records of Beddoe in which the sexes had not been kept separate. Fortunately, however, nearly fifteen thousand records on males alone remained available. In the Northern and Eastern Counties, in the lowlands of Scotland, and again in Sussex and Hampshire, the correspondence of the tracks of the hair and eye indices was most marked, whilst in the Western and West-Central Counties, in Wales, and in the Highlands of Scotland the darkness of the hair was very much greater than that of the eyes. It was pointed out that those regions in which the hair and eyes correspond in lightness were historically regarded as the sites of the purest Nordic blood in these islands, while those parts in which the hair track was much higher than that of the eyes were the sites in which we have every reason to believe the Mediterranean blood had mixed most freely with the Nordic. Where the two races had mixed it appeared that the light Nordic eyes and the dark Mediterranean hair were the dominant factors. Except in Wales, a percentage of more than 50 dark eyes is unknown in the British Isles.

On comparing town and country dwellers it was noticed that the towns were darker than the country, except in those parts where the nigrescence was very high, when the reverse was the case. It was suggested that one reason for this might be that the town dwellers were more migratory than those of the country, though probably this did not account for all the difference.

The distribution of red hair was worked out and found to be greatest in Scotland and the North of England, where the nigrescence was least. It was also pointed out that the evidence available showed that it was more prevalent among the upper than the lower classes, and that this probably coincided with a lower index of nigrescence in the upper than in the lower classes.

In opening the discussion, Prof. Keith said that Prof. Parsons's paper was of supreme importance to all who were interested in the origin of the peoples of this country. In his opinion, pigmentation was probably the key to the problem, and Prof. Parsons's new method of estimating nigrescence was a real contribution to the study of the subject. His index was, however, in a sense, an average, and must therefore be used with caution. In referring to the lack of correspondence between hair and eye colour, he instanced the dark hair found in conjunction with grey eyes in Wales, Ireland, and West Scotland—a conjunction also occurring in Scandinavia. After thirty years of observation, however, he himself was still in doubt as to the difference between a Celt and a Saxon, and felt it impossible to distinguish between individuals from, say, Suffolk and Connaught. In his view the basis of the population of these islands was predominantly Nordic.

Dr. Brownlea said that he considered the results based upon the distinction of sex were not quite trustworthy. He held that six distinct races went to make up the population of these islands, one of these being a distinct red-haired race.

Mr. H. Peake, while agreeing with Prof. Keith that averages were untrustworthy, said that Prof. Parsons's index was not quite an average, and in any case it was the best method of dealing with observations which had been advanced so far. The conjunction of dark hair and light eyes was a puzzle. Was it due to a tendency in the Mediterranean race towards light eyes, or was it due to a fusion between the Nordic and Mediterranean types? Certain characters seemed to follow sex, and in cases where there had been an immigrant male population intermarrying with the females of the country, the dominant character of the male reappeared in the male line.

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Prof. Parsons's results pointed to this, in that where there was a considerable Nordic influence there were wide sex differences; where Nordic influence was small there was little difference between the sexes. He pointed out that not all red-haired people were alike in shape and colour. It had been suggested that red was a variant of fair hair, e.g. in Scandinavia. The older theory was that it was a border-line colour between fair and black. In Ireland, Wales, and Scotland it might arise from a crossing of Nordic and Mediterranean types. On the other hand, in the North of England it might be a variant of fair hair, as in Scandinavia. But even Scandinavia, he pointed out, was not homogeneous; light and dark types occurred, and therefore in that country also red hair might be due to contact.

Dr. Shrubsall said that in his investigations of the incidence of dark hair in town populations he had found that the longer the town history of a family, the darker the hair. He pointed out that the occurrence of red hair in the March country of Ireland, Wales, and Scotland supported the view that it was due to contact of light and dark types.

Dr. Stannus said that while investigating albinism in Africa he had found a large number of red-haired individuals, but in these cases the pigment was always found in solution. The problem was biochemical, and, in his opinion, microscopical examination was essential to show whether individual cases were cases of black hair in which the pigment had not been thrown out in granular form.

The chairman, in bringing the meeting to a close after Prof. Parsons had briefly replied, said that the discussion had shown the desirability of a much wider survey of the people than had hitherto been made. The results would have an important bearing upon such questions as the relation between health and race. He hoped that the Government might be induced to help in this great undertaking.

