Original Communications.

THE INFLUENCE OF MILITARY SERVICE ON HYGIENE.

By Major-General Sir W. G. Macpherson, K.C.M.G., C.B., LL.D.

This time last year Sir Percy Bassett-Smith addressed you, as your President, on the "Progress of Hygiene, Pathology, and Bacteriology in the Royal Navy." The subject on which I propose to address you this evening is "The Influence of Military Service on Hygiene," although from a somewhat different point of view, and more in the form of historical retrospect than as an indication of progress. But before doing so I should like to rectify a grave omission on my part—and I may say also on yours—in not referring at our last meeting to Sir Percy Bassett-Smith's work as President of the group during the past year. Sir Percy entered on his duties imbued with that enthusiasm for which he became so well known not only in the Royal Navy but also in many circles outside it; and during his year of office he has won for himself our admiration and affection. I hope, therefore, that you will join me in expressing to him our deep appreciation of the services which he has rendered to the group.

When he handed over the chair at our last meeting, Sir Percy referred to the work of Major Daukes, as Secretary of the group, and I would ask you to express our cordial thanks to him also for his services. His task was by no means a light one and I am sure we all regret that his work is making such demands on his time as to oblige him to resign the secretaryship. At the same time we give a hearty welcome to Flight-Lieutenant W. H. Wood for so kindly taking up the burden which Major Daukes has thus been compelled to throw off.

1 Presidential Address delivered before the Navy, Army and Air Force Group of the Society of Medical Officers of Health, December 1, 1922.
In approaching the subject of "The Influence of Military Service on Hygiene," I should explain that my object is to show historically the direction in which armies and the demands of armies dealt with health problems rather than to present to you the manner in which hygiene as a whole benefited by military service. From the historical notes, however, which I have ventured to put together, some indication may be gathered of the extent of the influence which military service brought to bear in connexion with questions of health preservation and prevention of disease.

The maintenance of physical fitness, physical training, the hygiene of the march, the relationship between food and energy, camp sanitation and all that it implies are aspects of hygiene which belong specially to the domain of military service. But there are other features (such as the prevention of epidemics and preservation of health in communities of individuals living in close contact with one another) which, have been influenced to a great extent by the experience of armies in the field and military service in general, although they have an equally important bearing on civil life. The subject of medical topography also owes much to the experience of military service in various climates and countries. If the influence of military service, therefore, were to be explored fully, a subject of unwieldy dimensions would present itself; and I propose to touch on a few only of its more salient historical features this evening.

The maintenance of physical fitness and individual health is the earliest manifestation of the hygienic sense, if I may so call it. It assumes a prominent position in the history of campaigns from the earliest times; for it implies the man-power which enabled a nation to defeat its enemy and win battles. Consequently we find much in the writings of the ancients and in military literature at all times regarding the selection of recruits, and the training, feeding, clothing and housing of the soldier. In fact from the principles underlying these and the measures taken to prevent armies being attacked by epidemics, the science and practice of hygiene may be said to have emerged and to have expanded into civil life.

It was the army, for example, which constructed the public works, sewers and watercourses in ancient Rome, drained swamps and engaged in other sanitary work. As Lieutenant-Colonel Garrison of the United States army puts it, "the general sanitation of the Roman Empire was largely the work of the army." In this connexion it is interesting to note that the United States appears to have followed the example of the Romans, for the United States corps of engineers is employed in peacetime in the construction of public works. No better instance of this need be cited than the construction of the Panama Canal, which became possible only after the work was undertaken by the engineers and medical services of the United States army.

The selection of the best type of recruit is a subject which crops up constantly both in ancient and modern writings. Vegetius, for example, who wrote on the art of war in the fourth century A.D., devotes a whole
chapter to it, discussing questions of physique, age and previous occupation. He lays great stress on the graduated training of men, recruited from cities and accustomed to luxurious and sedentary lives, and compares them unfavourably with the hardier and stronger men from rural districts. In modern times the importance of this subject is indicated by the physical classification of the manhood of the nation during the recent war, and the voluminous and meticulous data published recently by the United States military authorities. Even Moses appears to have found it necessary to estimate physical fitness, by numbering the men "from twenty years old and upwards, all that were able to go forth to war." Constant reference will be found, therefore, to the selection of the best type of men physically and mentally from the earliest times up to that most recent development of the subject in the experimental work which was carried out in the military physical test station in Edinburgh by Professor Henry Briggs in 1918.

