BOOK II.

THE SERVICE OF THE SOLDIER.

In the First Book, the general principles of Hygiene were illustrated, as far as possible, by examples drawn from the life of the soldier; but this does not exhaust the subject. It is necessary to consider a little more particularly the nature of the service of the soldier, and the influence it has on him. At the same time, it will be unnecessary to return to various points already sufficiently discussed in previous chapters.

The life of the soldier is conveniently divided into five epochs: the period of entrance on his new life, and his first year's service—his service at home—abroad—on board ship—and during war. These five chapters include all that is important.

CHAPTER I.

THE RECRUIT.

In the English army, young men are enlisted at or after seventeen or eighteen years of age,* unless they are intended for drummers. They must be of a certain height, which is fixed by regulation from time to time, according to the particular arm, and to the demands of the service. There must also be a special girth of the chest.

In time of war, the measurements are reduced according to the demand for men; and even in time of peace, the necessary height of the infantry recruit, usually 65 or 66 inches, has been sometimes only 5 feet 4 inches. Before the enlistment is completed, the recruit is examined by a medical officer, and then by the staff-surgeon of the recruiting district, according to a scheme laid down in the Medical Regulations† (p. 99). The scheme is a very good one,

* In reality, they sometimes enlist under this age.

† For a full account of the system of recruiting, the mode of examination, and much useful information on disabilities, see a paper by Dr Crawford in the "Army Medical Report for 1862."—*Blue-Book*, 1864.

and aims at investigating, as far as can be done, the mental condition; the senses; the general formation of the body, and especially of the chest; the condition of the joints; the state of the feet; the absence of hernia, varicocele, piles, &c.; and the condition or physical examination of the heart, lungs, and abdominal organs generally.* A certain girth of chest according to the height is required.

A Horse-Guards' order (No. 806, 14th January 1862) fixes the height and girth as under:—

TABLE *formed to show the limits of Age, Standard Height, and Girth of Chest, of Recruits, required by General Order, No.* 806, *dated Horse Guards,* 14*th January* 1862.

Corps.	Limits of Age. Years. Min.	Max.	Limits of Height. Inches. Min.	Max.	Minimum of Girth of Chest according to Variations in Height in different Corps. For Height of	Girth of Chest must be
CAVALRY—						
Heavy	18	25	68	71	70 inches and upwards	35 inches.
Medium	18	25	67	69	68 „ and under 70	34 „
Light	18	25	66	68	66 „ and under 68	33 „
MILITARY TRAIN	18	25	63	66	63 „ to 66 inches	34 „
ROYAL ARTILLERY—						
Gunners	18	25	67 & upwards		Same as Cavalry	Same as Cavalry.
Growing Lads	17 under 18		66 & upwards		Not defined	Not defined.
Drivers	18	25	64	66	64 inches to 66 inches	34 inches.
Artificers	Not defined		66 & upwards		Not defined	Not defined.
ROYAL ENGINEERS—						
Sappers	18	25	66 & upwards		Same as Cavalry	Same as Cavalry.
Drivers	18	25	64	66	64 inches to 66 inches	34 inches.
INFANTRY*	17	25	66 & upwards		Same as Cavalry	Same as Cavalry.
China, India, St Helena, and New South Wales	18	25	66 & upwards		Same as Cavalry	Same as Cavalry
Rifle Brigade and 60th Regiment	17	25	66 & upwards		66 inches and upwards	34 inches.
CAPE MOUNTED RIFLES	16	18	60	63	Not defined	Not defined.
Boys and Lads	14	16	In the proportion of one boy to one hundred men. Height and chest measurement not defined.			
Boys and Lads for R. E.	14	15				

The recruit is to be measured round the chest in a line over the nipples, with his arms placed straight above his head, the backs of his hands touching each other, and the edges of the feet close together, and at the same time made to count the numbers from one to ten, in a loud tone of voice and slowly.

* By Horse-Guards' order of 4th March 1864, the standard for infantry recruits was reduced to 65 inches, the measurement round the chest being 33 inches, except for rifle corps, when it is to be 34 inches.

After joining his regiment he is again examined, and may be rejected if any defect is discovered. Rejections may take place then either at the primary or secondary inspection.

Both the average weight and height, especially the latter, will vary with the demand for men.

The trades of the men furnishing the recruits must also vary greatly from year to year.

In 1860 and 1861, out of every 1000 recruits from all parts of the kingdom, labourers, husbandmen, and servants, furnished about one-half; mechanics

* As the Medical Regulations are in the hands of all medical officers, it is unnecessary to go into more detail on this point. My colleague, Professor Longmore, uses in the Army Medical School a set form of examination, which renders it almost impossible that any point should be overlooked.

employed in occupations favourable to physical development, about one-quarter; manufacturing artisans (as cloth-workers, weavers, &c.), about one-sixth; shopmen, a little less than one-tenth; and the small remainder was made up of professional occupations, students, and boys.*

The average weight of the British recruit, as given by Dr Balfour, was among 10,000 recruits:—

Weight.	1860.	1861.	1862.	1863.
Below 100 lb, .	157	209	411	280
From 100 to 110 „ . .	663	365	117	134
„ 110 „ 120 „ . .	2,296	1,651	1,183	1,002
„ 120 „ 130 „ . .	2,817	2,581	2,458	2,610
„ 130 „ 140 „ . .	2,090	2,539	2,831	3,050
„ 140 „ 150 „ . .	1,254	1,679	1,761	1,786
„ 150 „ 160 „ . .	488	652	805	777
„ 160 „ 170 „ . .	180	240	330	286
Above 170 lb, ...	55	84	74	75
	10,000	10,000	10,000	10,000

The height was as follows in the four years:—

Height.	1860.	1861.	1862.	1863.
Under 63 inches, . .	150	201	419	365
63 to 64 „ . . .	580	52	66	157
64 „ 65 „ . . .	2,409	1,823	592	251
65 „ 66 „ . . .	2,075	1,552	816	691
66 „ 67 „ . . .	1,764	1,917	3,105	4,049
67 „ 68 „ . . .	1,243	1,890	2,358	2,232
68 „ 69 „ . . .	811	1,268	1,308	1,162
69 „ 70 „ . . .	480	685	767	641
70 „ 71 „ . . .	293	425	350	259
71 „ 72 „ . . .	138	156	150	136
Over 72	57	91	69	57
	10,000	10,000	10,000	10,000

The number of recruits drawn from each division of the kingdom varies with the state of trade, degree of distress, emigration, &c. In 1860–1862, of every 1000 recruits, 553 were English, 127 Scotch, 314 Irish, and 6 foreign and colonial.

After the recruit has been enlisted and approved, he joins his depot or his regiment; receives his free kit, which he subsequently in part keeps up at his own cost; and is put on the soldier's rations. He enters at once on his drill, which occupies from $3\frac{1}{2}$ to $4\frac{1}{2}$ hours daily. Wherever gymnasia are established, he goes through a two-months' course of gymnastic training for one hour every day. He then goes to rifle drill, which lasts about six weeks, and then

* For further detailed information, see Dr Balfour's reports in the "Army Medical Reports." —*Blue-Books.*

joins the ranks. After the rifle drill, he has another month's gymnastic training, and is then supposed to be a finished soldier.

The total number of rejections, either at once or after re-examination by a second Medical officer, on various grounds, of men brought by the recruiting serjeant to the medical officer, varies somewhat from year to year. The ratio in 1860–61 was 293 per 1000, in 1862, 401, and in 1863, 441 per 1000 in each year. Of these rejections, some are primary (*i.e.*, at once by the examining officer), and some secondary (*i.e.*, by the staff-surgeon of the district or at the head-quarters of the regiment).

About $\frac{2}{3}$ths of the rejections arise from causes connected with general bad health or feeble constitution, and $\frac{1}{3}$th from causes affecting the marching powers of the men (Balfour).

In the French army, the height was fixed in 1860 at 69 inches (1·76 metres) for the carabiniers, and $61\frac{1}{2}$ inches (1·56 metres) for the infantry of the line.

The rejections in the French conscription includes men rejected for insufficient height, as well as reasons of health. Excluding the former, the exemptions from infirmities amount (1850–58 inclusive) to 267·6 per 1000.*

Such being the system, it will be desirable to consider certain points.

1. *The Age of the Recruit.*—Strong opinions have been expressed by Ballingall (English army), Lévy (French army), Hammond (American army), and other army surgeons, that the age of 17 or 18 is too low—that the youngest recruit should be 20 or 21 years of age.

This opinion is based both on actual experience of the effect produced on boys of 17 to 20 when exposed to the hardships of war, or even to heavy duty in time of peace, and on a physiological consideration of the extreme immaturity of the body at 18 years of age.

With regard to the first point, there is no doubt that to send young lads of 18 to 20 into the field, is not only a lamentable waste of material, but is positive cruelty. At that age such soldiers, as Napoleon said, merely strew the roadside and fill the hospital. The most effective armies have been those in which the youngest soldiers have been 22 years of age.

With regard to the second, it is also certain that at 18 the muscles and bones are very immature, and, in fact, it is not till 25 years of age, or even later, that all the epiphyses of the bones have united, and that the muscles have attained their full growth.†

The epiphyses of the transverse and spinous processes of the vertebræ hardly commence to ossify before 16 years of age, and it is not till after 20 years that the two thin circular plates form on the body of the vertebræ. The whole process is not completed till close on the 30th year. The consolidation of the sacrum only commences at the 18th year, and is completed from the 25th to the 30th. The fourth and third bones of the sternum are only united between the 20th and 25th years, and the second is not united to the third bone before the 35th year. The epiphyses of the ribs commence to grow between the 16th and the 20th years, and are completed by the 25th year. The epiphyses of the scapula join between the ages of 22 and 25. The epiphysis of the clavicle begins to form between the 18th and 20th years. The internal condyle of the humerus unites at 18, but the upper epiphysis does not join till the 20th year. The epiphyses of the radius and ulna, the femur, the tibia, and fibula, are all unjoined at 18 years, and are not completely joined till 25 years. The epiphyses of the pelvic bones (viz., crest of

* Sistach, "Recueil de Mém. Mil." 1861, Nov., p. 353.
† See Aitken's "Growth of the Recruit and Young Soldier," 1862.

ilium, spine, and tuberosity of the ischium) begin to form at puberty, and are completed by the 25th year.*

That the muscles are equally immature is just as certain; they grow in size and strength in proportion to the bones.

These facts show how wrong it is to expect any great and long-continued exercise of force from men so young as 18 and 20, and what will be the inevitable consequences of taxing them beyond their strength.

Are we, then, to conclude that the soldier should not be enlisted before 20?

It appears to me that the case stands thus. If the State will recognise the immaturity of the recruit of 18 years of age, and will proportion his training and his work to his growth, and will abstain from considering him fit for the heavy duties of peace and for the emergencies of war till he is at least 20 years of age, then it would seem that there is not only no loss, but a great gain, by enlisting men early. At that most critical period of life the recruits can be brought under judicious training, can have precisely the amount of exercise and the kind of diet best fitted for them, and thus in two years be more fully developed, and be made more efficient, than if they had been left in civil life.

2. *The Height and Weight of the Recruit.*—The desire of almost all military officers is to get tall men. The most favoured regiments, especially the cavalry, get the tallest men. It has been recommended both that shorter men should be generally taken, and that the infantry should have the tallest men. The last point is one for military men to determine, and must be decided by considerations of the respective modes of action of cavalry and infantry.

The first point is entirely physiological, and opens a difficult question. What is the height, at 18 years of age, which is attended with the greatest amount of health, strength, and endurance, or is it possible to fix such a standard?

Tables of average height and weight have been compiled by Quetelet and much used, and lately somewhat similar tables have been framed by Danson, Boyd, and Liharzik.† With regard to all of these it may be said that the observations (however numerous) are yet too few for such a large question, and that the influence of race has been too little regarded.‡

Boyd gives the height at 18 years at 60·4 inches, and at 25 years at 67 inches, and Liharzik at the same ages give 64·17 and 68·9 inches. The English army returns (1860–63) give the following numbers, but it must be understood that we cannot deduce the mean height of the population from these figures, as the shorter men are not taken as recruits (see table, page 502).

Although these numbers are not very accordant, we may perhaps assume that at 18 the average height will be something near 64 or 65 inches, and the average weight about 124 lb.

But the difficulty of the case only commences here; taking the age at 18 (for over 20 the case is simple), what is the range above and below the average which is consistent with perfect health and growth? How far is it safe to apply an average to an individual? Will not an excess of weight and height imply that an individual comes of a larger race, or has been better fed and nourished, and is so far a stronger man than he who only just reaches the average?

The range, in fact, appears to be very great, as much as six inches above and below the mean (Danson); *i.e.*, a boy at 18 may be 58 or 71 inches tall.

* See Aitken's "Growth of the Recruit," p. 37, and Quain's "Anatomy," for still fuller details.

† Liharzik's number professes to be based on a law induced from great numbers of measurements in different animals.

‡ Boudin, in a late paper on the size of the French conscript, is inclined to attribute differences in height more to race than to any other condition.

But are these extremes consistent with perfect health, such as we demand in a recruit? It seems very doubtful if they are.

The following are the Averages given by Quetelet (Belgians) and by Danson (English criminals), at the Ages when Recruits are enlisted:—

Age.	Height.		Weight.	
	Quetelet.	Danson.	Quetelet.	Danson.
	Inches.	Inches.	lb avoir.	lb avoir.
16	57	...	109	...
17	64·3	...	116	...
18	65·2	64·34	126	122¾
19	...	64·94	...	130¾
20	65·9	65·11	132	131½
25	66·1	66·3	138	145⅔

It may be well to put the same question in rather a different way. In the English army the minimum height has been always (except in times of great emergency) above the mean height of the population at that age. Has the State, then, secured a larger framed and more powerful set of men by only taking those who are above the mean height, or has it unnecessarily limited its choice?

The experience of other armies cannot answer this question. The French height for infantry is 61½ English inches, or 2½ below the mean. The Austrian height for infantry is 60 inches; in the Prussian army* the least height (in English inches) of the recruits for the cuirassiers is 65·9 inches, and the greatest 69 inches; for the light cavalry (hussars and dragoons), the least height is 63·8, the greatest 68 inches. In the Jäger battalions the height is not less than 63·8 inches (English), and not more than 69 inches. Men of 60 inches are, however, exceptionably taken, if strongly built. In the infantry (not Jäger) the least height is 63·8 inches, but men of 60 inches are also occasionally taken. In the Northern American army the height of the infantry was, in 1863, fixed at 63 inches (Hammond), but men are really taken as low as 60 inches.†

It is therefore clear that the great military nations go 2 inches or even more below the mean height of the population at the recruiting age, and find no injury to the quality of their soldiers, and it would certainly appear unnecessary that the English should fix their standard at 1 inch above the mean height for infantry, and 2 or 4 inches for cavalry. But this does not settle the question, as it may still be argued that the taller men are most desirable when they can be procured, although shorter men may answer very well when others cannot be obtained. I really know of no good evidence which can settle this question.

The best rule to guide us is that given by Dr Aitken, viz., to take into consideration the three points of age, height, and weight, and if either in weight or height, or both together, there is any great divergence from the mean, then something wrong will probably be found. But as long as weight and height are in accord, the taller and heavier the man the better, as a rule.

* Prager, Das Preusissche Militaire-Méd. Wesen, 1864, p. 312.

† The minimum height of the Roman soldier was 62¼ inches.

The height and weight of the recruits from 18 to 19 years of age are given in the following tables :—

Heights of Recruits (inspected) between 18 *and* 19 *years of age.*

Height.	1860.	1861.	1862.	1863.
Under 63 inches . . .	44	...	...	34
63 to 64 „ . . .	443	23	23	40
64 „ 65 „ . . .	2553	932	212	93
65 „ 66 „ . . .	1786	678	203	242
66 „ 67 „ . . .	1053	574	821	1784
67 „ 68 „ . . .	629	497	460	651
68 „ 69 „ . . .	268	254	161	244
69 „ 70 „ . . .	116	123	70	115
70 „ 71 „ . . .	52	58	38	25
71 „ 72 „ . . .	20	16	9	13
72 and over, . . .	2	5	3	5

Weights of Recruits between 18 *and* 19 *years of age.*

Weight.	1860.	1861.	1862.	1863.
Under 100 lb . . .	68	11	4	7
100 to 110 „ . . .	923	227	24	46
110 „ 120 „ . . .	2978	961	414	525
120 „ 130 „ . . .	1768	1021	604	1191
130 „ 140 „ . . .	784	616	536	987
140 „ 150 „ . . .	344	255	229	353
150 „ 160 „ . . .	83	55	67	102
160 „ 170 „ . . .	18	13	17	26
170 and over, . . .	...	1	5	9

One point is, however, quite clear. When the height is much below the mean, the bodily development generally is bad. Hammond states that, in the American war, men of less than 5 feet have broken down by a few weeks' campaigning, while men of 5 feet have stood the work well. Probably 62 inches at 18 years of age, and 112 lb to 116 lb weight, should be a minimum, even in times of the greatest pressure. So also a very great height at 18 years of age is objectionable, and anything over 67 inches at that age should be looked on with great suspicion. As a rule, also, adult men of middle size (67 to 69 inches) appear to bear hard work better than taller men. There is one alteration in the regulations which would be desirable, viz., that the required height and weight at the respective ages should be expressly named; at present the minimum height for the whole range of years from 18 to 25 is alone stated in the Horse-Guards' Circular.

With regard to weight alone, the rule is simple. Unless there be any great disproportion in height, the heavier the recruit is the better; this will be found a rule with very few exceptions.

3. *The Physical Training of the Recruit.*—A great improvement has been introduced by the late order that each recruit shall have three months' gymnastic training. If properly done, this will have a most beneficial effect.

The medical officer will have power to continue this if necessary, and care should be taken to use this power (see chapter on Gymnastic Training for the points to be attended to by the medical officer).

It would be very desirable to make a rule that no soldier under 19 years of age should carry his pack, except on parades for inspection of kit; he should be excused the pack in marching out, field-days, and drills. Indeed, it may be questioned whether this rule should not be extended till 20 years of age. The young soldier under 19 or 20 years of age should also be excused from guard; heavy guard duty, even an amount which gives three nights in bed out of four, is too much for an immature frame. In fact, the soldier, till he is 20 years of age, should be spared all heavy duty. The time thus saved would be well spent in other matters presently to be noted.

4. *The Mental Training.*—Since the introduction of rifle practice, the trade of the soldier has become much more interesting to him; he is now taught scientifically how to manage his arm, and learns to take interest in his shooting. It would be most desirable to give him some knowledge of the Military Art, and of the object of the different manœuvres he goes through. A military literature fitted for the private soldier is still wanting. It is also very important to train him for the field, and to teach him to perform for himself all the offices which in time of war he will have to do—not merely trench work, but hutting, cooking, washing and mending his clothes, as in time of war (see War). It is too late, at the commencement of a campaign, to begin these necessary parts of a soldier's education; they should form part of his training as a recruit; and if he is excused guard and other duties during his first year, there would be ample time.

Great attention is now being directed to the importance of soldiers keeping up their trades, or learning some trade if they have none. Such a system occupies men, makes them contented, keeps them from dissipation, and opens a career for them when they leave the army. Instead of interfering with their military training, it can be made to subserve it, and possibly might be found to be advantageous to the State, even in a pecuniary point of view. The recruit then would have to keep up or learn his trade.

5. *The Moral Training.*—The recruit, on entering the army, is brought under moral influences of a strong kind. A discipline always rigorous, and sometimes severe, produces often a ready obedience and a submission of character, and, when not carried too far, greatly improves him. At the same time, independence is preserved by the knowledge which the soldier has of his rights and privileges, and the result is a manly, conscientious, and fine character. But occasionally, a too sensitive nature on the part of the recruit, or a discipline too harsh or capricious on the part of his officers, produces very different results, and the soldier becomes cunning, artful, and false, or morose and malicious. The two characters are often seen well marked in old soldiers, and no contrast can be greater than between the two. A heavy responsibility rests, then, with the officers of the army who have power thus to influence for good or evil natures like their own.

The influence of companionship is also brought to bear on the recruit, and is fraught with both good and evil. The latter probably predominates, though there are many excellent, high-minded, and religious men in the army. Indeed, in some regiments the proportion of steady religious men is perhaps beyond the number in the analogous class in civil life. But if the influences be for bad, the recruit soon learns some questionable habits and some vices.

Thus he almost invariably learns to smoke, if he has not acquired this habit before. It is indeed remarkable what a habit smoking tobacco is in every army of Europe; it seems to have become a necessity with the men, and

arises probably from the amount of spare time the soldier has, and which he does not know what to do with. A recruit, on joining, finds all his comrades smoking, and is driven into the habit.

The discussion on the effects of tobacco does not seem to have led to any clear conclusions. The immoderate use brings many evils to digestion and circulation especially. But no great evil appears to result from the *moderate* use, though no good can be traced to it. In moderation it has not been proved to lessen appetite, to encourage drinking, or to destroy procreative power. But, on the other hand, it probably lessens bodily, and perhaps even mental, activity, in spite of the illustrious examples to the contrary. It is certainly remarkable how uniformly the best trainers prohibit its use, and men of the highest physical vigour are seldom, I believe, great, and often are not even moderate, smokers. As it is of no use, and indeed injurious, by bringing men under the thraldom of a habit, it seems very desirable to discourage it.

But in the army it seems useless to fight against this custom, nor is it indeed one which is sufficiently injurious to be seriously combated, except for one reason. In time of war, the soldier often cannot obtain tobacco, and he then suffers seriously from the deprivation. The soldier should have no habits which he may be compelled to lay aside, and which it would pain him to omit. As the time of the soldier becomes more and more occupied with his vocation and with a trade, it is possible that the amount of smoking may lessen.

A much more serious matter is the vice of drinking, which many recruits are almost forced into, in spite of themselves. The discipline of the army represses much open drunkenness, though there is enough of this, but it cannot prevent, it even aids, covert drinking up to the very edge of the law. Formerly, a most lamentable canteen custom made almost every man a drunkard, and a young boy just enlisted soon learned to take his morning dram, a habit which, in civil life, would mark only the matured drunkard. Now, happily, spirits are not sold in the canteens, and no regulation thrusts raw spirits down a man's throat.

Drinking, is, however, still the worst vice of the army, and that which strikes most of all at the efficiency of the soldier.

How is this great vice to be combated? The Duke of Wellington, in 1845, abolished teetotal societies in regiments, in accordance with the general principle of allowing in the army no form of combination. The great influence of a common cause and enthusiasm cannot therefore be used. We must look to the same causes to remove drunkenness in the army as in civil life; an improved tone in this respect among officers; the influence of officers, and especially medical officers, with their men; more occupation for the men, and the establishment of reading-rooms and soldiers' institutes, which, in several places, have done marvels in lessening drinking.

Another vice is almost as certainly contracted as smoking by the recruit. Probably, before enlistment, he has led no very pure life, but when he enters the army, he is almost sure to find his moral tone higher than that of some of his new associates. A regiment, in fact, is composed of young men with few scruples and small restraints. Prevented from marriage, and not able, indeed, to look forward to it, as civilians do; tempted by low prostitutes, who, to the disgrace of our laws, are permitted to hang about every barrack, and to haunt every neighbouring public-house, it is no wonder if, to the extent of his means, the soldier indulges in promiscuous sexual intercourse. He does this, in fact, to excess, and the young recruit is led at once into similar habits. That many recruits are most seriously injured by this habit, even if they

neither contract syphilis nor gonorrhœa, is, I believe, certain. The remedies for this have been already discussed (p. 468).

It has also been supposed that solitary vice is particularly rife in armies. I am unaware of any evidence on this point, and believe that, in the English army, such habits are uncommon.

6. *The Amount of Sickness and Mortality suffered by the Recruit during the First Six Months and Year of Service.*—This is an extremely important matter, but at present we are not able to answer the question for the English army. (See page 398 for a few facts.)

In the French army,* the amount of sickness among soldiers under one year of service is more than one-third greater than among the army generally; this is partly caused by slight injuries, though not solely, for the admissions to hospital† are nearly one-fourth more among them than in the army at large. In 1862, the mortality from disease under one year's service was 11·45. In 1863, it was 13·26 per 1000 of strength of that service, which is much greater than the mortality at all ages (which was 8·31 and 9·16 in 1862 and 1863.)

A School for Recruits.—Looking to the very great importance of properly training the recruit in all ways, and recognising the fact that an army badly recruited was never yet made a good one, it may be questioned whether the present system of enlisting a man for a particular regiment, and sending him at once to his regiment or depôt, is the best that can be adopted. It would seem much wiser to conduct his physical training altogether apart from the older men, to give him a different and more nutritious diet than the full-grown man requires, and to secure him, as far as can be, from the bad influences of injurious companionship.

In a school for recruits, not only could physical, mental, and moral training be much better conducted than under the present system, but men might be selected for the different arms of the service; weakly men might be got rid of, or employed in the corps requiring least vigour of body.

Six months' training at such a school would be the best possible initiation, nor would the State lose any period of service in reality. If the recruit entered the ranks at six months instead of three, the trifling loss would be far more than compensated by the greater vigour and the lessened sickness.

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* Statistique Médicale de l'Armée pendant l'Année 1862. Paris, 1864, p. 11. Ibid. pendant l'Année, 1863. Paris, 1865, p. 51.

† The French treat some cases in barracks, some in the regimental infirmaries, some (the severe cases) in general hospitals.

CHAPTER II.

HOME SERVICE.

The recruit having entered the ranks, begins his service, we will assume, at home. This does not necessarily follow, for he may be soon sent out to his regiment serving abroad. Usually, however, he is kept at his depôt as long as possible. It would be desirable, however, to make a rule that the first two years of service should always be at home. In previous chapters, the food, clothing, housing, &c., of the soldier have been discussed, so that I have now merely to describe the effects of the life upon him.

We should suppose the life would be a healthy one. It is a muscular, and, to a certain extent, an open-air life, yet without great exposure or excessive labour; the food is good (though there might be some improvement), the lodging is now becoming excellent, and the principles of sanitation of dwellings are carefully practised. Although the mode of clothing might be improved, there is not much that can affect health. There is a freedom from the pecuniary anxiety which often presses so hardly on the civil artisan, and in illness the soldier receives more immediate and greater care than is usual in the class from which he comes.

There are some counterbalancing considerations. In a barrack, there is greater compression of the population than in the most crowded city, and beyond a doubt the soldier has greatly suffered, and even now suffers, from the foul air of barrack rooms. But this is a danger greatly lessening, owing to the exertions of the Barrack Improvement Commissioners, and, as is proved by the experience of some convict jails, can be altogether avoided.

Among the duties of the soldier is some amount of night-work; it is certain that this is a serious strain, and the Sanitary Commissioners, therefore, inserted in the Medical Regulations an order that the number of nights in bed should be carefully reported by medical officers. Commanding officers should be informed how seriously the guard and sentry duties, conducted as they are in full dress, tell on the men if they are too frequent; one guard-day in five is quite often enough, and as there are often unnecessary posts, four nights in bed can usually be secured to the men, if the commanding officer is impressed with the importance of this matter.

The weights and accoutrements are injurious, and of late years a practice has crept in of making the soldier carry his pack much more frequently than formerly. Twenty years ago he merely paraded twice a-week in heavy marching order for inspection. Now, he often carries his pack on field-days, sentry, and even regimental drill. Instead of accustoming men to the pack, and making it easier, it breaks them down; but as this whole subject is under the consideration of the authorities, it is possible that alterations will be made.

The habits of the soldier are also unfavourable to health; in the infantry, especially, he has much spare time on his hands, and *ennui* presses on him. *Ennui* is, in fact, the great bane of armies; less in our own than in many others. It is said to weigh most heavily on the German, the Russian, and even on the French army. Hence, indeed, part of the restlessness, and one of the dangers of large standing armies. The Romans appear to have avoided this danger by making their distant legions stationary, and permitting marriage and settlement; in fact, by converting them into military colonies. We avoid it in part by our frequent changes of place, and our Colonial and Indian service; but not the less, both at home and abroad, do idleness and *ennui*, the parents of all evils, lead the soldier into habits which sap his health. Not merely excessive smoking, drinking, and debauchery, but in the tropics mere laziness and inertia have to be combated. Much is now being done by establishing reading-rooms, trades, industrial exhibitions, &c., and by the encouragement of athletic sports to occupy spare time, and already good results have been produced.

The establishment of trades, especially, which will not only interest the soldier, but benefit him pecuniarily, is a matter of great importance. It has long been asked why an army should not do all its own work; give the men the hope and opportunity of benefiting themselves, and *ennui* would no longer exist. In India, Sir Hugh Rose has done most essential service by the establishment of trades, and the system, after long discussion and many reports, is now likely to be fully tried in England.

Every military officer should remember that one of the proofs of ability for command and administration is the power of occupying his men, not in routine, but in interesting and pleasant work, to such an extent that rest and idleness may be welcomed as a change, not felt as a burden. Constant mental and much bodily movement is a necessity for all men; it is for the officers to give to their men an impulse in the proper direction.

Among the conditions of the soldier's life adverse to health, enforced celibacy must be reckoned. This produces not merely promiscuous intercourse, that terrible evil, but other effects. We do not require the statistical proof that both in the army and civil life married men have less illness and longer lives than single men; we might be certain, *a priori*, that the great function of procreation cannot be thus endangered by the conditions we impose on our soldiers without injury. The continental system of conscription for limited periods has prevented this matter from assuming the importance it does in armies enlisted for long or permanent service, but as the soldier's trade is now becoming a skilled one, and as he will be retained for longer periods, it cannot be doubted that the great military powers will in a few years have to meet this difficult problem.

For our own army the question is already pressing enough, nor is it easy to offer a solution; it can only be hoped that some great soldier who has, what all great soldiers must have, a conviction of the importance and a knowledge of the laws of health, may be found to reconcile the demands of military service with the dictates of a rule of nature. (See page 469.)

The last point which, probably, makes the soldier's life less healthy than it would otherwise be, is the depressing moral effect of severe and harassing discipline. In our own army in former years, it is impossible to doubt that discipline was not merely unnecessarily severe, but was absolutely savage. An enlightened public opinion has gradually altered this, and with good commanding officers, the discipline of some regiments is probably nearly perfect; that is to say, regular, systematic, and unfailing, but from its very justice and regularity, and from its judiciousness, not felt as irksome and oppressive by the men.