Army Hygiene and its Lessons.¹

By LT. GEN. SIR THOMAS GOODWIN, K.C.B.

UNTIL quite recent years it has never been sufficiently recognised that a very large proportion of Army medical effort should be directed towards the prevention of disease. The fact that in all wars in the past more men died from disease than from enemy action appears to have been accepted more or less with resignation, and regarded as inevitable. During the later years of the nineteenth century the increasing advances in science and our more exact knowledge regarding the ætiology and transmission of infective diseases led many medical officers to attempt to create barriers against the spread of disease by known paths, but there was a lamentable lack of co-ordinated effort.

Towards the close of the eighteenth century we begin to glean something in the nature of figures regarding sickness in armies in the field. In 1792 the allied Austrian and Russian armies were in Champagne; they commenced their retreat on September 30, and by the end of October had evacuated France, and during that short month, without any considerable fighting, they lost 25,000 men, or more than one-fourth of their number, every village being filled with dead and dying.

Accurate figures are unobtainable regarding Napoleon's campaign in 1812, but we learn that in June, 1812, he crossed the Niemen with a magnificent army

¹ From three Chadwick Lectures delivered on March 8, 15, and 22, 1919, entitled "Army Hygiene prior to the Recent War," "Army Hygiene during the Great War," and "Army Hygiene in the Future."

of 400,000 men; he reached Moscow on September 14, the retreat began on October 19, and on December 13 he recrossed the Niemen, and of his great army more than four-fifths had melted away.

Probably one of our most disastrous campaigns, from a hygienic point of view, was the Walcheren Expedition of 1809, where our mortality from disease amounted to 346.9 per thousand of strength of troops.

Regarding the Crimean campaign in 1854 I shall say but little; we have all read of the trials and hardships of the troops in that campaign, in which the mortality from disease amounted to 230 per thousand of the strength.

In the Afghanistan War of 1878-80 the mortality was 93.7 per thousand, which appeared to be an improvement compared with the terrible figures which we have just considered.

Bad as these figures are, yet those of other nations are even more unfavourable; for example, in the French Sudanese campaign of 1888-89 the mortality from disease amounted to 280 per thousand—worse figures than those of our own Army in the Crimean campaign thirty-five years previously.

I think that perhaps the most striking example of the havoc which may be wrought by disease on an army in the field is that furnished by the French Army in Madagascar in 1895, where the mortality from disease amounted to 300 per thousand of strength. In this campaign 7 men were killed by the enemy and 94 wounded, while the deaths from disease numbered 5600. The actual admissions for sickness amounted to more than 15,000, or 85 per cent. of the whole force.

The evils in the past were mainly due to lack of co-ordination and of real knowledge on which concerted action could be based. Nevertheless, advances were made, and, as an example of the steady, progressive improvement in the health conditions of the soldier and the increased success in disease prevention, it is interesting to note that in India during the five years 1878-82 the following were our sickness and mortality rates per thousand of men serving among European troops:

	Constantly sick	Deaths	Malaria	Dysentery	Cholera
1878-82	68.1	20.5	569	42.8	5.7 (4.2 deaths)
1912	28.8	4.6	82	5.2	0.3 (0.2 deaths)

Compare these figures with those for 1912:

As regards conditions in the civil community, probably the first really important step towards an improved condition of affairs in England dates from the passing of the Public Health Act in 1875. Two hundred years ago the annual death-rate in London was 80 per thousand; I think it is now about 18 per thousand.

Military hygiene differs little in theory from that relating to the public health of a civil community, and in times of peace is closely allied to that ordinarily carried out in all branches of the Public Health Services.

There are, however, certain considerable advantages in military hygiene which find no counterpart in civil life. The measures which the sanitary officer recommends, when accepted, are carried out with all the power of military organisation and discipline behind them, and insanitary conditions and disease are subject to a far greater control than can usually be obtained with a civil population; so that, before the South African War, great advances had been made in the status and training of the Medical Service generally, but there were still many defects, the chief of which were lack of organisation in the Sanitary Service, deficient education and training in hygiene of the officers and men of all branches of the Service,

and lack of co-ordination between the Medical Service and the rest of the Army.

