CHAPTER XVIII

PREVENTIVE MEDICINE IN THE WAR—(II) THE PROMOTION OF HEALTH

IT has been well said that

> "Health at its best—for it is a variable state of being—is that condition of body in which all its organs and parts are sound and perform their functions duly, easily, and satisfactorily."[1]

With certain obvious reservations and corrections, measures for the promotion of health were applicable mainly to disease due directly or indirectly to pathogenic elements in the physical —as distinct from the parasitic—environment.

Environment—the Western Front

No question in relation to the health of the A.I.F. has been debated more persistently or more bitterly than this:—were there present in the Australian soldier's war experience, especially on the Western Front, physical factors that in themselves might legitimately be held to have initiated, immediately or remotely, a large body of permanent ill-health, or to have "aggravated" any existing tendency to disease? Such hypothetical disease states would doubtless include various forms of disability that reflected physiological or psychic dysfunction *per se*; "*morbi sine materia*," diseases without a lesion —causing disability but without structural change and capable of complete reversion or resolution. But it might well be supposed that they would also include many in which a permanent and irreversible degradation of function would ensue, with subsequent permanent degeneration of essential tissue cells and so of organs. To what extent, it is being asked with increasing urgency, can the effects of physical war environment be sup-

[1] Maj. Gen. Sir Robert McCarrison, "Nutrition in Health and Disease," in *B M J, 26 Sept, 1936, p 611.*

posed to have influenced the course of physical and mental senescence in the returned soldier?[2]

In the present state of our knowledge of the "causes" of disease other than by infection, and in the absence of exact data bearing on the matter in A.I.F. experience, it is impossible to give a clear answer to this important question. As will be seen later[3] the professional men responsible for deciding on questions of "attribution" or "aggravation" have found it necessary to rely almost wholly on a continuous personal history or on convincing *prima facie* evidence. Nevertheless, it would be unscientific to attempt to appreciate the problems in preventive medicine presented by the attrition warfare in Europe, or in the health history of the A.I.F. during and after the war without giving due weight to the effects of physical environment.

And while it is not possible to present an authentic picture of every element in this environment, one aspect may be selected as characteristic and a likely source of dysfunction and even of "disease." The following presents an accurate, if perhaps extreme, illustration of the front line in France in winter.

Winter warfare in France

End of October, 1916. "'Wait till you get on the Somme,' said men who had been through Pozières. 'The rest is a joke.'... We left the motor lorries and entered the squalid village of Dernancourt. Here was the edge of the zone of death, newer and fiercer than Ypres. Out of Dernancourt we walked along a road deep in mud. 'Fricourt' was a notice on a signpost. Here for the first time I saw the appalling waste of modern war—stacks of bombs sinking into the mud—all man-

[2] The question is well presented in the following extract from a personal letter to the Medical Historian from the Medical Officer to an important municipal body—who was also the "Principal Medical Officer" of one of the Commonwealth Military Districts (Col. E S. Stokes).—

"The question of the relationship of respiratory diseases, especially Bronchitis and Pneumonia, to exposure of the body to cold and wet, has recently arisen here in connection with some compensation cases. It has been contended that this morbid condition may be caused by such external influences, or, as an alternative, that these influences may aggravate the disease if the exposure occurs at any time, whether immediately before the receipt of infection, during the incubation period, or after the onset of symptoms. It has been further claimed that if such exposure was not the exciting cause, then it operated as a predisposing cause by establishing a lowered resistance of the body to invasion by the attacking organisms.

"War time experiences, where bodies of men have been exposed to extreme conditions of hunger, fatigue, wet and cold, either singly or in combination, have been quoted, and seem to shew that men under such circumstances do not suffer to a greater degree than others more fortunately placed"

[3] Under Pensions, in *Vol. III.*

ner of abandoned munitions. We debouched into a field of soft mud, and erected bivouacs, and there in rain and wind, we slept. . . . Next evening on our way again through an avenue of dead horses, mules, and wrecked wagons. No trees remained standing—only signs of death, more and more numerous as we went forward. Off the road on each side was a morass. Here was desolation beyond all compare. In the darkness our strung out line of heavily laden men trudged along the duckboards, great shell craters, water filled, below us . . . night and rain could not mask the stench that told its tale. The wood [Delville Wood] petered out on the forward slope—the duckboards ended at the edge of the valley. We plunged into mud from knee to waist deep churned to the consistency of pea-soup. . . . Here were our 18-pounders, emplaced against the further bank [which was] lined with dugouts. Fitful gleams of candle-light crept from the blanket-hung entrances. . . . [On again] with terrific effort we ploughed through the morass; our troubles were commencing. The front line was about three miles away, it took us seven hours of constant struggle to reach it. Shell craters on shell craters. Water filled them to varying depths. The pulverised soaked earth made every step a supreme effort. No two steps were ever on the same level. We fell, rose and fell again, soaked to our very hides. Every hundred yards or so, strength failed, as we tried to extricate a deep sunk leg. Then we would collapse and lie inert in the soft mud. Our sweaty faces would become cold in the chilly wind and wet clothes press icy against our skins. With a despairing effort we would rise and battle on. The slough of despond! I fought hard against an impulse to burst into childish tears. Hour after hour we struggled automatically. Later,[4] duckboards spanned this country in curving miles; but we unfortunates had no help. . . .

"At length we reeled and tottered into derelict shattered Flers. The shell-bitten road, a foot deep in slime, was grateful to our trembling legs. Again the muddied burdened line was moving ghostlike in the night. Sucking squelching noises of mud underfoot. The flares were much nearer now. . . . We blundered into the forsaken confines of Cheese Road. A narrow sap led to the front line. The churned mud was knee-deep. In places the arms and legs of dead men protruded, ghastly in the light of the flares. Where two men tried to pass they jammed. About 300 yards forward we came to an old German gunpit. A deep dugout ran down at the side. Fritz's Folly, just beyond, was occupied by the enemy. We stood on a plank track, waiting our turn to go down. A German flare hissed at us, and hung overhead. On its heels came a shell that burst redly on the bank. The shock toppled five of us into the mud alongside. I sank swiftly to my waist and was held firm. A roar of other approaching shells filled the air. . . . Squalls of metal ripped and thudded. I pressed the upper part of my body close along the mud. This then was the culmination of all my fears. I lay helpless and passive beneath the hot hail, picturing myself as those others we had seen. Red hot panic and cold clammy fear possessed me alternately. The shells ceased. . . . I groped for my rifle and reached the boards again. A board was laid out to the other four, and their heads were pulled clear of mud. Three were dead."[5]

[4] That is, in later months

[5] The quotation is from *Backs to the Wall pp 12-18* (slightly abbreviated) by Captain G. D Mitchell, M.C., D C M, 10th and 48th Battalions. (At this time he was serving in the ranks) This experience may be contrasted with the experiences of the Light Horse related in *Vol. I pp 698-9*—"Summer in the Jordan Valley."