The general result of the life at home on soldiers must now be considered.

It is by no means easy to say whether soldiers enjoy as vigorous health as the classes from which they are drawn; the comparison of the number of sick, or of days' work lost by illness by artisans, cannot be made, as soldiers often go into hospital for slight ailments which will not cause an artisan to give up work. The amount of comparative mortality seems the only available test, though it cannot be considered a very good one.

Following the order laid down in the chapter on STATISTICS, we have to consider—

SECTION I.

I.—THE LOSS OF STRENGTH BY DEATH AND INVALIDING, PER 1000 PER ANNUM.

(*a.*) *By Death.*—It is to be understood that the mortality is here reckoned on the strength, that is, on the number of healthy persons actually serving during the time. The mortality on the sick is another matter.

From the Parliamentary Statistical Returns of the Army (1840 and 1853, which include the years 1826–1846), we find that the mortality among the cavalry of the line was about ⅓d more than among the civil male population at the same age (nearly as 15 to 10* per 1000), among the Foot Guards more than double (very nearly 20½ per 1000 as against 10), among the Infantry of the line ¾ths more (or nearly 18 per 1000 as against 10).

The State was thus losing a large body of men annually in excess of what would have been the case had there been no army, and was therefore not only suffering a loss, but incurring a heavy responsibility.

In the splendid men of the Household Brigade, diseases of the lungs (including phthisis) accounted for no less than 67·7 per cent. of the deaths, in the cavalry of the line for nearly 50 per cent., and in the infantry of the line for 57 per cent.; while among the civil population of the soldier's age, the proportion in all England and Wales was only 44·5 per cent. of the total deaths. The next chief causes of death were fevers, which accounted in the different arms of the service for from 7 to 14 per cent. of the total deaths. The remainder of the causes of deaths were made up of smaller items.

These remarkable results were not peculiar to the English Army. Most armies did, some still do, lose more than the male civil population at the same age. The following are the most reliable statistics:—†

	Per 1000. Army Loss.	Civil Population at Army Ages.
France (1823),	28·3	
France (Paixhans, 1846),	19·9	about 11
France (1862),	9·42	about 11·09
„ (1863),	9·22	
French in Algeria (1846),	64	
„ „ (1862),	12·21	?
„ „ (1863),	12·29	
„ Italy (1862),	17·69	?

* In reality the deaths from the civil male population of the soldiers' ages (20 to 40) were below 10, and in the healthy districts much below; the case against the soldier is, therefore, even worse than it reads in the text.

† Meyne (Eléments de Stat. Méd. Militaire, 1859) gives some of these figures; others are taken from the reports of the different armies.

	Per 1000. Army Loss.	Civil Population at Army Ages.
French in Italy, (1863),	17·92	
Prussian,	13·1	10?
Russian (series of years),	39	uncertain, but under 39.
„ (1857–1861),	18·7	
Austrian,	28	uncertain, but much less.
Piedmontese (1859),	16	?
United States (before the war),	18·8	probably about 11.
Portuguese (1851–53),	16·5	?

The Danish army, however, is as healthy as the civil population, losing only 9·5 per 1000.

The Hanoverian army is healthier, losing only 5·3 per 1000 as against 9·5 among the civil population of the same ages.

In these foreign armies the same rule holds good; fevers (chiefly typhoid in all probability) and phthisis were the great causes of mortality. In Prussia phthisis caused 27 per cent. of the total mortality, but in that army phthisical men are sent home, and after a certain time are struck off the rolls, so that the army deaths are thus fewer than they would be if the men died at their regiments. In Austria phthisis caused 25 deaths out of every 100; in France, 22·9;* while in 1859, the proportion among the civil population was 17·76; in Hanover, 39·4; and in Belgium, 30; though in the latter country the proportion among the civil population was only 18·97 deaths from phthisis per 100 of all deaths. In Portugal the mortality from phthisis constitutes 22 per cent. of the deaths,† while in the civil population the deaths are 12 per cent. of the total deaths. In these armies, also, fevers caused a greater number of the deaths than in the English army, even in the period referred to. In Prussia, 36; in France, 26;‡ in Belgium, 16·6; and in Hanover, 23·68 per cent. of all deaths were from fever (typhoid?). In Portugal only 3·9 deaths are from typhoid out of every 100 deaths; this is owing to its rarity in the country districts; it is common in Lisbon.

Nothing can prove more clearly that in all these armies the same causes are in action. And from what has been said in previous chapters, it may be concluded that the reason of the predominance of these two classes, lung diseases and typhoid fever, must be sought in the impure barrack air, and in the defective removal of excreta.

The Crimean war commenced in 1854, and ended in 1856. A large part of the army was destroyed, and a fresh force of younger men took its place. Soon afterwards, the great sanitary reforms of Lord Herbert commenced. In 1859, yearly statistical returns began to be published, and have now (1866) been completed to 1863 (five years).

In these five years the mortality of all arms underwent an extraordinary decrease from that of the former period.

Mortality per Thousand per Annum, including Suicides and Violent Deaths.—1859, = 9·965; 1860, = 9·95; 1861, = 9·24; 1862, = 8·72; 1863, = 8·86.

In the different corps of the service the amount of mortality varied. In 1860, for example, it ranged from as little as 1·55 in the Royal Engineers, to 19·08 in a Military Train battalion.

* This was in 1860; I have calculated this from Laveran's returns from eleven of the great garrisons. In 1863, the mortality from typhoid in the French army was 1·87 deaths per 1000 of effectives in France; 1·63 in Algeria; and 3·55 in Italy.

† Marques, reviewed in an excellent article in the British and Foreign Medico-Chir. Review for April, 1863.

‡ Laveran in 1860 made the number 25·9 in the deaths from eleven garrisons.

The diminution over the years previously noted (1826–46) is extraordinary. Three causes only can be assigned for it—the youth of the army, and a better selection of men; or a partial removal of the causes of diseases; or earlier invaliding, so as to throw the fatal cases on the civil population.

The question of age has been examined and disposed of by Dr Balfour,* who has shown that the youth of the army does not account for the lessening. Selection has always been made with equal care, and invaliding does not appear to have been in excess sufficient to account for the lessening, though it certainly has been greater of late years. There can be no doubt, then, that the great result of halving the yearly loss of the army by disease has been the work of Lord Herbert and the Royal Sanitary Commission.

It will be observed (see table, p. 508) that the diminution in the mortality in the French army has also singularly lessened from 1846 to 1862 and 1863, and this is, no doubt, owing to the great sanitary precautions now taken in that army.

When in the last five years we examine the causes of death among 100 deaths, taking out the principal diseases in order of fatality,† we find the result as follows:—

Ratio of Certain Causes of Death to Deaths from all Causes.

Order.	Diseases in order of fatality.	Of every 100 deaths.					
		1859.	1860.	1861.	1862.	1863.	Mean of the five years.
1.	Tubercular diseases (scrofula, phthisis, hæmoptysis),	37·9	31·79	36·1	41·6	31·48	35·77
2.	Diseases of heart and vessels,	4·08	6·68	6·81	7·36	8·34	7·28
3.	Violent deaths, exclusive of suicides and executions,	6·7	5·14	7·17	5·47	5·21	6·56
4.	Diseases of the nervous system, exclusive of delirium tremens,	5·4	4·5	7·42	5·48	11·48	6·09
5.	Pneumonia,	5·52	7·4	5·47	5·82	4·52	5·88
6.	Fevers (typhoid, typhus, and continued; probably chiefly, typhoid)	7·14	4·32	5·47	6·16	7·65	5·52
7.	Bronchitis, acute,	3·64	3·39	3·04	3·42	2·95	3·28
8.	Suicides,	2·9	2·98	1·12	3.08	3·13	2·64
9.	Bronchitis, chronic,	2·77	2·26	2·43	2·39	3·13	2·59
10.	Delirium tremens,	1·75	1·23	0·24	1·2	0·52	0·98
	All other causes,	...	...	...	...	...	24·29
							100

As the percentage of mortality of a certain disease to the whole number of deaths is not an accurate plan of stating the case, I have prepared the following table as testing more perfectly the amount of phthisis:—

* Report for 1859, p. 6.

† This table has been calculated from the table called "Appendix, No. I." in Dr Balfour's Reports; the numbers in those tables only being used.

Army.	Strength.*	Deaths from phthisis and hæmoptysis.*	Deaths from phthisis and hæmoptysis per 1000 living.
1859,	71,714	269	3·7
1860,	83,386	322	3·86
1861,	81,500	276	3·38
1862,	76·029	243	3·19
1863,	70·819	179	2·53
Male civilians.†		Age.	
All England and Wales,		20 to 25	3·5
„ „		25 „ 30	4·0
„ „		30 „ 35	4·1
„ „		35 „ 40	4·1
„ „		15 „ 55	3·7
„ „		25 „ 45	4·02
London,		15 „ 55	4·5
Worst districts in England, excluding hospitals,			5.0
Best districts in England,			1·96

During the five years named, it thus appears that the mortality in the army hospitals from phthisis was not above that of the country generally, though it is greatly above that of the healthy districts; but then an important element is omitted, viz., that a certain number of soldiers are invalided for phthisis, and swell the mortuary civil returns; and some of these are lost sight of, and do not appear in the army returns. The following table, taken from Dr Balfour, shows the amount in the different arms:—

Tubercular Diseases (chiefly Phthisis and Hæmoptysis, with some other Diseases (such as Morbus Coxarius, Scrofula, Tabes.)

Corps.	Rate per 1000 of strength in 1860-2. Average of 3 years.			Total of deaths and invalided in 1863 per 1000 of strength.
	Died.	Invalided.	Total.	
Household Cavalry,	3·55	3·55	7·10	14·80
Dragoon Guards and Dragoons,	2·34	6·85	9·19	8·58
Royal Artillery,	2·65	6·44	9·09	8·97
Military Train,	2·55	7·43	9·98	6·85
Foot Guards,	4·33	13·56	17·89	16·08
Infantry Regiments,	2·69	5·22	7·91	10·65
Cavalry Depots,	3·54	5·15	8·69	1·04
Royal Artillery Depots,	6·94	6·44	13·38	10·26
Depot Battalions,	5·14	9·15	14·29	10·16

There can be no doubt, then, that there is still an excessive prevalence of tubercular disease in the army; and the astonishing disproportionate number of cases in the Foot Guards is still as remarkable as it was twenty years ago. It may be safely concluded that the larger part of the men invalided will shortly die, and their deaths will swell the mortality from tuberculosis of the

* Taken from the tables, Appendix No. I. in Balfour's Reports.

† Parliamentary Return of Annual Average Mortality during the Decennial Period, 1851-60, Feb. 1864; and Dr Farr's Report to the Sanitary Commission, p. 507.

civil population. These tables show, in fact, that there must be a large amount of phthisis generated in the army; and in the Foot Guards it would seem to be nearly four times as much as among the civil male population of 25 to 45 years of age.

In the French, the deaths from phthisis are rather less than in the British army.

The deaths from continued fever (typhoid almost entirely) to 1000 of strength declined extremely from the early to the later period. A table copied from Dr Balfour shows this very clearly:—

Admissions and Deaths from Continued Fever per 1000 *of Strength.*

Corps.	1837–46.		1859.		1860.		1861.	
	Adm.	Died.	Adm.	Died.	Adm.	Died.	Adm.	Died.
Household Cavalry, .	...	...	...	...	18·81	...	5·74	...
Dragoon Guards and Dragoons, . . .	51·9	1·36	27·8	·37	20·09	·11	27·08	·53
Royal Artillery, . .	51	·65	26	·35	14·93	·26	12·38	·5
Military Train, . .	...	...	...	...	32·59	1·21	20·36	·55
Foot Guards, . . .	77·7	2·44	32·2	·84	27·93	·52	29·77	·52
Infantry Regiments, .	69·9	2·45	29	·66	22·33	·56	19·24	·6
Cavalry Depots, . .	...	...	...	...	32·85	·8	36·33	...
Royal Artillery Depots,	...	...	...	...	...	...	18·7	·3
Depot Battalions, . .	...	...	...	...	24·92	·17	25·4	·64

In 1862 and 1863 the numbers are not very different from those of the preceding 3 years.

The decline of continued fever is therefore very great.

There can be no doubt that, both as regards phthisis and fever, a reduction can still be made; and future returns will see considerable progress, though we can hardly expect again to witness so great a reduction. There is every encouragement from the past to carry on actively all measures which can do away with the causes still existing. (See chapter on Prevention of Disease.)

So also it may be questioned whether pneumonia, bronchitis, and heart disease could not be further reduced. The observations already made in the chapter on Accoutrements render it very likely that this can be done.

I am strengthened in this opinion from finding that a great difference in mortality, and in its causes, exists in the different arms of the service and in different corps. This argument will be stronger, however, when the figures are derived from a larger number of years. So also in the French army, in which the dress and accoutrements are both better arranged than our own, the amount of heart disease is less. Taking Dr Balfour's figures,* it appears that the deaths per 1000, from diseases of the organs of circulation, are in the French army in France, only ·255 per 1000 of strength; in our own army ·895, or 3½ times as much.

To show the effect of age and of the arms of the service on the total mortality, I subjoin a table compiled from Dr Balfour's reports.

* Army Medical Report, vol. v. p. 165.

Annual Ratio of Deaths per 1000 *Living at the following Ages* (*Balfour*).

Corps.	Under 20.		20–24.		25–29.	
	1837–46.	1859–63.	1837–46.	1859–63.	1837–46.	1859–63.
Household Cavalry, . . .	7·5	...	11·7	6·34	10·3	6·806
Dragoon Guards and Dragoons,	8·1	2·47	11·8	4·498	14·3	7·288
Military Train, ...	...	4·398	...	5·282	...	4·292
Foot Guards, ...	11·1	6·33	21·6	8·062	21·1	9·252
Infantry Regiments, . . .	13·1	3·146	17·8	6·658	19·8	8·598
Depot Battalions, ...	...	5·036	...	9·684	...	11·646
Royal Artillery, ...	...	0·7	...	4·576	...	6·938
Civil male population. England and Wales generally, ...	...	7·41	...	8·42	...	9·21
Civil male population. Healthy districts in England and Wales, . .	...	5·83	...	7·30	...	7·93

Corps.	30–34.		35–39.		40 and upwards.	
	1837–46.	1859–63.	1837–46.	1859–63.	1837–46.	1859–63.
Household Cavalry, . . .	13·3	6·95	8·4	9·508	13·4	20·442
Dragoon Guards and Dragoons,	14·6	11·624	15·3	13·58	18·3	25·232
Military Train, ...	...	6·852	...	30·622	...	41·332
Foot Guards, ...	19·5	12·712	22·4	14·306	26·2	16·314
Infantry Regiments, . . .	19·8	13·956	21	15·776	23·4	17·39
Depot Battalions, ...	...	18·148	...	26·41	...	31·048
Royal Artillery, ...	...	7·498	...	13·158	...	0·968
Civil male population. England and Wales generally, ...	...	10·23	...	11·63	...	13·55
Civil male population. Healthy districts in England and Wales, .	...	8·38	...	9	...	9·86

The effect of length of service on mortality has not yet been fully worked out, but appears to be very great.

From the French army Reports (1862 and 1863), mortality appears to lessen with service after the third year is passed, and is least in the period seven to ten years' service (*Satisque Méd. de l'Armée pendant l'Année* 1862, p. 32, ibid. 1863).

In the French Army.

	Deaths by Disease per 1000.		Deaths by Suicide per 1000.	
	1862.	1863.	1862.	1863.
Less than 1 year of service,	11·45	13·26	·16	·39
From 1 to 3 years, . .	13·38	12·81	·32	·28
„ 3 „ 5 „ . .	9·30	9·77	·42	·35
„ 5 „ 7 „ . .	7·40	6·62	·86	·54
„ 7 „ 10 „ . .	4·99	6·14	·98	·68
„ 10 „ 14 „ . .	5·72	6·12	1·12	·61
Over 14 years, . .	7·11	7·82	1·25	·65

The decrease of mortality with length of service, in the French army, is quite remarkable. Had the later years of service been given, no doubt the mortality would have shown an increase at that time. The regular increase in suicidal deaths, with length of service, is also very striking, particularly in 1862.

The effect of rank is also very marked. In all armies, the commissioned officers are more healthy than any other class. The non-commissioned officers are more healthy than the men, even to the extent of 40 or even 45 per cent.

(*b.*) *By Invaliding.*—Taking the men under 21 years' service only, the number of men discharged for illness has varied in different years and regiments very greatly.

Number per 1000 *Invalided under* 21 *years' Service.*

Arms.	1839–53.	1859.	1860.	1861.	1862.	1863.
Household Cavalry, .	15·2	7·42	14·7	8.2	12·27	16·44
Cavalry of Line, .	20·9	14·6	22·8	47	28·53	24·70
Royal Artillery, .	...	...	20·2	21·1	31·01	22·19
Military Train, . .	...	...	21·7	38·5	26·66	30·85
Foot Guards, . .	15·9	19·87	24·6	28·2	38·45	30·63
Infantry, . . .	20·8	10.41	21·3	35	25·71	33·90
Cavalry Depots, .	...	...	...	...	59·29	14·56
Depot Battalions (Infantry), .	...	...	21·6	72·3	50·85	36·40

The amount of invaliding is influenced by other causes than mere inefficiency of the men; sometimes a reduction is made in the army, and the opportunity is taken to remove weakly men who would otherwise have continued to serve. This was the case in 1861. As invaliding greatly affects the mortality of the army, a source of fallacy is introduced which it is not easy to avoid. In 1861 the ratio of invaliding per 1000 was, for the whole army, 51·419; in 1862 it was 41·27; in 1863 it was 32·58.

It thus appears that the total loss of men per 1000 per annum by deaths and invaliding differs greatly in the different arms, but is about 42 per 1000 per annum for the whole army. With a mean strength of 70,000 men serving at home, this amounts to a yearly decrease of nearly 3000 men.

SECTION II.

LOSS OF SERVICE FROM SICKNESS PER 1000 PER ANNUM.

Sub-Section I.

(*a.*) *Number of Admissions into Hospital.*—On an average 1000 soldiers furnish rather over 1000 admissions into hospital per annum.

In 1837–46	(Infantry)	1044	In 1861	(total)	1025
1859	(total)	1066	1862	,,	989
1860	,,	1053	1863	,,	960

The number varies in the different arms from about 500 in the Household Cavalry, which is usually the lowest, to about 1400 in the Cavalry and Artillery Depots. In the first case the steady character of the men, many of whom are married, and in the second the frequency of contusions during drill, accounts for this great range. In the Infantry the average is from 850 to 1020.

It appears, therefore, that the number of admissions has remained tolerably constant for 25 years, although during that time the mortality has so much decreased, a fact which proves how inferior a test of health the number of admissions is. In no part of the world, indeed, have they a constant relation to the deaths.

In the French army everywhere the admissions were as follows in 1862. It must be understood that the French system is essentially different from our own, as the slight cases of sickness are treated either in the barrack-rooms or in the infirmaries, while the severer cases are sent to general hospitals. In 1862 the mean strength (*l'effectif moyenne*) was 372,166 men; the number "present" with the regiments was 316,578.

	Admissions in 1862.	Per 1000 of mean strength.
Into hospital,	106,262	285
Into infirmaries, or treated in the barrack-room,	697,950	1875
Total,	804,212	2160

In France alone there were 636,370 total admissions to 304,733 of effective strength, or at the rate of 2088 per 1000 of strength. In Italy the admissions were 3460, and in Algeria 2248 per 1000 of strength. In 1863, on the 1st January, there were 255,013 men present with their regiments in France on that day there were in hospital 26 men per 1000, and in the infirmaries or in barracks sick there were 19, or altogether 45 non-effective per 1000 of strength.

The French plan clearly shows how slight three-fourths of the cases in the French army are, as no man sick for more than a day is kept in the barrack, or for more than a few days in the infirmaries; all severer cases are sent to hospital.

In the different arms the proportion varied from a total sick of 1153 (Imperial Guard) to 2425 (Cavalry) per 1000 of strength.

Sub-Section II.

(*b.*) *Daily number of Sick in Hospital per* 1000 *of Strength.*—About one-twentieth of the army is constantly sick in time of peace, or 5 per cent.

In 1860,	the proportion was	54·72	per 1000, or	5·4 per cent.
1861,	,,	54·54	,,	5·4 ,,
1862,	,,	52.45	,,	5·2 ,,
1863,	,,	49·14	,,	4·9 ,,

The different arms, however, present different numbers.

Arms.	1837–46.	1859.	1860.	1861.	1862.	1863.
Household Cavalry,	...	28·70	28·68	31·38	33·21	33·52
Cavalry of the Line,	40	51·13	41·67	43·43	43·62	47·22
Royal Artillery, .	...	...	57·51	57·13	50·62	46·87
Military Train, .	...	71·82	62·66	50·22	54·25	51·61
Foot Guards, . .	43	51·76	52	51·73	57·12	58·58
Infantry Regiments,	48·50	50·91	48·13	46·12	45·65	40·92
Depot Battalions (Infantry), . .	...	...	57·55	51·48	47·63	45·73

In England, the number of members of friendly societies, between 20 and 30 years of age, who are constantly sick is nearly 16 per 1000.

The daily sick in foreign armies per 1000 of men actually with their regiments is—

French (1846),	45·5
„ (1862),	47·93
„ (1863),	45
Prussian,	44
Austrian,	45
Belgian (1859),	54·2
Portuguese (1851–53),	39·4

The number of daily sick has, of course, a wide range; sometimes an hospital is almost closed, at other times there may be more than 100 sick per 1000 of strength. The composition and the duties of the several arms sufficiently indicate some of the reasons for the differences in the above table.

Sub-Section III.

(*c.*) *Number of Days spent in Hospital per head in each* 1000 *of Strength.*—The number of days' service of a battalion 1000 strong in a year would be of course (1000 × 365 =) 365,000. If we assume the average number of sick to be 54 per 1000, there are lost to the State (54 × 365 =)19,710 days' service per annum, or 19½ days per man; that is to say, each man has a little under three weeks' illness in the course of the year. As already said, it is difficult to compare the sickness of soldiers and civilians, but the above amount seems large when we remember that, in the friendly societies, the average sickness per man per annum (under forty years of age) is less than seven days.

The number of days of hospital to each sick man (mean duration of cases) is nearly the same, as the number of admissions nearly equals the strength.

It can be most easily calculated as following: multiply the mean number of sick (sick population) by the number of days in the period, and divide by the cases treated. The "cases treated" is the mean of the admissions and discharges in the period.

In the different arms the mean duration of cases is as follows:—

Days in Hospital to each Sick Man (= Duration of Cases).

Arms.	1837-46.	1859.	1860.	1861.	1862.	1863.
Household Cavalry,	15	19·46	20·39	20·41	20·43	19·03
Dragoon Guards and Dragoons,	15	19·02	16·51	16·35	16·07	18·74
Royal Artillery,	...	...	20·06	20·63	19·22	18·56
Military Train,	...	20·75	19·84	19·85	17·76	16·53
Foot Guards,	18	23·87	25·07	23·79	24·04	22·35
Infantry,	17	19·28	19·43	19·84	20·03	18·08
Depot Battalions,	...	...	19·09	19·99	19·24	17·07

Austrian army, 17 to 18 days,
French (1846), 16 days.
French at home, all cases (1862), 7·84 days.
French at home (1863), 8·02 days.
French in hospitals only (1862 and 1863), 27 days.
Prussian, 16 days.
Belgian, 23·6 days.
Portuguese, 19 days.

Sub-Section IV.

(*a.*) *Mortality to Sickness.*—This is, of course, a different point from that of the relation of mortality to strength. A few cases of very fatal illness may give a large mortality to cases of sickness, but the mortality to strength may be very small.

The mere statement of the ratio of mortality to sickness gives little information; what is wanted is the mortality of each disease, and at every age. Otherwise the introduction of a number of trifling cases of disease may completely mask the real facts.

When, however, the general ratio is to be determined, it must be calculated in one of three ways:—

1. Mortality to admissions in the time. This is, however, an uncertain plan; a number of cases admitted towards the close of a period, and the greater part of whose treatment and mortality falls into the next period, may cause an error.

2. Mortality to cases treated (= mean of admissions and discharges).* This is the best method of calculation.

3. Mortality to sick population, *i.e.*, the number of deaths furnished per annum by a daily constant number of sick. This, however, must be taken in connection with the absolute number of sick in the time, and with the duration of the cases, or, in other words, with the kind of cases.

The degree of mortality to the several causes of sickness is given very fully in the Army Statistical Reports, and in a few years some of the most valuable evidence that has ever been given in this direction will be available.†

* It has not infrequently happened that the mortality on sickness has been calculated in this way; the number of sick remaining in hospital at the commencement of the period, say a year, are added to the admissions in the year, and the mortality is calculated on this number. At the end of the year a certain number of sick remaining in hospital are carried on to the next year, and added to the admissions of that second year for the calculation of the mortality of that year. In this way they are counted twice. This has been done in calculations of weekly mortality, and in this way the same sick man has been made to do duty as a fresh case many times over. This is to be avoided by either calculating on the admissions, or by considering half the "remaining" at the beginning to belong to the previous period, and half the "remaining" at the end of the period to belong to the following period; or, what is the same thing, taking half the admissions and half the discharges in the period as representing the "cases treated" in that time.

† To analyse these tables (appended to the Statistical Reports) would take up too much space, and probably it is undesirable to do so for a few more years, but already the information is becoming very interesting. Take, for instance, pneumonia.

Years.	Total Cases.	Total Deaths.	Percentage of Deaths.
1859,	320	38	11·87
1860,	442	72	16·28
1861,	359	45	12·53
1862,	334	34	10·18
1863,	281	30	10·67

There is a great diversity in the mortality in the several corps. It thus appears that the mortality of pneumonia on the admissions has been, as a mean of five years, 12·306 per cent. In a very few years, supposing the diagnoses are well made, the mortality of pneumonia in males, if the soldiers are under good medical treatment, will be determined with certainty.

Calculated on the admissions, the mortality to total sickness is nearly the same as the mortality to strength, or about 9·5 per 1000 per annum.

Sub-Section V.—Causes of Sickness.

The causes leading men to go into hospital are, of course, very different from those which produce mortality. For example, admissions from phthisis will be few, mortality great; admissions from skin diseases numerous, mortality trifling.

Taking the most common causes of admission in the order of frequency, we find—

1. *Enthetic or Venereal Diseases.*—Under the term enthetic, all diseases, immediate or remote, resulting from sexual intercourse, are included. Secondary as well as primary syphilis; stricture and orchitis, as well as gonorrhœa, &c.; also a few cases not strictly venereal.

Years.	Admissions for 1000 of Strength.	Average number constantly Sick per 1000.	Duration of illness in Days.
1859, . .	422	26·8	23·22
1860, . .	368·96	23·69	23·5
1861, . .	354	23·45	24·19
1862, . .	330	22·24	24·61
1863, . .	306·8	20·28	24·10

In some corps the admissions have been as low as 120 (Household Cavalry), in others as high as 511 per 1000 of strength (Artillery Depots).

In 1861 these diseases caused a loss to the State of a period equal to 8·69 days for every man serving at home; the number of troops at home in 1861 being nearly 89,000, there was a daily inefficiency from venereal of 2077 men; in 1862, the troops being 78,173 in number, there was a daily inefficiency with venereal of 1739 men; in 1862, of 8·12 days, or equal to the loss of two regiments constantly; in 1863, of 7·4 days. How many of these cases are of infecting syphilis; how many are non-infecting sores, is doubtful; but Dr Balfour has calculated that about 60 per cent. is syphilitic (recent or remote) and 40 gonorrhœal. It varies, however, from year to year.

It would be of great moment to determine the exact number of true cases of infecting syphilis presenting themselves for the first time. In 1862, there were 7771 cases returned as "syphilis primaria" out of a total of 25,787 admissions from "enthetic diseases," or at the rate of 30·13 per cent. of the admissions from "enthetic" diseases. If we can trust to the diagnosis, the admissions from primary syphilis would be 99·4 per 1000 of strength in 1862. In 1863 there were 7131 cases of "primary syphilis," or 93·8 per 1000 of strength.

We have no certain facts with which we can compare the syphilitic disease of the civil population with the enthetic diseases of the army. The amount among the civil population at large is really a matter of conjecture. But whether it is greater or less than that of the army does not affect the result drawn from the above figures, viz., that there is an appalling loss of service every year from the immediate or remote effects of venereal disease.

In foreign armies the evidence is very imperfect. M. Jeannel, in his remarkable book on the prostitution of Bordeaux,* has given a table of

* Sur la Prostitution Publique, par le Dr J. Jeannel, Pharmacien principal de première classe à l'Hôpital Militaire, &c. Paris, 1862, pp. 196 and 214.

cases of venereal (*vénériens*) in the garrison hospitals of thirty French and Belgian garrisons, from which the following is an abstract. The rule in the French service is to send all bad cases from the regimental hospitals to the garrison (the French regimental hospitals are intended only for the treatment of the slight cases of sickness), but yet some slight cases of venereal disease are treated in the infirmaries. This lessens the value of his table, from which the table below is an extract.*

Number Admitted per 1000 *of Strength in some of the Principal Garrisons, and Average Number of Days of Sickness* (*Jeannel*).

Garrisons.	1858.		1859.		1860.	
	Admissions per 1000 of strength.	Days in hospital for each case.	Admissions per 1000 of strength.	Days in hospital for each case.	Admissions per 1000 of strength.	Days in hospital for each case.
Paris, . .	34·2	29·1	51·1	18·5	33	27
Briançon, .	28·8	34·1	49·3	30·5	19·9	56·7
Montpellier,	52·9	50·5	11·3	46	71	52·6
Toulouse, .	90·4	47·3	83·4	55·6	81·6	37·1
Marseilles, .	113·3	40·2	...	...	127·8	32·6
Calais, . .	132·5	25	60·9	29·3	73·8	30·2
Lyons, . .	136	49·9	165·5	33·6	163	42·2
Nancy, . .	...	...	159·6	33·9	598·1	18·1
Bordeaux, .	255·4	29·4	158·2	27·5	103·5	29·1

In Brussels the average admissions per 1000 of strength were 89·1 (years 1858–59–60).