With regard to physical training the exercises and sports of the ancient Greeks, in the open air and stripped of clothing—gymnastics or gymnics in other words—differ in principle but very slightly from the doctrines preached in more recent times. Alexander the Great issued a strict order to his soldiers to take care of their bodies, and gymnastics and sports were their chief amusements. Vegetius, whom I have already referred to and will refer to again—as of all the ancient military writers he appears to have been the greatest exponent of military hygiene—states that those skilled in the art of war considered that daily exercises did more than the doctors to preserve the health of the soldiers. Amongst more modern hygienists, Sir John Pringle, the Physician to the Forces in the War of the Austrian Succession of 1741 to 1747, expressed the opinion that more sickness was caused by inactivity than by fatigue, and recommended encouragement of sports of all kinds, with a caution as to excess. A mean between love of ease and pursuing the most violent exercise was the principle advocated by him.

Robert Jackson, than whom there has been no greater or more courageous and adventurous army medical officer, although he died in obscurity in 1827 in his 77th year, unnoticed by the authorities of his day, had much to say on the subject of recruiting, training and exercise, repeating practically the observations of Vegetius. A whole section of his remarkable work, "A systematic view of the formation, discipline and economy of armies," published in 1804, with a second edition in 1824, is devoted to these subjects. He extols dancing, fencing and gymnastics as important elements in physical training; and he enforced the principle of graduated training and of carrying out exercises in the open air. Jackson’s attempt to influence hygiene is expressed in the words of his biographer, Dr. Borland: "He had a pervading anxiety respecting the health and well-being of the soldier."

It is curious to note how soon the principles enunciated by Jackson
and the earliest writers were forgotten or ignored; and it is to this fact that we must attribute the recommendations which appear, in strong protest, from time to time in the writings of subsequent military hygienists, so much so that, as recently as 1908, a committee had to be appointed by the War Office to investigate the physiological effects of food, training and clothing of the soldier, with the result that, so far as training was concerned, all that could be said was that it should be graduated and carried on out of doors, as far as possible. The ancient Greeks and Romans told us that; the great military hygienists of the three last centuries told us it; yet in 1908 we had to produce a new system of training, in accordance with these principles, in the "Manual of Physical Training" published in that year.

The opposition of military commanders to the advice of medical officers in this respect was no doubt due to the influence of the Prussian system of drill introduced by the father of Frederick the Great and to the writings of Clausewitz, whose classical work "On War," written in 1827, and published after his death from cholera in 1831, has been the Bible of the general staff officer, at any rate of the German staff officer. The theory that tall men, with stiff necks and "ramrods down their backs," were the acme of military efficiency seems to have dominated the military hierarchy for more than a century after the time of Frederick the Great, in defiance of the wisdom of men like Pringle and Jackson and indeed of the great military commanders of ancient times. In an old pamphlet of 1799, for reference to which I am indebted to Mr. Hudleston, the War Office librarian, the following significant passage occurs: "Such an army as he (General Burgoyne in North America) had was not fit to fight in woods, composed of heavy useless Germans and high dressed British infantry." The Austrian troops of the period are alluded to in the same pamphlet as "high dressed, stiff and unwieldy."

Clausewitz's influence appears to be still more pernicious, for he states that the theory of sanitary measures has not such an influence on strategic decisions as to make it worth while to include a consideration of them in the theory of war. The first English translation of Clausewitz's book "On War" appeared when Lord Wolseley was commencing his great career, and I wonder whether it could have inspired his well-known opposition to the sanitary officer. "The sanitary officer," he says in his "Soldier's Pocket Book" published in 1886, "is the creation of recent years, and as a general rule he is a very useless functionary." In any case I feel sure that had Lord Wolseley lived to witness the spread of sanitary organization into every nook and cranny of the field, and the marvellous activity of the sanitary officer and his influence in maintaining man-power and efficiency during the recent war, he would have expressed differently his appreciation of the value of sanitation.

But this is digressing somewhat from the subject of physical training; a subject which carries us on to the hygiene of the march. Here again we find remarkable evidence of how well the military commanders and
writers in early times understood the importance of the principles preached by modern military hygienists.