Now let us consider the South African War. From what I have said you will realise that we entered on that war fairly equipped with knowledge, but with a deficiency of organisation as regards the hygienic requirements of an army in the field. It is true that affairs improved very considerably during the course of the war, but the unpreparedness at the outset bore its inevitable harvest. During this campaign some 14,000 men died from disease as compared with about 7000 killed. As regards enteric fever, we had 57,684 cases with 8022 deaths. Dysentery alone accounted for 86 admissions per thousand of the strength, and from all diseases we suffered 843 admissions with 24 deaths per thousand of the strength; while wounds in action accounted for 48 admissions with slightly less than 3 deaths per thousand.

South Africa saw the dawn of the organised scientific study of disease as regards its actual incidence in the field. Much of the success achieved by field hygiene and sanitation in the recent war may be traced to experience gained in the war in South Africa.

The Army Medical Service emerged from the South African War convinced of the absolute necessity for improving the sanitary organisation on certain definite lines. It was, in fact, at last generally realised throughout the Army that in war nothing is so costly as disease. The main requirements were, first, the education of the troops themselves—officers, non-commissioned officers, and men—in the aims and methods of hygiene. The second necessity indicated was the allocation of certain officers and personnel for sanitary work alone, and for their special training, in addition to the continued training of all medical officers, in the very latest scientific work. The third, and perhaps the most important, requisite was organisation for war.

This organisation was so arranged as to compass a thorough sanitary control of the lines of communication in order to filter off unfit men suffering from contagious or infective disease, and at the same time to maintain a freedom from disease of all personnel passing through the various channels and fixed establishments comprising the lines of communication. In France, for example, during the past war, it may be said that, beyond an outbreak of dysentery at one training centre, clearly traced to an influx of "carriers" from the East, the lines of communication during the whole period were maintained almost free from outbreaks of epidemic disease of any serious or extensive nature.

How very different were the conditions under which the Army took the field in 1914 from those of former wars! The scientific investigations of the preceding years had stabilised to a very large extent the hygienic environment of the soldier. Careful work on his foodstuffs as regards quantity, variety, and quality assured him a sound basis on which to wage war.

Undoubtedly much of the low incidence of infectious diseases enjoyed by the troops in the field during the whole war was due to a high resistance maintained by the ample and excellent condition of the food-supply. In the same way the equipment, clothing, and personal hygiene of the troops had all been envisaged on the soundest lines; while the method and practice of sterilising water-supplies and safeguarding foodstuffs, as well as the disposal of waste products, had been carefully thought out and generally inculcated.

Now let us consider the three main essentials to life, namely, food, water, and air. The food of the troops and its intimate relation to that important organ

"on which" (we are informed by high authority) "the army marches" likewise gave cause for the most careful study and preparation. In the past the military ration had been arranged upon more or less empirical lines after actual test marches. During the war, however, the menace of a national shortage of food and the importance of avoiding waste led to more exact studies of the needs of the troops by a detailed assessment of their actual energy output by the method of indirect calorimetry. Simultaneously with these studies, the assessment of the needs of the civil population by the Royal Society (War) Committee furnished information of incalculable value both for the future and, indeed, for the present time of world shortage.

It was a matter of no little difficulty to provide the many varied rations required by different peoples in different theatres at differing seasons and under varied military conditions; but, speaking generally, the Army of eight and a half millions had throughout been fed in such a manner as to enable it to fight effectively to provide the energy and heat required, and to avoid outbreaks of disease traceable to the diet, with the exception of minor outbreaks of neuritis and scorbutic cases in those most distant areas—Mesopotamia and North Russia. In these localities the difficulty of at once arranging for local produce in severe climatic extremes and the dependence on preserved supplies from home were accountable for the outbreaks in question. Steps were quickly taken, however, to provide the necessary accessory food factors, at first by germinating pulses and by yeast, later by the intensive cultivation locally of fresh foodstuffs—measures which proved of great value both to the native inhabitants and to the troops.