In Lille during the same year it was 104·2.

In Russia, the admissions from syphilis are about 55 per 1000 (in Europe).

In the Hanoverian army, 37·1 per 1000 from syphilis, 28 per 1000 from gonorrhœa, 65·1 per 1000 from both.

From the French Army Report of 1862, already quoted, the total amount of "enthetic disease" is not very readily determined. In 1862, out of a mean strength of 304,733 men serving in France, there were 10,985 admissions into hospital from "syphilis primitive," or at the rate of 36 per 1000 of strength. Also 2636 cases of "syphilis constitutionnelle" were admitted. But then we must add to this number all the slighter cases treated in the infirmaries. This, however, is nowhere stated, and the total amount of enthetic disease can only be obtained by inference. Dr Balfour has calculated that the average non-effective from syphilis in hospital, infirmaries, and quarters was, in 1862, 11·11 per 1000 serving; while in the English army the proportion in the same year was 10·82 per 1000 serving,† or giving a little advantage to the English army. But the French reporters state (pp. 43 and 52), that on

* The rule in the French army about the plan of treatment of venereal disease appears to be this. The Ordonnance of 1839 ordered that slight syphilis requiring local treatment only should be treated in the infirmaries, but that severer cases should be sent to hospital. An order of 1860 (Didiot, *Code Sanitaire*, 1863, p. 204) directs that in any place where there is no (general) hospital, every form of syphilis is to be treated in the infirmaries, under the express condition that the place allows the police surveillance to which these patients are subjected to be carried out. If this cannot be done, the Ordonnance of 1839 is adhered to, viz., that cases requiring local treatment only are kept in the infirmaries.

† Army Medical Report for 1862, p. 153. (Syphilis, and not venereal, is referred to.)

every 5·27 days of sickness from all causes there is one day from venereal (*vénériens*) treated in hospitals, infirmaries, and barracks, which would give, if the loss of service were distributed over the whole army, a loss of 3·9 days yearly for each man. In England the loss is between eight and nine days for each man, and, therefore, it is double the French amount. But we certainly require more perfect French statistics before any result can be fairly reached.

The comparison between our own and other armies will not affect the facts as regards us—viz., that there is an enormous loss to the State from venereal diseases, and it is urgently necessary that some steps should be taken to lessen the evil (see Prevention of Disease). It should be understood, also, that the action of syphilis is long continued. Many soldiers die at Netley * from various diseases, whose real affection has been syphilis, so that the influence of this cause is very imperfectly indicated by the number of admissions and service lost under the head of enthetic diseases.

2. The important diseases included under the miasmatic class give about one-fifth to one-fourth of the total admissions, or about 220 per 1000.

1859, ...	194
1860, ...	246
1861, ...	221
1862, ...	234·3
1863, ...	188·6
Mean, . .	218·4

(*a.*) Eruptive fevers are not very common, about 3 per 1000. Small-pox is checked by vaccination; measles and scarlatina are not frequent.

(*b.*) Paroxysmal fevers (many of which have been contracted out of England), give about 11 per 1000.

(*c.*) The continued fevers are more common, but their frequency is lessening. There is no doubt that typhoid is the chief, perhaps almost the only fever besides febricula which is now seen. Spotted typhus is at present very uncommon. The continued fevers cause about 30 admissions per 1000 of strength.

(*d.*) Rheumatism gives between 50 and 60, dysentery and diarrhœa 25 to 30, sore throat and influenza 53, and ophthalmia 30 cases per 1000 of strength.

3. Integumentary diseases usually give the next greatest number of admissions—viz., from 100 to 130. This does not include scabies, but is made up of a great number of cases returned as phlegmon and ulcers (which appear to be rather more common among the cavalry and artillery), and a much smaller number of cases of eczema, herpes, psoriasis, and impetigo.

4. Diseases of the respiratory organs (excluding tuberculosis) give the next largest number—viz., from 75 to 110 per 1000, the mean being nearly 100; acute bronchitis gives the largest number (more than two-thirds); chronic bronchitis, one-sixth; and pneumonia and pleurisy, about one-twelfth each.

5. Accidents follow with from 70 to 80 admissions per 1000 of strength. Contusions are much more common in some regiments than in others, especially in the artillery and cavalry depôts, where recruits are in training.

6. Diseases of the digestive system cause from 35 to 50 admissions; dyspepsia is the chief heading; then chronic hepatitis (although it is very questionable if this term is not a conventionalism), and hœmorrhoids.

7. Parasitic diseases come next, with an average of about 30 to 40 cases per 1000; which are made up of scabies, and a smaller amount of "porrigo."

8. Diseases of the nervous system give about 15 to 20 per 1000. Epilepsy gives the largest number; then otitis; then cephalœa.

9. Tubercular diseases cause about 18 admissions per 1000.

10. Diseases of the reproductive (venereal excluded), locomotive, and urinary, give 6, 3½, and 3 admissions per 1000 of strength.

11. The remaining admissions are made up of smaller classes; corporal punishment sends 2 men into hospital yearly out of every 1000 men; these points are summed up in the following table, copied from Dr Balfour's reports:—

Ratio per 1000 *of mean Strength.*

Classes.	1860.		1861.		1862.		1863.	
	Admitted.	Died.	Admitted.	Died.	Admitted.	Died.	Admitted.	Died.
Class I.								
Miasmatic, . .	246·2	1·23	221·2	·98	195·3	·96	188·6	·89
Enthetic, . .	369·0	·08	353·8	·16	329·9	·11	306·8	·09
Dietetic, . .	5·5	·10	7·1	·03	7·3	·05	8·3	·05
Parasitic, . .	30·2	·02	35·1	...	44·3	...	47·2	...
Class II.								
Diathetic, . .	1·8	·12	2·4	·16	3·1	·14	3·4	·14
Tubercular, . .	17·8	3·47	18·7	3·34	19·5	3·67	16·9	2·99
Class III.								
Nervous System, .	18·8	·62	19·9	·79	20·2	·61	18·4	·73
Circulatory „ .	7·5	·72	10.3	·79	8·9	·68	9.2	·89
Respiratory „ .	106·5	1·77	98·2	1·44	86·4	1·13	75·9	1·17
Digestive „ .	36	·51	38·9	·45	39·0	·47	37·0	·48
Urinary, „ .	2·7	·14	3	·09	2·8	·08	2·7	·17
Reproductive System,	4·9	...	7·5	...	10·3	...	12·8	...
Locomotive „	3	·03	3·6	...	4·1	·01	4·4	·03
Integumentary „	118	·14	119·9	·07	128·2	·03	137·6	·06
Class IV.								
Diseases of Nutrition,	1	·03	2·1	0·4	3·2	0·3	2	·03
Class V.								
Accidents, . .	78·5	·60	80	·68	82·5	·46	85·8	·74
Homicides, . .	·2	·02	·1	·02	...	·01	...	·01
Suicides, . .		·34		·16	·1	·27	·3	·31
Execution, . .	...	...	...	·03	...	·01	...	·01
Corporal Punishment,	1·9	...	2·1	...	2·1	...	2·4	...
Not specified, .	3·1	·01	1·6	...	2	...	·3	·01
Total, . .	1052·7	9·95	1025·5	9·24	989·2	8·72	96·0	8·86

* My colleagues, Professors Maclean and Aitken, are both very much impressed with the frequent occurrence of marks of continued and dominant syphilitic action in the bodies of men who die from what are considered other diseases.

Can the causes of any of these admissions into hospital be lessened or removed? On this point there is no room for doubt that the enthetic admissions could be greatly lessened; so also could the admissions from fever, which have in fact been already reduced from 60 to 30 per 1000 of strength. The large class of integumentary diseases would probably admit of reduction. What is the exact nature of the phlegmon and ulcers which form so large a proportion of the admissions? Trifling as the cases are, they form a large aggregate, and a careful study of their mode of production might show how they might be diminished. Probably, however, these are mere conventional terms, under which a number of trifling cases are conveniently recorded, but a complete analysis of the returns of one year under phlegmon would be desirable. So also of all the other classes, it may be concluded that an active medical officer might succeed in reducing the cases of rheumatism, bronchitis, and dyspepsia.*

Sickness in Military Prisons.—The admissions into hospital in the military prisons do not appear to be great; they have varied per 1000 of admissions of prisoners from 316 (in 1851) to 136 in 1863.† Calculated in the mean strength, the result is as follows:—In 1863, the daily average number of prisoners were 1064; the admissions for sickness, 772; the mean daily sick, 21; the mortality, 0. These numbers give 725·5 admissions, and 19·74 mean daily sick per 1000 of strength. Prisoners are healthier than their comrades at duty in the same garrisons where the prisoners are under sentence.

SECTION III.

Such, then, being the amount of mortality and sickness at home, it may be concluded, that the soldier at present is not yet in so good a condition of physical health as he might be; and we can confidently look to future years as likely to show a continuance in the improvement now going on.

Health is so inextricably blended with all actions of the body and mind, that the medical officers must consider not only all physical but all mental and moral causes acting on the men under their charge.

The amount of work, the time it occupies, its relation to the quantity of food, the degree of exhaustion it produces, the number of nights in bed, and other points of the like kind; the mental influences interesting the soldier, or depressing him from *ennui;* the moral effect of cheerfulness, hope, discontent, and despondency upon his health, as well as the supply of water, air, food, clothing, &c., must be taken into account. And just as the body is ministered to in all these ways, so should there be ministration of the mind. It is but a partial view which looks only to the body in seeking to improve health; the moral conditions are not less important; without contentment, satisfaction, cheerfulness, and hope, there is no health.

Hygiene, indeed, should aim at something more than bodily health, and should indicate how the mental and moral qualities, essential to the particular calling of the man, can be best developed.

How is a soldier to be made not merely healthy and vigorous, but courageous, hopeful, and enduring? How, in fact, can we best cultivate those martial

* It is right, however, to say that no medical officer ought to sacrifice his men in the slightest degree for the purpose of appearing to have a small sick list and an empty hospital. There is a temptation in that direction which we have to guard against, and to remember that the only question to be asked is, What is best for the men? not, What will make the best appearance?

† Report on Prisons for 1863, p. 24.

qualities which fit him to endure the hardships, vicissitudes, and dangers of a career so chequered and perilous?

Without attempting to analyse the complex quality called courage, a quality arising from a sense of duty, or love of emulation, or fear of shame, or from physical hardihood, springing from familiarity with, and contempt of danger, it may well be believed that it is capable of being lessened or increased. In modern armies, there is not only little attempt to cultivate courage and self-reliance, but the custom of acting together in masses, and of dependence on others, actually lessens this. It is, then, a problem of great interest to the soldier, to know what mental, moral, and physical means must be used to strengthen the martial qualities of boldness and fortitude.

The English army has never been accused of want of courage, and the idea of pusillanimity would seem impossible to the race. But drunkenness and debauchery strike at the very roots of courage; and no army ever showed the highest amount of martial qualities when it permitted these two vices to prevail.* In the army of Marlborough, the best governed army we ever had, and the most uniformly successful, we are told that the "sot and the drunkard were the object of scorn." To make an army perfectly brave, it must be made temperate and chaste.

Good health and physical strength, by increasing self-confidence, increase courage; and self-reliance is the consequence of feeling that, under all circumstances, we can face with strength the dangers and difficulties that present themselves.

Few wiser words were ever written than those by William Fergusson,† at the close of his long and eventful service.

"Of the soldier's life within these barracks," writes Fergusson, "there is much to be said, and much to be amended. To take his guards, to cleanse his arms, and attend parade, seems to comprehend the sum total of his existence; amusement, instruction beyond the drill, military labour, and extension of exercises, would appear, until very recently, to be unthought of; as it is impossible that the above duties can fully occupy his time, the irksomeness of idleness, that most intolerable of all miseries, must soon overtake him, and he will be driven to the canteen or the gin-shop for relief.

"Labour in every shape seems to have been strictly interdicted to the soldier, as water for his drink. All, or nearly all, must have been bred to some trade or other before they became soldiers; but they are to work at them no longer. Labour (the labour of field-works and fortifications) strengthens the limbs and hardens the constitution, but that is never thought of in our military life at home; so thought not the ancient Romans, whose military highways still exist, and who never permitted their soldiers to grow enervated in idleness during peace. Better, surely, would it be that every one should work at his own craft, or be employed on the public works, in regulated wholesome labour, than thus to spend his time in sloth and drunkenness.

"But his exercises, without even going beyond the barrack premises, may be made manifold—running, wrestling, gymnastic games of every kind, swimming, leaping, pitching the bar, the sword exercise, that of the artillery, all that hardens the muscles and strengthens the limbs, should be encouraged;

* There are many sober and excellent men in the army. But as a rule, the English soldier cannot be depended upon under any circumstance, if he can get drink. Well does Sir Ranald Martin say, "Before that terrible vice can be overcome, something far more powerful than medical reasoning on facts, or the warnings of experience founded on them, must be brought into active operation. Discipline must still further alter its direction;—in place of being active only to punish wrong, it ought and must be exerted further and further in the encouragement to good conduct."—*Ranald Martin, "Tropical Climates,"* p. 263.

† Notes and Recollections of a Professional Life, 1846, p. 49.

and when the weather forbids out-door pastimes, the healthier exercise of single-stick, in giving balance and power to the body, quickness to the eye, and vigour to the arm, may properly be taken as a substitute for the drill, which, after the soldier has been perfected in his exercise, is always felt to be a punishment. So is the unmeaning evening parade and perpetual roll-calling.

"Surely, if the soldier present himself once every morning, correctly equipped and in order, the most teasing martinet ought to be satisfied, and then no more should be required than to see that the men are all in their quarters on the beating of the tattoo. Surely the use of the sword has been too much frowned down, as if it had been a forbidden thing. In the night attack the musket is worse than useless, its fire leading to every kind of confusion; and at the breach it is little better, for it can only be presented against stone walls and ramparts that conceal the defenders; but it [the sword] would cover the swordsman advancing to the breach, and a couple of chests of ships' cutlasses furnished to every regiment as regimental baggage—a single horse-load—provided the men had been taught to use them, would generally supply all that could be wanted for the exigency of the service.

"Let any one reflect on the fearful expenditure of life at the breaches at Badajos and St Sebastian, and say if some means should not, if possible, be devised to render it less costly hereafter. One is almost tempted to regret the times 'when,' according to the old song, 'our leaders marched with fusees, and we with hand-grenades;' and could the good grenadier have carried a sword by his side, to use after he had tossed the ball, he would, I believe, have done much more execution than with a musket and bayonet; and why should the artillery be to him a closed book, as if in the course of his service he was never destined to handle or to suffer from it? A couple of guns, even if wooden ones, in every barrack-yard, with an old invalid bombardier to teach the use of the rammer, and the sponge, and the match, would fill up many a vacant dreary hour, and open his mind to a most useful professional lesson.

"The lesson, moreover, would be as useful to the infantry officer as to the private. He would then, should he ever prove the captor of a prize gun, at least know what it was, and be able to turn upon the enemy the engine that had just been used for the purpose of destroying himself. Every sailor, even on board a merchant ship, where there are no idlers, must become more or less an artilleryman, and why should not the too often idle soldier?

"Foot-racing too, the art of running, so little practised, and so supremely useful, should be held amongst the qualities that constitute military excellence. It was so held at the Isthmian games of ancient Greece, and deserves a better place than has hitherto been assigned to it in the military pastimes of modern Britain. In our school-books we are told that the youth of ancient Persia were taught to launch the javelin, to ride the war-horse, and to speak the truth. Let the young British warrior be taught to use his limbs, to fire ball-cartridge, to cook his provisions, and to *drink water*. The tuition may be less classical, but it will stand him in far better stead during every service, whether at home or abroad.

"Regular bodily pleasurable exercise has been said to be worth a host of physicians for preserving military health; and occupation without distress or fatigue is happiness. The philosopher can make no more of it; and every idle hour is an hour of irksomeness, and every idle man is, and must be, a vicious man, and to a certain extent an unhealthy one; for the mind preys upon the body, and either deranges its functions in a direct manner, or drives the possessor to seek resources incompatible with health.

"Barracks, from time to time, should be evacuated for purification. The

evils and dangers of accumulation will otherwise beset them, inducing disease; and to obviate this, it would be well, whenever practicable, to march out their inhabitants, in the summer season, to the nearest heath or common—always, however, without tents—and there make them hut themselves. No military lesson could be more useful than this. Every man so hutted would be advanced in soldiering to the full instruction of the campaign. The change breaking the monotony of barrack life—the novelty would animate; he would be taught how to live in a camp, how to cook and to forage, to use the mattock, the shovel, and the axe.

"Tents, when the soldier lies upon the cold ground, with a crowd of comrades enclosed within a superficially heated atmosphere, loaded with animal exhalations, can only be considered hot-beds for the generation of dysentery. On their return to barracks they will find everything healthy and refreshed, and they will know that they have been made better soldiers.

"Some have strenuously recommended barrack libraries; and surely, when we think of the dismal monotony that hangs over the soldier in barrack life, no one with good feelings could object to them. Still, I must confess that I never knew or heard of a reading army. The military exercises and pastimes would seem better adapted to the soldier's character; and I acknowledge I would rather see him a cook than a student, for on that art his very existence may depend; but if he feel disposed to read, let him have every advantage and opportunity that the rules of the service can admit.

"Music would seem far better adapted than even books to fire the soldier's mind, for, when played in national airs, it awakens a chord which has often electrified armies; and amongst all nations, at some period or other of their history, it has been the accompanient and incentive to war. The highly civilised English soldier now fights, and can fight, without it; but if taught to feel its power, would he not fight better with it? To the Irish and the Scotch soldier it still speaks the language of the heart; and the Highlander, when he hears the gathering of his clan blown from the mountain war-pipe, becomes elevated and transported beyond himself; he will then encounter anything in human shape, unappalled by all the forms of death that the engines of war can inflict."*

In many of the foreign stations of the British army, excellent opportunities exist for both occupying the men and developing their spirit. All history teaches us that a hunting race is a martial one. The remarkable fighting qualities of the English, as drawn in Froissart's Chronicles, were owing to the fact that at that time they were "a nation of hunters," and trained from infancy to face dangers alone. In India there are many places where men could not only be allowed to hunt, but where such permission would be the greatest boon to the inhabitants. Yet this is never thought of, because it is imagined it would relax discipline, or would expose the soldier to the sun. But discipline and health are both infinitely more imperilled by the present system, to say nothing of the soldierly qualities which should be cultivated with so much care.

Moral and mental means for increasing health, courage, and self-reliance, must also be adopted.

The English army offers but few incentives to good conduct, scanty encouragement for the cultivation of martial qualities. Men must have rewards,

* Such, then, was the advice of an old Peninsular surgeon many years ago; how time is bringing the fulfilment of every recommendation; how much lost time would have been saved had William Fergusson's counsel found a Sidney Herbert to recognise its value and to carry it into effect!

and feel that earnest endeavour on their part to become in all respects better soldiers is neither overlooked nor unrewarded.

The cultivation of the martial qualities of the soldier is in reality a part of hygiene considered in its largest sense, but this part of hygiene must be studied and carried into effect by the combatant officers. Let us trust it may not be long before they seriously study and endeavour, by precept and example, to promote the formation of those habits of boldness and endurance, and that fertility in resources, which alone can render an army the formidable instrument it is capable of becoming.

CHAPTER III.

FOREIGN SERVICE.

The foreign service of the British army is performed in every part of the world, and in almost every latitude, and probably more than two-thirds of each line-soldier's service is passed abroad. The mere enumeration of the stations is a long task; the description of them would demand a large volume. In this short chapter, to give a few general statements as to climate and geology, and the past and present medical history of the stations, only can be attempted; such an outline as may give medical officers a sort of brief summary of what seems most important to be known.

Detailed and excellent accounts of most of the foreign stations exist, either in the independent works of army surgeons, such as those of Marshall, Hennen, Davy, and many others, or in reports drawn up for Government, and published by them. In the early Statistical Reports of the Medical Department of the army, short topographical notices of the stations were inserted; they are models of what such reports should be, and must have been drawn up by a master in the art of condensation. In the Annual Reports now published, many excellent topographical descriptions will be found; and some of the Indian Governments have published complete descriptions of all their stations. In the "Bombay Transactions," the "Madras Medical Journal," and the "Bengal Indian Annals," are very full accounts of almost every station that has been, or is, occupied by European troops in India. Finally, in the "Indian Sanitary Report," is much important information on the meteorology and topography of the present Indian stations. Young medical officers first entering on foreign service are strongly advised to study these accounts of the stations in the command where they are serving; it will not only give them interest in their service, but will aid them in their search how best to meet the climatic or sanitary conditions which affect the health of the men under their charge.

SECTION I.

MEDITERRANEAN STATIONS.*

Gibraltar.

Usual peace garrison = 6000 men. Period of service, three years. Civil population = 17,750 (in 1857). Height of rock, 1439 feet at highest point. Nature of rock, grey limestone, with many cavities filled with reddish clay; under town, an absorbent red earth forms the subsoil.

* A very important Report on the Mediterranean Stations has been published by the Barrack Improvement Commissioners (Dr Sutherland and Captain Galton).—*Blue-Book*, 1863.

Climate.—Mean temperature of year = 64·1 ;* hottest month, August (invariably in eight years) = 76·6 ; coldest month, either January or February, in equal proportions, 53·77 ; amplitude of the yearly fluctuation, 22·83 (= difference between hottest and coldest months).

Mean monthly maximum and minimum in shade†—Hottest month, July or August—mean maximum = 89° ; coldest month, December, January, or February—mean minimum, 42°. Range of highest and lowest monthly means of maximum and minimum, 47°. Extreme yearly range (difference between highest and lowest temperature recorded in the time) about 50° to 58°. The minimum thermometer on grass sometimes falls to 4° or 6° below freezing.

Rain-fall.—Mean 32·8 inches (mean of seventy years, 1790–1860). Greatest amount in any one year, 75·8 (1855). Least amount in any one year, 15·1 (1800). The importance of this great variation, as regards sieges, is evident ; Gibraltar might be embarrassed for water, if the rain-fall were only 15 inches in a year of siege.

Number of rainy days = 68. The rain is therefore infrequent, but heavy. The rain falls in nine months, September to May ; greatest amount in January and November ; most rainy days in April. Summer, rainless.

Humidity.

	Dew-point.	Grains of Vapour in a cubic foot.	Relative Humidity Sat. = 100.
Mean dew-point of year, .	55°·9	5·75	72·3
Mean highest dew-point in August, . . .	67°·9	7·5	70·9
Lowest dew-point in January or February, . .	43°·5	3·25	69·1

Gibraltar is thus seen to be a rather dry climate ; at any rate, the air is on an average only three parts saturated with moisture, and therefore evaporation from the skin and lungs will be tolerably rapid, provided the air moves freely. It is certainly not a moist insular climate, as might have been anticipated. At the times of rain, however, and during the fogs and moist sirocco, the air is nearly saturated.

Winds.—Chiefly to the N.W. or S.W. or W., in January, April, May, June, and October. Easterly in July, August, and September. But sometimes the easterly winds are more prevalent, or may be moderate for almost the whole year. The east and south-east winds are sirocco (Levanteros), and are often accompanied by rain and fogs.

Sanitary Conditions.

Water Supply.—Quantity is very deficient ; in 1861 only 2½ gallons daily were supplied for non-commissioned officers and privates.

Sources.—Wells and tanks, rain water, and a small aqueduct carrying surface water. Nothing has been done to improve the water supply for 150 years.

* Mean of eight years' observations by the Royal Engineers (1853–1860), as given in the Barrack Commissioners' Blue-Book (1863). The numbers given by Dove are rather different, viz., mean of year 66°. Hottest month, July, 79°·5. Coldest month, February, 56°·6. Mean yearly range, 22°·9. Extreme yearly range, about 50°.

† Of the eight years (1853–60) given in the report above quoted, the difference between the monthly mean maximum and minimum is so much less in the last three years, as to make one suspect some error in observation.

Quality.—In a well from the neutral ground analysed by Mr Abel, there was much sulphate and nitrate of lime (4·5 and 6 grains per gallon), and carbonate of lime (12 grains per gallon), also alkaline chlorides (7 or 8 grains), and 4 grains of organic matter. A tank water contained less lime, but much carbonate of magnesia. A well water in the town contained no less than 49·6 grains of nitrate of lime, and 15 grains of sulphate of lime, per gallon. The immense amount of nitric acid points unequivocally to the oxidation of animal organic matter.

In 1861, the storage in the military tanks was 1,971,844 gallons, while the daily consumption was 18,759 gallons, which is equal to 6,845,935 gallons yearly ; or, in other words, the storage is not equal to three months' consumption.

Many of the houses of the civilians have tanks, and no new house is allowed to be built without a tank. The distribution of water, both to soldiers and civilians, is very defective ; it is almost entirely by hand.

Drainage.—The sewers which exist are badly planned, without ventilation, and from bad outfall are liable to be choked ; the sewage is poured out into shallow sea-water, which is very offensive ; the supply of water for sewers is most deficient. Surface draining and cleansing was, in 1861, extremely defective.

Barracks.—More than half the garrison is in casemates, which are "mere receptacles of foul air, dark, damp, and unwholesome."* The barracks are, for the most part, badly arranged, and are over-crowded ; the average cubic space (in 1862) was only about 450 feet, and the average superficial space under 40. Ventilation is very defective, especially in the casemates. The means of ablution are, of course, defective. Latrines and urinals are also defective.† The duties are not heavy, and the rations are said to be good. In 1860 some improvements were made in the dress of the troops, and a light summer suit ordered. Flannel next the skin has been recommended strongly for Gibraltar, on account of the occasional cold winds.

Health of the Civil Population.

Gibraltar is now a place of considerable trade ; whether the Government have been right in allowing a mass of people to herd closely together in the midst of the most important fortress we possess, is very questionable. In case of a siege they would be a serious embarrassment, and even in time of peace they are objectionable. The health of this community is bad ; in 1860, the northern district, where population is densest, gave 38 deaths per 1000, or, excluding cholera, 33·5 ; in the more thinly populated southern end, the mortality was 27·5 per 1000, or more than St Giles', in London. The deaths in children under one year form 17·33 per cent. of the total mortality. The prevailing causes of this mortality are fevers (in all probability typhoid), and tuberculous consumption, which causes 13 per cent. of the total deaths at all ages, or 37·6 per cent. of the total deaths at the soldiers' ages. Dysentery and diarrhœa are common.

In this compressed and dirty population several great epidemics have occurred. The bubo plague has not been seen since 1649 ; but yellow fever prevailed in 1804, 1810, 1813, and 1828. Cholera has prevailed several times.

* Barrack Commissioners' Report, p. 37.

† All these points are noted in the Barrack Commissioners' Report, and will no doubt be soon altered ; they are merely referred to here as bearing on the question of the amount and prevention of disease. Plans of all the proposed improvements are given in the Commissioners' Report.

An immediate and complete amendment of all these bad sanitary conditions is imperatively demanded, on account of the danger to the troops during a siege, if for no other reasons.

Health of the Troops.

1. *Loss of Strength by Death or Invaliding per* 1000 *per annum.*

(*a.*) *By Death.*—From year to year there has been a considerable variation in the number of deaths, occasionally as low as 7·46, and as high as 16·9.

Years.	Deaths per 1000 of Strength.
1837–56 inclusive, ...	12·9
1859 (including deaths in invalids sent home), .	7·76
1860 (including deaths in invalids sent home), a cholera year,	11·06
1861 „ „ . .	9·06
1862	7·46
1863	5·05

Exclusive of cholera, the yearly mortality seems to be now about 7 or 8 per 1000. It differs greatly in the different regiments.

Causes of Death.—In the earlier years, the large causes of deaths were—

Phthisis, . .	41	per cent of total deaths.
Fever (typhoid?) .	17·65	„ „
Head affections (D.T.)	9·28	„ „
	67·93	„ „

This great amount of phthisis in such a climate naturally excited great surprise; it was certainly not owing to climatic agency, as of late years the number of cases has declined; it was almost certainly owing to the great crowding and to the number of ill-ventilated casemates inhabited by troops. The excess of fevers is seen by comparing the number given above with that of the home service.

During the last few years, the mortality from phthisis at Gibraltar has lessened, the fevers have increased.

	In 100 Deaths.		
	1859.	1860.	1861.
Phthisis, . . .	12·5	11·3	12
Fevers (typhoid?) . .	22·5	9·6	39·95

The decline of one disease and increase of the other, in the early and late periods, is, however, better seen by taking the admissions.

	Admissions per 1000 of Strength					
	1837–46.	1859.	1860.	1861.	1862.	1863.
Tubercular diseases, .	11	6	4·8	8·9	6·9	9·35
Continued fevers (typhoid),	75·46	107·51	59·4	108·3	102·6	115

The decrease in tubercular diseases from 11 to a mean of 7, may be owing probably to some improvement in ventilation, and to the practice of encamping the men out, or it may be more apparent than real; for, as will be seen immediately, a large number of tuberculous cases are sent home. The increase in continued fevers must be simply attributable to an increasing imperfection in drainage.

Dysentery and diarrhœa form the next class of diseases, which, in former years, caused a considerable mortality and a large number of admissions. Their prevalence was nearly three times that of the same affections at home,

and at the same time other digestive diseases of some kind were very frequent. Of late years they have decreased, but are still more common than they should be. There is no doubt that they are owing to impure water, and not to any recondite climatic conditions. In 1860 and 1865 cholera prevailed, and caused an increase in the deaths.

(*b.*) *By Invaliding.*—The amount varies considerably from year to year; in 1859–60, the average invaliding for discharge was 10 per 1000 of strength; 1861, no less than 22·8; in 1863, it was 18: a very large proportion of these are tuberculous cases, so that the apparent lessening of these cases of phthisis in the death list may simply be that the men are not now allowed to die on the Rock. In addition, men are sent home for change of air; the proportion is about 20 per 1000 of strength. Cardiac diseases, diseases of the eyes, dysentery, and liver diseases, constitute the next chief classes of disability.

The causes of the large proportion of cardiac diseases are not clear, but those of the eyes and dysentery are obvious enough. In both cases the water is no doubt the main cause; quantity in the one case, quality in the other, being to blame.

The excess of liver cases is a curious subject, which requires looking into; it was noticed very early in the Statistical Reports.