It is difficult to realize the extraordinary marches recorded in ancient times. They make one doubt the veracity of historians. Herodotus, the Father of History, was also called the "Father of Lies," and, if I remember rightly, our modern Pepys, Colonel Repington, quotes M. Briand as saying that "history is a lie promoted to the rank of truth by repetition." However, that may be, we have in Xenophon's narrative of the march of Cyrus' army of Persians and Greek mercenaries from the coast of Cilicia against Artexerxes in the year 401 B.C., and the subsequent retreat of the Greeks from the battle of Cunaxa south of Baghdad, up the Tigris and across the mountains of Kurdistan and Armenia to Trebizond on the Black Sea, a record of a march of 3,465 miles in 215 marches averaging over 15 miles each. This record was surpassed some seventy years later by Alexander the Great's famous expedition, as told by Arrian, into India through Persia and Afghanistan and back from the mouth of the Indus through Baluchistan.

Another famous march, quoted by historians, is the march of Marlborough's army from the Meuse to the Danube before he fought the battle of Blenheim. Here again some historian has made an error as to the distance and time, for Lieutenant-Colonel Garrison in one of his articles this year in the Military Surgeon, quotes it as a march of 1,176 miles in 86 days; whereas the distance as the crow flies is not more than 300 miles, and two military books which I have consulted make the march either 250 or 300 miles, although the time of the shorter distance is given as six weeks and of the longer just over a month.

But whatever may be the truth regarding these historical marches, all are agreed that they were only possible by strict attention to the hygiene of the march and the food, clothing, equipment and individual care of the soldier.

The pace of Cyrus' march was apparently three miles per hour, and this has been regarded as the most economical pace by all military hygienists. It was proved scientifically by experiments made by Cathcart and others during 1917 and 1918. They showed that the expenditure of energy in marching at a pace much slower than 90 yards per minute (that is to say a little over 3 miles an hour) was much greater than marching at that rate or indeed at a rate up to 130 yards per minute.

Almost the only contribution of Clausewitz to military hygiene is in connexion with the march; for he points out that a succession of even moderate marches is certain to tell on the instrument and that a succession of severe ones will, of course, do so much sooner. He regarded six or nine English miles as the most economical distance for an army to travel daily and was strongly in favour of periodic rests. But in discussing the subject of rests he makes some observations with which no hygienist will agree. Apparently the objection in his time to prolonged rests was that soldiers...
would then be confined to crowded camps and billets; but he considered that this could be ignored because, to quote his words, "it is so easy to give them while at rest in packed quarters both air and exercise so that the want of these can never be a cause of sickness"!

In more recent times the hygiene of the march has been closely studied in its physiological aspects. A remarkable and standard work was published by Marey on "Le Mouvement" in 1868. Thurn in 1872 wrote on the diseases caused by severe marches, and in 1901 Zuntz and Schumburg published a volume on the "Physiology of the March" in V. Coler's well-known library of military medical books. In 1905, a French writer, Manoeuvrier, wrote a short monograph on methods of classifying recruits based on estimating scientifically their capacity for marching.

Investigations of a similar character have been carried out by military medical authorities in England, but more in connexion with the expenditure of energy in relation to food. Thus in 1875 Edmund Parkes carried out an experimental march from Netley to test the restorative values of rum, coffee and meat extract; and in 1909 an experimental march, known as the "hunger march," was made by twenty-five soldiers under the medical charge of Lieutenant-Colonel Melville, Major Beveridge, as he then was, and Captain Dunbar Walker of the R.A.M.C. to investigate the amount of food required by men on active service and the composition of the iron ration. A second experimental march was made under the same direction in the following year.

During these marches many points were noted, such as the importance of marching with open jacket and shirt and of graduated and progressive training. The results were embodied in the Infantry Training Manual of 1911.

The chief consideration, however, in connexion with marches and especially prolonged marches, such as those historical ones which I have just mentioned, was sufficiency of food. All historians agree that the success of the march of the Persians and Greeks in Xenophon's time and of the British to Blenheim in Marlborough's time was due to the careful arrangements made for feeding the soldiers, as well as to the regulation of pace, daily length of the march, periods of rest and individual care. It is this relationship of food to work, and the calculation of the requirements and constituents of a soldier's ration, that form perhaps one of the most important features in the influence of military service on hygiene. Until more modern times, of course, scientific calculations of the value and nature of food constituents were not made; but there is much that is of interest in the general organization of the ancients for feeding armies during prolonged expeditions.

Let us take, for example, the arrangements made by Cyrus in his march to Babylon. They have close resemblance to those of modern armies, and consisted of

1) A regimental train, organized for carrying sufficient food for each unit to last from one source of supply to another.
(2) A three days' halt for rest in a locality where there was abundance of supplies and where areas for requisitioning supplies could be exploited.