In this account we can identify as conspicuous, physical exhaustion, exposure to cold, and wet, and dirt; strong and unrelieved emotion, and nutritional deficiency. This picture of a relief should be complemented by one of trench life and the struggle to keep dry and to get warm food; of the cheerless huts of the staging camp, and the long march of the relieved unit to the rest area, and back. It should be offset, by an account of the very successful efforts made to ameliorate the conditions of life and living: of food and feeding; of housing; of warmth and comfort; of clothing and cleanliness; of roads, transport, and reliefs; and (far from least) of psychic relaxation—leaves, amusement, sports, recreation, provided as part of the military machinery for preventing wastage or that of humane and patriotic bodies—Comforts Fund, Y.M.C.A., Red Cross, and the like.

All of these, in their sum, made up the vast machinery for promoting health in the interest of victory, and, perhaps, of humanity.[6] Stated in terms of scientific analysis their purpose was to promote and exploit the natural resistance to injury contained in the defensive mechanism of the body; whether *structural*, such as the skin, hair, cilia, mucous glands and so forth; or the self-adjusting *functional constitution* (*"milieu intérieur"*), such as the heat- and energy-regulating mechanisms; nutrition; immunity reactions; endocrine balance; basal (thalamic) nervous control; cortical inhibitions and sublimations, as of fear and sex; and the power of rational deduction from experience (educability)—and so forth.

No more is possible than to glance at this vast structure of social health activities built up behind the entrenched lines to implement the strategy of attrition. Nor is a serious study possible of the effect on this of the change to open warfare in 1918. The whole procedure of promoting health merges with the normal process of modern war. No more can be done than to select a few features for a suggestive note, as salient in the matter of health, or as pertinent to A.I.F. history.

[6] The environment of the Western Front, and the diseases associated with it as shown in the tables, may profitably be compared with those described in *Vol. I* of Gallipoli (*Part I Chapter xii*); Sinai (*Part II Chapter iv*), and Palestine (*Part II Chapter v*)

Two sets of factors were involved, those of material and those of action; thus:—*Food and feeding*—the ration, and its supply, preparation, cooking, and distribution. *Protection and warmth*—as by housing, heating, clothing, footwear. *Minor bodily repairs, and cleaning*—as by first aid for minor ailments, dental repair, care of feet, skin, and teeth, provision of underwear, washing, disinfection. *Rest and recuperation*—as by sleep, relief, relaxation. *Mental and moral tonics and anodynes*—such as entertainments, recreation, sports, leaves, alcohol. *Education*—as in schools of instruction, lectures, and so forth. *Spiritual ministrations.*[7]

Specific problems of health promotion

The mere list of those with special medical interest suggests the vast expenditure of capital and labour, of time, constructive thought, administrative energy, and executive toil, involved in sustaining a major war.[8]

"He[9] sent out, in an unbelievably short time, the most perfectly equipped army that has ever taken the field. . . . Having sent forth this matchless little band of 100,000 men, he watched it grow day by day till it numbered some four millions. He watched it spread over . . . half the world, and for long harassed years he kept it fed, clothed and transported it, as no other army has ever been cared for in the history of the world"

Food and feeding

For the first time in the modern history of the world the problem of national food supplies was in the Great War a major factor in the international conflict. For the Allies, from 1916 food was an urgent problem, at the end of 1917 a menacing one. But though rationing in Britain, France, and Italy was much more drastic than Australians have ever troubled themselves to appreciate, it did not approach that which sapped the morale of the German people, and in Austria-Hungary brought about in children a degree of malnutrition for which a parallel must be sought in the wars of the Middle Ages—or in the industrial era of Great Britain.[10]

[7] Most of these have been the subject of some comment in *Vol I* (*See index*) Only a cursory note can be permitted here.

[8] It may be recalled that the field armies of the nations involved in the Great War, for which some provision of the kinds mentioned was made are estimated at a total of over 50 million men.

[9] Sir John Cowans, throughout the war the British Quartermaster-General. From biography by Major Desmond Chapman-Huston and Major Owen Rutter, *Vol. I, p 288.*

[10] *See Vol I, pp 465-6*

A dietician of world-wide repute has said that "A primary purpose of the function of nutrition is to prevent, so far as its limitations permit, that disturbance or impairment of structure or function of organs or parts of the body which is disease."[11] It is relevant to the question of the influence of the war on health, and it is significant also for the future of warfare that, though civil communities might starve, by neither side was the ration of the soldier permitted to pass below the level of caloric adequacy. In the British Army indeed the ration was for a time based on an estimate of caloric requirements much in excess of that laid down as necessary in civil occupations.

The Army Ration.[12] In a discussion in the "Interallied Sanitary Conference," held in March of 1918, on the supply of foodstuffs available to the Allies, remarkable differences were disclosed in the Army rations of the various nations, in respect both to their "caloric values," and also in the relative proportions of proteins, carbohydrates, and fats.[13] National habits made any exact pooling of resources a very difficult matter. At this time (it may be recalled), though the place in nutrition of proteins, carbohydrates, and fats "was fairly well understood," speaking broadly "food value" meant "calories," as estimated chiefly on Atwater and Bryant's "tables,"[14] and nutritional requirements were provided for accordingly.

But by the second year of the war the impact of experience in Gallipoli and Mesopotamia, and the intellectual pressure of the new outlook on "nutrition," created by the pre-war discoveries and work of Eijkman, Gowland Hopkins, Casimir Funk, McCarrison, Chick, and a host of others, had begun to influence British Army outlook and practice. For the first time an exact investigation was made of the vitamin content of preserved and portable foodstuffs. It is not necessary to

[11] Maj.-Gen. Sir Robert McCarrison, "Nutrition in Health and Disease," *B.M.J., 26th Sept., 1936 p. 611* For an authoritative opinion on the place of nutrition in the promotion of the public health in Australia *see Vol. III* in connection with recruiting in Australia.

[12] For Gallipoli ration, *see Vol. I, p 242.*

[13] The Italian Army ration was stated to contain "3,303 calories with, and 3,087 without potatoes." The calorie value of the Japanese war ration was given as 3,206, 80 per cent. of which was obtained from rice. The average weight of the Japanese soldier was 57 kilograms (9 stone).