The loss at Gibraltar by death and invaliding appears therefore to be from 20 to 25 men per 1000, or 120 men yearly out of the garrison.

2. *Loss of Service by Sickness.*

Per 1000 *of Strength.*

Years.	Admissions per Annum.	Mean daily Sick.	Mean Stay in Hospital of each Sick Man.
1837–56, .	976	...	...
1859, .	949	46·90	18·04
1860, .	825	40·55	17·93
1861, .	927	47·64	18·75
1862, .	878	44·05	18·30
1863, .	877	40·77	16·96

Each soldier loses from sickness about sixteen days' service annually, or rather less than at home. As compared with home service, the admissions are rather fewer; the mean daily sick rather less, and the duration of cases rather less.

Of the diseases causing admissions, venereal affections are less frequent than in England, varying from 127 to 240 per 1000. Integumentary diseases give the next greatest number; phlegmon and ulcers forming the largest number, as at home. Continued fevers give the next greatest number, and in 1859 they amounted to no less than 107 per 1000, or one admission for every ten men in the garrison; in 1863 they reached the still higher figure of 115 per 1000. The digestive and dysenteric diseases come next in order of frequency; and after these, rheumatism, which is about as common as at home.

These figures tell the same tale as the mortality returns. Bad drainage and bad water are the causes of the diseases giving the largest number of admissions.

Venereal diseases are somewhat less than at home, being repressed by police

regulations. One point that needs investigation is, whether there is any other cause (in food?) for the rather large number of cases of digestive disorder.

Sanitary Duties at Gibraltar.—Captain Galton and Dr Sutherland have already indicated the measures which must be adopted, viz., a better supply of water, by arranging a larger storage; a better drainage, with sea-water for flushing, and a different outlet; and an improved ventilation, with less crowding in barracks. There is no doubt these measures will greatly improve health.

It may be suggested whether, as water is so deficient, a removal of sewage by hand might not be employed. The soil might be used for cultivation in the neighbourhood of the Rock, or carried out to sea.

Supposing war were to arise at this moment, and that we lost the command of the sea for a time, the points of danger would apparently be these:—

1. *Deficient Water, Storage being small, and Rain-fall uncertain.*—This would have to be supplied by distillation, and it would be prudent to keep a good apparatus always at Gibraltar.

2. *Overcrowding and Bad Ventilation, leading to Spotted Typhus.*—With a full garrison, and with some barracks untenable, there is no doubt there would be serious danger of this disease; and it is a matter of great moment to ventilate as perfectly as possible all casemates which, even if now disused, must be used in time of war.

3. *Typhoid Fever from Bad Drainage.*—The drainage should be put into thoroughly good order in time of peace, either by adopting good sewers, and sea-water for flushing, or using the dry method.

4. *Diseases arising in the Town, and spreading to the Garrison.*—In case of war, it would seem most desirable to clear out the native town as far as it can be done. More space and more water would be available. There would be less chance of famine, destitution, and disease.

In the war in 1782, scurvy prevailed from deficiency of food and fresh vegetables.

Malta.

Size, 17 miles by 8. Usual peace garrison = 6000 to 7000; period of service, three years; population (civil) in 1851 = 98,021.

Geology.—Soft, porous rock; the greater part is sandstone resting on hard limestone; in some parts marl and coral limestone over the sandstone. In the centre of the island, at Citta-Vecchia, there is, in order from the surface, alluvium, upper limestone, red sand, marl, sandstone, and lower limestone. Valetta is on thin alluvium, with thick sandstone below, and beneath this the lower limestone.

Climate (at Valetta).—Mean of year, 68°; hottest month (July), 77° coldest (January), 57°; amplitude of the yearly fluctuation, 20°; extreme yearly range (from highest to lowest temperature in shade), 62°, from 100° in July to 39° in January; mean yearly range, about 50°; extreme monthly range (*i. e.*, from highest to lowest in month), about 25° to 35°.

Undulations of temperature are frequent, and there are often cold winds in winter from N.W. The south-east wind is an oppressive sirocco, raising the temperature to 94° or 95°. It is chiefly in the autumn, and blows for from 60 to 80 days every year. At Citta-Vecchia (600 feet above the sea) the temperature is lower and the air keener. Rain-fall about 32 inches. Chief rain in November, December, and January; less in February and March; small in amount in the other months. From June to August almost rainless.

Humidity.—(Mean of 1859–60); observations at 9·30 A.M. and 3·30 P.M.

	Dew-point.	Grains of Vapour in a cubic foot.	Relative Humidity.
Mean of year,	60·5	5·87	62
Highest in year (August),	72·7	8·73	...
Lowest in year (February),	49	3·96	...

Malta thus appears to be a dry climate, *i.e.*, with little relative humidity.

Sanitary Condition.

Much has been done of late years, and, as far as external cleanliness goes, Valetta is very clean. Water supply from rain and springs (the largest of which is in the centre of the island, and the waters of which are led by aqueduct), is not very deficient in quantity (8 to 10 gallons per head), and, except in some places, good in quality, though the rain-water contains chlorides from the spray falling on the roofs of buildings. Some of the tanks are too near the sea, which percolates into them. The tanks require, however, careful looking after. Within the lines there are 272 public and military tanks, with storage for 55 millions of gallons, and 4294 private tanks, with storage for 323 millions of gallons. The military tanks, if full, would give 6 gallons of water per man daily for eleven months, but even now the water often falls short. The water is now carried everywhere by hand, and the drinking-water for the men is not filtered. The sewers in Valetta are bad in construction and outlet, and much typhoid has been and is still caused in consequence. In many cases "they are nothing but long cesspools."*

The barracks are bad, many casemates being used, and buildings intended for stores and not for habitations. In some cases, all sanitary considerations have been sacrificed for the purposes of defence. They are built of soft sandstone, which both crumbles and absorbs wet. The ventilation of the casemates is very bad. The Barrack Commissioners, in their Report, recommended that in every way which can be done the ventilation should be improved by admitting the wind, especially from the north, and that each barrack will require a separate plan to meet the particular case. They recommend that air shafts shall be made, much larger than ordered for home service, viz., 1 square inch for every 20 cubic feet of space, or for a barrack of twelve men with regulation space (7200 ÷ 20 =) 360 square inches (= 2½ square feet) of outlet opening. At the present time the amount of cubic space is below the home service amount (600 cubic feet), and the superficial area is very small, one-fourth of the men having less than 40 square feet each.

Means for ablution are very deficient. Urinals and water latrines are made of porous stone, and are also bad in construction.

It is therefore evident that the condition of Malta is a parallel to that of Gibraltar, and very much the same diseases may be expected, viz., typhoid fever from bad drainage, and lung disease from the faulty ventilation. As the water is less impure, the amount of dysentery may be expected to be less.

Health of the Civil Population.

There is some, but no great amount, of malarious disease, but a good deal of the so-called bilious remittent,† and typhoid. Typhus is not at present

* Barrack Commissioners' Report, p. 111.

† See Dr Marston's excellent Report in the Army Medical Report for 1861, for the symptoms of this disease among troops.

seen. Bubo plague has prevailed seven times, the last in 1841, slightly. Yellow fever has been known, but not of late years. Cholera has occurred thrice. Dysentery is common; tænia not infrequent; ophthalmia common, from dust and glare. Boils or anthrax are frequent, rheumatism is not uncommon, and phthisis is said to be frequent (from dust?). The death rate is said to be 21·3 per 1000 in the towns, and 28·7 in the country districts; while nearly 57½ per cent. of this is in children under five years,* the great causes of infantile mortality being registered as teething and convulsions.

Health of the Troops.

On the whole, the health of the troops is worse than at Gibraltar, but it has singularly fluctuated (even without great epidemics), more so probably than at any station in the same latitude. The mortality has varied as much as threefold without cholera.

Years.	Loss of Strength per 1000 per annum.		Loss of Service per 1000 per annum.		
	Deaths.	Invalided for discharge.	Admissions.	Mean daily Sick.	Days in Hospital to each sick man.
1837–46, . .	15·3	...	1120	43·79	...
1859, . .	18·08	8·29	1214	51·81	18·91
1860, . .	10·59	6·05	983	47·40	17·30
1861, . .	11·15	9·20	772	48·67	23·01
1862, . .	9·23	7·90	695	39·27	20·63
1863, . .	7·31	13·5	666	42·73	18·79

Therefore the total loss of men per year is 20 per 1000, or 120 for a garrison of 6000, and the days' service lost per annum is 17,078 days out of (365 × 6000 =) 2,190,000 days. It will thus be seen that of late years the mortality and admissions have both declined; but the mortality in former years has been as low as 5·6, and it is impossible to be certain that the present low mortality will continue.

In former years phthisis was the cause of 39 per cent. of the deaths, or nearly the same as at Gibraltar. Latterly there have been fewer deaths at Malta, but a considerable number of tubercular cases are sent home. The disease is probably detected more early, and the men do not die as formerly at the station. Still this does not account for the whole diminution, and there has been clearly a lessening of phthisis. There was a large amount of stomach and bowel disease, and dysentery was forty times as frequent as in England.† This is certainly a very remarkable circumstance, that both at Gibraltar and Malta there should have been this extraordinary liability to affections of the alimentary canal. At Malta, as at Gibraltar, it may have been chiefly owing to impure water and to food (Report of 1853, p. 118). Of late years stomach and bowel affections have been less frequent, but are still more common than

* Report of Barrack Commissioners, p. 87. The Commissioners justly remark that these figures are so striking as to demand further inquiry. Probably they are quite untrustworthy, yet both at Gibraltar and Malta it would be of the greatest importance, not merely for the health of the troops in peace, but for the security of the fortress in war, to know everything about the social life and the diseases of the native population.

† In England, in 1837–46, every 1130 men gave one case of dysentery; in Malta, in the same years, every twenty-eight men gave one case of dysentery. The mortality of the disease was, however, nearly the same (see pages 21 and 118 of the Report of 1853).

at home; in 1861, the 89,000 men on home service gave only sixty-seven cases of acute dysentery and no deaths, while the 6000 men at Malta had thirty-four cases and two deaths.

A continued fever (which was probably in great measure typhoid) has prevailed more or less for the last forty years at Malta, and doubtless also before that time. It has been quite as prevalent and fatal of late years as formerly; in 1859 there were 1413 admissions out of a garrison of 5310 men, or at the rate of one man in every four; and the deaths from fever were 44 out of 96 total deaths, or 45·83 of the total mortality. In 1863 there were 844 admissions and 21 deaths out of a garrison of 5494 men. This is more than in any town or village in England.

In the Statistical Report for 1853, it is observed that the number of cases of liver disease at Malta are remarkably high; and the writers, while believing there must be "something in the climate of Malta peculiarly favourable to the production of hepatic affections," were unable to find, on bringing the cases into relation with the temperature, any connection. The cause of this may be something very different, and it is very desirable that the food should be looked to. There is a suspicion at Netley (which requires a few years more experience to test it) that the cases of echinococcus of the liver are more frequent in men from the Mediterranean stations than others (Dr Maclean). The case of Iceland (see page 175, and the Report on Hygiene in the Army Medical Report for 1862, p. 339) should lead us to look into this point. The history of admission for venereal disease is important; in 1837–1846, inclusive, the admissions were only 99 per 1000, or two-thirds less than at home; in 1859, when the next report appeared, they were 149 per 1000; and in 1860 they were 147·9 per 1000. In the early period there were police regulations, which were suspended in the two latter years. In June 1861 the police regulations were re-enforced, and the admission for the year sank to 102. The 4th battalion of the Rifle Brigade showed the following remarkable result:—In the first half of 1861, there were fifty-seven admissions; in the last half, only seventeen. In 1862, the total number of cases of "enthetic disease" in the whole garrison were only 49·5; and in 1863, 44·1 per 1000, a result which, compared with home service, is marvellous; the reduction is almost entirely of syphilis, not of gonorrhœa. The large number of admissions from phlegmon and ulcers is as striking in Malta as at Gibraltar and at home, and here as there, these are probably mere conventional terms. Such then, in brief, seem to be the chief medical points of importance at Malta, viz., a liability to phthisis, less marked of late years; a great amount of fever, from bad sanitary conditions in great part; a liability to stomach and intestinal affections, which, though less obvious, is still great, and a singular tendency to a liver affection, which may be parasitic. The chief improvements advised by the Barrack Commissioners refer to a larger water supply, a better distribution, improved drainage, and efficient ventilation.

In time of war, the dangers at Malta would be the same as at Gibraltar; the aqueducts might be cut by a besieging force, and the water supply restricted to the tanks. Although these are supposed to hold a large quantity, they are not kept full, and could not, perhaps, be rapidly filled. The garrison might be driven to distil the sea water. The Barrack Commissioners very properly strongly advise that a tank inspector should be appointed. A still more serious danger would be the overcrowding of a war garrison. Doubtless, in case of a war, the garrison would only be concentered in the lines when the siege commenced, but the crowding during a siege of three or six months might be very disastrous. This danger should be provided for beforehand by a clear recognition of what accommodation would be wanted

for war, and how it is to be obtained without violating either the conditions of health or of defence.

The drainage will no doubt be soon remedied in accordance with the recommendations of the Barrack Commissioners.

SECTION II.

WEST INDIES.

The history of sanitary science affords many striking instances of the removal of disease to an extent almost incredible, but no instance is more wonderful than that of the West Indies. Formerly, service in the West Indies was looked on as almost certain death. It is not fifty years since the usual time for the disappearance of a regiment of 1000 strong was five years. Occasionally in a single year a regiment would lose 300 men, and there occurred from time to time epochs of such fatality that it was a common opinion that some wonderful morbid power, returning in cycles of years—some wave of poison—swept over the devoted islands, as sudden, as unlooked-for, and as destructive, as the hurricanes which so sorely plague the

"Golden isles set in the silver sea."

What gave countenance to this hypothesis was, that sometimes for months, or even for a year together, there would be a period of health so great that a regiment would hardly lose a man. But another fact less noticed was not so consistent with the favourite view. In the very worst years there were some stations where the sickness was trifling; while, more wonderful still, in the worst stations, and in the worst years, there were instances of regiments remaining comparatively healthy, while their neighbours were literally decimated. And there occurred also instances of the soldiers dying by scores, while the health of the civil inhabitants in the immediate vicinity remained as usual.

If anything more were wanted to show the notion of an epidemic cycle to be a mere hypothesis, the recent medical history of the West Indies would prove it. At present this dreaded service has almost lost its terrors. There still occur local attacks of yellow fever, which may cause a great mortality; but for these local causes can be found, and apart from these the stations in the West Indies can now show a degree of salubrity almost equalling, in some cases surpassing, that of the home service.

The causes of the production, and the reasons of the cessation, of this great mortality are found to be most simple. It is precisely the same lesson which we should grow weary of learning if it were not so vital to us. The simplest conditions were the destructive agents in the West Indies. The years of the cycles of disease were the years of overcrowding, when military exigencies demanded that large garrisons should hold the island. The sanitary conditions at all times were, without exception, infamous.

There was a great mortality from scorbutic dysentery, which was almost entirely owing to diet.* Up to within a comparatively late date, the troops were fed on salt meat three, and sometimes five, days a-week, and the supply of fresh vegetables was scanty. It required all the influence of Lord Howick, the then Secretary at War, to cause fresh meat to be issued, though it had been pointed out by successive races of medical officers that fresh meat was not only more wholesome, but was actually cheaper. The result of an improvement in the diet was marvellous; the scorbutic dysentery at once lessened, and the same amount of mortality from this cause is now never seen. Another cause of dysentery was to be found in the water, which was impure from being drawn from calcareous strata, or was turbid and loaded with sediment. The substitution of rain water has sufficed in some stations to remove the last traces of dysentery.

If the food and water were bad, the air was not less so. Sir Alexander Tulloch has given a picture of a single barrack at Tobago, said to be the "best in the whole Windward and Leeward Command,"* the figures of which tell their own tale.

Barrack at Tobago in 1826.—Superficial space per man, 22½ feet; breadth, 23 inches; cubic space, 250 feet.

The men slept in hammocks, touching each other. In these barracks, crowded as no barracks were even in the coldest climates, there was not a single ventilating opening except the doors and windows; the air was fœtid in the highest degree. With this condition of atmosphere, it is impossible not to bring into connection the extraordinary amount of phthisis which prevailed in the soft and equable climate of the West Indies. There was more phthisis than in England, and far more than in Canada. The first great improvement was made in 1827, when iron bedsteads being introduced, each 3 feet 3 inches wide, greater space was obliged to be given to each man.

Every arrangement for removal of sewage was barbarous, and in every barrack sewage accumulated round the buildings, and was exposed to heat and air. When yellow fever attacked a regiment, every stool and evacuation was thrown into the cesspools common to all the regiment; and in this way the disease was propagated with great rapidity, and was localised in a most singular manner, so that a few hundred yards from a barrack, where men were dying by scores, there would be no case of fever. In spite of this, it was many years before the plan of at once evacuating a barrack where yellow fever prevailed was adopted.

The barracks themselves were usually very badly constructed, and when in some cases the architects had raised the barracks on arches from the ground, in order to insure perflation of air below the buildings, the arches were blocked up or converted into store-rooms; and the barracks, with spaces thus filled with stagnant air beneath them, were more unhealthy than if they had been planted on the ground.

The localities for barracks were often chosen without consideration, or for military reasons,† into which no consideration of health entered. Almost all were on the plains, near the mercantile towns, where the soil was most malarious, and the climate hottest and most enervating. Malarious fevers were, therefore, common.

To all these causes of diseases were added the errors of the men themselves. For the officers there existed, in the old slave times, the greatest temptation. A reckless and dangerous hospitality reigned everywhere; the houses of the

* This is pointed out, in the Statistical Report (1838) on the West Indies, by Tulloch and Balfour; and it is believed that the improvement in the diet was in a great measure owing to these gentlemen.

* Report, 1838.

† The history of the old St James's Barracks in Trinidad is too remarkable to be passed over. It was determined to build a strong fort—a second Gibraltar—on the lower spurs of the hills overlooking the plain where the barracks now stand. When the works had been carried on for some time, it was discovered that they could not hold the troops. The barracks were then ordered to be placed on the plain, under cover of the guns of the fort. Before the fort was quite finished, it was found to be so unhealthy that neither white nor black men could live there, and it was abandoned. The barrack, it is said, was not then commenced; yet, though the reason for placing it in that spot had gone, it was still built there, on a piece of ground near two marshes (Cocorite and the Great Western Marsh), below the general level of the plain, and exposed to the winds from the gullies of the neighbouring hills. Yet this bad position, so fruitful of disease, was in reality less injurious than the local bad sanitary arrangements of the old St James's Barrack itself.

rich planters were open to all. A man was deemed churlish who did not welcome every comer with a full wine, or more often a brandy cup.

In a climate where healthy physical exertion was deemed impossible, or was at any rate distasteful, it was held to be indispensable to eat largely to maintain the strength. To take two breakfasts, each a substantial meal, was the usual custom; a heavy late dinner, frequently followed by a supper, succeeded; and to spur the reluctant appetite, glasses of bitters and spirits were taken before meals.

The private soldiers obtained without difficulty abundance of cheap rum, which was often poisoned with lead. Drunkenness was almost universal, and the deaths from delirium tremens were frequent and awfully sudden. The salt meat they were obliged to eat caused a raging thirst, which the rum bottle in reality only aggravated.

To us these numerous causes seem sufficient to account for everything, but in former days an easier explanation was given. It was held to be the climate; and the climate, as in other parts of the world besides the West Indies, became the convenient excuse for pleasurable follies and agreeable vices. In order to do away with the effects of this dreaded climate, some mysterious power of acclimatisation was invoked. The European system required time to get accustomed, it was thought, to these climatic influences, and in order to quicken the process various measures were proposed. At one time it was the custom to bleed the men on the voyage, so that their European blood might be removed, and the fresh blood which was made might be of the kind most germane to the West Indies. At other times an attack of fever (often brought on by reckless drinking and exposure) was considered the grand preservative, and the seasoning fever was looked for with anxiety. The first statistical report of the army swept away all these fancies, and showed conclusively that instead of prolonged residence producing acclimatisation and lessening disease, disease and mortality increased regularly with every year of residence.

The progress of years has given us a different key to all these results. It is now fully recognised that in the West Indies, as elsewhere, the same customs will insure the same results. Apart from malaria, we hold our health and life almost at will. The amount of sickness has immensely decreased; occasionally in some stations which used to be very fatal (as at Trinidad) there has not been a single death in a year among 200 men. Among the measures which have wrought such marvels in the West Indies have been—

1. A better supply of food; good fresh meat is now issued, and vegetables, of which there is an abundance everywhere.
2. Better water.
3. More room in barracks, though the amount of cubic space is still small.
4. Removal of some of the stations from the plains to the hills: a measure which has done great good, but which can explain only a portion of the improvement. The proper height to locate troops is by most army surgeons considered to be at some point above 2500 feet.
5. Better sewage arrangements, and more attention generally to sanitary conservancy.
6. A more regular and temperate life, both in eating and drinking, on the part both of officers and men.
7. The occupancy of the unhealthy places, when retained as stations, by black troops.
8. A better dress. It is only, however, within the last few years that a more suitable dress has, at the instance of the present Director-General, been provided for the West India islands.

The army stations in the West Indies are, Jamaica, Barbadoes, Trinidad, St Lucia; the last three being included in the term "Windward and Leeward Command." British Guiana, on the mainland, is part of this command. There are small parties of artillery and some black troops in Honduras and the Bahamas.

The period of service is now three or four years; formerly it was eleven or twelve, but this was altered after the first statistical report. Usually the Mediterranean regiments pass on to the West Indies, and subsequently to Canada.

The proper time for arriving in the West Indies is in the beginning of the cold season, viz., about the beginning of December, when the hurricanes and autumnal rains are usually over.

Jamaica.

Present strength of white garrison, 600 to 700; black troops, 700 to 800. A range of lofty hills (Blue Mountains) divides Jamaica into two parts, connected by a few passes. The troops were formerly stationed chiefly in the south plains, at Kingston, Port-Royal, Spanish Town, Up-Park Camp, Fort-Augusta, &c. After the Maroon war in 1795, some troops were stationed at Maroon Town (2000 feet above the sea) on the north side, and at Montego Bay. Subsequently Stoney Hill (1380 feet above the sea), at the mouth of one of the passes, was occupied.

Since 1842 some, and now nearly all the troops, are at Newcastle, in the hills, 4000 feet above the sea, with detachments at Kingston and Port-Royal. The other stations are now disused for white troops. The sanitary condition at Newcastle was formerly not good; the sewage arrangements were very imperfect; it is now somewhat improved.

Climate.—The climate is very different at the different stations. At Kingston (sea-level)—temperature, mean of year = 78°·0; hottest month, July, mean = 81°·71; coldest month, January, mean = 75°·65; mean yearly fluctuation = 6°·06. Undulations trifling. The climate is limited and equable. At Newcastle, the mean annual temperature is about 66°; hottest month, August = 67°·75; coldest month, February, = 61°. The diurnal range is considerable, but the annual fluctuation is trifling (about 6°). The mean of the year is therefore much lower than on the plains; the amplitude of the yearly fluctuation about the same; the diurnal change greater.

Humidity.—This is considerable in the plains—often from 80 to 90 per cent. of saturation = 7 to 9 grains of vapour in a cubic foot. At Newcastle the mean yearly dew-point is about 60°; the amount of vapour in a cubic foot of air is 5·77; the mean yearly relative humidity is 68 per cent. of saturation.

Rain.—Amount on the plains = 50 to 60 inches, in spring and autumn, viz., April and May, and October and November. Showers in July and August.

Winds.—Tolerably regular land winds at night, and sea breezes during the hot and dry months during the heat of the day. The central chain of mountains turns the north-east trade wind, so that it reaches the south side diverted from its course; from December to February the wind is often from the north, and brings rain and fogs ("wet northers"). The south-east wind in April and May is very moist. The hurricane months are from the end of July to the beginning of November. The climate in the plains is therefore hot, equable, and humid.

Health of the Black Civil Population.

Of the specific diseases, smallpox and the other exanthemata are common.

Spotted typhus is said to be unknown; typhoid is said to be uncommon, but is probably more common than is supposed. Influenza has prevailed at times, and also the so-called dandy or polka. Cholera has prevailed severely. Malarious fever is common over the whole of the south plains. Yellow fever is common, though less frequent and severe among the blacks than the whites. Dysentery is common, though it has always been less frequent than among the troops. Organic heart disease is frequent. Liver diseases are uncommon. Spleen disease, in the form of leucocythæmia, is common among the blacks (Smarda). Gout is said to be frequent, and scrofula and rickets to be infrequent. Syphilis is not common, but gonorrhœa is. Cancroid of the skin and elephantiasis of the Arabs (Pachydermia) are common. Leprosy is also seen.

Health of the Troops.

In the years 1790–93, the annual mortality of the white troops varied in the different stations from 111 (Montego Bay) to 15·7 per 1000 of strength at Stoney Hill (1380 feet above sea level). In the years 1794–97, the mortality was much greater, the most unhealthy regiment in the plains lost 333; the most healthy, 45·4 per 1000 of strength; at the hill station of Maroon Town (2000 feet), the mortality was, however, only 15·6 per 1000. In the years 1817–36, the mean mortality was 121·3; the mean of the four healthiest years gave 67, and of the four unhealthiest years, 259 per 1000. The causes of death in these twenty years was—

Fevers, . . .	101·9	per 1000 of strength.
Lung diseases, . .	7·5	,,
Bowel complaints, .	5·1	,,
Brain disease, . .	2·6	,,
Liver diseases, . .	1	,,
Other complaints, .	3·2	,,
	121·3	,,

The admissions in these years were 1812 per 1000 of strength. In 1837–55, the following were the mean results:—Mortality per 1000 of strength—white troops, 60·8; black troops, 38·2. Admissions, per 1000—white troops, 1371; black troops, 784. So that the mortality had declined one-half. At present, the statistics of the white troops are—

Per 1000 *of Strength.*

Years.	Mortality (including Violent Deaths).	Invalided for Discharge.	Admissions.	Mean Daily Sick.	Mean Time in Hospital of each Sick Man.
1859,	14·42	4·8	1335	58·08	15·88
1860,	20·02	17·7	816·5	23·95	10·71
1861,	9·43	1·57	819	29·87	13·31
1862,	12·81	4·3	644	44·79	15·85
1863,	9·02	13·8	947·6	36·91	14·22

The difference between these figures and those formerly given is indeed most remarkable; the small number of admissions, the small mortality, and the short period in hospital, contrast favourably even with home service. The decrease in admissions is chiefly owing to the lessening of paroxysmal fevers

consequent on removal from the plains; (in 1859, Newcastle gave 29·1 admissions, and Port-Royal 443·5 per 1000 of strength, from malarious disease). In 1863, some white troops were sent to Up-Park Camp, and furnished a large number of malarious cases (547·6 admissions per 1000 of strength), while at Newcastle they were only 48 per 1000. The decrease in the mortality is owing to lessened fever and dysentery. Among the black troops there is now greater sickness and mortality than among the whites; the mortality in 1837–1855, was 38·2 per 1000; in 1860, 31·42; in 1861, 18·65; and in 1862, 30·25 per 1000. There is among these troops a large mortality from paroxysmal fevers, phthisis, and diseases of the alimentary canal, and it is evident that this condition requires a close examination.

The mortality of the white troops shows a marked increase with age.

The following seem to be the most important points connected with the white troops which require notice.

It is impossible to avoid paroxysmal fevers without placing all the troops in the hills, and it is very desirable Newcastle should be made the only station for white troops.

The possibility of yellow fever occurring at an elevation of 4000 feet, was shown by the appearance of yellow fever at Newcastle in 1860. In that year occurred the remarkable instances of contagion on board the ships Icarus and Imaum described by Dr Bryson. Whether yellow fever was imported into Newcastle or not was a subject of discussion; it certainly appears probable that it was carried there; but the important point for us is that mere elevation is not a perfect security. There were, however, only a small number of cases.

In the returns for a number of years past, cases are returned as "continued fever;" it has never yet been clearly made out whether or not these were cases of typhoid fever; but the existence of typhoid fever in India, on the west coast of Africa, in Algeria, and in other tropical countries, makes it possible that typhoid fever does occur in Jamaica.

Formerly there were a large number of cases of phthisis; phthisis is now uncommon; in 1817–36 lung diseases (almost entirely phthisis) caused 7·5 deaths per 1000 of strength, or more than in England. In 1859–60 the ratio was only 2·46 per 1000 of strength, and in 1861, out of 636 men there was not a single death, though four men were sent home with consumption.

In 1862 there was 1 death from phthisis in Jamaica, and 1 in an invalid sent home, or at the rate of 2·85 per 1000 of strength, which is rather greater than formerly, but still below the home standard. In 1863 the number was greater; there were 3 deaths out of 477 men, or 6·28 per 1000 of strength.

At Newcastle there occurred for some years an excess of affections of the alimentary canal, chiefly indigestion; at present these have lessened, but it would be important to make out the cause. In 1860 there was not a single admission from dysentery at any station.

In the worst times in Jamaica it was always remarked that there was rather a singular exemption from acute liver disease; very few cases appear in the returns under hepatitis; whether this is a matter of diagnosis, or whether there was really an immunity compared with India or the Mauritius, is a question of great interest which cannot now be solved. At present, liver disease unconnected with drinking is uncommon.

There is still too much drinking, and the medical officers have strongly advised the issue of beer instead of the daily dram.

Venereal diseases have never prevailed much in Jamaica; they have caused, on an average, from 70 to 90 admissions per 1000 of strength. In 1862 there were only 47 admissions per 1000 of strength. This is owing to the

connection usually formed between the black women and the soldiers, and to a lessened amount of promiscuous intercourse.

Under the present system there seems little chance of the sickness and mortality of Jamaica becoming excessive; but if war came, and it were considered necessary to have a large force there, and the barracks in the plains were reoccupied and overcrowded, the old state of things would at once recur. This seems to be the only danger to be avoided, and probably there would be no military objection to keeping the troops on the hills, unless in the case of the actual presence of a hostile force.

Trinidad.

Strength of garrison, 200 men.

Geology.—Tertiary formation of miocene age; central range of hills is an indurated formation of cretaceous age; the northern littoral range consists of micaceous slates, sandstones, limestones, and shales. The highest hill is 3012 feet; the central hill (Tamana) is 1025; $\frac{1}{17}$th of the island is swampy.