The question of *water-supply* is one of the first importance. During the few years before the war experimental work on the various physical and chemical means of sterilisation—or at least of purification—of water had been carried out in several directions. Just prior to the war dependence had largely been placed on the use of filter-candles, but they were found to be unsuitable for active service conditions, and were replaced in every case by chlorination. The net result of war experience was the undoubted value for sterilisation purposes of chloride of lime in the form of bleaching powder. This substance, as is generally known, contains from 30 to 33 per cent. of available chlorine, which in turn liberates nascent oxygen in water, and this is effectively lethal to micro-organisms. Chloride of lime was used throughout the war as the means of dealing with all water-supply, either in bulk, as in the big "water-points," or regimentally in water-carts, pakhals, or containers of different shapes and sizes. As the war proceeded the need for the provision to advancing troops of properly treated water in large quantities led to the development of special Water-tank Companies. These units—first recommended in France by our own sanitary advisers—are capable of collecting, filtering under pressure through sand, sterilising by chlorine gas (by means of an ingenious regulator), and transporting large quantities of water wherever the motor-lorry (which was their basis) could move. In the same way barges for use along the waterways of the various theatres of war were developed. As an example, it may be mentioned that the ordinary barge of Northern France would deal with—and deliver—5000 gallons of pure, sterile, and tasteless water per hour; any suggestion of flavour of chlorine was removed by a "dechlorinating" process with sulphur dioxide gas.

These new water units proved of immense value, and are effective against mineral poisons as well as against

bacterial or protozoal contamination. To meet the varying requirements of the different waters utilised in, e.g., France or Egypt or Murmansk, different amounts of "bleach" were needed. The estimation of the required quantity would have been a matter of some difficulty but for the provision of a special test in the form of the "Horrock's Test Case," the action of which is based on the known fact that, generally speaking, 1 part per million of free chlorine suffices to ensure bacterial sterilisation in water, and that before this amount of free chlorine is available a certain varying amount will be used up indirectly in the oxidation of organic matter and the ordinary non-pathogenic or saprophytic organisms. Similarly, in view of the possibility of mineral poisons, medical officers were supplied with test cases to detect arsenic and the other commoner metallic poisons. Of the detail of the water organisation there is barely time to speak here. It is perhaps enough to say that, despite the variety of the theatres of war and the possible contaminations in these various areas, there was no outbreak of those water-borne diseases which have been so destructive to armies in the past. In this connection it may be of interest to add that the success of water chlorination in the field led to its adoption in certain major schemes at Boulogne and Rouen, where, for example, we were enabled to undertake chlorination of the municipal water-supplies, and so satisfactory was this that laboratory tests showed the tap-water of Boulogne, drawn at random some few weeks after the scheme was initiated, to be absolutely sterile. It is interesting to note that the American Forces adopted a similar scheme in a number of the larger towns in France occupied by their troops with equally good results. It is necessary to say how much of the excellence of the water arrangements was due to the high technical skill of the Royal Engineers in their very difficult task of providing the huge quantities required. In many cases this necessitated the actual boring of wells and the pumping forward to large "water-points," even in some cases to the trenches, by means of rapidly laid pipe-lines. During the offensive in the summer of 1918 the Third Army advanced through a waterless zone having a frontage of 12 miles and a depth of 20 miles; water was obtained by means of 6-in. bore-holes sunk by the Royal Engineers in the chalk, which yielded 9000 gallons per hour. Altogether, 500,000 gallons were obtained daily from the bore-holes and distributed to the troops by the Water-tank Companies. This method was continued until the enemy's water system was available.

I would now briefly touch on the question of *air and ventilation*. At an early date after the Crimea it was recognised that "spacing out" of men in barracks was essential, and the Army Regulations were framed to give every man a space of 600 cub. ft., or, assuming a 10 ft. high room, 60 sq. ft. of floor-space. This very excellent decision was in itself sufficient to reduce markedly the sick-rate and death-rate from tubercular and other respiratory diseases; and, in view of latter-day knowledge, was a remarkable piece of foresight. One need scarcely recall Pflüger's experiments on droplet infection, and how he showed the range of such infection from mouth to mouth to be somewhere within $1\frac{1}{2}$ metres—in other words, that that range should represent the minimum proximity of men's heads in barracks or beds. The importance of that knowledge had not, perhaps, been fully realised, or, at any rate, had been submerged by reason of national necessity. Two instances have, however, recently shown that the principle involved—now known as "spacing-out"—cannot be disregarded. These were (1) the cerebro-spinal meningitis outbreak, starting in