[14] An authoritative series of analyses had long been required, and the need became urgent during the war, when the army, in common with other sections of the community, was strictly rationed in 1917. Capt. R. H. Plimmer of the University of London, a recognised authority on analytical technique, was directed to make a series of analyses for the use of the army medical authorities. Until Capt Plimmer's figures were available, the calculations of energy values appear to have been made by using those tables and figures given in a Report by the Royal Society on the Food Supply of the United Kingdom, and supplemented by analyses carried out in the Royal Army Medical College. The aim in the new investigation was to arrive at an average for each group of foodstuffs The energy value for the analyses of protein, carbohydrates, and fat was calculated by multiplication with the usual physiological factors, namely, 4·1, 4·1, 9·3 respectively. An original feature of this important research (reflected in present-day teaching on food and feeding which is concerned with the *available* rather than the *total* units of food value) was the discrimination of the various elements in the crude foodstuffs. Thus, in the case of meat, the joints were separated into fat and skin and flesh and the proportion determined, and the proportion of the joints of the carcass also ascertained, so that the composition of any part and ultimately of the whole animal could be arrived at. The analyses numbered about 900. A full report of Capt. Plimmer's work was published in book form by the War Office in 1921. (The data here given are from the *Official History of the War: Medical Services, Hygiene, Vol II, pp. 1-2,* and from Plimmer's work)

follow the effect of this impetus on the army rationing, nor of war experience on the scientific study of nutrition. In both it was profound.[15] In the B.E.F. the influence of the new outlook in dietetics was seen chiefly in an extension of the facilities given to the Director of Supplies for supplementing the "hard" army ration by "local purchase" of foodstuffs, in particular, of vegetables. Indeed, the "lesson of the war" in respect to nutrition would seem to be this, that reliance should be placed not only, or even chiefly, on providing artificially concentrated individual vitamins, but rather upon disseminating widely the knowledge of the sources and values in essential constituents of every type of foodstuff and upon elasticity in the arrangements for exploiting every available source.

In 1917 a great advance was made in the rationing by differentiating three classes of rationed persons, namely, the fighting troops, 4,200 calories, 130-150 grammes of protein; the troops in the Line of Communications, 3,570 calories, 120 grammes of protein; and the civil population at Home.

"*Supply.*" "Supply" was organised on highly scientific lines—the caloric value of foodstuffs being made the basis of rationing. This was implemented by a scheme whereby the Quartermaster of each unit made his "demand" on the divisional Supply Column for the "alternative" issues provided for in the army ration in terms of their "calorie values," and the Company cook made his complaint of deficiency in the same terms.

Schools for Cooks. One of the major advances in the feeding of the soldier was in the education and assistance given to the Company cook. In the winter of 1917-18, especially, schools for cooks were held in every division of the A.I.F. and ingenious recipes were devised for palatable dishes from the "hard" army ration. Field ovens for roasting the fresh meat ration (so as to displace the universal stew) were in general use.[16] The enormous extension of treatment in the field in "rest stations" (field ambulance or C.C.S.) made the position of the quartermaster in these units one of the most onerous and responsible in the medical service. Many of these positions were filled by members of the Australian Instructional Staff, and the high quality of the work of these officers—and it must be added of the cooks—is the subject of frequent comment by commanding officers.

Distribution of Food. The close relation between the problems of supply and of distribution does not require emphasis; in the attrition warfare of 1916-17 the distribution of food was a problem of major military importance. The introduction in the winter of 1916-17 of insulated hot-food containers had a military significance only less decisive than that of the "Mills bomb" or of poison gas.

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[15] Reference may be made to the Presidential Address by Sir Robert McCarrison inaugurating the new Section of "Nutrition" in the annual meeting of the B.M.A held at Oxford in 1936 (*B.M.J., 26 Sept., 1936*). ' *See also Vol I, pp 462-5*—work of the Lister Institute, observations at No. 3 A.G.H at Lemnos, and experience in the Palestine campaign.

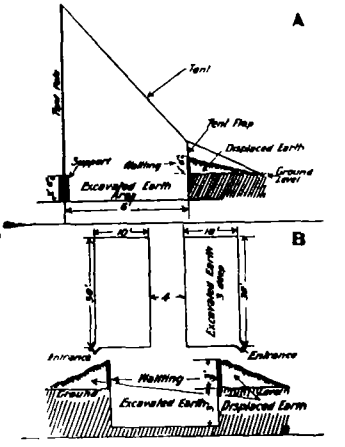
[16] Portable ovens for roasting were carried by most field ambulances in addition to the official "Soyer"—originally designed for Miss Florence Nightingale, by M. Soyer, the celebrated London *chef* who accompanied her to the Crimea C.C.S's carried a complete cooking range. In the general hospitals the designing of kitchens and their relation to the wards were given close attention—in some more than 2,000 patients and personnel had to be served from a central kitchen

Housing and warmth

In civil life housing serves many purposes, but for the soldier at the front, speaking broadly, only one—to give shelter from "the elements." For the "private" soldier "privacy" was non-existent; the "latrine" like the cook-house was a social resort. At "the front," to the primitive purpose of shelter from heat, cold, and wet was added protection from missiles of war and from gas; in the rear that from aeroplane bombs. The problem of "housing" thus merges insensibly with defence.

Housing as a Factor in "Wastage." From the point of view of the medical service the problem of housing presents two aspects which may very exactly be summed as serving respectively the prevention of casualties—battle and non-battle—and the treatment of casualties. Here we are concerned with the first, *i.e.* with "housing" as a factor in the prevention of wastage. The matter of accommodation for treatment of casualties on the line of evacuation from aid-post to base hospital is dealt with elsewhere.

Under this reference housing therefore starts at the front line with the *"trench," trench "bay,"* and *"splinter-proof" shelter.* Immediately behind this—in the attrition warfare of 1916-17—was a vast system of *"deep dugouts"* where the front line troops lived; and a mile or so in rear the dugouts and concealed and *sandbagged* shelters, often of *"elephant iron,"* which held the battalion reserves. Thence through the sandbagged *"Nissen"* huts and ruins that sheltered the Divisional reserves we move back to the several "approach" and "staging" zones of the Corps and Army reliefs, and reinforcements, where the relieved and relieving formations sheltered in *hutments* and *tents,* sometimes camouflaged, and more or less broken buildings; and so to the *billeting villages* and *hutted camps* of the resting areas. Behind the Army areas, on the L. of C., and at the Base and at home, were the vast tent and hutted camps of the Reinforcement and Convalescent Depots, and the General Hospitals [17]



Methods of protection against shell and bomb splinters adopted by field ambulances (A) for bell and marquee tents; (B) for horse lines. (From war diary of 12th Aust. Field Ambulance.)