(3) Trading canteens, forming a mobile market, where troops could supplement their rations by purchase.

(4) A reserve supply column for providing rations when the distances from one supply area to another were too great for the supplies to be carried in the regimental train.

The essential constituents of the ration in Xenophon's time were cereals, fresh meat, fruit, vegetables, cheese, wine and oils; and there is no record of those deficiency diseases which were so prevalent in the campaigns of the Romans, in the Middle Ages and in more modern times.

Both Pringle and Jackson devoted considerable attention to the question of the soldiers' diet, but they discuss its nature and amount more from the point of view of what is good for the soldier to take than from the point of view of physiological constituents.

Jackson sums this up by saying that the diet should be "wholesome in kind and spare in measure." He believed in Spartan diets and Spartan habits. Pringle also laid much stress on the evil effects of excess in food, as well as on the dangers of such diseases as scurvy arising from scarcity of food. He has many pertinent remarks on the subject. He believed scurvy and malignant fevers to be due to putrefaction of the blood, and that this could be prevented or retarded by the use of foods that had, in his opinion, antiseptic qualities. In fact he carried out a series of experiments for the purpose of noting and standardizing the efficacy of various substances in preventing or delaying putrefaction. An account of these experiments was submitted to the Royal Society in a series of seven papers read before it between June, 1750 and February, 1752. Pringle's belief in the value of certain constituents of diet in counteracting putrefaction of the blood is expressed in the following quotation:

"Hopped beer, wine and vinous liquors, coming more and more into general use, have been some means of suppressing putrid diseases. Greens and fruits are likewise more universally eaten, and salted meats make a much less part of our diet than formerly. To this add the more general consumption of tea and sugar, which I have shown elsewhere to be no inconsiderable antiseptics."

In more recent years military problems led to detailed scientific investigations on the physiological importance of the chemical constituents of food and their relationship to expenditure of energy. Much of this investigation was initiated by Pettenkofer and Voit in Germany, but also by the Rev. Professor Haughton in this country. In military service it attained much prominence in the writings of Edmund Parkes and his successors; more especially when concentrated and preserved foods became more or less essential in the Army in order to reduce bulk in transport and at the same time give the soldier a ration sufficient to maintain his physical fitness and vigour. The estimate of the chemical constituents of every...
variety of food and their conversion in terms of calories into work represent the direction in which military service influenced this branch of hygiene. During the recent war and when the shortage of food was felt, much additional knowledge was obtained in this respect by the work carried out under the Food (War) Committee of the Royal Society in 1917. New tables of food values, supplementing the well-known American tables of Atwater and Bryant, were then prepared by Plimmer, and these, combined with the work of Cathcart and Orr on energy expenditure, have a scientific value which is bound to exercise a lasting influence on the hygiene of food in relation to work.

Associated with this we have the exhaustive investigations into food deficiency diseases and their prevention, which resulted from the experiences of the Great War, notably those carried out in the Lister Institute, by Miss Hume and Miss Chick and other able lady workers, together with the practical experience of the physicians in Egypt and Mesopotamia; although we must credit the Japanese for going far long ago in the direction of preventing and eliminating the cause of food deficiency diseases in their army and navy.

Another important result of the war was the careful supervision of the manufacture of preserved foods. I remember in the South African War, too, when complaints reached the War Office of the calf's foot jelly supplied to hospitals, I was deputed to inspect the factories, where some interesting facts throwing light on the cause of the jelly going bad were noted. Again only last week Professor Kenwood told us in his lecture at University College how the war had increased the practice of milk pasteurization in the milk trade.

While on the subject of food it may be of interest to refer to the many controversies that have taken place on the value of the so-called "rum ration." Wines and vinous liquids have always been a constituent of the soldiers' ration in the armies of ancient Greece and Rome, and in the present day in the armies of wine-growing countries. Rum is a peculiarly British ration, dating probably from the time we owned sugar-growing colonies. Consequently we hear little about its effects before the time of Robert Jackson, who spent much of his service in the West Indies, and who was strongly opposed to its issue. Pringle, however, some fifty years earlier was a great advocate of the value of wine and alcoholic drinks as a constituent of the ration, as I have already indicated. He was probably influenced by his experience on service in Flanders and Scotland.