1915, and (2) the influenza outbreak of 1918. In both these instances a populace, largely non-immune, was unavoidably—by military and national necessities—concentrated, with a resultant reduction in the spacing-out, and an opportunity arose for “mouth-to-mouth” or “droplet” infection. It is scarcely necessary to say that the pressure of hygienic advice was sufficient to represent the needs of the problem in each case. In the cerebro-spinal meningitis outbreak immediate spacing-out of the affected troops produced a rapid fall in the case and “carrier” incidence; in the same way, strong representations as to the need for drastic reductions in the number of troops carried in confined areas, such as ships, or of the methods of slinging hammocks in respect of the head positions, were latterly effective in reducing the unfortunately high incidence of influenza on its last appearance as a pandemic.

It may be of interest to note that the experience of the war had led to a reconsideration, and still further enlargement, of the cubic space allowed the troops, particularly overseas; and also of the correlated questions of pharyngeal and pulmonary disinfection. The importance of the former point—pharyngeal disinfection—was early recognised, and all transports were provided with means for dealing with the *personnel* aboard in special inhalation chambers. It is intended that these shall be a permanent feature of transports in the future, and it is of interest in this connection to note the recent encouraging reports from industrial works of the value of certain gases, inhaled in insensible but definite amounts, in inhibiting the incidence of influenza and allied respiratory disorders.

So much, then, for questions affecting all the troops. Now we come to the more special problems affecting particular groups of soldiery, and perhaps the most important is the *control of outbreaks of infectious disease*.

Epidemic disease, with the exception of the influenza pandemic, was noticeably absent, and the care taken to filter off “unfits” on the lines of communication went far to explain the remarkable freedom from disease of the men in the line. In respect of the excremental diseases, with their evil record of morbidity in past wars, and particularly of Enterica, the problem was approached in two ways: First, by the general inoculation of the troops so as to provide a relatively high immunity, and, secondly, by the careful disposal of all infected matter—in other words, by good conservancy methods. Inoculation during the early part of the war was carried out with typhoid vaccine, and a very large proportion of the troops was protected in this way. Later, in 1915, a triple vaccine was used—“T.A.B.”—while troops proceeding East were provided also with cholera vaccine.

The sanitary sections were chiefly responsible for the constructional, advisory, and inspectorial duties involved in providing fly-proof field latrines of the deep-pit type, food larders, and safes for units otherwise unprovided, for the continued and varying problems connected with the reduction of the fly population, and for the supervision of large water schemes. The fly question, especially in Eastern theatres, is a vast and difficult one in view of the quantity of horse-litter inevitably associated with the Army, and frequently of the tactical or climatic impossibility of burning such fertile breeding matter. The Army was fortunate in being able to utilise expert advice on the problems raised from prominent entomologists, and in having officers and men who set themselves enthusiastically to carry out the methods adopted or tested.

But while the more serious diseases were largely defeated, it was found that there was a very con-

siderable wastage in all theatres of war from insect-borne diseases of different types. In France a very great deal of the minor sickness of the troops was traceable to louse infestation, either as the cause of various septic skin conditions or from trench fever, which was early recognised as a new clinical entity, and has now been clearly proved to be a louse-borne disease. This question of the infestation of troops with lice is one of the most difficult problems of the sanitary officer, particularly in the case of troops crowded together or living under unnatural trench conditions. To this question the energies of a very considerable *personnel* were directed, and to it all the support of the military authorities was lent. The sufferings of our Allies the Serbs, and since then of a majority of the population of Eastern Europe, from another louse-borne infection, typhus fever, also emphasised the necessity for a vigorous campaign of disinfection. The problem was met largely by the simultaneous provision of facilities for bathing at intervals not exceeding a week or ten days, and by the increase in facilities for disinfecting personal clothing and blankets at one and the same time.