Save for its own personnel the medical service was not directly concerned in all this, however deeply it might be involved indirectly. How-

[17] An account of the problem of housing, from the point of view of the prevention of disease will be found in *Appendix No 11.*

ever greatly protection might appeal as a means for the prevention of wastage from wounds, or from disease due to exposure, and as a rational line of endeavour, its concern was solely with the wasteful business of evacuation and repair.[18] The prevention of battle-casualties belonged to "G"; the housing of the soldier to "Q"; in each case the executive service was provided by the Engineers. Only in the matter of over-crowding and arrangement of bunks in the huts of the great depot camps at the seat of war and at the home base could its advice carry weight as against "the exigencies of the military situation." Yet it is not open to question but that in the circumstances of the war on the Western Front, as described in preceding pages of this and of *Chapter V* expenditure of money and energy on this—as on other matters of "maintenance"—"paid" in terms of efficient man-power and thus of "striking power." At any rate the construction of dugouts, huts, and shelters cannot but be regarded as a matter of first rate medical importance.

Warmth.—Closely allied with, and complementary to this matter of housing was that of providing artificial warmth, as by fuel stoves and hot food; and this again was allied with the promotion and protection of body heat as by food, clothes and blankets. This was a matter whose importance from a health standpoint comes second only to that of nutrition, and after nutrition, it was the chief preoccupation of the Q M.G. The medical service lent a hand only when its advice was sought. Officially initiative lay first with the Command and the General Staff through the Adjutant-General's branch; but in practice close and immediate *liaison* with "Q" was found materially to promote their common purpose.

It is not possible to enter upon any detailed account of the vast business of providing warmth. By far the most important was the provision for hot food and drinks to which reference has already been made. The matter of clothing is dealt with later. The immense business of heating stoves calls only for two notes. First, to conserve heat, a "central" type of heating was essential.[19] Second, the business of *drying of clothes* was only less insistent than that of warming premises. The provision of drying huts for socks was an essential item in the prophylaxis of trench feet. Behind the front lines the heat from incinerators was sometimes made to serve a dual purpose.

Clothing and equipment

For men as they are to-day, clothing is necessary for protection against heat, cold, and physical trauma. To keep clean calls for washable underclothing.[20] And the soldier must carry a kit. In the field army each of these elemental factors had medical

[18] In the opinion of the writer it is gravely open to question whether, in the vast preparations for the "totalitarian warfare" foretold for the future, action would not with greater profit be directed more seriously than at present seems popular to the preventing of civilian casualties from H.E. as against preparations for their disposal and treatment

[19] The fuel ration in the Australian Corps for both cooking and warmth was, in summer, at the rate of 1½ lb. of coal, 2½ lb. of wood; in winter 2½ lb. coal, 1½ lb wood per man per day In case of "shortage," preference was given to medical units. Solidified alcohol, for use in "Tommy's Cookers," was issued to troops in the trenches at the rate of 12,000 oz. weekly per division.

[20] The invention of the cotton gin ranks very high among the social factors that have helped to suppress scabies, lice, and fungoid skin disease.

involvements. Thus, the weight of the soldier's "kit" or "equipment" and the manner of its distribution to suit the erect posture might be expected to influence the development of circulatory and respiratory disorders; or of traumatic degeneration such as "osteo-arthritis," or "rheumatism," in the joint-structures of knee, spine and feet; or the incidence of non-septic traumatic inflammations such as fibrositis—"muscular rheumatism." All these conditions were so prominent during and after the war that it is difficult to exonerate equipment as a factor in the production of war-disability. The malign influence of unsuitable clothing—for example, of the puttee in producing trench foot—the advantage of washable underclothes in preventing the disease of dirt, the part played by the boot in the prevalence of or freedom from foot trouble, illustrate the direct concern to the medical service in this matter.

Items of Clothing. The clothes of the Australian infantry soldier comprised eight items as follows:—

(1) *Uniform*: tunic—known officially as "jacket, service dress"—of a soft woollen khaki-coloured cloth, with collar hooking at the neck; and cord breeches. As well as warmth and covering the military "uniform" gave the soldier the right to carry arms and to kill men.

(2) *Shirt*: soft grey flannel, without a collar, for warmth and "comfort."

(3) *Underclothes*: vest and drawers of cotton, or wool and cotton, and washable. Beside the minor purpose of preventing "body odour" these were a major rampart against skin disease.

(4) *Puttees*. These covered the leg below the knee with a winding spiral of woollen cloth. Their purpose was aesthetic—to complete the hiatus below the knee-breeches—and protective against cold and traumatic abrasion.

(5) *Boots*: bark-tanned leather (sole) and chrome-tanned (uppers). They were a factor of major importance in the efficiency of the foot-soldier. The artificial "aesthetic" kinks of civil "fashion" had very detrimentally influenced their structure.

(6) *Socks*: wool, cotton, or preferably mixed. These served the dual purpose of protection against traumatic abrasion and cold. As a washable article of underwear they were not only preventive of smell but prophylactic against *tinea albigmia* ("foot rot," athlete's foot, beach foot, soft corns, and so forth).

(7) *Greatcoat*: woollen, though officers usually provided themselves with a waterproof "trench-coat." The soldier's chief protection against cold and wet in the trenches; and, in moving warfare, often his only bedding. It was commonly carried in the "pack."

(8) *Hat*: behind the lines, Australian felt hat and a peaked woollen cap. In the line the "tin-hat" for protection chiefly against shrapnel.

The blankets and a rubber ground-sheet were sometimes carried on the "pack," but when possible by G.S. Waggon. In winter a special type of ground-sheet was issued which could be worn as a cape. For winter wear the Australian soldier was supplied from home with a lamb's wool jerkin to be worn in addition to the uniform. Balaclava caps, protecting the ears in the cold, were always, and in France mittens were often, part of the soldier's kit. The greatcoat, jacket, and shirt were made of the fine merino wool, in the production of which Australia leads the world.

The scope of this work does not permit of detailed study of the problems involved.[21] The following points, however, may be noted.

The Uniform. The Australian uniform is described in *Volume XI* of the *Australian Official History*.[22] The jacket was loose in body, neck, and sleeve, buttoned at the cuff. The breeches, on the other hand, were of riding pattern and gripped the leg below the knee—a feature which was not utilitarian, at least for infantry soldiers. The procedure of dis-infestation of underclothing, exchange and laundry—is also dealt with later. The average life of underwear was short so that provision had to be made for its frequent re-issue.

Influence of clothing on health

The Puttee. The weak point in this awkward piece of the soldier's clothing was revealed in the Somme winter when, as a prophylactic against trench foot the substitution, while in the line, of sandbags tied around the lower leg was officially recommended.