"As to spirits," he writes, "it is to be observed that even when drunk in excess they tend more to weaken the constitution than to produce any of the common camp diseases." And again, "soldiers have often to struggle with the extremes of heat and cold, with moist and bad air, long marches, wet clothes and scanty provisions. Now to enable them to undergo these hardships it is proper that they should drink something stronger than water or even than small beer, which is commonly new
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and bad in camps." He considered that the danger was greater from excess in eating than in drinking, and quotes Celsus on this point: "Si quae intemperantia subest, tutior est in potione quam in escā." Pringle, it may be mentioned, drawing a conclusion from his theory of blood putrefaction and the antiseptic qualities of wine, referred to the greater prevalence of pestilential fevers amongst the Moslems than amongst neighbouring Christians as being due to their abstinence from wine and fermented liquors. Parkes' experimental march in 1875 appears to have settled the question and to have established the present military view with regard to the "rum ration," namely that it is of value at the end of a day of fatigue and exposure, or in order to induce special effort over a very short period of time. This is exemplified by the evidence given before the recent War Office Committee on shell shock by Lieutenant-Colonel Rogers, who had a very special knowledge of soldiers in the trenches as Regimental Medical Officer of the 4th Battalion of the Black Watch. "Had it not been for the rum ration," he said, "I do not think we should have won the war. Before the men went over the top they had a good meal and a double ration of rum and coffee." The ration, as you know, is only issued on the recommendation of the Medical Officer.

But on controversial matters such as these, to use the words of Jackson when he discussed the hygiene of clothing, "opinions of men fluctuate like the tides of the ocean."

We come thus to the influence of military service on the hygiene of clothing. In 1901 a War Office committee dealt with the question and introduced the present field service dress, on principles of hygiene which had been preached long before. It was the Prussian influence to which reference has already been made that kept us back, and against which Jackson strongly protested. He makes scathing remarks on the "spit and polish" of the army. "Pipe clay," he says, "is employed to cover dirt." "A soldier notwithstanding he might be encrusted from head to foot was said to be clean if his small clothes and facings were covered with pipe clay, and his head was said to be dressed if the hair was matted with a pasty of grease and flour." Against this Jackson emphasized the importance of clothing which gives freedom of movement to the chest and limbs and of boots the natural shape of the foot, such as did the War Office Committee of 1901. Similar views were held by the Maréchal de Saxe in 1738, when he issued orders for greasing hands and feet as a protection against cold and for the abolition of foot and leg clothing which impeded the circulation. Nor were these principles of hygiene ignored by Xenophon, who issued orders for the prevention of trench foot or frost bite which were practically the same as those issued in France during the war; for his narrative records that the lacing of the shoes of his men caused constriction with resulting frost bite and gangrene, and under a rigid system of discipline he ordered his Captains to see that the men removed their foot gear at night, rubbed and dried their feet, anointed them with
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oils and fatty substances, and were kept moving or employed in exercises such as felling trees to maintain bodily warmth.

We come now to camp sanitation, a subject more than any other on which military service has taught us most. When the children of Israel fled from Egypt "with their armies" and prepared for warfare in the Land of Promise, Moses, as all who read the Bible know, issued laws which were to be obeyed in war, and drafted regulations for camp sanitation not unlike those of the present day, for they include such basic principles as the isolation of infectious diseases, the prevention of venereal disease, care in the selection of food, sanitary disposal of excreta and waste products, and sanitary inspections. The priests were the sanitary officers authorized to see that the regulations were obeyed. How far similar sanitary measures were carried out by future generations in Palestine cannot be traced, but Lieutenant-Colonel Garrison notes that the Saracens in the Middle Ages had a system of sanitation which included the digging of trenches for dead animals and excreta outside the camp and filling them in with earth, the selection of pure water supplies and the detection of impure sources.

In the military writings of the Greeks and Romans camp sanitation takes a prominent place. Vegetius more especially devotes space to this subject, saying that measures for preserving the health of troops comprise the selection of camping grounds, water supplies, shelter, and so on, and that if an army is left too long in the same area during summer and autumn, the fouling of the ground, the pollution of the water supplies, and aerial infection spread epidemics which may cause its destruction. His remedy was frequent change of camping grounds and sanitary inspections. In his day there were camp commandants, who seemed to have command over the medical services, and to them and to commandants of labour companies was entrusted the duties of sanitary officers. These duties were, in many respects, similar to those of the sanitary officers in the recent war, and included sanitary inspections of tents, huts, and constructions generally.

Pringle held strongly to the opinion that pestilential fevers were caused by foul sites of camps and insanitary billets. His theory was that the remittent and intermittent fevers of the army in Flanders originated in putrid air, and that the infection spread from faeces and foul latrines and from the occupation of low-lying marshes and damp ground, and dirty and overcrowded billets.