Climate.—Temperature of the plains: Mean of year about 79°·3; coldest month, January = 78°; hottest month, May = 81°·5; next hottest, October = 80°·4. Mean annual fluctuation, 3°·5. The climate is therefore very equable and limited. There are, however, cold winds from the hills blowing over small areas.

Hygrometry.—Mean dew-point, 75°·1, mean relative humidity = 81 per cent. of saturation; mean weight of vapour in a cubic foot = 9·4 grains; most humid month is May, as far as the amount of vapour is concerned. Month with greatest relative humidity, August.

Winds from east to north-east and south-east. West winds rare, and oppressive.

Rain on the Plains about 60 to 70 inches. Greatest rain-fall in one day, 4·67 inches. Dry season, December to May. June and July showery. Heavy rain in August, September, and October.

Sanitary Condition.—St James's Barrack is on a depression on an alluvial soil three miles from Port of Spain, the capital; it is one mile from the Cocorite, and three from the Great Eastern Swamp; the drainage, for many years most defective, is now improved, as the main sewer is carried to the sea. On many occasions yellow fever has prevailed in this barrack, and nowhere else in the island; the last occasion was in 1858–59, and then it was proposed by Dr Jameson (the principal medical officer) to erect barracks on a spot 2200 feet above sea-level.

The capital, the Port of Spain, is built at the principal outfall of the island; it is on a low and unhealthy plain. Formerly, it was so unhealthy as to be scarcely habitable, but after being well drained and paved by Sir Ralph Woodford, it became much healthier. This was the result of great sanitary efforts in a very unpromising locality, and should be a lesson for all climates.

There is still, however, much malarious disease, dysentery, and at times yellow fever, but this last disease has occasionally been very severe at St James's Barracks, without a single case being seen in Port of Spain. The ascent of the malaria from the barrack plain is certainly more than 500, and probably as much as 1000 feet.

Diseases of Troops.—The state of health has been and is very similar to that of Jamaica, with, however, a larger percentage in former years both of phthisis and diseases of the stomach and bowels, chiefly dysentery.

In the years 1817–1836, the average mortality of the white troops was 106·3 per 1000 of strength, and of these deaths there were—

From fevers,	61·6
Lung diseases,	11·5
Diseases of stomach and bowels,	17·9
Dropsies (probably partly malarious, partly renal),	7·7
Brain disease (especially from intemperance),	4·7
Liver diseases,	1·1
All other diseases,	1·8
	106·3

As in Jamaica, the statistics of the white troops of late years tell a very different story.

Per 1000 *of Strength.*

Years.	Mortality from Disease, Suicides and Violence excluded.	Admissions (Total).
1859,	84·27	1452·7
1860,	0	1357·4
1861,	8·88	1079·8
1862,	5·15	1180·4
1863,	16·12	786·2

In 1859 there were only 190 men on the island; yellow fever broke out in St James's Barracks, and caused 10 deaths. There were 4 deaths from delirium tremens and one suicide. Had there been no yellow fever, no drinking, and no suicide, there would have been in 1859 only 2 deaths from disease, or 10·1 per 1000, and both these were from some form of fever.

Among the diseases in the returns, the largest item is malarious fever; there are also cases of "continued fever," as in Jamaica, and this term, in fact, has never been absent from the reports. Is this typhoid fever? A considerable number of cases of dyspepsia are admitted; in 1860 there were 16 cases out of 221 men, or 72 per 1000 of strength. In 1862 there were 103 per 1000 admissions from "digestive" diseases. Venereal diseases have always been low; in 1860, 1861, and 1862 there were only 49·8, 44·4, and 20·6 admissions per 1000 of strength. Dysentery is now infrequent. In 1860, out of 221 men, and in 1861, out of 225 men, there was not a single case. Phthisis is much less common, yet in some years there is still too much of it.

It is evident that if Dr Jameson's suggestion is acted upon, and the troops are removed up to the hills, malarious fever will disappear, and yellow fever can be prevented. In such a case, if the men will abstain from drinking, this island, which formerly killed rather more than 1 man in every 10 yearly, will be one of the healthiest spots in the world.

The black troops are now less healthy than the white, having in 1860 and 1861 an annual mortality of nearly 21 per 1000. Their condition requires looking into.

The invaliding from Trinidad is combined in the Army Reports with that of the other islands of the Windward and Leeward Commands.

Barbadoes.

Strength of Garrison, 500 to 600 men.

Geology.—Limestone (coralline); sandstone (tertiary); beds of bituminous matter and coal (tertiary), clay in parts (especially in the hilly district called "Scotland").

An open country, well-cultivated, no marshes except a small one at Græme Hall, one mile to the east of St Ann's Barracks.

The country is divided into two parts: a mountainous district termed "Scotland," and a lower country consisting of a series of five gigantic terraces, rising with some regularity one above the other. The highest hill is 1100 feet.

Climate of the Plain.—Temperature: Mean of year, 80°; hottest month (October), 83°; coldest month (January), 78°; mean yearly fluctuation, 5°. Climate equable and limited.

Wind.—N.E. trade, strongest in February to May; weak in September to November inclusive; hurricane month, August.

Rain.—About 56 to 58 inches, on an average, but varying a good deal in the autumn chiefly, though there is rain in all months, but much less. The dry season is from December to May.

Water.—Formerly supplied from wells; it was highly calcareous. At present good water is supplied by a water company. Rain water is also collected in tanks.

Sanitary Condition.—St Ann's Barracks are placed above one and a-half mile from Bridgetown, on the sea; the locality and the construction of the barracks have been much complained of, and a position in the hills advised.* Arrangements for sewering and the water supply were both formerly bad; considerable improvements have been made, and, since 1862, 30,000 gallons are supplied daily to St Ann's Barracks. It is a limestone water, containing carbonate of lime, but no sulphate of lime, and is remarkably free from organic matter. The total solids are 18·72 grains per gallon. The troops are still too much crowded in barracks, the allowance being under 600 cubic feet.

Formerly vegetables were very deficient in Barbadoes, and even now there is some difficulty in procuring them. They are often imported from other islands.

Diseases among Civil Population.—Yellow fever has appeared frequently, although the island is not marshy. It is not so frequent as formerly—it used to be expected every four years.

Barbadoes and Trinidad contrast greatly in the freedom from marshes of the one, and the prevalence of marshes and malarious disease in the other; yet Barbadoes has had as much yellow fever as Trinidad.

Dysentery was common formerly, partly from bad water; influenza has been epidemic several times. Barbadoes leg, or Elephantiasis of the Arabs, is frequently seen. Leprosy, or Elephantiasis Græcorum, is also not very uncommon. Variola and Pertussis have from time to time been very bad.

Hillary, in 1766, described a "slow nervous fever," under which term our typhoid fever appears to have been indicated by most writers of that period. His description is not quite clear, but resembles typhoid fever more than any other. He also speaks of "diarrhœa febrilis." Can this have been typhoid? Of late years, there has been no evidence of typhoid to my knowledge.

The heading "continued fever" appears in the Army Returns; from 1817–36, there were 169 cases.

Dracunculus was formerly very frequent, and Hillary attributes it to the drinking water, and states that there were some ponds, the water of which was known to "generate the worm if washed in or drank."

Yaws used to be common.

Colica pictonum was formerly frequent.

Diseases of Troops.—Yellow fever has several times been very fatal.

Scorbutic dysentery, arising from the wretched food, was formerly very frequent, and appears from Sir Andrew Halliday's work to have been very bad even in his time (1823 to 1832).

* For an extremely good and concise account of Barbadoes, see Dr Jameson's Report in the Army Medical Report for 1861, p. 261.

From 1817 to 1836 (20 years)—

Average Mortality (white troops),	58·5 per 1000 of strength.		
Greatest,	204	„	„ (in 1817).
Least,	18	„	„ (in 1823).

In 1817 there were 1654 men on the island, and yellow fever broke out. In 1823 there were only 791.

Of late years, as in all the other islands, the sickness and mortality has been comparatively trifling.

	Per 1000 of Strength. Admissions.	Deaths (exclusive of Suicides).		Per 1000 of Strength. Admissions.	Deaths.
1859,	1051	6·36	1862,	1120	16·77
1860,	1018	5·15	1863,	1106·9	5·2
1861,	974.5	2·54			

The increased mortality of 1862 was owing to yellow fever. It appeared first among the civil population in Bridgetown, and afterwards attacked the troops in the (stone) barracks. As it continued to spread, the men were moved out and placed under canvas, with the best effects. A remarkable feature of this epidemic was that the officers suffered in attacks six-fold more than the men, and had a mortality more than twenty-fold. The women also suffered three-fold more than the men. Formerly the case would have been reversed. In 1861 there were only two deaths out of 787 men, one from phthisis and one from apoplexy.

Dysentery is now uncommon.

The great improvement to be made at Barbadoes is decidely a complete change of barracks. The persistent recurrence of yellow fever in these old barracks, with their imperfect arrangements, shows them to be the main cause of the appearance of the disease. The cost of a single epidemic would amply repay the outlay.

As in the other islands, the black troops are now much more unhealthy than the white, and the sanitary condition of their barracks and their food evidently require looking into.

St Lucia.

Strength of Garrison, = 100 men.

St Lucia is divided into two parts: Basseterre, the lowest and most cultivated part, is very swampy; Capisterre, hilly, with deep narrow ravines, full of vegetation. The climate is similar to that of the other islands, but is more rainy and humid.

Diseases of the Troops.—From 1817–36; average strength, 241; average deaths, 30 = 122·8 per 1000 of strength. Of the 122·8 deaths, 63·1 were from fevers, 39·3 from bowel disease, and 12·5 from lung disease.

Pigeon Island (a few miles from St Lucia) was formerly so unhealthy that on one occasion 22 men out of 55 died of dysentery in one year, and of the whole 55 men not one escaped sickness. The cause is supposed to have been bad water. Now, Pigeon Island is considered healthy.

Although the mortality was formerly so great, St Lucia has been very healthy for some years.

In 1859, mean strength, 96; admissions, 113, and there was not a single death, although, if the mortality had been at the rate of the twenty years ending 1836, 12 men would have died.

Better food, some improvement in barracks, and the use of rain instead of well water, have been the causes of this extraordinary change.

22 men were admitted with "continued fever," 18 with ophthalmia, and only two with venereal.

In 1860 there was no case of dysentery and only two of diarrhœa among 100 men in this island, where formerly there would have been not only many cases, but four deaths. One man died from phthisis, or at the rate of 10 per 1000.

In 1861, out of 94 men, there was one death from jaundice, or at the rate of 10·6 per 1000.

In 1862 there were 88 men on the island; one man was drowned; there was no death from disease. No case of jaundice was admitted.

In 1863 there were 55 men, and one death from accident; there were 64 admissions, of which 15 were accidents.

Invaliding.—In 1859–61 there were discharged from the Windward and Leeward Command 8 per 1000 of strength, and in 1862, 22 per 1000. The cause of the increase in the latter year was chiefly from eye diseases.

British Guiana.

Strength of Garrison, = 200 to 300 men.

This other station in the West Indian Command is on the mainland, extending from the equator (nearly) to 10° N., 200 to 300 miles, and inland to an uncertain distance.

It is a flat alluvial soil of clay and sand, covered with vegetation.

The water is not good; it is drawn from a fresh-water lake and an artesian well; the water from this well contains a good deal of iron.

Trade-winds from N.E. and E. for nine months. In July, August, and September, S.E. and S. and land-winds. This is the unhealthy season.

Two wet seasons, January and June; the last is the longest.

Temperature of summer, 86°; of winter, 82°. Rain about 160 inches.

Formerly there was an enormous mortality among the troops from yellow fever and scorbutic dysentery. The men used to have salt meat five times a-week.

The climate is most highly malarious, but this does not cause much mortality.

Yellow fever has prevailed here several times. On the last occasion, 1861, the troops were moved out and encamped at some distance from Georgetown; they escaped (seven mild cases only), although they were on a swampy plain.

In 1817–36, the average deaths were 74 per 1000 of strength.

In 1859, out of a mean strength of 143, there were 156 admissions = 1091 per 1000 of strength; 2 deaths = 13·9 per 1000 of strength. One death from apoplexy, one from drowning. The deaths from disease were only 6·9 per 1000. Of the 156 admissions, no less than 81 were from malarious disease, or at the rate of 519 per 1000 of strength, or nearly one-half the total admissions.

In 1860, 1861, and 1862, the admissions from malarious disease continued high (673, 1380, and 1104 per 1000 of strength), the mortality was very small, being only 6·6 per 1000 in each year; in fact, the single death in 1860 and in 1861 was in one year from "acute hepatitis," and in the other from accident. In 1862, in spite of the immense malarious disease, there was no death. In 1863, there was a great reduction in the admissions from malarious disease; there were only 51 admissions among 133 men, or 377 per 1000 of strength. There was no death in that year. Some important lessons are drawn from the medical history of this station. It has been shown that even in a high malarious country yellow fever is not common, and that it may be escaped by change of ground, although the men are still obliged to encamp on a swamp. Another remarkable point is the very small mortality attending the paroxysmal fevers. It would be very interesting to know the future history of such men, but it cannot be doubted that the lessened mortality since former years must be owing to better treatment.

The extent of malarious disease shows how desirable it would be to avoid sending white troops to Demerara, or, if this cannot be avoided, to change the men every year, and, during their service, to use quinine as a prophylactic regularly.

In French Guiana, Dr Laure, besides malarious fevers, describes typhoid fever to have been seen for some short time after the arrival of French political prisoners after the *coup d'état* of 1851. It then disappeared.

Bahamas and Honduras.

The black troops garrison both those places, and show a degree of mortality nearly the same as in the other stations, the amount of phthisis being very great. In 1862, at the Bahamas, there were no less than 4 deaths out of a strength of 439, or at the rate of 9·1 per 1000 of strength; there were also 3 deaths from pneumonia and 1 from pleurisy. Out of 27·31 deaths per 1000 of strength, no less that 18·2 (or 66 per cent. of total deaths) were from phthisis and other lung diseases. This is evidently a matter for careful inquiry.

At Honduras, among the black troops, the deaths from tubercular disease, in 1862, were 3·26 per 1000 of strength.

SECTION III.

BERMUDA.

Usual strength of garrison about 1100 to 1300 men.

Climate.—Hot, equable, and rather limited.

Temperature.—Mean of year, 74°; hottest month (July), 83°·5; coldest month (February), 64°·5; amplitude of yearly fluctuation, 19°·0.

The sanitary condition is very bad; there are no sewers, and no efficient dry method removal. Rain water is used for drinking.

Diseases of the Troops.

Years.	Loss of Strength per 1000 of Strength.		Loss of Service per 1000 of Strength.		
	Deaths, all kinds.	Invaliding.	Admissions.	Daily Sick.	Days in Hospital to each Sick Man.
1817–36, . .	28·8	...	768	...	...
1837–46, . .	35·5	...	1080	...	...
1859, . . .	11·16	...	537	35·11	23·75
1860. . . .	8·55	6·6	752	39·01	18·94
1861, . . .	13·86	8·9	461·4	24·75	19·58
1862, . . .	11·75	8·63	767·0	29·80	14·18
1863, . . .	11·10	...	684	31	14·11

This history of the West Indies may be applied to Bermuda, though, with the exception of yellow-fever years, it never showed the great mortality of the West Indies. There is no great amount of paroxysmal fevers; in ten years (1837–46) there were only 29 admissions out of an aggregate strength of 11,224 men.

Yellow fever has prevailed eight or nine times in two centuries.

In 1819 it destroyed ¼th of the force.
„ 1837 it appeared but did not spread.
„ 1843 it destroyed ⅐th of the force.
„ 1847 it caused a large mortality.
„ 1853 „ „
„ 1856 „ „
„ 1864 „ „

The history of the yellow fever in 1864 is given in detail by Dr Barrow.*

The total mortality was 14 officers, 173 men, 5 women, and 4 children. The deaths to strength were, among the officers, 18·9, and among the men, 14·9 per cent. This was owing to a large number of deaths among the medical officers.

The town of St George's in Bermuda presents every local condition for the spread of yellow fever; the town is quite unsewered; badly supplied with water; badly built.

"Continued fevers" (no doubt in part typhoid) have always prevailed more or less at Bermuda. In the ten years (1837–46) they gave 1004 admissions out of 11,224 men, or 88 per 1000 of strength, being much greater than at home.

In 1859 there were only 11 cases of "continued fever" out of 1074 men; but in 1860 "continued fever" prevailed severely (209 cases in 1052 men). It was of a mild type, and caused little mortality. It was probably not typhoid, but I have learned nothing definite of its nature. It prevailed in September, October, and November. Was it mild, bilious, remittent, or "relapsing fever?" It is said that the drainage was defective at Hamilton.

Formerly tuberculous diseases caused a considerable mortality. In the years 1817–36, diseases of the lungs gave a mortality of no less than 8·7 per 1000 of strength. In 1837–46, the lung diseases gave a yearly mortality of 8·3 per 1000 of strength. Of late years the amount has decreased. The admissions and deaths were 7·3 and 2·55 per 1000 in 1859–60, and 11 and ·78 per 1000 in 1862.

Diarrhœa and dysentery were also formerly very common, but of late years there has been a great decrease. Diseases of the eyes are common.

There has always been much intemperance, and a large number of deaths from delirium tremens.

Venereal (enthetic) diseases have averaged from 55 to 80 per 1000 of strength.

In considering the sanitary measures to be adopted at Bermuda, it would seem that drainage and ventilation are still most defective, and that means should be taken to check intemperance. If yellow fever occurs, the measures should be the same as in the West Indies.

* Army Medical Report, vol. v. p. 290.

SECTION IV.

AMERICAN STATIONS.

Sub-Section I.—Canada.*

Usual garrison, from 3000 in profound peace, to 10,000 or 12,000 in disturbed times. In 1862, it was 10,763; in 1863, it was 10,764.

Lower Canada.

Chief Stations.—1. *Quebec.*

Temperature.—Mean of year, 41°; hottest month (July), 71°·3; coldest (January), 11°. Annual fluctuation, 60°·3.

The undulations of temperature are enormous. In the winter, sometimes, there is a range of 30, 40, and even more degrees in 24 hours, from the alternation of northerly and southerly winds. In one case the thermometer fell 70° in 12 hours. The mercury is sometimes frozen.

The mean temperature of the three summer months is 69°; winter months, 12°·8. The climate is "extreme" and variable.

Rain.—About 36 to 40 inches. The air is dry in the summer, and again in the depth of winter.

Barracks.—Built on lower Silurian rocks. No ague is known, though the lower town is damp.

Amount of cubic space small. Casemates in citadel very bad, damp, ill ventilated, ill lighted.

2. *Montreal.*

Temperature.—Mean of year, 44°·6; hottest month (July), 73°·1; coldest (January), 14°·5. Annual fluctuation, 58°·6. The undulations are very great, though not so great as at Quebec.

Mean of the three summer months, 70°·8; of the three winter months, 17°.2.

Rain.—36 inches to 44 inches.

Barracks.—Bad; very much over-crowded.

In Lower Canada are also many smaller stations.

Upper Canada.

Chief Stations.—1. *Toronto*

Temperature.—Mean of year, 44°·3; hottest month (July), 66°·8; coldest (February), 23°·1. Difference, 43°·7. Great undulations.

Rain.—31·5 inches.

The town stands on ground originally marshy. The new barracks are built on limestone rocks of Silurian age. Average cubic space, only 350. Drainage bad.

Intermittent fevers among the civil population; not very prevalent among the troops.

2. *Kingston.*

Temperature.—Mean of year, 45°·8.

Malarious.

London, Hamilton, and several smaller stations—Fort George, Amherstberg, &c.—are also occupied.

* For an excellent account of the Canadian stations, see Dr Muir's Report on the Army Medical Report for 1862, p. 375.

Diseases of the Civil Inhabitants.

Formerly ague was prevalent in Upper Canada, especially in Kingston; it is now much less. At Montreal ague used to be seen; now is much less frequent. It prevails from May to October, and is worst in August.

If the isothere (summer temperature) of 65° be the northern limit of malaria, both Quebec and Montreal are within the limit; yet the winter is too severe, and the period of hot weather too short, to cause much development of malaria.

The climate is in both provinces very healthy, and has been so from the earliest records, though, when the country was first settled, there was much scurvy.

Typhoid is sometimes seen.—Typhus has been often carried in emigrant ships, but has not spread, or at least has soon died out.—Cholera has prevailed.—Yellow fever dies out.—Consumption is decidedly infrequent.

Acute pulmonary diseases used to be considered the prevalent complaints, but it is doubtful whether they are much more common than elsewhere.

Diseases of the Troops.

Years 1817–36 (20 years)—Admissions per 1000 of strength = 1097; deaths, 16·1.

Admissions and deaths per 1000 *per annum of the* 1097 *admissions and* 16·1 *deaths.*

	Admissions.	Deaths.
Fevers, intermittent and "common, continued,"	214	2·4
Diseases of lungs,	148	6·7
Diseases of stomach and bowels,	155	1·3
Venereal diseases,	99	...
Abscesses,	109	...
Wounds and injuries,	162	...
Punished,	32	...
Diseases of the eyes,	45	...

Years 1837–46 (10 years).—Yearly admissions per 1000 of strength, 982; average daily sick per 1000 of strength, 39·1; mortality (violent deaths excluded), 13; mortality with violent deaths, 17·42.

The mortality (17·42) was made up in part of—fever, 2·13; lung disease, 7·44; stomach and bowels disease, 1·11; brain disease, 1·28. Nearly two-thirds of the fevers are returned as "common continued," probably typhoid.

Venereal admissions, 117 per 1000.

Erysipelas was epidemic at Quebec, Montreal, and Toronto in 1841; at Montreal in 1842, from bad sanitary conditions.

The number of days' service lost per man in 1859–62 was only 10, or little more than half the amount on home service. It will be observed (See Table p. 551) that there is a greater discrepancy between the admissions (which are few) and the mortality in Canada than in almost any station. This arises from the violent deaths having been large in 1861 and 1862, a good many men being drowned in the latter year, and from the fatal diseases—phthisis and continued fever—causing a small number of admissions.

If these two diseases could be prevented, Canada would be in all respects remarkably healthy. It is to be observed, however, that erysipelas sometimes

prevails, an indication (like the "continued fever") of a bad sanitary condition.

Years 1859–63.

Years.	Loss of Strength per 1000.		Loss of Service per 1000.		
	Deaths, (all causes).	Invaliding.	Admissions.	Mean daily sick.	Days in Hospital to each sick man.
1859,	10·42	7·91	545	28·27	18·93
1860,	10·33	14·7	539	30·08	20·36
1861,	9·42	13·68	597	27·12	16·59
1862,	8·36	14·21*	667	28·06	15·36
1863,	9·57	14·40*	680	31·49	16·91

Causes of Mortality.

In 100 deaths, the percentage of the different causes was as follows:—

Causes of Death in order of Fatality.	In 100 Deaths.				
	1859.	1860.	1861.	1862.†	1863.
Violent deaths,	11·11	13·64	36·36	29·10	24·0
Phthisis,	18·51	22·73	9·10	10·13	14·58
Brain diseases (including delirium tremens),	14·81	9·10	15·15	12·65	15·62
"Continued fever,"	14·81	...	6·06	7·59	6·25
Pneumonia,	11·11	13·64	6·06	6·35	7·29
Bronchitis,	14·81	4·54	3·03	3·80	1·04
Diseases of organs of circulation,	...	18·19	6·06	6·35	13·53
Diseases of digestive sytem,	...	4·54	3·03	6·35	4·17
Drunkenness,	3·71	4·54	3·03	1·26	2·08
Suicides,	...	...	3·03	3·80	3·12
Pleurisy and Empyema,	...	...	3·03	2·53	2·08
Erysipelas,	3·71	...	...	1·26	2·08
Rheumatism,	3·71	...	...	1·26	...
Remittent fever,	...	...	...	2·53	...
Laryngitis,	...	...	...	1.26	...
Asthma,	...	...	3·03	...	...
Anthrax,	...	4·54	...	...	...
Scarlet fever,	...	4·54	...	...	...
Diphtheria,	...	...	...	1·26	...
Diabetes,	...	...	3·03	...	...
Stricture of urethra,	...	...	...	1·26	...
Integumentary abscess,	...	...	...	1·26	...
Kidney disease,	...	...	...	...	3·12
Dysentery (acute),	...	...	...	...	1·04
	100·00	100·00	100·00	100·00	100·00

* These numbers are taken from the tables in Dr Balfour's Report, and include both those sent home for discharge and for change of air.

† One execution not included.

This table shows that this plan of reckoning the percentage of any cause of death, although useful as a guide, must not be pushed too far. The percentage of phthisis, for example, contrasts very favourably in this table, for the years 1861 and 1862, especially, with similar tables on home service, but this arises in part from the immense preponderance of violent deaths in Canada in those years, which reduces the proportionate number of deaths from phthisis. Still the returns as regards phthisis are very favourable. Calculated on the strength, the deaths from tubercular diseases and hæmoptysis in 1859–1861 (inclusive), and in 1862, were in Canada itself 1·54 and 1·3 per 1000 of strength. There were, however, in the last-named year, 19 tubercular patients sent home for discharge, and 17 for change of air; adding these together it gives us for 1862 :—

Mortality per 1000 of strength—Tubercular diseases,	.	1·3
Invaliding per 1000 of strength, „ „	.	3·33
Total,	.	—— 4·63

If the tables for home service (p. 511) are looked at, it will be seen that Canada is thus much better as regards phthisis than home service. This may, in fact, arise from phthisical men being kept at the depots; it is a matter, however, which is well worthy of perfect inquiry.

With regard to pneumonia and bronchitis, the following table gives the results for five years :—

Mortality per 1000 *of Strength.**

Years.	Canada.		England.	
	Pneumonia.	Acute Bronchitis.	Pneumonia.	Acute Bronchitis.
1859,	1·070	·719	·527	·350
1860,	1·400	·469	·736	·338
1861,	·570	·285	·552	·306
1862,	·464	·278	·447	·276
1863,	·650	·092	·423	·240
Mean,	·831	·368	·537	·302

It is therefore by no means certain that in the cold climate of Canada soldiers have much greater mortality from pneumonia and acute bronchitis than at home; in fact, it seems probable that there is no very great difference, though we must remember that the period of observation is yet but limited. The latest observations in Russia also seem to make it very doubtful if pneumonia be, as usually supposed, a more common disease in cold than temperate climates. Exposure without protection to the cold winter winds does, however, seem to induce a rapid and fatal congestion of the lungs.

The great healthiness of Canada in part probably depends on the fact, that the extreme cold in winter lessens or prevents decomposition of animal matter and the giving off of effluvia; hence, in spite of bad drainage and deficient water, there is no great amount of fever. In the hot summer, the life is an open air one. Even in winter the dry cold permits a good deal of exercise to be taken.

The amount of drunkenness and delirium tremens in Canada used to be

* Calculated on the numbers, given in the tables in the Appendix to Dr Balfour's Reports in the Army Medical Reports.

great, and is still so considerable as to show that something should be done to check it. In 1863, no less than 9 out of 96 deaths, or nearly $\frac{1}{10}$th, were caused by delirium tremens.

Sub-Section II.—Nova Scotia and New Brunswick.

Strength of garrison, 1500 to 4000 men.

The state of health at these stations is almost identical with that of Canada, and it is hardly necessary to do more than cite the figures of the earlier and later years.

Per 1000 *of Strength.*

Years.	Admissions.	Mortality.		Number constantly Sick.	Days in Hospital to each Sick man.
		Without Violent Deaths.	With Violent Deaths.		
1837–1856, .	836	15·1	15·3	34·8	...
1859, .	558	7·23	...	22·39	14·65
1860, .	590	3·35	5·17	30·10	18·62
1861, .	586·7	6·95	7·53	24·34	15·15
1862,* .	586·0	7·77	8·63	26·74	16·66
1863, .	561	5·15	8·06	24·87	16·19

Taking the year 1862, the average loss of service to each soldier was 8·89 days; in 1863, almost the same.

The remarks already made in respect of Canada apply to Nova Scotia. Continued fever (typhoid) causes some mortality every year, and should be prevented. Drunkenness and delirium tremens are less common than they were, but still prevail too much.

Sub-Section III.—Newfoundland.

Garrison about 200 to 300.

Newfoundland has had the reputation of being extremely healthy ever since it has been garrisoned, or even frequented by sailing ships (Lind). Among the troops, the Colonial Battalion (now disbanded) has had remarkable health, and if drunkenness had been avoided, it would have been almost unexampled.

In 1837–56 (twenty years) the average yearly admissions per 1000 were 689, and the deaths 11.

In 1859–62 the admissions were 980, and the deaths 6·72 per 1000, or much below the home standard in men of the soldier's age. At present Newfoundland is garrisoned by the Canadian Rifles, who are younger men than the men of the old colonial corps (the Royal Newfoundland Companies).

In 1863 there was only 1 death out of 318 men, or at the rate of 3·15 per 1000 of strength.

The causes of sickness and mortality are the same as those in Canada.

Sub-Section IV.—British Columbia.

Garrison, 100 to 150 men.

New Westminster is to be the capital. Lat. 49° 12′; long. 122° 49′.

Soil.—Gravel, sand, and clay.

* Of the permanent force; not of troops *en route*.

Climate.—The temperature of the hottest month, August, mean 69°·4; coldest month, January, mean 35°·7; mean yearly range, 33°·7.*

Rain, 56·42 inches, on 152 days. Relative humidity, 90·8 in December; in June 65 per cent. of saturation.

Strength, 142; admissions into hospital, 115, of which 25 were from influenza, 6 from rheumatism—acute and chronic. Deaths 5; of which 4 were from accidents, and 1 from "encephalitis."

In 1861, in a force of 130, there were 97 admissions (22 catarrh (like, but not true influenza), 22 venereal, and 24 injuries), and one man frozen to death.

In 1862, in a strength of 160, there were 90 admissions (28 accidents, 24 sore throat, 19 diarrhœa, and 8 gonorrhœa), and one death from dropsy in an intemperate man.

In 1863 the deaths from disease were only 3·04 per 1000 of strength.

