Europe, and Asia. So far as has been ascertained, the adult fly usually lays her eggs on the legs of the host, and this often terrifies the animal, which may plunge about in a frenzy, or rush into water, in an attempt to dislodge the fly. The egg hatches in about a week, and the larva penetrates the skin directly or via a hair follicle. This process, in those cases observed in man (and presumably in our case), is painless. Once inside the host the larva moves about, usually among the viscera, and especially between the muscular and mucous layers of the oesophagus. In autumn, winter, or spring it migrates through the muscular tissues of the back to lie under the skin, through which it bores a hole for respiration. It then moults, and during this time a local purulent reaction develops, causing the "warble," which finally bursts, to allow the larva to fall out and pupate on the ground. The warbles are sometimes treated locally by farmers with derris or phenol.

Cases of human infestation by the warble-fly *Hypoderma bovis* are very rare, and I have found only five in the literature (Hermes, 1939; Miller, 1910; Smart, 1939). A case involving the allied species, *H. lineata* (Style, 1924), was probably the first British case of infestation of man by a species of *Hypoderma* to be reported. In our case the boy's sore throat may have been caused by wanderings of the larvae in the oesophageal wall, especially as his pharyngeal flora showed no pathogens at the time. It is hard to be sure when the eggs were laid; the emergence of all the maggots during a period confined to about two months suggests that he was infested only once, or, at any rate, during one season only. This most probably was during the summer of 1943, perhaps while he was asleep on Epsom Downs. The manifestations seem to have been due partly to an allergic response (causing oedema and eosinophilia) and partly to the bodies of the larvae themselves. As the case stands it is impossible with certainty to say whether the larvae migrated in the patient or whether they emerged where oviposition occurred, as has been noted in infestation by other species (Hermes, 1939, p. 354); though in view of their widespread distribution over the body, the sensation of "creeping," and the apparent surfacing and sinking of the larvae in the swellings, it seems likely that migration did take place.

I wish to make acknowledgment to the late Sir Thomas Lewis and Prof. P. A. Buxton for their help in preparing this report.

REFERENCES

- Hermes, W. B. (1939). *Medical Entomology*, p. 342, Macmillan, New York.
 Knipling, E. F. (1935). *J. Parasitol.*, **21**, 70.
 Miller, R. T. (1910). *J. Amer. med. Ass.*, **55**, 1978.
 Smart, J. (1939). *Parasitology*, **31**, 130.
 Style, F. W. (1924). *British Medical Journal*, **1**, 1086.

ABACTERIAL PYURIA

BY

HUGH DONOVAN, M.B., F.R.C.S.Eng.&Ed.

Honorary Surgeon, United Hospitals, Birmingham

There exists a condition, provisionally called by the unsatisfactory name of "abacterial pyuria," which is quite well known to urologists, but which is not sufficiently known to medical men as a whole. Of the 15 or so cases which have come under my care in the last six years, one was that of a doctor in full practice who was troubled for months with the condition until the diagnosis was made; another that of a young man who was invalided out of the Army, diagnosed interstitial cystitis; a third was a soldier sent home from the Western Front. It is because of such cases that the following account of the condition is given.

The patient, an adult male, begins to suffer from very frequent and uncomfortable or painful micturition. There may be some associated urethritis sufficient to stain the linen. The urethritis is not constant, and does not precede by much, if at all, the bladder symptoms, which are often the main and only complaint. Fever has not been recognized. At this point the man, if he has a urethral discharge, will be examined for gonorrhoea. The negative bacterial report will probably result in his being given a pot. cit. mixture and a pat on the shoulder—but his frequency will continue. The two-glass test shows an equal amount of pus in the second glass. Heavy treatment with sulphonamides brings no result. The urine is examined bacteriologically, but fails to show organisms in a specimen full of leucocytes. At this point tuberculosis of the urinary tract is suspected because of "pus in a sterile urine." Intravenous urograms show a normal upper urinary tract. Cystoscopy reveals a bladder too irritable for really good examination, but shows a complete cystitis and an angry red mucosa with no portion of the bladder wall uninvolved. A guinea-pig inoculation test for the tubercle bacillus is of course negative.

The above clinical picture warrants a provisional diagnosis of the disease. It is remarkable, and fortunate, that a specific and apparently infallible remedy is to hand. 0.3 g. of neoarsphenamine, given once a week, will improve the condition after two and will apparently cure it after three injections. I do not think I have seen a relapse yet, nor have I observed any systemic complications.

When one has surmounted a natural disinclination to accept a new disease, one begins to recognize peculiarities which make diagnosis easier. A purulent urethritis of non-gonococcal causation is itself rather unusual. When it is associated with marked frequency and a cloudy second glass of urine the disease must be definitely considered. When no organisms, or only a few colonies of an obvious contaminant, are reported in this urine full of leucocytes, there is a strong probability of the condition being present, for tuberculosis of the urinary tract is associated with urethritis with extreme rarity. Moreover, it is not so sudden in its onset, and the urine is as a rule only moderately cloudy. The completely red bladder is not at all like that of tuberculosis, in which there are practically always some areas of bladder almost normal in appearance.

Discussion

Moore (1943) has dealt with the pathology of the condition and with the various views as to its aetiology. My own preference is for the theory that it is caused by a virus—after all, the commonest cause of mucous surface infection in the body. Probably the pathogenic agent will remain unproved until Koch's postulates can be established by human experiment.

There has been recognized of recent years, and especially since the war, a subacute or chronic epididymitis often with little or no evidence of urinary infection. I do not think this can be related to abacterial pyuria, a striking feature of which is the failure of the urinary infection to respond to most forms of treatment.

I have not met with the condition in the female. It is reasonable to ask the question: Is there a vaginitis or cervicitis of similar causation and likely to respond to intravenous neoarsphenamine?

If the cause of abacterial pyuria is a virus, response to organic arsenic is worthy of attention. If one may be permitted to speculate a little—Domagk found protosol to cure certain