Jackson never went so fully into questions of camp sanitation as his predecessor, Pringle, but urged the importance of medical topography. Medical topography, in his opinion, was as important as military topography, and disregard of it was destruction of the forces in the field. This was certainly so in the case of the ill-conceived Walcheren expedition of 1809 and of many other expeditions, such as that of the French in Madagascar in 1895 and indeed to some extent our own occupation of the Struma.
Valley in 1916. Napoleon well knew the importance of medical topography, for he realized what would happen to the British in Walcheren when he refused to send a force against them, saying that within three months fever would finish them, and in Napoleon's correspondence of August 16, 1811, there is the following passage: "Il vaut mieux la bataille la plus sanglante que de mettre ses troupes dans un lieu malsain."

In connexion with camp sanitation, we have the problem of water supplies and their purification. Purity of water was not ignored in the military services of ancient times. Although we do not hear very much about the methods of purification, there are a few indications that military commanders were not indifferent to its importance.

I am again indebted to Mr. Hudleston, the War Office Librarian, for the following quotation from Herodotus regarding Cyrus the Great in his warlike expeditions: "There is also carried with him water of the river Choaspes, which flows near Susa, for the King drinks of no other; wherever he goes he is attended by a number of four-wheeled carriages, drawn by mules, in which the water of Choaspes, being first boiled, is disposed in vessels of silver."

Sterilization of water by boiling was, therefore, no new discovery; but it appears to have been a luxury, granted only to the mightiest in the land, although possibly it may have been more generally practised than history records.

Again Arrian tells us that Alexander the Great took care that those who came to the water first should not run into it with their feet and thereby render it unwholesome for the rest of the army.

The Greeks and Romans added vinegar to water to render it palatable and wholesome. Jackson refers to this and himself advocates its use when water is flat or mawkish, but was opposed as usual to the British adding rum for the same purpose. He does not go further, however, in connexion with water supplies, than to mention the use of alum for clarifying water.

Vegetius considered muddy and polluted water a danger to health; and required all officers to pay particular attention to the question of water supplies and the diseases caused by bad water, from the first day of a campaign. He was referring specially to dysentery.

But it is only in modern times that the hygiene of water supplies was investigated scientifically; and much of the progress in this direction has been due to military service. Chemical impurities were first investigated and limits of permissibility of chemical constituents standardized. The "Manual of Military Hygiene" by Edmund Parkes went a long way to disseminate knowledge of this kind. Later, as we all know, bacteriology

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1 I had been under the impression that the passage which I had read a long time ago, had occurred in Xenophon or Arrian, and that it referred to Alexander the Great, and it was only after searching their anabases carefully and failing to find it that Mr. Hudleston came to my rescue.
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took the field and changed the character and standards of water analysis. At our last meeting Colonel Anderson told us of the wonderful work which was done in the war to purify water supplies. In this direction military service has brought us to a stage in hygiene in which the most foul and poisoned water can in an incredibly short time be clarified, sterilized and converted into a table water.

Reviewing the whole question of water supplies and camp sanitation, one is impressed by the fact that advances in consequence of modern civilization have only been technical in character, and that the principles underlying this branch of hygiene were realized in the military service of the ancients as much as in that of the present day. The means for maintaining cleanliness in camps, disposing of waste products and purifying water can only be described as technical advances in hygiene; and in these technical advances the British Army has undoubtedly taken the lead. The history of sanitation in the recent war forms a compendium of information on the subject.

Passing now from the influence of military service on camp sanitation, or what might be called sanitation by improvised measures as distinct from municipal sanitation, we come to the influence of military experience on the hygiene of habitations. Pringle and Jackson were apostles of this branch of hygiene. "The want of pure and wholesome air," writes the former, "cannot be compensated by diet and medicine." "The best rule is to admit so few patients into each ward"—speaking of hospitals—"that anyone unacquainted with the danger of bad air might imagine there was room to take in double or triple the number." "I have generally found those rooms most healthful where by broken windows and other wants of repair the air could not be excluded." Pringle also recognized the value of open fires and chimneys for ventilation and describes a form of ventilator. He recommended the dispersal of the sick into a number of small hospitals, instead of concentrating them together in one large overcrowded hospital, and had thus in his mind the germ of a pavilion system of hospital construction.