No measles, scarlatina, hooping-cough, or other zymotic diseases have yet been seen in the colony among the children.

It is probable, then, this colony will be found to be, like Canada, a very healthy one; in fact, out of the malarious range, America seems remarkably healthy.

SECTION V.

AFRICAN STATIONS.

Sub-Section I.—St Helena.

Garrison, 500 to 700.

Until very lately this small island has been garrisoned by a local corps (St Helena Regiment). This system is now altered, and a West India Regiment now serves in the island for three or four years.

The island has always been healthy; seated in the trade-winds, there is a tolerably constant breeze from south-east. There is very little malarious disease (about 50 to 60 admissions per 1000 of strength), but there has frequently been a good many cases of "continued fever," and dysentery and diarrhœa are usual diseases. Formerly there appears to have been much phthisis, but this is now much less, giving another instance of the real or apparent decline of this disease as in so many stations.

In the years 1837–46, the admissions from tubercular diseases averaged 21 per 1000 per annum, and the deaths 5·45. In 1859 the admissions were only 6·45, and there were no deaths. In 1860 there were 6·5 admissions, 4·34 deaths per 1000 from tuberculosis. In 1862 there were no admissions, but 2·87 deaths per 1000 from tuberculosis in men out of hospital. In the years 1859–62 the admissions from all causes were 880, and the deaths 11·28, or without violent deaths, 9·11 per 1000. In 1863 there were 822 total admissions, and 8 deaths per 1000 of strength. The health of the troops would have been even better if the causes of the continued fever and dysentery could have been discovered and removed, and if the amount of drunkenness had been less.

Sub-Section II.—West Coast of Africa.†

The principal stations are Sierra Leone, Gambia, Cape-Coast Castle, and Lagos (500 miles from Cape-Coast Castle, occupied first in 1861).

* From Dr Seddall's paper in the Army Medical Report for 1859.

† For a very good account of the topography of the Gold Coast, see Dr R. Clarke's paper in the "Transactions Epid. Society," vol. i.

Sierra Leone.

Strength of garrison, 300 to 400 (black troops). Hot season from May to the middle of November; Harmattan wind in December; soil, red sandstone and clay, very ferruginous. There are extensive mangrove swamps to N. and S. Water very pure. The spring in the barrack square contains only 3 to 4 grains per gallon of solids.

This station had formerly the reputation of the most unhealthy station of the army. Nor was this undeserved.

From 1817 to 1837 (20 years), there were yearly among the troops—

Admissions, ...	2978 per 1000.
Deaths, ...	483 „

At the same time, about 17 per cent. of the whole white population died annually.

The chief diseases were malarious fevers, which caused much sickness, but no great mortality; and yellow fever, which caused an immense mortality. Dysentery, chiefly scorbutic, was also very fatal.

The causes of this great mortality were simple enough. The station was looked upon as a place for punishment, and disorderly men, men sentenced for crimes, or whom it was wished to get rid of, were draughted to Sierra Leone. They were there very much over-crowded in barracks, which were placed in the lower part of the town. They were fed largely on salt meat; and being for the most part men of desperate character, and without hope, they were highly intemperate, and led, in all ways, lives of the utmost disorder. They considered themselves, in fact, under sentence of death, and did their best to rapidly carry out the sentence.

Eventually, all the white troops were removed, and the place has since been garrisoned by one of the West Indian regiments. Of late years, the total white population of Sierra Leone (civil and military) has not been more than from 100 to 200 persons.

The great sickness and mortality being attributable, as in so many other cases, chiefly to local causes and individual faults, of late years Europeans have been comparatively healthy; although from time to time fatal epidemics of yellow fever occur. They are, however, less frequent and less fatal than formerly. The position of the barracks has been altered, and the food is much better. One measure which is supposed to have improved the health of the place, is allowing a species of grass (Bahama grass) to grow in the streets. The occupiers of the adjacent houses are obliged to keep it cut short, and in good order.

Among the black troops, the returns of the four years 1859–1862 gave 740 admissions and 29·53 deaths (or 27·42, exclusive of violent deaths) per 1000. Among the causes of death, tubercular diseases hold the first place, amounting to 7·74 per 1000 of strength, or to 27·2 per cent of the total deaths from disease. In 1862, phthisis amounted to no less than 12·6 per 1000 of strength, and constituted 43·7 per cent. of all deaths from disease. There were also 9·46 per 1000 of strength deaths from pneumonia. In 1863, the deaths from phthisis were 9·3 per 1000 of strength, and made up 36·3 per cent. of the total deaths. It seems clear, indeed, that in all the stations of the West India corps (black troops), the amount of phthisis is great; in fact, the state of health generally of these regiments requires looking into, as in the West Indies.

In 1862, there were only five cases of intermittent, and eighteen of remittent fever among 317 negroes.

In 1861, some of the troops from Sierra Leone and the Gambia were employed up the Gambia against the Mandingoes, and also against the chiefs of Quiat. In 1863 and 1864 the Ashanti war prevailed. All these wars added to the sickness and mortality, so that these years are not fair examples of the influence of the climate. In 1863, there were 1125·6 admissions, and 25·59 deaths per 1000 of strength.

Gambia.

Garrison, about 200 to 400 (black troops). This station is much more malarious than any of the others. The drinking-water is bad; all barrack and sewage arrangements imperfect. Yellow fever from time to time is very destructive. In 1859, two out of four European sergeants, and in 1860, three medical officers, died of yellow fever.

As at Sierra Leone, phthisis and other diseases of the lungs cause a large mortality. In 1861, phthisis gave five deaths out of a strength of 431, or at the rate of 11·6 per 1000 of strength; and pneumonia gave four deaths, and acute bronchitis three, or (together) at the rate of 16·24 per 1000 of strength. Phthisis, pneumonia, and bronchitis gave nearly 60 per cent. of all deaths from disease. This was higher than in previous years; but in 1862, phthisis gave 14·35 deaths per 1000 of strength, and constituted 75 per cent. of the whole number of deaths! There was, however, no pneumonia or bronchitis in that year. In 1863, however, there were no deaths from phthisis. Although the period of observation is short, it can hardly be doubted that here, as elsewhere in the stations occupied by the West Indian regiments, some causes influencing the lungs prejudicially are everywhere in action. It is probably to be found in bad ventilation of the barracks.

Among the few white residents at the Gambia, diarrhœa, dysentery, and dyspepsia appear to be common. These, in part, arise from the bad water; in part from dietetic errors (especially excess in quantity), and want of exercise and attention to ordinary hygienic rules.

Cape-Coast Castle (Gold Coast).

Garrison, 300 to 400 (black troops).

This station has always been considered the most healthy of the three principal places. It is not so malarious as even Sierra Leone, and much less so than the Gambia, and has been much less frequently attacked with yellow fever. Dysentery and dyspepsia are common diseases among the white residents. Among the black troops the prevalence of phthisis, pneumonia, and bronchitis is marked, though less so, perhaps, than at the other two stations.

One peculiarity of the station is the prevalence of dracunculus. This is uncommon on Sierra Leone, and at the Gambia. It is, on the other hand, very frequent at Cape-Coast Castle.

Admissions from Guinea-Worm, per 1000 *of Strength.*

Garrisons.	1860.	1861.	1862.	1863.
Sierra Leone, . .	2·6	...	...	11·62
Gambia, . . .	...	...	...	...
Cape-Coast Castle, .	246	285	115	12·8
Lagos, . . .	...	...	38	...

The investigation of the cause of dracunculus at Cape-Coast Castle is one which would well repay the trouble, so abundant is the material of observation; it would probably clear up the still doubtful points on the mode of ingress.*

The following table shows the mean admissions and discharges for four years, 1859–62 :—

Black Troops.

Garrisons.	Admissions per 1000 of Strength.	Deaths per 1000.	
		From Disease.	Including Violent Deaths.
Sierra Leone, .	740	27·42	29·53
Gambia, . .	978	31·43	33·74
Cape-Coast Castle,	624	20·01	26·45
Lagos (1862), .	1885	28·57	...

Hygiene on the West Coast.

There is no doubt that attention to hygienic rules will do much to lessen the sickness and mortality of this dreaded climate. In fact, here as elsewhere, men have been contented to lay their own misdeeds on the climate. Malaria has, of course, to be met by the constant use of quinine during the whole period of service. The other rules are summed up in the following quotation from Dr Robert Clarke's paper;† and when we reflect that this extract expresses the opinion of a most competent judge on the effect of climate, we must allow that, not only for the West Coast, but for the West Indies, and for India, Dr Clarke's opinions on the exaggeration of the effect of the sun's rays and exposure to night air, and his statement of the necessity of exercise, are full of instruction :—

"Good health may generally be enjoyed by judicious attention to a few simple rules. In the foremost rank should be put *temperance*, with regular and industrious habits. European residents on the Gold Coast are too often satisfied with wearing apparel suited to the climate, overlooking the fact that exercise in the open air is just as necessary to preserve health there as it is in Europe. Many of them likewise entertain an impression that the sun's rays are hurtful, whereas in nine cases out of ten the mischief is done, not by the sun's rays, but by habits of *personal economy*. Feeling sadly the wearisome sameness of life on this part of the coast, recourse is too frequently had to stimulants, instead of resorting to inexhausting employments, the only safe and effectual remedy against an evil fraught with such lamentable consequences. Europeans also bestow too little attention on ventilation, far more harm being done by close and impure air during the night than is ever brought about by exposure to the night air.

"Much of the suffering is occasioned by over-feeding." (P. 124.)

Sub-Section III.—Cape of Good Hope.

Garrison, 4000 to 6000 men, chiefly Europeans.

The chief stations are Cape Town, Grahams Town, King William Town; Port Elizabeth, Algoa Bay, and several small frontier stations. At Natal there is also a small force. The climate is almost everywhere good; the temperature is not extreme nor very variable; the movement of air is considerable.

* For anybody interested in the investigation of the anatomy of the dracunculus, Dr Bastian's paper in the Linnean Transactions (1863) can be recommended.

† Trans. of the Epidem. Soc. vol. i. pp. 123, 124.

At Cape Town the mean annual temperature is 67°, with a mean annual range of about 38°.

	Loss of strength yearly per 1000.		Loss of service yearly per 1000.		Number of days
	Deaths, all kinds.	Invaliding.	Admissions.	Mean daily Sick.	to each Sick man.
1859–61,	11·28	15	876·2	46·72	19·89
1862,	9·73	16·2	864	44·7	18·88
1863,	11·14	17·58	841	45·84	19·89

Malarious diseases are very uncommon. "Continued fevers" (probably typhoid) are seen and are rather common, though not very fatal. In 1859–61 they gave a mortality of 1·2 per 1000, and in 1862 of 1·11 per 1000 of strength. In the earlier periods dysentery and diarrhœa were very common; they are now less so; in many cases, especially in the small frontier stations, they were clearly owing to bad water.

Ophthalmia has prevailed rather largely, especially in some years; there is a good deal of dust in many parts of the colony, and it has been attributed to this; the disease is probably the specific ophthalmia (grey granulations), and is propagated by contagion. Whether it had its origin in any catarrhal condition produced by the wind and dust, and then became contagious, is one of those moot points which cannot yet be answered (see page 467).*

The Cape has always been noted for the numerous cases of rheumatism and cardiac disease, and a good monograph on this subject is much wanted. The prevalence of this affection has been attributed to the exposure and rapid marches in hill districts during the Kaffir wars. In 1863 there was, however, less rheumatism than usual.

Taking the years 1859–62, as expressing tolerably fairly the effect, *per se*, of the climate, we find that the whole colony gave twenty-two admissions and 1·58 deaths per 1000 of strength from diseases of the circulation. This is certainly somewhat greater than at any other station during these years, as will be seen from the following table:—

Diseases of the Circulatory Organs.†

	Admissions per 1000 of strength.	Deaths per 1000 of strength.
Home,	9	·73
Gibraltar,	6	·64
Malta,	5	·51
Canada,	3	·73
Windward and Leeward Command,	4	·81
Jamaica,	6	·78
Mauritius,	11	·56
Ceylon,	17	·83
Australia and Tasmania,	13	2·34
New Zealand,	7	·98
Bengal Presidency,	10	·62
Madras Presidency,	15	1·27
Bombay Presidency	12	·53

It seems therefore probable that there is an excess of cardiac cases at the Cape, especially as we find that the number invalided for such affections is large. (*Statistical Report* for 1862, p. 94.)

Scurvy has prevailed a good deal at the Cape, especially in some of the

* Dr Lawson has published a memoir on this subject (Army Medical Report, vol. v. p. 338), to which reference may be made.

† Copied from a paper of Dr Balfour.

Kaffir wars. Venereal diseases are common, and in some years have given admissions equal to 250 per 1000 of strength; the average is about 190 per 1000. The Cape has always been considered a kind of sanitarium for India. Its coolness and the rapid movement of the air—the brightness and clearness of the atmosphere, and the freedom from malaria, probably cause its salubrity. It has been supposed that it might be well to send troops to the Cape for two or three years before sending them on to India. This plan has, I believe, never been perfectly tried, but in the case of regiments sent on hurriedly to India on emergency, it has been said that the men did not bear the Indian climate well. Probably they were placed under unfavourable conditions, and the question is still uncertain.

As a convalescent place for troops who have been quartered in a malarious district it is excellent.*

SECTION VI.

MAURITIUS.

Garrison, about 1500 to 2000 men.

Mauritius in the eastern, has been often compared with Jamaica in the western seas. The geographical position as respects the equator is not very dissimilar; the mean annual temperature (80° Fahr.) is almost the same; the fluctuations and undulations are more considerable, but still are not excessive; the humidity of air is nearly the same, or perhaps a little less; the rain-fall (66 to 76 inches) is almost the same; and the geological formation is really not very dissimilar. Yet, with all these points of similarity in climatic conditions, the diseases are very different.

Malarious fever is not nearly so frequent as in Jamaica, and yellow fever is quite unknown; Mauritius, therefore, has never shown those epochs of great mortality which the West Indies have had. Hepatic diseases, on the other hand, which are so uncommon in the West Indies, are very common in the Mauritius. For example, in 1859 there were 47 cases of acute and chronic hepatitis in 1254 men, while in Jamaica there was 1 case out of 807 men. In 1860 there were 31 admissions from acute hepatitis out of 1886 men; in Jamaica, there was not a single case. In 1862 there were 12 cases of acute, 11 of chronic hepatitis, and 72 cases of hepatic congestion out of 2049 men; in Jamaica, in the same year, there was only 1 case of acute hepatitis out of 702 men. This has always been marked; is it owing to an error in diagnosis, or to differences in diet? It can scarcely be attributed to any difference in climate. In 1863 the difference was less marked, but was still evident.

In the Mauritius, as in Jamaica, a "continued fever" is not uncommon; this is now being returned in part as typhoid. It has occasionally been imported. Dysentery and diarrhœa have largely prevailed, but are now becoming less frequent, though still in too great amount. In this respect Jamaica now contrasts very favourably with the Mauritius; thus, in 1860, there were altogether 213 admissions per 1000 of dysentery and diarrhœa, and 6·8 deaths per 1000; in Jamaica, in the same year, there was not a single admission from dysentery, and only 19 from diarrhœa among 594 men, and no death. Cholera has prevailed five times (first in 1819; not afterwards till 1854; then again in 1856, 1859, and 1861. It appears to have been imported in all these cases). Formerly there was a large mortality from lung diseases; now, as in Jamaica, this entry is much less, not more than half that of former days. The deaths from phthisis per 1000 of strength were, in 1860, ·521;

* See effect on the 59th Regiment in the Army Medical Report for 1859, p. 99.

in 1861, 1·03; in 1862, 1·94 (but in this year 11 men were invalided for phthisis); and in 1863, 2. Venereal (enthetic) diseases give about 100 to 120 admissions per 1000 of strength. Ophthalmia prevails moderately; to nothing like the same extent as at the Cape.

In the earlier periods, owing to the absence of yellow fever, the mortality of the Mauritius contrasted favourably with that of Jamaica, but now it is rather greater.

Per 1000 *of Strength.*

Years.	Loss of Strength.		Loss of Service.		
	Mortality (all Causes).	Invaliding.	Admissions.	Mean Daily Sick.	Days in Hospital to each Sick Man.
1817–36,	30·5	...	1249	68	20
1837–56,	24	...	909	...	...
1859,	16	...	1237	48·76	14·39
1860,	23·86	11·13	1119	44·83	14·62
1861,	11·97	4·2	608	25·51	15·31
1862,	43·92	19·5	822	31·72	14·77
1863,	13·10	18·71	651	36·40	20·40

The large mortality in 1862 was owing to epidemic cholera, and partly to the arrival of troops who had served in China, and were in bad health.

For the means to be adopted for lessening the amount of "continued fever," dysentery, diarrhœa, and hepatitis, see chapter on the prevention of these diseases (p. 458.)

SECTION VII.

CEYLON.*

Garrison, 800 to 900 white troops, 1200 to 1500 black troops. Population, 1,800,000, including nearly 5000 Europeans. The stations for the white troops are chiefly Galle, Colombo, Kandy, and Trincomalee, with a convalescent station at Newera Ellia (6200 feet above sea-level). The black troops are more scattered, at Badulla, Pultan, Jaffna, &c.

Geology.—A considerable part of the island is composed of granite, gneiss, and hornblende granite rocks; these have become greatly weathered and decomposed, and form masses of a conglomerate called "cabook," which is clayey like the laterite of India, and is used for building. The soil is derived from the débris of the granite, is said to absorb and retain water eagerly. In some parts, as at Kandy, there is crystalline limestone.

Climate.—This differs of course exceedingly at different elevations. At Colombo, sea-level, the climate is warm, equable, and limited. Mean annual temperature about 81°. Mean temperature—April, 82°·70; January, 78°·19; amplitude of the yearly fluctuation = 4°·51. April and May are the hottest months; January and December the coldest. Amount of rain about 74 inches; the greatest amount falls in May with the S.W. monsoon (about 13 to 14 inches); and again in October and November with the N.E. monsoon (about 10 to 12 inches) in each month. Rain, however, falls in every month, the smallest amount being in February and March. The heaviest yearly fall ever noted was 120 inches. The humidity is very great, about the same as

* For a full account, see Sir E. Tennant's Ceylon.

at Jamaica. The S.W. monsoon blows from May to September, and the N.E. monsoon during the remainder of the year, being unsteady and rather diverted from its course (long-shore wind) in February and March.

At Kandy (72 miles from Colombo, 1676 feet above sea-level), the mean temperature is less, 3° to 5°; the air is still absolutely humid, though relatively rather dry. At 9.30 A.M. the mean annual dew-point is 70°·4, and at 3.30 it is 71°·54. This corresponds to 8·11 and 8·42 grains in a cubic foot of air; as the mean temperature at these times is 76·37 and 79·27, the mean annual relative humidity of the air at 9.30 A.M. and 3.30 P.M. is 71 and 63 per cent. of saturation (see tables, pp. 407 and 410). The heat is oppressive, as Kandy lies in a hollow, as in the bottom of a cup.

At Newera Ellia (48 miles from Kandy, and 6210 feet high) is a large tableland, where, since 1828, some Europeans have been stationed; the climate is European, and at times wintry; the thermometer has been as low as 29°, and white frosts may occur in the early morning in the coldest months. The mean annual temperature is about 59°.*

In the dry season (January to May) the daily thermometer's range is excessive; the thermometer may stand at 29° at daybreak, and at 8 A.M. reaches 62°; at mid-day it will mark 70° to 74°, and then fall to 50° at dark. In one day the range has been from 27° to 74° = 47°. The air is very dry, the difference between the dry and wet bulbs being sometimes 15°. Assuming the dry bulb to mark 70°, this will give a relative humidity of only 38 per cent. of saturation; the barometer stands at about 24·25 inches. Although the range of temperature is thus so great, it is equable from day to day.

Such a climate, with its bright sun and rarefied air, an almost constant breeze, and an immense evaporating force, seems to give us, at this period, the very beau ideal of a mountain climate.

In the wet season (May or June to November) all these conditions are reversed. The mean thermometer of 24 hours is about 59°, and the range is only from 56° at daybreak to 62° at midday, during the height of the monsoon; about 30 inches of rain-fall, and sometimes as much as 70; the air is often almost saturated.

Two more striking climatic differences than between January and June can hardly be conceived, yet it is said Newera Ellia is equally healthy in the wet as in the dry season; the human frame seems to accommodate itself to these great vicissitudes without difficulty.

Although there is some moist and even marshy ground near the station, ague is very uncommon; the temperature is too low in the dry season, and the fall of rain too great in the wet. It is said that dyspepsia, hepatic affections, and nervous affections are much benefited; phthisis to some extent, but, it would appear, scarcely so much as our European experience would have led us to expect; rheumatism does not do well, nor, it is said, chronic dysentery; but it would be very desirable to test this point, as well as that of the influence on phthisis carefully. The so-called "hill diarrhœa" of India is unknown.

The neighbouring Horton Hills are said to be even better than Newera Ellia itself. Probably, in the whole of Hindustan, a better sanitary station does not exist. It is inferior, if it be inferior, only to the Neilgherries, and one or two of the best Himalayan stations.

Diseases of the Native Population.

In some parts of the island, especially at Trincomalee, there is much malarious disease, and hepatic and splenic engorgements are common; dysen-

* I have taken many of these facts from an excellent Report by Assistant-Surgeon R. A. Allan, which I had the advantage of reading, as well as from Sir E. Tennant's book.

tery, diarrhœa, rheumatism, and skin diseases are all common. At Colombo, smallpox, cholera, and continued fevers are frequent. The sanitary condition of Colombo is bad; the native town is badly drained; there are many cesspools, and wells close to them.

Elephantiasis and leprosy are common in some parts, scarcely seen in other (Trincomalee). At Trincomalee, Dr Kelaart states that scrofula is very common, and is attributed by the natives to syphilis introduced by the Portuguese, and kept up by intermarriage.

In the district of Kandy the population would seem to be healthier; in 1859 the deaths were 20·27 per 1000 living, and the births 24·93* If this be true for all years, it contrasts favourably even with England.

Diseases of the Troops.

In Ceylon, as in so many other stations, we find that the amount of sickness and mortality has greatly declined of late years. In the earlier periods it was very great. Destructive fevers (malarious? typhoid? bilious remittent?) of uncertain nature prevailed, and in some years, as in 1817, were very fatal. Liver diseases (often attended with abscess) have always been much more common at Colombo and Trincomalee than at Kingston or Port-Royal in Jamaica, with the same high annual temperature and the same equability of climate.

Dysentery and diarrhœa have also always been frequent, and are still so. In fact, the diseases of troops are very similar to those of Hindustan, except that, on the whole, there has been less fatality.

Per 1000 *of Strength* (*White Troops*).

Years.	Loss of Strength.		Loss of Service.		
	Deaths (all Causes).	Invaliding.†	Admissions.	Mean daily Sick.	Days in Hospital to each sick man.
1817–36,	69·8	...	1678	...	...
1837–56,	38·6	...	1407	...	...
1859,	35·05	...	1693	79·31	15·12
1860,	19·65	...	1671	70·14	17·32
1861,	19·85	12·1	1440	66·15	16·77
1862,	19·43	33·2	1233	75·51	22·35
1863,	29·41	35·1	1536	72·40	17·2

If these numbers be compared with the west Indian or Canadian stations, the great amount of sickness and mortality in Ceylon is evident. The loss of service is very serious. Thus, to take the year 1862, the table shows that 1000 men would have furnished 75·51 daily sick; as the white troops actually present in Ceylon in 1862 numbered 874, the daily amount of sick was 66. Therefore there were for the whole force (66 × 365 =) 24,090 days lost to the State, or each man lost 27·56 days—a very large amount.

When the causes of this great sickness and mortality are looked into, they are found to be as follows. Paroxysmal fevers, dysentery, ophthalmia, enthetic diseases, acute and chronic hepatitis, acute and chronic bronchitis, drunkenness, phlegmon, and ulcers, give the largest admissions. Cholera, dysentery, hepatitis, and phthisis, appear to be the chief causes of mortality.

The diseases, in fact, are chiefly those of India.

* MS. Report on Kandy, by Surgeon M'Gregor.

† By the term invaliding is implied the troops actually discharged the service for ill health.

The deaths from phthisis in Ceylon in 1860, 1861, 1862, and 1863, were 2·18, 2·2, 3·43, and 3·39 per 1000 of strength. There does not appear to have been much invaliding from this cause (none in 1860–1861), so that phthisis is apparently rather infrequent in Ceylon, though perhaps more common than in the Mauritius.

With regard to the lessening of this considerable amount of sickness, the measures necessary for India must be adopted in Ceylon. (See also chapter on Prevention of Disease, p. 443.)

Among the black troops in Ceylon, the admissions have averaged 1064, and the deaths 11·97, or without violent deaths, 10·97 per 1000 of strength. The chief causes of admissions are paroxysmal fevers, and of deaths, cholera, dysentery, and paroxysmal fevers. "Continued fever" also figures among the returns, but is less common of late years. The average number constantly sick is about 32, and the duration of the cases 10 or 11 days.

In Ceylon, therefore, the black troops are healthier than the white, contrasting in this remarkably with the West Indies.

In conclusion, it may be said that much sanitary work has evidently to be done in Ceylon before the state of the white troops can be considered at all satisfactory.

SECTION VIII.

INDIA.*

More than 72,000 Europeans are now quartered in India, and there is in addition a large native army. In this place the Europeans will be chiefly referred to, as it would require a large work to consider properly the health of the native troops.†

In the First Book various points connected with the health of Europeans in India have been discussed; in this place I have merely to give a short outline of the conditions of service in that country, and of the amount of sickness and mortality.

The 72,000 Europeans are thus distributed:—About 46,000 are serving in the Bengal Presidency, which includes Bengal proper, the North-West Provinces, the Punjab, and Trans-Indus stations. About 14,000 are serving in the Madras Presidency, which also garrisons some part of the coast of Burmah, and sends detachments of native troops to the Straits of Malacca. About 12,000 are serving in the Bombay Presidency.‡ The troops consist of all arms.

* No medical officer should serve in India without carefully studying one of the best works ever published on hygiene, Dr Norman Chevers' essay on the "Means of Preserving the Health of Europeans in India," published in the Indian Annals. It is to be regretted that it has not been published as a separate work. The Introduction to Sir Ranald Martin's great work on "Tropical Diseases" contains most valuable sanitary rules. Dr Moore's "Health in the Tropics" is also a work all should read. I need not say that the Report of the Indian Sanitary Commission should be very carefully considered. The Government have just published in a small form the Report of the Indian Sanitary Commission, and an Abstract of all the Station Returns sent in to the Commission, with some of the evidence, and this will be a most valuable document for all officers serving in India. The present chapter may perhaps serve as a sort of introduction to this larger work. The Barrack Improvement Commissioners have also published a very useful work, entitled "Suggestions in Regard to Sanitary Works for Indian Stations."

† The general principles of hygiene are of course to be applied in the case of the natives of Hindustan, and so far there is nothing unusual. In the chapter on Food I have purposely included the chief articles of diet; the question of water and air is the same for all nations, and other hygienic rules of clothing or exercise can be easily applied to them. But their health is much influenced by their customs, which are in many races peculiar. The only proper way of treating such a subject would be by a work on the hygiene of India generally, including the native army as a branch of the community.

‡ For brevity, it is customary to speak of serving in Bengal, Bombay, or Madras, when speaking of the Presidency, so that these names are sometimes applied to the cities, sometimes to the presidencies; but a little care will always distinguish which is meant.

These men are serving in a country which includes nearly 28° of lat. and 33° of long., and in which the British possessions amount to 1,465,322 square miles. Stretching from within 8° of the equator to 15° beyond the line of the tropics, and embracing countries of every elevation, the climate of Hindustan presents almost every variety; and the troops serving in it, and moving from place to place, are in turn exposed to remarkable differences of temperature, degrees of atmospheric humidity, pressure of air, and kind and force of wind, &c.

Watered by great rivers which have brought down from the high lands vast deposits in the course of ages, a considerable portion of the surface of the extensive plains is formed by alluvial deposit, which, under the heat of the sun, renders vast districts more or less malarious; and there are certain parts of the country where the development of malaria is probably as intense as in any part of the world. A population, in some places thickly clustered, in others greatly scattered, formed of many races and speaking many tongues, and with remarkably diverse customs, inhabits the country, and indirectly affects very greatly the health of the Europeans.

Cantoned over this country, the soldiers are also subjected to the special influences of their barrack life, and to the peculiar habits which tropical service produces.

We can divide the causes which act on the European force into four subsections :—

1. The country and climate.
2. The diseases of the natives.
3. The special hygienic conditions under which the soldier is placed.
4. The service, and the individual habits of the soldier.

Sub-Section I.—The Country and Climate.

The geological structure and the meteorological conditions are, of course, extremely various, and it is impossible to do more than glance at a few of the chief points.

1. *Soil.**—There is almost every variety of geological structure. In the north-west, the vast chain of the Himalayas is composed of high peaks of granite and gneiss; while lower down is gneiss and slate, and then sandstone and diluvial detritus. Stretching from Cape Comorin almost to Guzerat, come the great Western Ghauts, formed chiefly of granite, with volcanic rocks around; and then stretching from these, come the Vindhya and Satpoora Mountains, which are chiefly volcanic, and inclose the two great basins of the Taptee and Nerbudda rivers. Joining on to the Vindhya, come the Aravalli Hills, stretching towards Delhi, and having at their highest point Mount Aboo, which is probably destined to become the great health resort of Central India.

On the east side, the lower chain of the Eastern Ghauts slopes into the tableland of the Deccan; and at the junction of the Eastern and Western Ghauts come the Neilgherry Hills, from 8000 to 9000 feet above sea-level, and formed of granite, syenite, hornblende, and gneiss. But to enumerate all the Indian mountains would be impossible.

Speaking in very general terms, the soil of many of the plains may be classed under four great headings (Forbes Watson).

(*a.*) Alluvial soil, brought down by the great rivers Ganges, Indus, Brahmapootra, rivers of Nerbudda, Guzerat, &c. It is supposed that about one-third of all Hindustan is composed of this alluvium, which is chiefly siliceous,

* See Carter's "Summary of the Geology of India," in the "Journal of the Bombay Asiatic Society Transactions," 1853.

with some alumina and iron. At points it is very stiff with clay—as in some parts of the Punjab, in Scinde, and in some portion of Lower Bengal. Underneath the alluvial soil lies, in many places, the so-called clayey laterite (see page 277.) Many of the stations in Bengal are placed on alluvial soil.