At this point it appears suitable to mention the development in methods of disinfection by steam. In the early days the troops in the field were dependent on the few box-disinfectors available, while the rearward units were supplied with Thresh disinfectors. With the provision of divisional sanitary sections, portable Thresh machines were also supplied to each division. It was soon apparent, however, that for the regular treatment of clothing required by the anti-louse campaign this was not sufficient. The ultimate development which resulted was the Foden-Thresh apparatus, comprising two large Thresh disinfecting chambers mounted on, and operated under slight pressure by, a Foden steam lorry. In this way the apparatus could be rapidly moved to any area in which it was required, at once commence operations by turning the steam into the chambers, and then be driven to a fresh centre for operations.

The disinfection centres were of immense value, but were often inadequate to eradicate the louse plague entirely owing to the escape of certain individuals or articles. To meet the needs of men in such circumstances, general issues were made of certain repellent substances of proved value, but more reliance was placed on the regular treatment of clothing and blankets; and the experience gained in this connection will be of lasting value, for there has developed, as one profoundly valuable result, the use of hot air as a practical method of disinfection—a method even simpler, cheaper, and more rapid than steam, and one destined, it is hoped and anticipated, to hold a permanent place in the larger schemes of control of insect infections of the future. It is of interest to note that flour-millers in Canada are now utilising this method for the destruction of moths in preference to the older and more dangerous “H.C.N.” method. The latest “Orr hot-air huts” are models of efficient disinfectors. The subject, however, remains one for further study and co-operative methods of control. The problem to be met during the demobilisation of 20,000 men daily from France (and of smaller numbers from elsewhere), was no easy one, but of the utmost importance in order to avoid the dissemination of infective disease among the civil community. Careful personal inspection was, of course, required in every case, combined with bathing, disinfection, and the issue of fresh clothing, and this colossal undertaking was carried out to complete satisfaction at a series of stations—at base ports in France each capable of dealing with no fewer than

3000 men per day prior to their embarkation. The absence in the community at home of any noticeable incidence of trench, relapsing, or typhus fevers goes to show the justification of the claim to success of the sanitary officers and *personnel* concerned in these works.

There were other insect-borne infections to be guarded against in different parts of the world where the military situation required our troops to serve. In some of these cases hygienic control was necessarily subservient to military urgency, and outbreaks of sickness occurred, the more readily so, perhaps, in the light of the unprepared soil which our young troops offered on first entry into tropical and sub-tropical zones. There is not time to detail the various minor hygienic campaigns, but the vast amount of anti-malaria work carried on in the various overseas war zones justifies notice. Being carried out, often with most complete success, from the point of view of mosquito elimination, there were at the same time areas where enemy action almost entirely forbade active measures of drainage, canalisation, or oiling. Even in these circumstances, however, it was not uncommon for certain of our officers, accompanied by a guard of two or three men, to push out into No Man's Land to oil certain stagnant waters known to be mosquito-breeding places. As to the extent of work carried out in draining, ditching, filling-in, etc., exact figures are scarcely procurable, but in the aggregate the efforts made must rank among the major schemes of the world, and be of incalculable value both by the improvement made and as an example to the inhabitants of the various areas concerned—Egypt and Palestine, Macedonia, Lower Mesopotamia, etc. In addition, however, to these offensive measures, defensive action against malaria was generally and thoroughly carried out by means of the provision of quinine, of netting of different forms, of special clothing, gloves, head-nets, etc., and of repellent substances, as also by the treatment of infected natives and various schemes for the isolation and removal of infected men who would otherwise act as foci for fresh cases.

From another aspect altogether the sanitary sections rendered valuable service; I refer to the economies effected. These economies were both direct and indirect. In the latter category may be placed the saving effected by the adoption of destruction of excremental matter by unit incineration which otherwise had to be disposed of with considerable expense by contract removal. Even of greater interest, however, was the direct saving resulting from the adoption of improved sanitary technique. In this category may be mentioned, first of all, the saving of fat. One of the most difficult waste-matters to get rid of in a cleanly way is greasy water—wash-up water, kitchen swill, etc. In seeking for better methods of disposal of this sillage the special cold-water grease-trap was devised, and soon pointed the way to an obvious economy. By the careful collection of all such wash-up fat, and of the scrap-fat and bone-fat rendered in cookhouses, a bulk of crude fat was obtainable which proved of immense use in aiding the national resources. A campaign of fat-saving was first initiated by the sanitary sections, and later developed and organised by the Quartermaster-General's Department. It was so successful that many of the war zones were able to make all their own soap locally, and, furthermore, to send home many tons of fat for making glycerine, then so necessary for the manufacture of munitions. As an instance, the saving of an average battalion was some 60 lb. of fat per day at a time when fat fetched at least 40*l.* per ton.