Jackson urged disinfection of walls and floors in barrack rooms; and specially the prevention of overcrowding in transports, a subject which military hygienists have been constantly impressing upon the authorities in recent times. He noticed the ravages of contagious fevers in transport ships, describing them as terrible; and considered it important that in taking up a transport, the character of the ship, its wholesomeness and freedom from infection should be investigated, that there should be a definite tonnage allowance per man, that the height between decks should not be less than seven feet, and that there should be proper equipment of bedding and arrangements for sleeping, accommodation for sick and convalescents, general means of ablution, etc.; and careful inspection and classification of troops before embarkation.

There is probably no branch of hygiene in which the teachings and
experience of Pringle and Jackson suffered so much neglect as the hygiene of dwellings, of hospitals and of transports. It was this neglect that led to the onslaught on the military and medical services by Florence Nightingale in the Crimean War, with all the subsequent results. Modern hygiene, in fact, as set forth in Parkes' immortal classic, "A Manual of Practical Hygiene," dates from that war. The Royal Commission appointed in 1857 to inquire into the Army introduced reforms which gave the army medical officers authority to advise commanding officers on all matters affecting the health of the troops whether as regards garrisons, stations, camps and barracks, diet, drill, duties or exercises. (Previously medical officers were only entrusted officially with the care of the sick.) Parkes wrote his manual to meet these demands, but found that, as the general principles of hygiene were involved and could be illustrated by examples drawn from army life, it might be made applicable to civil as well as to military communities. It is fortunate that Edmund Parkes was appointed to the Chair of Hygiene, the first chair of its kind, in the new Army Medical School, for no one of higher attainments or wider philosophical outlook in connexion with hygiene existed then or subsequently. As Florence Nightingale says of him in one of her letters, "his knowledge and instruction, diffused from the Army Medical School as a centre, has extended and will extend wherever the English language is spoken and beyond."

The Crimean War had thus far-reaching results in the application of hygienic principles to practical sanitation both in civil and military life. It led, amongst other details, to the introduction of standards of cubic and superficial space in houses, barracks, hospitals and institutions; to the pavilion system of hospital construction; to standardizing of hospital statistics, such as those introduced by Dr. Graham Balfour in the Army Medical Department Reports, and to many other inquiries into problems of the preservation of health, prevention of disease, and the incidence of epidemics. The Barracks and Hospitals Improvement Commission which followed the Royal Commission on the health of the Army entered into details of warming and ventilation, drainage and water supplies, all of which had a bearing on civil as well as on military constructions. It was in this direction that military service at that time had its greatest influence on hygiene, and in fact led to the Public Health Acts which followed the Crimean War.

The story of the influence of military service on the prevention of specific diseases is a long one and there is time only for a superficial glance at it. Generally speaking this influence only commenced to be felt within the last half century. Up till then the knowledge of specific causes of disease had not been determined with scientific accuracy, and it was not until bacteriology, protozoology and entomology assumed the importance they now have that definite progress was made. Previously measures of quarantine were relied on for the prevention of epidemics, if
we except the vaccination methods of Jenner in the prevention of smallpox. Quarantine methods were in vogue from early times. According to Garrison, quoting Sudhoff, the wars of the Middle Ages brought extensive epidemics of bubonic plague and led to a system which included “sanitary control of incoming vessels, observation stations, isolation hospitals and methods of disinfection, all of which measures have been adopted in modern times, in more definite and rigorous form, but with relatively few changes.” These measures were adopted first by the great trading ports of Venice and Marseilles in the fourteenth century.

It was military service in Malta that brought to light the causes of Mediterranean fever. David Bruce’s discovery of its micro-organism was made while he was a young army medical officer there in 1886, and the demonstration of the micrococcius in goats’ milk by Horrocks, in Malta, in 1905, led to the total elimination of the disease from military life. Service in Malta added also to our knowledge of sandfly fever, through the investigations of Marett and Birt, following those of Doerr in Austria.

Prophylactic inoculation against enteric fever was first tried in the South African War by Almroth Wright. Leishman perfected the vaccines and methods of inoculation in the laboratories of the Royal Army Medical College with results in the recent war that form one of the most brilliant chapters in the history of disease prevention.