The "Australian Pattern" Boot. This boot as made in Australia was the subject during the war of a vigorous triangular debate between the Imperial authorities (War Office) who paid for the boots,[23] the Australian Government (Defence Department) which supplied most of them, and the Australian force in the field, which was shod with them.

Beginning in June, 1916, the controversy was still "going strong" in 1919. The chief points at issue concerned (*a*) durability, and ability to exclude wet; (*b*) Australian production, (*c*) comfort for general wear and marching, and appearance. All were of first rate importance but the question of most interest here is that of "fit." The problem of "fit" was largely due to the fact that, apart from congenital deformity, modern taste, dictated by the fashion makers, had caused the "normal" adult Australian foot to be commonly a deformed foot, and in adult males, unfortunately for military purposes, the degree of deformity varied greatly.

In this matter of foot-wear, as in "orthopaedics" generally, before

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[21] Some are dealt with in *Vol. III*

[22] It is of interest to note that Surgeon-Gen. W.D.C. Williams, A.A.M.S "Director-General of Medical Services and Commonwealth Cadets," Australian Military Forces, 1906-11, took a leading part in the evolution of the Australian service jacket from the "shirt" with pockets designed for the "cadets" and worn also by the Citizen Force trainees.

[23] Under the agreement with the Australian Commonwealth whereby the British Government maintained the Australian Force in the field on payment of an agreed amount per head *See pp 826-7* and *Vol I pp 44 and 57.*



58. A HUTTED CAMP AT DICKEBUSCH, NEAR YPRES

The huts are of the "Nissen Bow" type

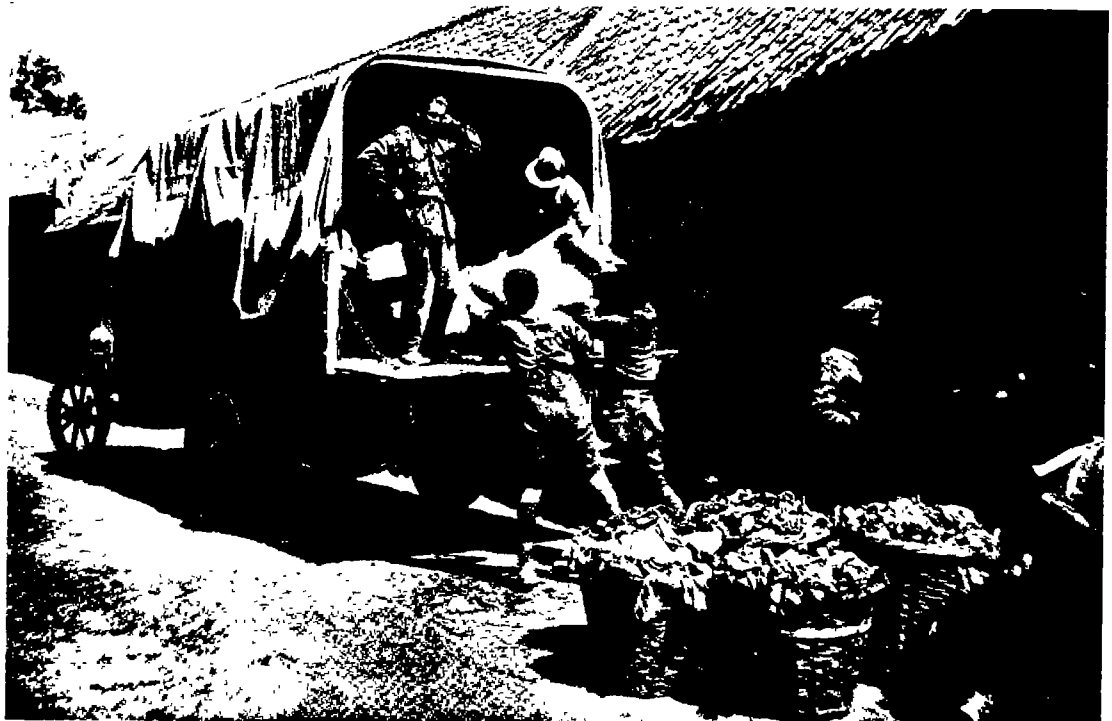
Aust War Memorial Official Photo No E13866
Taken on 15 November 1917



59. A COMPANY COOK-HOUSE OF THE 2ND BATTALION, YPRES, NOVEMBER, 1917

Aust War Memorial Official Photo No E1064

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60. SUPPLYING FRESH VEGETABLES FOR THE 5TH DIVISION NEAR AMIENS

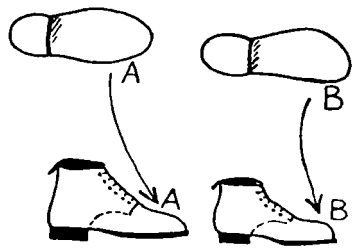
A lorry of the 5th Divisional Supply Column being loaded from the abandoned market gardens at Camon

Aust War Memorial Official Photo No E2431
Taken in May, 1918

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the war America led the world; and the publication in 1912 of *The Soldier's Foot and the Military Shoe* by Major Edward Lyman Munson, of the U.S.A. Medical Corps, constitutes a landmark in the evolution of the Australian military boot as of the American.[24] It is true that the military bootmaker's "last" evolved but slowly along the physiological lines therein set out, but in 1914 the Australian Defence Department (Quartermaster-General) issued for the guidance of the officers of the citizen forces a pamphlet[25] which closely followed its teaching. The course of the development of the Australian military boot before and in the war is followed further in *Volume III*, but the following note made by an R.M.O. exactly and clearly sets out the two factors that matter.[26]

"*May, 1918.* While at Blangy Tronville a foot parade of the whole unit was held and 10 cases of ingrowing toenail and about 20 corns were treated. Most of the former were on the medial side of the great toe and in most cases were stated to have originated since joining the A.I.F. These could be avoided if the army boots were made with due consideration to the natural shape of the foot. Most of the boots have an inner line which deviates outwards slightly whereas the natural inner line of the foot is straight; and this causes friction and pressure. If the army boot were modelled on the American Army lines this trouble would to a great extent disappear. An aggravating factor also is the flatness of the toe of the boot. This is constantly complained of by the men themselves. The normal great toe is squeezed in a vertical direction by a boot which is otherwise well fitting. If these toes were blocked or made more roomy their efficiency would be improved."



The Australian boot: A = defective; B = corrected.

It is but fair to say at once that the Australian soldiers for the most part strongly favoured the Australian-made boot; and that the "lessons of the war" have been put to good purpose in the "new model" Australian military boot.