This alluvial soil, especially when, not far from the surface, clayey laterite is found, is often malarious; sometimes it is moist only a foot or two from the surface; and, if not covered by vegetation, is extremely hot.

As a rule, troops should not be located on it. Whatever be done to the spot itself—and much good may be done by efficient draining—the influences of the surrounding country cannot be obviated. Europeans can never be entirely free from the influences of malaria. There is but one perfect remedy: to lessen the force in the plains to the smallest number consistent with military conditions, and to place the rest of the men on the higher lands.

Somewhat different from the alluvial, is the soil of certain districts, such as the vast Runn of Cutch, which have been the beds of inland seas, and now form immense level marshy tracks, which are extremely malarious. The Runn of Cutch contains 7000 square miles of such country.

(*b.*) The so-called "regur," or "cotton soil," formed by disintegrated basalt and trap, stretches down from Bundelcund nearly to the south of the peninsula, and spreads over the table-land of Mysore, and is common in the Deccan. It is often, but not always, dark in colour. It contains little vegetable organic matter (1·5 to 2·5 per cent.), and is chiefly made up of sand (70 to 80 per cent.), carbonate of lime (10 to 20 per cent.), and a little alumina. It is very absorbent of water, and is generally thought unhealthy. It is not so malarious as the alluvium, but attacks of cholera have been supposed to be particularly frequent over this soil.

(*c.*) Red soil from disintegration of granite. This is sometimes loamy, at other times clayey, especially where felspar is abundant. The clay is often very stiff.

(*d.*) Calcareous and other soils scattered over the surface, or lying beneath the alluvium or cotton soil. There are, in many parts of India, large masses of calcareous (carbonate of lime) conglomerate, which is called kunkur. It is much used in Bengal for footpaths and pavements.

In Behar, and some other places, the soils contain large quantities of nitre, and various of the sand plains are largely impregnated with salts.

2. *Temperature.*—There is an immense variety of temperature. Towards the south, and on the sea-coast, the climate is often equable and uniform. The amplitudes of the annual and diurnal fluctuations are small, and in some places, especially those which lie somewhat out of the force of the south-west monsoon, the climate is perhaps the most equable in the world.

At some stations on the southern coast, the temperature at the sun's zenith is lower than at the declination, in consequence of the occurrence of clouds and rain, brought up by the south-west monsoon.

In the interior, on the plateaux of low elevation, the temperature is greater, and the yearly and diurnal fluctuations are more marked. On the hill stations (6000 to 8000 feet above sea-level), the mean temperature is much less; the fluctuations are sometimes great, sometimes inconsiderable.

The influence of winds is very great on the temperature; the sea winds lowering it, hot land winds raising it greatly.

The temperature of a few of the principal stations is subjoined, merely to give an idea of the amount of heat in different parts of the country.* Those of the hill stations are given under the proper headings.

* These are taken from Mr Glaisher's very excellent report in the India Sanitary Commission, which must be consulted for fuller details of the greatest value.

Mean Temperature and Height, above Sea-level, of some of the larger Stations.

Bengal Presidency.

Months.	Calcutta, Fort-William, 8 feet above sea-level.	Benares, 270 feet above sea-level.	Cawnpore, 500 feet above sea-level.	Lucknow, 360 feet above sea-level.	Meerut, 900 feet above sea-level.	Ferozepore, 720 feet above sea-level.	Punjab, generally 800 to 900 feet above sea-level.	Peshawur, 1056 feet above sea-level.
Mean of year, . .	82°	78°	80·4	79°	77°	78°	73°	74°
January, . . .	70	66	64	66	61	59	54	52
February, . . .	75	69	70	68	65	68	60	55
March, ...	83	75	72	79	70	76	68	65
April, ...	88	84	89	88	83	81	77	75
May, ...	89	93	97	91	90	94	86	88
June, ...	87	88	91	90	92	95	89	91
July, ...	85	86	87	88	88	90	87	91
August, ...	85	82	87	84	84	86	86	88
September, . .	85	83	85	85	82	86	83	84
October, . . .	84	79	79	79	76	79	76	73
November, . .	78	70	75	70	68	68	61	64
December, . . .	72	64	68	60	62	58	55	56
Amplitude of yearly fluctuation (difference between hottest and coldest months), . .	19	29	33	31	31	37	35	39

The increase in the amplitude of the yearly fluctuation is thus seen as we pass to the north, and ascend above sea-level.

Madras Presidency.

Months.	Madras, Fort St George, at sea-level.	Bangalore, 3000 feet above sea-level, 1 year only.	Bellary, 1500 feet above sea-level.	Secunder-abad, 1800 feet above sea-level.	Cannanore, 15 feet above sea-level.
Mean of year, . .	82°	76°	80°	80°	82°
January, . .	76	69	74	73	82
February, . .	78	73	79	76	82
March, . . .	80	79	85	81	84
April, . . .	84	79	88	86	86
May, . . .	87	82	86	89	85
June, . . .	88	77	83	83	80
July, . . .	85	77	80	80	79
August, . . .	85	75	79	79	79
September, . .	84	76	79	78	79
October, . .	82	75	78	78	81
November, . .	79	73	74	76	82
December, . .	76	71	73	73	81
Amplitude of yearly fluctuation, . .	12	13	15	16	7

Bombay Presidency.

Months.	Bombay, at sea-level.	Poonah, 1800 feet above sea-level.	Belgaum, 2260 feet above sea-level.	Nagpore.	Neemuch, 1 year.	Mhow, 1862 feet above sea-level.	Hyderabad (Scinde), 99 feet above sea-level.	Kurrachee, 27 feet above sea-level.
Mean of year,	80°	78°	74°	81°	71°	77°	81°	78°
January, .	74	72	72	71	55	70	64	62
February, .	76	75	75	75	60	72	71	67
March, .	80	79	78	84	70	80	81	74
April, . .	83	83	81	93	81	86	87	84
May, . .	86	85	78	93	84	87	91	84
June, . .	83	81	75	86	80	74	92	88
July, . .	81	77	73	81	74	82	91	88
August, .	81	76	72	81	74	75	88	82
September,	80	77	74	82	75	75	85	81
October, .	82	79	74	82	71	77	82	79
November,	79	76	72	75	67	75	73	73
December,	76	73	70	73	65	71	66	65
Amplitude of yearly fluctuation, .	12	13	11	22	29	17	28	26

These temperatures, which represent those of stations of the countries where the troops are stationed, should be compared with the temperature of hill stations subsequently given.

The mean monthly maximum and mean minimum temperatures of some of these places are as follows :—

Places.	Mean Maximum Hottest Month.	Mean Minimum Coldest Month.	Greatest possible Monthly Amplitude.
Calcutta, ...	May, . 94°	December, . 59°	35°
Madras, ...	May, . 91	January, . 65	26
Lucknow, ...	May, . 100	January, . 53	47
Peshawur, ...	June, . 102	January, . 44	58
Bellary, ...	May, . 92	February, . 65	27
Bangalore, ...	April, . 91	January, . 59	32
Secunderabad, . .	May, . 95	January, . 64	31
Neemuch, ...	May, . 94	January, . 49	45
Poonah, ...	April, . 95	January, . 58	37
Kurrachee, . . .	June, . 95	January, . 50	45

The mean daily range of temperature is as follows :—

Months.	Bengal Presidency.				Madras Presidency.				Bombay Presidency.		
	Calcutta, Fort-William,	Lucknow.	Meerut.	Peshawur.	Madras, Fort St George.	Bellary.	Bangalore.	Secunderabad.	Poonah.	Neemuch.	Kurrachee.
	°	°	°	°	°	°	°	°	°	°	°
January, . .	18	25	22	16	21	10	20	14	23	13	36
February, .	18	19	19	13	21	16	20	16	24	21	15
March, . .	17	20	18	16	21	17	18	14	23	20	14
April, . .	16	20	21	23	20	15	15	16	24	20	9
May, . . .	15	19	26	18	20	15	19	13	19	19	13
June, . . .	10	16	14	23	19	10	15	9	13	4	14
July, . . .	8	16	14	19	6	10	14	8	10	3	12
August, . .	8	7	12	22	20	9	12	9	9	2	13
September, .	8	6	9	21	21	11	12	9	11	8	10
October, . .	10	13	27	19	21	10	13	11	18	11	21
November, .	15	16	31	20	19	8	12	12	22	22	37
December, .	18	11	16	15	18	10	18	13	22	21	39
Mean daily range of year,	13	16	19	19	19	12	16	12	18	14	19

The extreme daily range is, of course, greater than this.

In addition, there are at several places great undulations of temperature from hot land winds, or from sea or shore breezes, or from mountain currents, which give to the place local peculiarities of temperature.

The temperature of the sun's rays has not yet been properly determined with the self-registering black-bulb thermometer in vacuo. The temperatures which are recorded are, I believe, all made with the common thermometer, and give no adequate idea of the real heat of the sun. (See page 431.)

These few figures give a general view of the chief thermometric points, and it will be seen that many of these stations are marked by a continued high temperature and a small mean daily range. To get the same mean annual temperature as in England, it would be necessary that 9500 feet be ascended in places south of lat. 20° ; between lat. 20° and 26°, 9000 feet ; between lat. 26° and 30°, 8700 feet ; and north of lat. 30°, 8500 (Glaisher).

The mean monthly temperatures would, however, at such elevations, differ somewhat from those of England. Speaking generally, an elevation of 5000 to 6000 feet will give over the whole of India a mean annual temperature about 10° higher than that of England, and with a rather smaller range (Glaisher).

Mr Glaisher has calculated that in the cold months the decrease of temperature is 1°·05 for each 300 feet of ascent, but increases from March to August to 4°·5, and then gradually declines. These results are not accordant with the recent balloon ascents in this climate.

Humidity.—The humidity of different parts of India varies extremely ; there are climates of extreme humidity—either flat, hot plains, like Lower Scinde, where, without rain, the hot air is frequently almost saturated, and may contain 10 or 11 grains of vapour in a cubic foot ; or mountain ranges like Dodabetta, in Madras, 8640 feet above sea-level, where, during the rainy season, the air is also almost saturated ; a copious rain, at certain times of the year, may make the air excessively moist, as on the Malabar coast, the coast of Tenasserim, or on the Khasyah Hills, where the south-west monsoon parts with its vapours in enormous quantities.

On the other hand, on the elevated table-land of the interior, and on the hot plains of north-west India, during the dry season, or in the places exposed to the land winds at any part, the air is excessively dry. In the Deccan the annual average of the relative humidity is only 55 per cent. of saturation (Sykes). Mr Glaisher has assembled all that is at present known on the humidity of India. I extract a few stations :—

Mean Dew-Point.

Months.	Calcutta, Fort-William.	Madras, Fort St George.	Bombay.	Benares.	Meerut.	Peshawur.	Bellary.	Secunderabad.	Poonah.	Kurrachee.	Belgaum.
	°	°	°	°	°	°	°	°	°	°	°
January, . .	57	67	64	48	54	39	54	54	51	48	54
February, .	61	68	64	53	56	43	60	51	50	55	51
March, . .	68	71	68	57	59	56	58	60	54	60	58
April, . . .	72	76	73	60	56	66	69	59	59	66	60
May, . . .	76	76	75	72	71	62	62	62	65	74	66
June, . . .	78	73	76	78	76	72	69	66	67	76	68
July, . . .	78	73	76	84	80	74	69	68	69	76	68
August, . .	78	74	74	80	71	74	66	71	69	75	67
September, .	78	75	75	80	75	65	59	73	67	71	66
October, . .	74	74	74	76	71	56	67	66	62	66	61
November, .	64	71	67	61	61	45	66	58	55	52	61
December, .	57	69	64	54	48	39	60	54	51	47	55
Mean daily average of Year,	70	72	71	67	65	57	63	62	59	64	61

If the table at page 407 be looked at, the mean monthly amount of vapour in a cubic foot of air will be the number opposite the temperature of the above table. If the mean monthly temperature of the month at any of the above stations be taken out of the table of mean monthly temperature already given, the mean monthly relative humidity (or, in other words, the evaporating force of the air) can be calculated.

Thus, let us take the month of July at Calcutta :—

Mean dew-point = 78 = 10·31 grains of vapour in a cubic foot of air.

Mean temperature = 85 = 12·78 grains of vapour in a cubic foot of air.

The relative humidity $\frac{10{\cdot}31 \times 100}{12{\cdot}78} = 80$ per cent. of saturation. (See Meteorology).

It may be well to mention the dew-point of the year at Greenwich for comparison ; it is 44° ; the mean weight of vapour is 3·3, varying from 4·7 grains in August to 2·4 in January ; the mean relative humidity is 82, varying from

89 in December and January to 76 in July. Calcutta, therefore, with a mean yearly humidity of 68·6 per cent. of saturation, is, as far as relative humidity (*i.e.* evaporating power) goes, less moist than England, and the evaporating power is also increased by the higher temperature.

Rain.—The amount of rain and the period of fall vary exceedingly in the different places. It is chiefly regulated by the monsoons.

When the south-west monsoon, loaded with vapour, first strikes on high land, as on the Western Ghauts, on the Malabar coast, or on the mountains of Tenasserim, and especially on the mountains of the Khasyah Hills, at some points of which it meets with a still colder air, a deluge of rain falls; as for example at Cannanore (Malabar), 121 inches; Mahableshwur, 253 inches; Moulmein (Tenasserim), 180 inches; Cherrapoonjee (Khasyah Hills), 600 inches. On the other hand, even in places near the sea, if there is no high land, and the temperature is high, scarcely any rain falls; as in Aden, on the south coast of Arabia, or at Kotu, in Scinde, where the amount is only 1·8 annually, or Kurrachee, where the yearly average is only 4·6 inches. Or in inland districts, the south-west monsoon, having lost most of its water as it passed over the hills, may be comparatively dry, as at Nusseerabad, where only 15·8 inches fall per annum, or Peshawur, where there are 13·7 inches annually.

The yearly amount of rain in some of the principal stations is—

	Average.
Calcutta,	56·8
Madras,	50
Bombay,	72·7
Bengal Presidency—	
Dinapore,	31·1
Berhampore,	49·8
Benares,	37·4
Ghazeepore,	41·4
Azimghur,	40
Agra,	27·9
Delhi,	25·1
Meerut,	18
Punjab,	56·6
Madras Presidency—	
Bellary,	21·7
Bangalore,	25
Trichinopoly,	30·6
Secunderabad,	34·6
Bombay Presidency—	
Belgaum,	51·5
Poonah,	27·6
Neemuch,	34·1
Kamptee,	41·8

Winds.—The general winds of India are the north-east monsoon, which is, in fact, the great north-east trade-wind, and the south-west monsoon, a wind caused by the aspiration of the hot earth of the continent of Asia, when the sun is at its northern declination. During part of the year (May to August) the south-west monsoon forces back the trade-wind or throws it up, for at great altitudes the north-east monsoon blows through the whole year, and the south-west monsoon is below it. But, in addition, there are an immense number of local winds which are caused by the diverting effect of hills on the monsoons, or are cold currents from hills, or sea breezes, or shore winds caused by the contact of sea breezes and other winds, or by the first feeble action of the south-west monsoon before it has completely driven back the north-east trade. The south-west monsoon is in most of its course loaded with vapour; the north-east is, on the contrary, a colder and drier wind, except when at certain times of the year, in passing over the Indian Ocean, it takes up some water, and reaches the Coromandel coast and Ceylon a moist and rain-carrying wind.

The hot land winds are caused by both the south-west monsoon, after it has parted with its moisture and got warmed by the hot central plains, and

the north-east monsoon; the temperature is very great, and the relative humidity very small; the difference between the dry and the wet bulb being sometimes 15° to 25° Fahr.

Pressure of the Air.—On this point little need be said. The barometer is very steady at most sea-coast stations, and its daily variations (see METEOROLOGY) are chiefly caused by alteration in humidity. An elevation of 5000 feet lowers the barometer to nearly 25 inches.

Electricity.—On this point few, if any, experiments have been made; the air is extremely charged with electricity, especially in the dry season, and the dust-storms are attended with marked disturbance of the electrometer.*

The estimation of the effects of such various climates is a task of great difficulty, which has been already, in great part, discussed in the chapter on CLIMATE. Long-continued high temperature, alternations of great atmospheric dryness and moisture, rapidly moving and perhaps dry and hot air, are common conditions at many stations; at others, great heat during part of the year is followed by weather so cold that even in England it would be thought keen. When to these influences the development of malaria is added, enough has been said to show that, *a priori*, we can feel certain that the natives of temperate climates will not support such a climate without influence on health, and the selection of healthy spots for troops is a matter of the greatest moment as affects both health and comfort. This much being said, it must at the same time be asserted that, malaria excepted, the influences of climate are not the chief causes of sickness.

The location of troops should be governed by two or three conditions: 1. Military necessities; 2. Convenience; 3. Conditions of health. The second of these conditions is, however, a mere question of administration; every place can be made convenient in these days of railways and easy locomotion. Military necessity and health are the only real considerations which should guide our choice.

What is now wanted in India is some great soldier, who, with the intuitive glance of genius, will indicate what are the vital military points. These must be held with the necessary forces, and then the whole of the remaining troops can be located on the most healthy spots.

These spots cannot be in the plains. Let any one look at a geological map of India, and see the vast tract of alluvial soil which stretches from the loose soil of Calcutta, formed by the deposit of a tidal estuary, up past Cawnpore, Delhi, to the vast plains of the Punjab, Scinde, and Beloochistan. The whole of that space is more or less malarious, and will continue to be so until, in the course of centuries, it is brought into complete tillage, drained, and cultivated.

In looking for healthy spots, where temperature is less tropical, and malarious exhalations less abundant, there are only two classes of localities which can be chosen—seaside places and highlands.

Seaside places.—The advantages of a locality of this kind are, the reduction in temperature caused by the expanse of water, the absence of excessive dryness of the air, and the frequent occurrence of breezes from the sea. All these advantages may be counteracted by the other features of the place; by a damp alluvial soil, bad water, &c.

It does not appear that many eligible places have yet been found, and as a substitute in Bengal, the Europeans from Calcutta go and live on board a steamer anchored off the Sandheads, thus literally carrying out a suggestion of Lind in the West Indies a century ago.

* See Baddeley's "Whirlwinds and Dust-storms of India" (1860), for a very good account of these singular storms.

In the Bay of Bengal, Waltair, in the nothern division of Madras, is one of the best.* Cape Calimere (28 miles south of Nagapatam) also appears to have many advantages (Macpherson). On the opposite coast, Cape Negrais on the Burmese coast, was pointed out as long ago as 1825, by Sir Ranald Martin as a good marine sanitarium, and Amherst in Tenasserim, and some of the islands down the coast towards Mergui are beautiful spots for such a purpose, being, however, unfortunately, at a great distance from the large military stations, and not being well supplied with food.

On the Bombay side, at Sedashagur or Beitkul Bay, between Mangalore and Goa, a spur of the Western Ghauts projects into the sea for upwards of a mile, and forms an admirable sea-coast sanitarium (Macpherson).

All these sea-coast stations seem adapted for organic visceral affections and dysentery, but they are not so well calculated for permanent stations for healthy men. Probably they are rather sanitaria than stations.

Highlands.—The location of troops on the hills or on elevated table-lands has long been considered by the best army medical officers as the most important sanitary measure which can be adopted. Not only does such a location improve greatly the vigour of the men, who on the hill stations preserve the healthy, ruddy hue of the European, but it prevents many diseases. If properly selected, the vast class of malarious diseases disappears; liver diseases are less common, and bowel complaints, in some stations at any rate, are neither so frequent nor so violent. Digestion and blood-nutrition are greatly improved. Moreover, a proper degree of exercise can be taken, and the best personal hygienic rules easily observed.

Indian surgeons appear, however, to think the hill stations not adapted for cardiac and respiratory complaints; it is possible that this objection is theoretical. The latest European experience is to the effect that phthisis is singularly benefited by even moderate, still more perhaps by great elevation; that anæmia and faulty blood-nutrition are cured by high positions with great rapidity, and that if the elevation be not too great (perhaps not over 3000 feet) even chronic heart diseases are improved (see page 437). In some of the hill stations of India bowel complaints were formerly so frequent as to give rise to the term "hill diarrhœa." The elevation was credited with an effect which it never produced, for, not to speak of other parts of the world, there are stations in India itself (Darjeeling, for example) as high as any other, where the so-called hill diarrhœa was unknown. At Newera Ellia, in Ceylon, too, if the simple condition of mountain elevation could have produced diarrhœa, it would have been present, but it has never been known there. The cause of the hill diarrhœa was certainly, in many stations, the impure drinking water; whether this was the case in all, I am not sure. Some of the hill stations are said not to be adapted for rheumatic cases; in other instances (as at Subathoo) rheumatism is much benefited. I infer, from reading the reports from these stations, that damp barracks, and not the station, have been in some cases the cause of the rheumatism.

But it must be noticed that the evidence given before the Indian Sanitary Commission shows, on all or almost all hill stations, a most lamentable want of the commonest sanitary appliances. At great expense men are sent up to the hills, where everything is, or was, left undone which could make that expense profitable. It appeared to be thought sufficient to ascend 6000 feet to abandon all the most obvious sanitary rules, without which no place can be healthy.

Admitting, as a point now amply proved, that stations of elevation are the

* Evidence of Dr Maclean in Indian Report, p. 139.

proper localities for all troops not detained in the plains by imperative military reasons, the following questions are still not completely answered:—

1. What amount of elevation is the best? We have seen that to reduce the temperature to the English mean, 5000 to 6000 feet must on an average be ascended. But then such an elevation brings with it certain inconveniences, viz., in some stations much rain and even fog at certain times of the year, and cold winds. However unpleasant this may be, it yet seems clear, from the experience of Newera Ellia, in Ceylon, that damp and cold are not hurtful. But it must also be said that, with a proper selection, dry localities can be found at this elevation.

From 3000 to 4000 feet have been recommended, especially, to avoid the conditions just mentioned. Whether places of this height are equal in salubrity to the colder and higher points is uncertain.

Even at 6000 feet there may be marsh land, though it is not very malarious. Malarious fever has been known during the rains at Kussowlie (6400 feet), and Subathoo (4000), and other Himalayan stations. Malaria may, however, drift up valleys to a great height;* but, apart from this, it seems likely that 5000 feet, and probably 4000, will perfectly secure from malaria. Probably, indeed, a less height will be found effectual.

At no point do hot land winds occur, or at any rate endure, at above 4000 feet.

Dr Macpherson (Inspector-General of Hospitals, Madras), divides mountain climates into three categories:—

1. Below 3500 feet, tonic and soothing.
2. Between 3500 and 6000 feet, tonic and invigorating.
3. Above 6000 feet, tonic and exciting.†

On the whole, it would appear probable that the best localities are above 5000 feet, but below 7000.

2. What stations are the best—the tops of solitary hills, spurs of high mountains, or elevated table-lands?

Ranald Martin has called especial attention to the solitary hills, rising as they do sometimes from an almost level plain to 2000 and 3000 feet. Such mountain islands seem especially adapted for troops if there is sufficient space at the top. They are free from ravines conducting cold air from higher land, and are often less rainy than the spurs of loftier hills.

The spurs of the Himalayas, however, present many eligible spots, and so do some table-lands. And perhaps, on the whole, if the elevation is sufficient, it is not a matter of much importance which of these formations is chosen; other circumstances, viz., purity of water, space, ease of access, and supplies, &c., will generally decide.

In choosing hill stations, the points discussed in the chapter on SOILS should be carefully considered, and it is always desirable to have a trial for a year or two before the station is permanently fixed.

It may be desirable to give an enumeration of the hill stations now in use. The following table is copied from Dr Macpherson:—

* It has drifted up even to the summits of the Neilgherries, 7000 or 8000 feet.—*Indian Sanitary Report*, Mr Elliott's Evidence, vol. i. p. 250.

† The statements of Jourdanet (see page 438) should receive due consideration, and be tested by observations, but it is probable they are not correct; they apply to elevations above 6000 feet.

Names of Hill Stations.		Mean Temperature outside in Shade.												Ascertained greatest Elevation.	Average Fall of Rain in Inches.
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.		
Bengal Presidency.	Darjeeling,	40	41	51	55	61	62	63	64	63	55	50	44	8000	132
	Simla,	40	44	53	61	66	80	75	78	70	67	52	46	8000	70
	Landour,	35	40	51	...	...	...	...	68	64	49	46	46	7300	...
	Murree,	...	...	...	...	...	69	68	66	62	62	...	...	6786	...
	Kussowlie,	42	47	58	64	77	73	70	70	72	66	...	...	6400	70
	Nynee Tal,	42	46	56	61	69	69	67	69	65	61	50	47	6200	83
	Dugshai,	42	47	57	64	69	71	72	68	66	62	54	53	6000	70
	Subathoo,	...	...	...	77	81	84	79	77	...	...	...	...	4000	70
	Ootacamund,	54	56	60	61	61	57	63	63	63	56	54	53	7361	60
	Kotagherry,	59	60	61	63	63	64	65	65	64	62	60	59	6100	55
	Wellington,	59	61	67	68	68	64	70	70	70	63	61	60	5840	50
	Coonoor,	60	62	68	68	68	65	70	70	70	65	62	62	5161	50
	Pulneys,	51	53	60	61	...	...	...	...	...	...	...	...	7000	...
	Mercara,	53	56	61	64	44	66	65	65	64	65	63	56	4500	100
Madras Presidency.	Annamullays,	...	...	...	...	...	...	...	...	66	56	...	...	6800	...
	Shevaroys,	65	65	68	71	71	68	68	68	67	66	66	65	5260	40
	Ramandroog,	70	76	80	80	75	73	71	70	70	71	71	67	3400	46
	Checuldah,	60	60	70	83	83	71	...	...	...	...	71	71	3600	...
	Sindwarrah,														
	Muthoor,														
Bombay Presidency.	Mahableshwur,	63	65	72	74	72	67	63	64	64	66	64	63	4700	240
	Poorandhur,	67	73	77	78	73	70	67	65	67	71	69	64	4200	73
	Mount Aboo,	61	61	79	77	77	77	69	69	69	69	69	71	4015	79
	An average of 8° lower than the station of Kamptee.							11°							
								Do.							
								Do.							

In all the presidencies of India elevated spots where troops can be cantoned exist in abundance.*

Fresh stations are, however, being constantly discovered, and it seems now certain that there is scarcely any important strategical point without an elevated site near it.

Near Nynee Tal, in Kumaon, are Almorah (5500 feet), and Hawalbagh (4000 feet), both well spoken of. Kunawar (5000 or 6000 feet), in the valley of the Sutlej, has a delicious climate; and Chini (about 100 miles from Simla), is a most desirable spot.

Passing down from the north-west towards Calcutta, Dr M'Clellan found elevated land within 100 miles of Allahabad; and farther south still there came the Travancore mountains, with numerous good sites.

If, then, the mass of the troops are cantoned on elevated places, the disadvantages of climate are almost removed. The Indian Sanitary Commissioners recommend that one-third of the force shall be in the hills, and that enfeebled men and recruits especially shall be sent there. But it is to be hoped that not only one-third, but a large majority of the troops will eventually be placed there.

Sub-Section II.—Diseases of the Natives.

It is impossible that Europeans can be perfectly isolated from the nations among whom they serve; they have suffered from the pestilential diseases of the Hindus, but still it is wonderful they have not suffered more. Cholera is the chief disease, which, arising in the native population, scourges their conquerors. Some fevers also, relapsing fever, perhaps a "febris icterodes," or bilious remittent, which has occasionally attacked Europeans, have had their origin, or at any rate their conditions of spread, in the dense populations of native cities. Happily, the black death (the Maha murree, or Pali plague) has never yet spread to the troops, and has indeed been confined within narrow limits. Still these pestilences among the native population are an ever-present menace to Europeans, and, as in the case of cholera, may pass to them at any time. Cholera, certainly, will never be extirpated until attacked in its strongholds, among the miserable dwellings which make so large a part of every oriental city.

The exact influence on Europeans of the customs and modes of life of the natives of India has not, as far as I know, been made an object of special study, but it cannot be inconsiderable. In many places the Europeans and the natives are in close neighbourhood, and the air at all times, and often the water, must be influenced by the social life of the native races. The proximity to large cities or bazaars is indeed often alluded to by army officers as affecting the health of their men; it would be very interesting to know the precise effect. The sanitary condition of almost all the large native towns, and the sanitary habits of the country people, are as bad as can be. Bad water, fœtid air, want of sewage removal, and personal habits of uncleanliness, abound everywhere. The Report of the Indian Sanitary Commission is now beginning a series of changes in this respect, which will probably change, *in toto*, the medical history of India.

Sub-Section III.—Special Hygienic Conditions.

The special hygienic conditions (apart from locality) under which the soldier serves in India have been the main causes of excess of disease. This

* See the evidence in the Indian Sanitary Report (vol. i.) of Sir R. Martin, Mr Elliott, Dr Maclean, Dr Alexander Grant, Mr Montgomery Martin, and others. Also most instructive reports by Dr Macpherson, Indian Report, vol. ii. p. 622, and by Dr Alexander Grant, Indian Annals.

subject has lately received a searching inquiry from the Sanitary Commissioners.* They declare, and after reading the Station Reports and the evidence given before them, no one will doubt the assertion, that while malaria, extremes of temperature, moisture, and variability of temperature, cause a certain amount of sickness, "there are other causes of a very active kind, connected with stations, barracks, hospitals, and the habits of the men, of the same nature as those which are known in colder climates to occasion attacks of those very diseases from which the Indian army suffer so severely."

And the Commissioners enumerate a list of causes connected with unhealthy stations, bad barracks, over-crowding, impure air and water, bad drainage, imperfect ablution, inferior rations and cooking, &c.

In fact, no doubt can exist in the minds of all who have studied the subject, that these form the most potent class of causes which affect health.

Sub-Section IV.—Habits and Customs of the Troops.

The habits of the men and the customs of service are, however, also great causes of disease.

The men are, as a rule, intemperate, great smokers, and indisposed for exertion. It has, indeed, been pointed out with truth, that in proportion to their amount of exercise the men are much overfed, and some diseases of the liver appear to result directly from this simple condition.