Another very useful economy was the collection of the solder from the sealing of the myriad tins used as food-containers. Nothing could be more striking than the picture presented by an up-to-date unit destructor consuming in cleanly fashion all the waste matter from a large camp, and at the same time melting out from improvised receptacles streams of solder, which dripped into cold-water receivers, while the heat of the furnace was utilised to heat large tanks of water, of value both for ablution and for the various washing-up processes so constantly required.

During the war many scientific investigations were carried out, both at home and in the actual theatres of war, for the elucidation of disease and the determining of the best modes of prevention. In some cases this necessitated the investigation of certain diseases which were either unknown in former campaigns or had been little studied in the past. Very valuable aid was given by the labours of the Trench-fever Committees at home and in France, and also by the War Nephritis Committee and Medical Research Committee in France. It having been clearly established that trench fever is conveyed by the louse, and diagnosis having been made possible, a great impetus was given to general measures of personal hygiene in the field, and also to improvement in methods of bathing and disinfection. Trench fever was made notifiable in consequence, and a very great improvement resulted from the increased attention to precautionary measures. At the termination of the war the diseases had greatly declined, and no infection was conveyed to England on demobilisation.

By the labours, in short, of the united profession, all doing that work which was required of them and which local authority considered most immediately necessary, the troops were served as few armies have ever before been served.

In France, for instance, in 1918, out of a mean strength of 1,250,000 men of all races, the typhoid admission rate amounted to only 0.2 per thousand per annum, whereas in the case of the war in South Africa the admission rate reached the high figure of 130 per thousand.

In the case of dysentery the total number of deaths from this disease in France during the whole war was fewer than 200. These figures in themselves are a sufficient and lasting tribute to that branch of the Army to which so many of our profession have belonged, and from which we hope they have taken something in exchange for the much they brought to it.

An inevitable result of the war has been the recognition by everyone engaged of the value of "preventive medicine." This has led, on one hand, to the definite recognition of the Sanitary Service in the Army as an organised department, and has aroused, on the other, an increased interest among thoughtful members of the civil community into their own state—an interest which provoked the demand for an organised national effort, and ultimately led to the formation of the Ministry of Health.

In summing up my views, I would say that, in my opinion, the future prosperity and success of our nation depend to an incalculable extent on the improvement of the physical and mental standard of all members of the community; it must not merely be—as I am afraid it has been to a considerable extent in the past—a case of the "survival of the fittest," but rather a perfection of every method by which mortality may be decreased, by which the production of "unfits" may be diminished, and by which the

standard of fitness as regards man, woman, and child may be raised.

To attain this result we must all work together. In the words of Pope :

By mutual confidence and mutual aid
Great deeds are done and great discoveries made.

University and Educational Intelligence.

CAMBRIDGE.—Dr. Adrian has been appointed University lecturer in physiology, and Mr. F. A. Potts, of Trinity Hall, has been appointed University lecturer in zoology.

The Harkness scholarship has been awarded to E. W. Ravenshear, of Clare, and the Frank Smart prizes in botany and zoology to R. E. Holthum, of St. John's, and G. T. Henderson, of Gonville and Caius, respectively.

A second *ad interim* grant of 30,000*l.* has been made by the Government to the University pending the result of the inquiries of the Royal Commission.

An important report has been made by the Local Examinations and Lectures Syndicate, urging an extension of the provision of both money and men for extra-mural teaching.

The Board of Agricultural Studies has received a donation of 1000*l.*, collected by Sir Arthur Shipley, for the provision of lectures on tropical agriculture for five years. Dr. C. A. Barber, of Christ's, late of the Imperial Department of Agriculture, West Indies, and of the Indian Agricultural Service, has been appointed lecturer in tropical agriculture for five years.

Miss B. A. Clough has been appointed principal of Newnham College in succession to Miss K. Stephen.