The Sock. The usage and wastage of this article were enormous. The supplementing of the official ordnance "issue" by voluntary aid and home efforts was a useful form of "war-work" as well as an emotional outlet It should, however, be added that the socks knitted by "Sister Susie" were not always a comfort.[27] The importance of an ill-fitting or ill-shaped sock as a factor in sore feet was fully borne out by R.M.O's.

The overcoats first issued to the force were apt to become very heavy when soaked with rain. The "British warm," with a less felted surface, threw off the rain better.

[24] By American usage the term "shoe" includes boots

[25] *Boots, Instructions regarding their fitting, preservation and care.*

[26] From report to the A D M S by Capt. G. P. Arnold, R M O, 51st Battalion.

[27] Instruction in this might well form part of the social scheme of education

The Hat. In Mesopotamia Australian troops were equipped with solar topees. In Palestine, on the other hand, and throughout operations in the Sinai Desert they wore the felt hat which proved an adequate and convenient covering. For wear in Europe also the felt hat was found to be an exceptionally useful headgear.

Equipment—the Problem of Weight. In 1867 a Royal Commission enquired into the causes of the high incidence of heart and lung disease among soldiers during and after the Crimean War. Its views may be found summarised in one sentence:—

"The conditions of war demand that the marching powers and endurance of the soldier must not be lessened by unnecessary weight or a defective mode of carrying it. *Ceteris paribus*, the army that is least weighted and can move with the greatest rapidity must have the advantage."

The authority from whom this quotation is taken[28] opens his discussion on the significance of this military factor in the Great War with the statement that

"when further we come to examine the results of the huge load carried in the recent war on the physique of the troops engaged, we find a tragic tale of wastage."

It is true that it may not be possible to go all the way with this writer in his finding that excessive or improper loading was the most potent pathogenic factor in the "soldier's heart" and in most degenerative cardiac and pulmonary disease. It can, however, be said that the experience of the A.I.F. confirms the verdict that the soldier's loading is a factor of first rate importance in his efficiency and health.

The soldier's load tended sharply to rise throughout the war. To the rifle and bayonet, small-arm ammunition and entrenching tool were soon added the gas-mask, steel helmet, and Mills bombs. "Specialists" were laden with new offensive apparatus in the several types of quick-firing guns and so forth. In France, to permit of winter campaigns, the soldier's clothing and bedding were greatly augmented. The needs of exact organisation compelled each soldier to carry the full load assigned to him; and a study of the loads and of physique suggests

[28] Major N. V. Lothian, R.A.M.C. in "The Load carried by the Soldier" (*Journal of the R.A.M.C., Oct 1921 et seq.*) traces the evolution of the soldier's load from the beginnings of history, and makes a particular study of developments in the British Army in the 19th century and the Great War. In post-war studies of the subject such as those by Cathcart and Orr, and Cathcart and Lothian, field experiments were checked by indirect calorimetry whereby the exact cost to the man of any special work could be arrived at.

great mal-adjustment between the weight the soldier was required to carry and his average physiological reserves of power. For while physique varied greatly, the load to be carried was absolute, and there was a definite tendency to arrange the load in terms of the highest rather than of average capacity. Australian experience endorses Major Lothian's statement that "it was a notable fact of the recent war that whenever great or continued exertions were required the kit had to be lightened."

The Load. The following table shows (approximately) the weight of the equipment actually carried by the soldier on the march.

Napoleonic Wars	Crimea War	South African War			
Circa 1800	1854	1900	1907	1914	1918
35 lb	65 lb.	58 lb	48 lb.	58 lb.	78 lb.

The infantry soldier's load at the outset of the Great War comprised—(*a*) clothing worn (14 lb. 11 oz.), (*b*) arms (10 lb. 8½ oz.), (*c*) ammunition (9 lb.), (*d*) tools (2 lb. 9¼ oz.), (*e*) accoutrements (8 lb. 4¼ oz.), (*f*) articles in pack (10 lb 1¾ oz.) (*g*) rations and water (5 lb. 13½ oz).[29]

Field studies and experimental work both pre- and post-war would suggest one-third of the body weight, say, 45-50 lb. on an average, as the optimum load, with an effective maximum of 45 per cent. The British infantryman in the war commonly carried a load well above that figure and one which bore too high a relation to his weight to leave available energy for combat after the expenditure resulting from the march. There is, it would seem, an age-long tendency to issue to the soldier in peace an equipment weighing some 50-60 lb. on the assumption that he could support it in a battle, or that auxiliary transport might be available, or the excess discarded. In the Great War the men would not, on their own initiative discard their own property, though they sometimes discarded Government property (such as picks or shovels) very important for their fighting task; and only gradually did the discarding of part of the soldier's load become part of the official technique of battle or the march When in 1914-15 the A I F. trained on the sands of the Sahara and "attacked" up the hills of Lemnos, it was assumed that the men would fight carrying full equipment.[30]

In the stationary warfare of Gallipoli and later in France provision was made for exchange from march to battle order and *vice versa.* The vast accumulation of equipment "additional to Mobilisation Store Table" was reflected also in the individual impedimenta of the infantryman. The solution indeed of the equipment problem in mechanised warfare

[29] *Field Service Pocket Book, 1914*

[30] While the principle that men should be trained fully equipped for service has the support of history, ancient and modern, and as well of science and common sense, this assumption had untoward effects At Mena it was a factor in the sick wave (*Vol. I, p 76*). At the Landing the technique of adjustment for battle was so little understood that many battalions made no provision for a guard on the packs which were dumped near the Beach, and these were ransacked by 'stragglers." The disasters of the famous trial march of the 14th Brigade from Tel-el-Kebir to Ismailia in 1916 were due to deep-seated errors in the military attitude toward the human machine.

would seem to be a twofold one; first, reduction in the weight of individual articles of equipment, second, provision for relieving the soldier of the part of his impedimenta not required at the moment: on the march his blanket, greatcoat, and the paraphernalia of battle; in battle the equipment required only for marching and camping. The equipment for static and mobile warfare respectively should be determined so that a quick change from one to the other can be made when necessary.[31]

Relation to Physique The matter is obviously bound up with the question of physique in the selection of recruits. For weight carrying the soldier's weight and chest measurement rather than his height would seem important. But it is not difficult to conceive conditions in which men with certain qualities would be desirable recruits though they could not qualify for carrying weights.

The "Web Equipment." The British "web equipment" whereby men of the A.I.F. eventually carried their ammunition, tools, and surplus clothing had been introduced into the British Army with the Haldane reforms in 1907-8. It was an admirable implement and vastly better than the green-hide or leather apparatus. All these matters had important medical involvements, and the problem of loading the soldier should be a direct concern of the medical department.