The American war with Spain had an almost equally great influence, for it led to the determination of the mosquito transmission of yellow fever and to the practical elimination subsequently of that disease from localities where it was previously endemic. It was this war, too, that drew attention to the influence of flies in transmitting disease. The observations made in the camps in Florida proved that flies carried fecal matter to food and from that time onwards the disposal of excreta by incineration and the prevention of fly-breeding have been routine measures of sanitation. It is interesting in this connexion to note that Pringle very nearly arrived at the truth with regard to the influence of flies in transmitting such fecal diseases as dysentery. In discussing the causes of dysentery he says: “And here is an old observation that such seasons as produce most flies, caterpillars and other insects, whose increase depends so much on heat and moisture and consequently in corruption, have likewise been most productive of dysentery.” “The first source of infection seems to be the privies, after they have received the dysenteric excrements of those who first fell ill.” He even went further and refers to a curious dissertation by Linnaeus regarding the observations of a Danish doctor on the presence in dysenteric stools of minute mobile “animalculæ” scarcely visible to the naked eye.

With regard to malaria, military service has taught nothing beyond the practical measures necessary to deal with the appalling and destructive outbreaks in armies which are forced to carry on operations in notoriously malarial areas, or which in peace occupy garrisons in malarial countries.
The discovery of its causation was due more to independent investigators, such as Manson, Ronald Ross and Laveran, than to those in military service, but an enormous amount was accomplished during the recent war in determining the habits of the mosquito carriers of the disease, more especially in Macedonia and Palestine, and in the malarial topography of these countries.

So, too, the Great War has had a profound influence with regard to the prevention of typhus fever, relapsing fever, and trench fever, and their association with infestation by lice and other insects.

The Great War is responsible again also in connexion with cerebrospinal fever and influenza for establishing the greater importance of lateral space than cubic space in determining conditions of overcrowding, and for applying this principle to the slinging of hammocks in transports.

Then again we must attribute to the influence of the war the investigations into the factors which produce and prevent food deficiency diseases, as I have already touched upon; the methods of transmission of schistosomiasis, the extraordinary propagandism and general activity in efforts to prevent venereal disease, and many other important practical details of sanitation.

The work of combating venereal diseases during and after the Great War has torn the veil, which concealed them from the public eye, ruthlessly asunder. Incidentally Colonel Reece has drawn my attention to a curious line in Horace's Epistle to Quintus, which shows that diseases in his day, too, were concealed by a pernicious sense of shame: "Stultorum incurata pudor malus ulcera celat."

All of these are so much of the nature of recent knowledge, and so well known to the members of this group of the Society of Medical Officers of Health that I need do no more than merely indicate them. Future generations will be better able to estimate their influence on hygiene than we are in a position to do now. But I might venture the opinion that, had there been no such incident as the national military service of the last war, there would have been no Ministry of Health in this country to-day.

But what seems to me an important result of military service is the education of the individual in sanitary habits. I have always held that sanitation depends more on the individual than on the system. A perfect system is useless if the individual does not apply it. Now the individual experience gained in military service is a great factor in aiding the sanitation of civil communities, especially in the less advanced villages and towns. In speaking to me some years ago Surgeon-General Stechow, of the German army, emphasized this, and said that the training of the soldier in sanitary habits had a wide influence in civil life when he completed his service with the colours and returned to his home. Again, we have the enrolling of the priests in the sanitary sections of the Italian army during the recent war, in the hope that they would spread a knowledge of hygiene amongst their parishioners after they were demobilized.

Individual sanitary education, too, formed an important feature in the
Japanese army during the Manchurian Campaign, and was introduced into the British Army as a consequence of the lessons learnt in that war. One cannot, therefore, attach too much importance to the sanitary education of the individual, and no better means of teaching individual sanitation exists than military service in the field.

In conclusion, I am deeply sensible of the many imperfections in the matter and manner in which I have presented to you this evening a subject that is full of fascination to those interested in the history of hygiene. I am fully aware of the fact that very many points have been omitted and overlooked in connexion with our knowledge of hygiene and its practice under the influence of military service. Still more am I conscious of the fact that the influence of the workers in civil life on military hygiene has been far greater, especially in modern times, than the influence of military workers on civil hygiene. The sanitary work during the Great War bears eloquent witness to this, and the nation can never repay what it owes to the medical officers of health and specialists in hygiene who were enrolled from civil life in the Royal Army Medical Corps during the war, and by whom the bulk of the practical work in maintaining a high standard of health and efficiency was carried out.

I fear I have wearied you with a jumble of suggestions that will only leave in your minds a sense of there being "no intrinsic newness others have not had before." I have merely ventured this evening to put before you a few notes from such literature and impressions as have come my way during forty years of army employment, during which the problems of hygiene and sanitation have occupied no inconsiderable portion of my time; and I have to thank you for listening to me with so much patience and indulgence.