EDINBURGH.—The University Court has appointed Mr. E. P. Stebbing, lecturer in forestry, to the recently instituted chair of forestry. The Court has also appointed Mr. John Petrie Dunn, a former Bucher scholar of the University, who at the outbreak of the war was Vice-Principal of the Kiel Conservatoire, as a part-time lecturer in the department of music.

The late Dr. I. G. Bartholomew has bequeathed to the University the sum of 500*l.*, to be applied towards the foundation of a chair in geography.

LEEDS.—Dr. W. E. S. Turner has been appointed professor of glass technology, Mr. J. Husband professor of civil engineering, and Dr. Mellanby professor of pharmacology. Mr. R. E. Pleasance has been appointed demonstrator in pathology.

LIVERPOOL.—Dr. W. I. Dakin, professor of biology in the University of Western Australia, has been appointed to the Derby chair of zoology in succession to the late Prof. Leonard Doncaster. Dr. I. M. Heilbron, professor of organic chemistry at the Royal Technical College, Glasgow, has been appointed to the chair of organic chemistry.

OXFORD.—Dr. Benjamin Moore, of the Research Staff, Department of Applied Physiology, Medical Research Committee, has been appointed to the new chair of biochemistry. The Halley lecture is to be delivered by Prof. R. A. Sampson.

PROF. J. STRONG, of the University of Leeds, has been elected president of the Association of University Teachers for the ensuing year.

DR. W. N. HAWORTH has been appointed to the chair of organic chemistry at Armstrong College, Newcastle-upon-Tyne, in succession to Prof. S. Smiles.

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DR. V. J. HARDING, associate-professor of biological and physiological chemistry at McGill University, has been appointed professor of pathological chemistry in the University of Toronto.

MR. J. W. SCOTT, lecturer in moral philosophy in the University of Glasgow, has been appointed professor of logic and philosophy in the University College of South Wales and Monmouthshire.

A SUMMER school of librarianship is to be held at Bristol from August 30 to September 11, under the auspices of the University of London School of Librarianship. Some twenty-five papers have been promised for delivery.

THE Report of the Librarian of Congress for the year ending June 30, 1919, shows that the work of the principal library in the United States was carried on with success during the war in spite of great difficulties. Members of the staff died in the war and others have not returned, or have resigned on finding more lucrative work elsewhere. The work has also been hindered by a general rise in prices. The number of printed books now in the library is about 2,700,000. The Library of Congress prints a card catalogue of its books, which is justly valued for its accuracy. By June 30, 1918, the number of different titles in this card-index was 789,000. The average stock of each card was 75 copies, making the total number of cards in stock 60,000,000. The number of subscribers to these cards is 2693, and the sale of cards for the year produced 73,000 dollars. A large number of Chinese books has recently been purchased. The Chinese section is a unique feature of the library, and now contains no fewer than 887 Chinese official geographical gazetteers. These gazetteers are of great value in the study of the industry, art, agriculture, and geography of China. The report invites executors or others who may possess manuscript papers relating to persons of national importance in politics, science, literature, or art to submit these papers for examination. The librarian undertakes to return papers of a strictly personal or family character, and to preserve any valuable material that might otherwise be lost or destroyed.

Societies and Academies.

LONDON.

Royal Society, June 10.—Sir J. J. Thomson, president, in the chair.—A. V. Hill and W. Hartree: The thermo-elastic properties of muscle. The employment of a thermopile in a carefully closed-in chamber, immersed in well-stirred water inside a double-walled vacuum flask, together with photographic registering of the galvanometer response, has made it possible to record the thermal consequences of stretching a muscle (or a piece of indiarubber) or of releasing a muscle already stretched. When a muscle, alive or dead, is *stretched*, heat is liberated in relatively large amount at first, but at a rapidly diminishing rate. When a stretched muscle is *released*, there is at first a rapid absorption of heat, followed by a more prolonged evolution of heat. In a complete cycle of lengthening and shortening the net result is a production of heat, which is greater the longer the interval between the two processes. These thermo-elastic effects are large enough to afford a notable complication in the measurement of the heat-production of a live muscle excited to contract. Their explanation is as follows:—(a) The muscle, like a fiddle-string, shortens on being warmed; conversely, according to the second law, it will warm on being