Other factors in health promotion

We here impinge, both on the physiological and the psychic side, on the problem of disease prevention as distinct from health promotion. Such matters as treatment of minor injuries, cleanliness and hygiene of the skin, care of the feet, prevention of vermin, merge insensibly with the prevention of scabies, of trench fever, I.C.T. and of impetigo, sore feet, trench foot. At the same time the problems of securing sleep and rest, the exploitation of psychic amenities such as alcohol, or of such methods as education, blend with problems of *morale*, and of prevention of psycho-physical exhaustion, war-neuroses and debility. In the promotion of health by such means and by the treatment of minor injuries and disease the part of the R.M.O. was far more important than may be generally realised. For every soldier sent "sick" to field ambulance, on an average some 10 to 30 were treated by the R.M.O. at the aid-post. His influence in promoting health and morale can indeed scarcely be over-estimated. A table given below[32] may with advantage be compared with graph in *Volume I p. 348.*

[31] Statements by individual soldiers indicate that in the hurriedly organised counter-attack at Villers-Bretonneux (24 April, 1918) many soldiers found themselves too heavily equipped to execute the swift movements required by the battle plan without discarding some of their S.A.A. and bombs.

[32] From the experience of the R.M.O., 11th Battalion (Major L. May), 1918. Those ordered "medicine and duty" are not shown.



61. AUSTRALIAN SOLDIERS IN WINTER KIT

A drawing by Will Dyson of infantrymen in the Somme area during the winter of 1916

Aust War Memorial Official Photo No J0049



62. HOT FOOD CONTAINERS OUTSIDE THE COOK-HOUSE OF THE 57TH BATTALION, BETHLÉEM FARM, NOVEMBER, 1917

The scene is on the old Messines battlefield

Aust War Memorial Official Photo No E1268

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63. An officer of the 30th Battalion inspecting feet near Zonnebeke, during the Third Battle of Ypres, October, 1917

Aust War Memorial Official Photo No E1120



64. Water carts at the water point, Montauban, during the Somme winter, 1916–17

Aust War Memorial Official Photo No E57

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Analysis of statistics of the work of the R.M.O. 11th Battalion, February, 1918-January, 1919.

	STRENGTH	PARADED SICK		ORDERED LIGHT DUTY		ORDERED NO DUTY		TO HOSPITAL SICK		TO HOSPITAL WOUNDED	
	MONTHLY AVERAGE	No.	Daily per cent of str	No.	Daily per cent. of str.	No.	Daily per cent. of str	No.	Daily per cent. of str.	No.	Daily per cent of str
1918											
FEBRUARY	750	767	3·65	171	0·81	97	0·46	61	0·29	—	—
MARCH	785	673	2·76	177	0·73	117	0·48	108	0·44	103	0·42
APRIL	759	488	2·14	87	0·38	80	0·31	64	0·28	48	0·21
MAY	721	530	2·37	110	0·49	94	0·42	61	0·27	22	0·09
JUNE	655	475	2·41	105	0·53	85	0·43	93	0·47	129	0·65
JULY	614	302	1·58	61	0·32	48	0·25	56	0·29	47	0·24
AUGUST	603	224	1·19	72	0·38	25	0·13	18	0·09	262	1·40
SEPTEMBER	426	197	1·54	49	0·38	48	0·37	24	0·19	61	0·47
OCTOBER	401	223	1·79	48	0·38	62	0·50	28	0·22	—	—
NOVEMBER	441	321	2·42	49	0·37	117	0·89	31	0·23	—	—
DECEMBER	416	342	2·82	81	0·63	110	0·85	26	0·20	—	—
1919											
JANUARY	390	371	3·05	39	0·32	219	1·81	15	0·12	—	—

Care of Feet and Chiropody. In spite of the extensive use of mechanised transport in the movement of troops, the care of the feet, closely involved as it was with the prevention of "trench foot," assumed an importance which can hardly have been surpassed in the wars of Marlborough or of Wellington. Yet, in contrast with the arrangements of the British Army, no official provision was made in the Australian force for the service of trained chiropodists In some battalions a chiropody "kit" was purchased through the "Regimental funds," and a private detailed from the ranks for this duty. Some units arranged for their man to be trained, but in most he picked up a serviceable routine of foot care; the R.M O gave advice and treated the more severe cases. There seems to be no doubt that an appreciable amount of wastage could have been avoided by more exact and scientific professional attention to this matter. In particular, the wide diffusion of tinea—and its influences as a cause of foot-trouble and of "chafing" (tinea cruris)—were almost unnoticed.

Psycho-physical Factors (*a*) *Rest and sleep* The clinical features presented by the mass-disorders that derived from the attrition warfare of the Western Front confirm the general experience that, of all the physiological traumata inflicted by this type of warfare *per se,* long deprivation from sleep and absence while in the line of any surcease from physical and mental strain must be ranked very high as factors in the attainment of the desired "attrition," and therefore as a proper subject for defensive action, military and medical. The part played herein by the R.M.O., and the importance of provision for securing such rest, is a matter of frequent reference in the Australian records.

(*b*) *Alcohol.* The Great War was in this respect constructive, that it required the truth naked from any shroud of self-interest—except such as might promote victory. Thus both as a social and as a physiological problem the study of alcohol was materially advanced during the war. In particular, like the allied problem of venereal disease, the study was placed on a rational and scientific footing.

This was largely the direct result of the action of the British "Central Control Board (Liquor Traffic)" in appointing an advisory committee composed of some of the most eminent of living scientists and publicists to investigate the problem. Their report was published in popular form as a pamphlet, and their investigations were subsequently continued by the Medical Research Council of National Insurance [33] The chief service performed by these councils was to bring out the fact that, in general, though its immediate effect on behaviour may be "stimulant," the *action of alcohol is essentially anodyne and depressant.* The social and the individual problems were generally illuminated by this scientific integration.

The "Rum" Ration. The consumption of alcohol was controlled in Great Britain by the Liquor Control Board (Civil) and the Committee of Imperial Defence (Military). In the field its general use and

[33] The original members of the Committee in 1918 were:—Lord D'Abernon (Chairman), Sir George Newman, M.D (Vice-Chairman); Professor A. R Cushny, M D, F R.S, H H Dale, M D, F R S, Major Greenwood, M R.C S; W McDougall, M.B, F R S; F W Mott, M D, F R S, Professor C S Sherrington, M.D., F.R.S.; W. C. Sullivan, M.D. Two further members were afterwards added, namely Professor E Mellanby, M D, and C. S Myers, M.D., Sc D, F.R S.

The report was published under the title *Alcohol Its Action on the Human Organism—1st Edition, 1918, 2nd, 1923, Revised and Enlarged, 1924.*

special "issue" were decided by the military command, with a quaint show of formal deference, but very little effective reference, to the medical service.[34]

The physiological evidence brought forward in the report of Lord D'Abernon's committee regarding the essentially anodyne action of alcohol was fully borne out in military experience. Its value lay wholly in euphoria, and the relief of anxiety. The continuous and compelling longing for some surcease, however temporary and partial, from war strain made the military use of the "rum ration" practically universal and, when not substituted for food, warmth and opportunity for rest, without doubt, often beneficial; and gave it a place in attrition warfare from which it would be difficult to expel it, even were it thought desirable to do so. At times the rum ration was used with the purpose of promoting action, not of inducing relaxation, its narcotic effect being called on to dull the edge of fear and anxiety before an attack.[35] It was, however, generally recognised by those who gave thought to the matter that the right place for the rum ration was after effort, not before, and in association with food, warmth, and rest; and this, emphatically, was the practice favoured in the A.I.F.[36]

In the A.I.F. it was the almost universal practice not to give it before but after attack. Commanders wanted clear heads on their men and feared the depressing effect on their men after a brief stimulation.

[34] Procedure in the A.I F. was based on British Army orders. Commissioned officers were allowed to have spirits, "other ranks" were not. The following regulation obtained in Fifth Army in 1917:—

"*Liquor. Issue from Expeditionary Force Canteen*

"1 Spirits shall only be sold for consumption by officers, and all orders for such shall be in the form of bulk orders on the nearest Expeditionary Force Canteen Branch, from Staffs of Armies, Corps, Divisions, or Base or Area Commandant on the L. of C or at G H Q

"2. . . . spirits will only be issued to messes on the production of a printed liquor voucher signed by a Staff Officer of the Formation. . . .

"3. No spirits will be allowed to be sold to sergeants' messes."

Beer was permitted in the sergeants' mess: privates got what they could pick up. Many units of the A.I F. bought local beer in bulk and retailed it in their own canteens. The following is from the diary of the 3rd Field Ambulance (19 Oct. 1917): "Rest station inspected by 1st Anzac Commander, Lieut.-General Birdwood; he expressed approval He commented especially on usefulness of canteen and importance of Q M. department and the feeding. . . . A canteen is a very important part of a field ambulance. It is of great benefit to patients in rest stations. Beer is an important part of sales. It enables men to get good beer. It . . . minimises the desire for spirits."

[35] At times it was thought justifiable to exploit this action. *c f.* C. E. Montague, *Disenchantment* (*p. 74*): "Isn't it (*i.e.*, the dulling of mental strain) just what more men'll get drunk for than anything else? And why the rum's double before you go over!"

[36] The official issue of "S.R.D." (Service Rum Diluted) was ¼ a gill—2½ fluid ounces—and by General Routine Orders was "at the discretion of the G O C. on the recommendation of medical officers" (*Second Army, Routine Order*, No 1363, *22 Nov., 1917*) In the Australian force a daily issue was commonly authorised during the winter months to battalions in the line, artillery-men in gun pits and working parties. Lieut-General Monash held strongly that the issue of alcohol must be with discretion, "as an effort to stimulate troops for a stunt 'No,' to revive them after heavy fatigue or stress when they could relax and rest 'Yes'" A 3rd Division memorandum in 1917 placed the responsibility for the issue of rum directly on the "medical authorities." General Monash held strong views on the use of ardent spirits by officers in particular when work was to be done which required complete mental and physical fitness. But when the troops were resting he was "very human and companionable," and as he became assured of the discipline of his men, both as G.O C. 3rd Division and of the Australian Corps, his rigour somewhat relaxed. (From notes furnished by Australian War Memorial. *See also Reveille*, "Liquid Rations," *July, Sept., Oct., 1938*, and *Australian Official History, Vol. V, p. 598.*)

There were, however, important exceptions to the rule, where it was thought that troops were exceptionally tired or chilled before being called on for tense action a "tot" was sometimes issued to them.

Use and Abuse of Alcohol. Alcohol was not officially advised in first aid or in resuscitation, and when so used often did more harm than good. In the treatment of sickness medical practice did not differ from that in civil life, that is to say, the scope of usefulness of alcohol in treatment was very limited.

Useful and desirable as might be an appreciation of this side of the problem, the records do not provide material for an authoritative pronouncement. The following comment is based on what may be termed a consensus of impressions.

For commissioned officers, if we except senescence, dependence on alcohol was probably the most frequent immediate cause of failure to "make good" in the field. On Gallipoli it was the direct cause of one major military tragedy. The fall of the "pseudo-dipsomaniac," as he was then known, was early and complete; spirit soaking was laid bare by failure to stay the pace or rise to occasion. In the rank and file, forbidden the use of ardent spirits, the chronic alcoholics sometimes did good service—the cycle from private to sergeant and back was a quite authentic experience. In lads under 18 alcohol played havoc

The Rational Factor: Education "Education" was used in the Great War not only as a means for the dissemination of factual knowledge, but as in itself a source of mental and moral stimulation and sustainment. Beginning with "Divisional" and other schools established behind the lines as soon as the I Anzac Corps entered the line on the Western Front, the educational system of the Australian Corps, Divisions, and Brigades had (like those of British formations) become by 1918 a highly important organisation. In this campaign the medical service fully participated. The "sanitary" policy, indeed, of the Australian force was based on the idea of education in self-help chiefly through the medium of the sanitary sections. The Corps and Divisional school system included as a matter of major importance that of health.[37]

Psychic Amenities. As the war progressed these, like many other matters of health, became more and more the concern of the army as a whole and a matter of organisation even more than of discipline.[38] They included leave, local and to the British Isles or Paris, and the organised entertainment there, organised games and boxing, inter-unit competitions in military or sporting activities—particularly keen where they concerned horses—concerts, cinema shows, and on a lower level (sometimes in default of the organisation that should have been provided) "two up," "crown and anchor," and "housey-housey." Late in the war educational lectures were given and were appreciated.

[37] *See p. 614.* In the Corps school lectures on "water" by the O C, No 2 Sanitary Section (Major M. J. Holmes), furnish the most complete account of the subject in the Australian records. "Sanitary models" made in the 4th Divisional School were rescued from Meteren a few hours before its capture in April, 1918, and with a number of others are now in the Australian War Memorial, Canberra. *See plate on p. 581.*

[38] They are dealt with in the chapter of the next volume concerned with the psychic disorders of the war.

SYNOPSIS OF CHAPTER XIX

PREVENTIVE MEDICINE IN THE WAR—(III) THE PREVENTION OF DISEASE

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PREVENTIVE MEDICINE—THE SIGNIFICANCE OF "P.U.O."