The want of exercise is not always the fault of the men. The early morning hours, and often the evening, are occupied with parades; in the period between, the men are often confined to barracks. Here, listless, unoccupied, and devoured with ennui, they pass the weary day, lying down perhaps for hours daily, or lounging on chairs smoking.

This forced confinement to barracks is indeed an evil often greater than that it is intended to remove. To prevent men from passing out into the sun they are compelled to remain in a hot, often ill-ventilated room, worse for health than the intensest rays of the sun,† that scape-goat of almost every fault and vice of Indian life.

All these causes are summed up by Miss Nightingale in some of those telling sentences which have done more than anything else to force attention

* Report of the Commissioners on the Sanitary State of the Army in India, 1863. Report, p. 79, published in 1864 in small bulk.

† I shall never forget the sufferings of the men in the old barracks at Madras. We arrived there from Moulmein, where the men had never been confined to barracks, and where, during two hot seasons, no injury had resulted from allowing them to go out when they liked. On arrival at Madras, in accordance with invariable custom, the men were confined to barracks. They lay all day on their beds, reeking with perspiration; the space was so small and ventilation so bad, that the heat was perfectly intolerable in the barracks, though the sun's rays were quite bearable. The sufferings were extreme. When the afternoon came, more injury had been done by the hot and impure air than exposure to the sun's rays could have caused.

At Moulmein, in Tenasserim, at one time, two European regiments served together. The barracks of each were perfectly healthy; the food and duties were the same; yet one showed a sick list and mortality always much greater than the other. Serving in the station shortly afterwards, I was so struck by this difference that I went over all the returns and reports in the staff-surgeon's office to make out the cause; the only difference I could detect was, that in the sickly regiment the men were confined to barracks, in the other they were allowed to go about as they pleased. Many years afterwards, I met with a medical officer who had served in the sickly regiment, and learned from him that he had always considered the confinement to barracks, and the want of exercise, and the impure air breathed by that system almost night and day, were the causes of a disparity so striking. No one would recommend imprudent exposure to the sun: men may be trusted to avoid its intensest rays; but to reduce men to enforced idleness for many hours, and to confine them in the small space of a barrack-room, is not the way of meeting the evil. (On this point see also page 557 for Dr Clark's observations on want of exercise as compared with exposure to the sun on the West Coast of Africa.)

to these vital questions. After referring to the large mortality of India, Miss Nightingale* continues:—

"1. Unofficial people are everywhere asking the question, how this great death-rate has arisen—how it happens that one of the most civilised and healthy nations in the world no sooner lands the pick of its working population in tropical climates (for similar losses occur in all tropical climates among us), than they begin to die off at this enormous rate?

"I am afraid the reply must be, that British civilisation is insular and local, and that it takes small account of how the world goes on out of its own island. There is a certain aptitude amongst other nations which enables them to adapt themselves, more or less, to foreign climates and countries. But, wherever you place your Briton, you may feel satisfied that he will care nothing about climates.

"If he has been a large eater and a hard drinker at home—ten to one he will be, to say the least of it, as large an eater and as hard a drinker in the burning plains of Hindustan. Enlist an Irish or a Scotch labourer who has done many a hard day's work almost entirely on farinaceous or vegetable diet, with an occasional dose of whisky, place him at some Indian station where the thermometer ranges at between 90° and 100°, and he will make no difficulty in disposing of three or four times the quantity of animal food he ever ate under the hardest labour during winter at home—if, indeed, he ever ate any at all.

"Now the ordinary system of dieting British soldiers in India is more adapted to a cold climate than that of out-door farm-servants doing work in England.

"More than this, the occasional dram at home is commuted, by regulation, in India, into a permission to drink two drams, *i.e.*, 6 oz. of raw spirits every day. And be it remembered that, at the same time, the men have little or nothing to do. The craving for spirits, induced by this regulation-habit of tippling, leads to increase of drunkenness—so that, what with over-eating, over-drinking, total idleness, and vice springing directly from these, the British soldier in India has small chance indeed of coping with the climate, so called. The regulation-allowance of raw spirit which a man may obtain at the canteen is no less than 18½ gallons per annum; which is, I believe, three times the amount per individual which has raised Scotland, in the estimation of economists, to the rank of being the most spirit-consuming nation in Europe. Of late years malt liquor has been partly substituted for spirits. But, up to the present time, every man, if he thinks fit, may draw his 18½ gallons a-year of spirits, besides what he gets surreptitiously at the bazaar.†

"So much for intemperance. But not to this alone, nor to this mainly, nor to this and its kindred vice together, is to be laid the soldier-mortality in India.

"The diseases from which the soldier mainly suffers there are miasmatic; now, intemperance never produced miasmatic diseases yet. They are foul-air diseases and foul-water diseases: fevers, dysenteries, and so on. But intemperance may cause liver disease; and it may put the man into a state of health which prevents him from resisting miasmatic causes.

"2. What are these causes? We have not far to look.

"The Briton leaves his national civilisation behind him, and brings his personal vices with him.

* "How people may Live and not Die in India," by Florence Nightingale, 1863, p. 5.

† Sir Hugh Rose has reduced the spirit ration one-half since Miss Nightingale wrote.

"At home there have been great improvements everywhere in agricultural and in town drainage, and in providing plentiful and pure water supplies.

"There is nothing of the kind in India. There is no drainage either in town or in country. There is not a single station drained. If such a state of things existed at home, we should know that we have fevers, cholera, and epidemics to expect. But hitherto only a few enlightened people have expected anything of the kind from these same causes in India (although they are always happening).

"As regards water, there is certainly not a single barrack in India which is supplied, in our sense of the term, at all. There are neither water-pipes nor drain-pipes. Water is to be had either from tanks, into which all the filth on the neighbouring surface may at any time be washed by the rains; or from shallow wells, dug in unwholesome or doubtful soil. So simple a piece of mechanism as a pump is unknown. Water is drawn in skins, carried in skins on the backs of men or bullocks, and poured into any sort of vessels in the barracks for use. The quantity of water is utterly insufficient for health. And as to the quality, the less said about that the better. There is no reason to hope that any station has what in this country would be called a pure water supply. And at some it is to be feared that, when men drink water, they drink cholera with it.

"The construction of barracks, where men have to pass their whole period of service, is another illustration of how completely home civilisation is reversed in India. All our best soldiers have been brought up in country cottages; and when in barracks at home, there are rarely more than from twelve to twenty men in a room. But as soon as the soldier comes to India he is put into a room with 100, or 300, and, in one case, with as many as 600 men. Just when the principle of subdivision into a number of detached barracks becomes of, literally, vital importance, the proceeding is reversed; and the men are crowded together under circumstances certain, even in England, to destroy their health.

"To take another illustration: Our home British population is about the most active in the world. In fact, we in this country consider exercise and health inseparable; but as soon as the same men go to India, they are shut up all day in their hot, close barrack rooms, where they also eat and sleep; they are not allowed to take exercise; all their meals are eaten in the hottest part of the day, and served to them by native servants; and they lie on their beds idle and partly sleeping till sunset! 'Unrefreshing day-sleep' is indeed alleged as one of the causes for the soldier's ill-health in India—the soldier, the type of endurance and activity, who now becomes the type of sloth!

"3. The Indian social state of the British soldier is not only the reverse of the social state of the soldier at home, and of the class from which he is taken, but there is a great exaggeration in the wrong direction. Yet people are surprised that British soldiers die in India, and lay the whole blame on the climate.

"It is natural to us to seek a scape-goat for every neglect, and climate has been made to play this part ever since we set foot in India. Sir Charles Napier says, 'That every evil from which British troops have suffered has been laid at its door.' 'The effects of man's imprudence are attributed to climate; if a man gets drunk, the sun has given him a headache, and so on.' In regard to Delhi, he says, 'Every garden, if not kept clean, becomes a morass; weeds flourish, filth runs riot, and the grandest city in India has the name of being insalubrious, although there is nothing evil about it that does not appear to be of man's own creation.'

"One most important result of the inquiry of the Royal Commission has been to destroy this bugbear. They have reduced 'climate' to its proper dimensions and influence, and they have shown that, just as hot moist weather at home calls people to account for sanitary neglects and acts of intemperance, so does the climate of India call to account the same people there. There is not a shadow of proof that India was created to be the grave of the British race. The evidence, on the contrary, is rather in the other direction, and shows that all that the climate requires is, that men shall adapt their social habits and customs to it; as, indeed, they must do to the requirements of every other climate under heaven.

"This necessity includes all the recommendations made by the Royal Commission for improving the health, and reducing to one-sixth the death-rate of the British Army in India. They all amount to this: You have in India such and such a climate; if you wish to keep your health in it:—

"Be moderate in eating and drinking; eat very little animal food; let your diet be chiefly farinaceous and vegetable.

"Spirits are a poison, to be used only (like other poisons) for any good purpose, under medical advice. Use beer or light wine, but sparingly. Drink coffee or tea. Clothe yourself lightly to suit the climate, wearing thin flannel always next the skin. Take plenty of exercise, and use prudence and common sense as to the times of it.

"So far for personal habits. But a man cannot drain and sewer his own city, nor lay a water supply on to his own station, nor build his own barracks. What follows pertains to Government:—

"Let it be the first care to have a plentiful supply of pure water laid on for every purpose; drain all dwellings; have no cess-pits; attend rigidly to cleansing, not only to surface-cleansing.

"Never build in a wet hollow nor on a sludgy river-bank, which would be avoided by sensible people even at home. Never crowd large numbers into the same room; build separate barrack rooms, instead of large barracks; place these so that the air plays freely round them; raise them above the ground with a current of air beneath.

"Do these things, and the climate may be left to take care of itself.

"But, if we would make India about as healthy as England, only somewhat hotter, let us have improved agriculture and agricultural drainage.

"If all these improvements were carried out, the normal death-rate of the British soldier would be, not 69 per 1000, but 10 per 1000, say the Commissioners.

"But it is not for the soldier alone we speak. The report has a much deeper meaning and intent than this:—it aims at nothing less than to bring the appliances of a higher civilisation to the natives of India. Such revelations are made, especially in the reports from the stations, with regard to the sanitary condition of these, as to be almost incredible. Everywhere the people are suffering from epidemic diseases: fevers, dysenteries, cholera—constant epidemics we may call them, and constant high death-rates (how high can never be known, because there is no registration).

"The plague and pestilence is the ordinary state of things. The extraordinary is when these sweep over large tracts, gathering strength in their course, to pass over gigantic mountain ranges, and to spread their ravages over Western Asia and Europe. And all this might be saved!

"We know the causes of epidemic outbreaks here. Take the worst condition of the worst and most neglected town district at home; and this is, to say the least of it, much better than the normal condition of nearly the whole surface of every city and town in India.

"Not one city or town is drained; domestic filth round the people's houses is beyond description; water supply is from wells, or tanks, in ground saturated with filth; no domestic conveniences; every spare plot of ground is

therefore in a condition defying us to mention it further; rains of the rainy season wash the filth of the past dry season into the wells and tanks. The air in, and for some distance round, native towns is as foul as sewer air. [At Madras a wall has actually been built to keep this from the British town.] No sanitary administration; no sanitary police.

"Here then we have, upon a gigantic scale, the very conditions which invariably precede epidemics at home. India is the focus of epidemics. Had India not been such, cholera might never have been. Even now, the Sunderbunds, where every sanitary evil is to be found in its perfection, are nursing a form of plague increasing yearly in intensity, covering a larger and larger area, and drawing slowly round the capital of India itself.

"Are we to learn our lesson in time?

"Some say, What have we to do with the natives or their habits?

"Others find an excuse for doing nothing in the questions arising out of caste. But caste has not interfered with railways.

"The people of themselves have no power to prevent or remove these evils, which now stand as an impassable barrier against all progress. Government is everything in India.

"The time has gone past when India was considered a mere appanage of British commerce. In holding India, we must be able to show the moral right of our tenure. Much is being done, no doubt, to improve the country—by railways, canals, and means of communication; to improve the people—by education, including under this word, European literature and science.

"But what at home can be done in education, if we neglect physical laws? How does education progress here, without means of cleanliness, of decency, or health? The school lessons of a month are sapped in an hour. If the people are left a prey to epidemics and to immoral agencies in their homes, it is not much good sending them to school. Where should we be now with all our schools, if London were like Calcutta, Madras, or Bombay, the three seats of Government in India?

"The next great work, then, is sanitary reform in India.

"There is not a town which does not want water supply, draining, paving, and cleansing.

"Healthy plans for arranging and constructing buildings.

"Together with agricultural drainage and improved cultivation all round.

"These things the people cannot do for themselves. But the India Government can do them. * * * * * *

"The work is urgent. Every day it is left undone adds its quota of inefficiency to the British army, and its thousands of deaths to the native population. Danger is common to European and to native. Many of the best men this country ever had have fallen victims to the same causes of disease which have decimated the population of Hindustan. And so it will be till the India Government has fulfilled its vast responsibility towards those great multitudes who are no longer strangers and foreigners, but as much the subjects of our beloved Queen as any one of us." (Page 5, *et seq.*)

There are one or two points, connected with the habits of the soldier, which must be a little more discussed. With regard especially to diet two points must be considered:—

1. What amount of food should be taken? In India, as in all parts of the world, food is taken in proportion to the mechanical work done by the body, and to the equivalent of mechanical force, viz., animal heat.

High temperature, as lessening the loss of the body heat, must, *pro tanto*, lessen the need of food to supply the temperature; and it has been supposed

that the diet of men in cold countries (arctic regions) and in hot, contrasted remarkably in respect of the amount of carboniferous food taken by each. But although it is certain that large quantities of meat and fat are taken by men living in or arriving in cold countries, it is now known that the natives of some of the hottest parts of the world take immense quantities of both fats and starches. In fact, both these substances perhaps, certainly fats, are taken to supply mechanical force directly, as well as animal heat. It is not, in fact, yet known what amount of lessening of food, or what kind of lessening, the increased heat of the tropics demands, or whether any is demanded, for exact experiments are wanting. Our best guide at present for the quantity of food to be taken in the tropics, is to apportion it to the amount of mechanical work done, as in temperate climates. In India, as elsewhere, it must be in balance with exercise. The points then to be considered are the amounts of daily food and of daily exercise, and by means of the tables (p. 139, *et seq.*) formerly given, and by knowing the habits of the men, little difficulty will be found in determining the proper ration quantity of food with accuracy.

Admitting that at present we are not in a position to say whether the relative proportions of the four great dietetic classes should be altered in India, from the standard proved to be the best for temperate climates, we can yet affirm that our present knowledge would seem to show that the amounts of these substances should not necessarily be altered.

The Indian regulation ration is as follows:—

Daily Ration in India, in most Stations, in ounces and tenths of ounces.

Name of Article.	Daily Quantity.	Nutritive Value.				
		Water.	Nitrog. Subst.	Fats.	Starches.	Salts.
Bread, . .	16	6·4	1·28	·24	7·8	·2
Meat, . .	16, less 3·2 for bone, = 12·8	9·6	1·92	1·07	…	·2
Vegetables,* taken as Carrots,	16	13·6	·96	·04	·93	·11
Rice, . .	4	·4	·20	·03	3·33	·02
Sugar, . .	2·5	·075	…	…	2·41	·012
Salt, . .	1	…	…	…	…	1
Coffee (or in part black tea),	1·75	…	…	…	…	…
Total, exclusive of Coffee,	52·3	30·075	4·36	1·38	14·47	1·542
			Total Solids, 21·752†			

Mutton is issued once a-week; beef six times. Instead of rice, the soldier may, if he pleases, receive flour. Breakfast is at 8·30; dinner at 2·30; and tea after evening parade.

If this diet be compared with the home ratio (page 152), it is found to be slightly more nitrogenous and less rich in starches. The difference is not

* The vegetables are of different kinds: yams, sweet potatoes, pumpkins, &c. If yams are used, the amount is greater than in the text.

† In calculating out these diets, there is a little apparent loss from not carrying on all the places of decimals.

considerable, however. Is it too much for India? This will depend entirely on the amount of exercise; no doubt for a perfectly idle man it would be too much, but not if the amount of exercise is that of the home standard. In fact, it is believed to be in reality insufficient in quantity and in quality, from the fact that good meat, and even in some parts good bread, is not readily procurable in India. Vegetables also are deficient in many stations at certain times of the year.* It appears, however, that the soldier almost always buys additional food, and he may eat much more than is stated above. As already said (p. 461), Dr Macnamara found the troops in Bengal taking no less than 76 ounces of food (*i.e.*, water containing food), while the regulation ration is only 52 ounces, so that these men were largely over-feeding. And Dr Dempster (Indian Sanitary Report—Evidence) states that the majority of the recruits from Scotland and England eat in the hot weather in India much more animal food than in the coldest seasons in their native countries.†

It would therefore seem that illness may arise in India from excess of food, but it is not the regulation ration which produces it, but the additional purchased food, or the extreme idleness of the men, in which case even the regulation ration is too much. The only remedy is instruction of the men in what is good for them, and no men are so stupid as not to perceive what is best for their own comfort and happiness when it is once pointed out to them.

In addition, the soldier in India had till very lately the spirit ration (now lessened to one-half), which has the effect of lessening the power of appropriation of food, though not always the appetite, and thus indirectly may cause over-feeding.

The amount of fat in the regulation ration is, as at home, too small; but the soldier buys butter and other milk, and takes more oily food.

2. Admitting (till better observations are made) that men in the tropics, undergoing as much exertion as at home, will demand as much food, and in the same proportions, as far as the four classes of aliment are concerned (and it seems to me all physiological evidence shows that this must be the case, and that not external temperature, *per se*, but mechanical work, is the chief measure of food), the next question is, whether the different articles of the diet should be altered; whether, for example, the same amount of nitrogen being given, it should be contained in vegetable or animal food?

It has been stated by several of the best observers in the tropics that those who eat largely of animal food are less healthy than those who take more vegetable food; and Friedel, in his work on China, has lately again directed attention to the fact‡ that the amount of digestive and hepatic disease is much greater among the English than among any other European settlers in China. But whether this is owing to excessive animal food, or excess generally in all food, and to too much wine, beer, and spirits, is not certain. The diet is probably too rich as a whole.

Supposing meat is taken in proper but not excessive quantity with farinaceous food, as at home, is it less healthy than a quantity of vegetable food containing an equivalent amount of nitrogen? On this point it seems to me that strict scientific evidence has not been produced. With regard to excess of animal food there is no doubt; but animal food in moderation has not, I think, been shown to be more active in causing liver complaints in India than at home.

* Memorandum on Rations of Troops, by Dr C. A. Gordon, C.B., (Sanitary Commissioner for Bengal).

† Colonel Sykes long ago directed particular attention to this point, stating with perfect truth that the soldier in India is over-stimulated by food and drink, and under-stimulated by bodily and mental exercise.

‡ Already noticed as regards India and the Mauritius.

Considering, indeed, how important it is, when the digestive organs have been accustomed to one sort of diet, not to suddenly and completely change it, it seems to me very doubtful whether it would be desirable for the European arriving in India at once to give up all previous habits, and to commence an entirely different kind of diet.

It is possible, however, that the meat standard of England might be somewhat reduced, and the bread, flour, and leguminosæ increased. This is not the opinion, however, of some of those who have lately paid particular attention to Indian rations (Dr C. A. Gordon and Dr Inglis*), and who believe that the amount of meat is even too small. Still the point is worthy of a careful trial, so that the question might be properly settled by the sole test of these matters, a sufficient experience. A certain number of men (one or two companies in a regiment) might be selected for these trials, and the state of health carefully noted.

It has often been said that Europeans in India should imitate the natives in their food, but this opinion is based (it seems to me) on a misconception. The use of ages has accustomed the Hindu to the custom of taking large quantities of rice, with pulses or corn; put an European on this diet, and he could not at first digest it; the very bulk would be too much for him. The Hindu, with this diet, is obliged to take large quantities of condiments (peppers, &c.) The European who did the same would produce acute gastric catarrh and hepatic congestion in a very short time; in fact, as already stated (p. 460), one great fault of the diet of Europeans arriving in India is too great use of this part of the native diet.

Two points about the diet of India seem quite clear. One is, that spirits are most hurtful, and that even wine and beer must be taken in great moderation. Of the two beverages, light wines (clarets), which are now happily coming into use in India for the officers, are the best. For the men good beer should be provided, but it is important to teach the men moderation. The allowance per man per diem should never be more than a quart, and men would find themselves healthier with a single pint per day. But it would seem probable that, especially in the hot stations and seasons, entire abstinence should be the rule, and that infusions of tea and coffee are the best beverages.†

The other point is, that in the tropics there is perhaps even a greater tendency to scurvy than at home; the use of fruits, then, is of great importance, and whenever practicable, the growth of fruit trees should be encouraged in the neighbourhood of stations. In some stations (Mooltan) lime juice has been issued with the greatest benefit when vegetables were scarce.‡

Sir Hugh Rose has lately issued some good orders with regard to cooking, which will have the effect of improving considerably the preparation and the variety of food.

Exercise in the Tropics.—The amount of exercise should not be less than at home; it must necessarily be taken at different hours, early morning and evening, in certain parts of India; but when the time comes that the major part of the troops are quartered on the hills, exercise will be able to be taken as at home. And this, in fact, is one reason for hill stations.

The hours during the extreme heat of the sun will be always avoided on the plains of India, though it is probable that idleness and inertia have done much more harm than a little exposure to the sun would have done.

* *Op. cit.* and Army Medical Report, vol. v. p. 380.

† The drinks which the private soldier often buys in the bazaars in India are of the worst description; arrack mixed with cayenne and other pungent substances, or fermenting toddy mixed with peppers and narcotics, or drugged beer, are common drinks. It would be easy to put a stop to this by legislative enactment.

‡ Dr C. A. Gordon—Memorandum on Rations, 1865, p. 11.

Health of the Troops.

The chief statistics of the forces in India are contained in—

1. Numerous scattered papers in the various Indian medical periodicals for the last thirty years, referring chiefly to the health of one presidency or of regiments or forces occupying small districts.

2. Summaries of the whole, by Colonel Sykes (for twenty years ending 1847, "Statistical Journal," vol. x.), Sir Ranald Martin ("Influence of Tropical Climates," 2d edition), Mr Ewart ("Vital Statistics of European and Native Armies," 1859), Drs Waring and Norman Chevers ("Indian Annals," 1858–1862); and as far as officers and civilians are concerned, by Colonel Henderson "Asiatic Researches," vol. xx.), and Mr Hugh Macpherson.

3. Official documents, the most important of which are contained in the Indian Sanitary Report, and in the yearly Army Medical Reports since 1860. These last statistics, however, refer only to Queen's troops, until 1863.

Loss of Strength of Europeans.

1. *By Death.*—From all these statistics it appears that the three presidencies differ in the amount of mortality. Bengal is the most unhealthy presidency, and Madras the least so.

Mortality per 1000 *of Europeans.*

Authorities.	Bengal.	Bombay.	Madras.
Sykes (20 years ending 1847),	73·8	50·7	38·46
Ewart (42 years for Bengal, 50 Bombay, 30 Madras),	69·4	55·2	38·8
Chevers (1845–1854),	63·38	60·2	59·2
Sanitary Commission, (56 years, ending 1856, Company's Troops),	74·1	66	63·5
Queen's Troops alone (Balfour, 1838–1856),	76·2	60·2	41·5
Queen's Troops alone (Tulloch, 1817–1856),	79·2	61·1	62·9
Queen's Troops alone (Balfour, 1860),	39·37	31·70	22·63
Queen's Troops alone (Balfour, 1861),	45·57	24·72	15·83
Queen's Troops alone (Balfour, 1862),	27·55	24·6	20·83
All Troops (Balfour, 1863),	26·26	16·14	22·11

These numbers are tolerably accordant—

	All India. Per 1000 of Strength.
Sir Alexander Tulloch (Queen's Troops, 1817–1855),	70
Sanitary Commission (Company's Troops, 1800–1856),	69
" " (" " 1847–1858),	51·2

The mortality of the Company's Troops, distributed according to ages, is as follows (Sanitary Commissioner's Report, p. 539) :—

Ages.	Company's Troops, 1847–1856. Per 1000 of Strength.	Queen's Troops, 1861.
10—20,	27·3	6·99
20—25,	56·5	14·02
25—30,	49	18·92
30—35,	50	34·96
35—40,	50	39·32
40—45,	58·3	38·48
45—50,	54·2	
50—55,	60	
55 and upwards,	46·4	

The mortality augments, therefore, greatly with age and service, in a ratio much quicker than on home service.

Effect of Residence in India.—From the Sanitary Commissioners' numbers it is concluded that the mortality is highest in the first year of residence, then slightly declines, and becomes sensibly less in the fifth year; from that time it rises slowly again. Entry into India in early life appears to give some advantage.

During the periods referred to in the preceding tables, the mortality has greatly varied. In Bengal the deaths were highest in the quinquennial period, 1812–1816, viz., 96·5 per 1000, and lowest in 1832–36, viz., 51·6 per 1000. In 1852, among the Company's Europeans, the deaths were only 41·1 per 1000; in 1829 they were 43·4 per 1000.

In Bombay the greatest mortality was in the years 1819–1823, viz., 80 per 1000, and least in 1849–1853, viz., 28·6 per 1000. In one year, 1855–56, there were only 10 deaths per 1000 of strength. The decrease has been supposed to be owing to better treatment, and *not* to improved sanitary conditions.

The mortality just enumerated is the gross loss, including the deaths in war, by violence, suicides, &c. The effects of war are not easily distinguishable, as the consequences of an unhealthy campaign show themselves for some time afterwards. The present mortality in times of profound peace, and when the force is not under peculiarly unfavourable conditions, is probably represented pretty closely by the mean mortality in 1860–61–62–63, viz. :—

Present Mortality per 1000 *of Strength.*

Bengal.	Bombay.	Madras.
34·69	24·29	20·35

The greater mortality in Bengal has been usually ascribed to the greater prevalence of malaria, and to the effects of more frequent wars. On the whole, more frequent outbreaks of fever and cholera have probably been chief causes.

Of late years the mortality in all India has lessened, while the admissions have remained the same. It is probable that this is owing to several causes :—

(*a.*) Better treatment, viz., especially a larger use of quinine in fevers and ipecacuanha in dysentery, and a lessened use of the terrible plan of giving mercury largely in hepatic and dysenteric affections.

(*b.*) Earlier invaliding, and the effect of hill sanitaria, though the full use of these has not yet been brought out.

The mortality not only differs in the three presidencies, but in different

stations in the same presidency, and in different years in the same station. This is partly owing to occasional outbreaks of cholera.

At some stations the mortality has been occasionally lower than at home; in others more than twenty times as much. Thus, to take a few stations in the Bengal Presidency in 1861:—*

Mortality per 1000 *of Strength.*

Dugshai (Himalaya hill station),	6·35
Rawul Pindee (Punjab),	8·18
Umritsir,	124·05
Mean Meer (Punjab), cholera,	352·75

These astonishing differences are the measure of the sanitary work which has to be done.

Ranald Martin gives a table with the admissions and deaths in the chief European stations during the years 1838–56, which will be useful as showing the usual mortality at that time. The numbers at the stations with only two or three years' returns must be held to be doubtful.

Abstract showing the Sickness and Mortality of the Troops of the Line at the under-mentioned Stations of the Indian Presidencies, as nearly as can be ascertained from the Annual Sanitary Reports forwarded to the War Office from 1838 *to* 1856 *inclusive.*

Stations.	Period of Observation.	Ratio per 1000 of	
	Years.	Admissions.	Deaths.
Bengal.			
Fort William,	7	1652	58·08
Chinsurah,	2	2601	69·96
Dinapore,	13	1847	82·73
Ghazeepore,	5	1878	91·94
Cawnpore,	10	2278	88·90
Agra,	8	2365	60·71
Meerut,	14	1690	44·03
Kurnaul,	5	2344	78·04
Hazareebaugh,	2	1622	34·15
Allahabad,	2	2479	115·14
Loodianah,	2	2259	127·10
Umballah,	10	1497	61·71
Kussowlie,	7	1222	49·01
Ferozepore,	5	1759	55·12
Jullundur,	5	1727	37·44
Lahore,	7	2848	90·40
Rawul Pindee,	4	1868	43·46
Peshawur,	5	3225	71·86
Wuzeerabad,	4	1660	59·22
Dugshai,	3	1423	26·36
Subathoo,	3	1630	31·02

* Balfour—Army Medical Report for 1861, p. 112.

Abstract showing Sickness and Mortality of the Troops, &c.—continued.

Stations.	Period of Observation.	Ratio per 1000 of	
	Years.	Admissions.	Deaths.
Madras.			
Fort George,	16	1754	28·93
Cannanore,	17	1611	31·65
Trichinopoly,	11	1913	31·07
Secunderabad,	8	1716	56·78
Bangalore,	17	1402	24·39
Kamptee,	7	2068	47·72
Tenasserim Provinces,	9	1770	33·00
Bellary,	7	1939	48·60
Bombay.			
Colabah and Bombay,	7	2165	60·73
Poonah,	13	2089	33·01
Belgaum,	10	1644	41·27
Deesa,	7	1641	33·45
Kirkee,	14	1886	25·63
Kurrachee,	12	1907	47·14
Ahmednugger,	3	2396	57·19
Hyderabad,	4	2495	42·43
Aden,	8	1239	43·64

Composition of the Force influencing Mortality.

The mortality among officers is always less than among men.

In the years 1814–33, the yearly mortality of officers of the East India Company's armies was 38 per 1000; in these twenty years, 3194 deaths occurred out of 4219 officers. The yearly mortality among the officers of the royal army serving in India during the same period was 34 per 1000, or 742 deaths out of 1079 officers. In all, 3936 officers died, whereas in England the deaths of the same class would have been 1060. There was, therefore, in twenty years, an excess of 2876 deaths, of which 122 only occurred in action or from wounds.* Macpherson determined the rate of deaths of officers in Bengal for eight years (1846–1854). The deaths were 21·2 per 1000; the ratio among the soldiers being 56·2 per 1000 for the same period.

No later returns have been made; but it is probable Macpherson's numbers are not far from the present amount. However much the officer suffers in comparison with England, he has less than half the mortality of the men. The causes of mortality of officers have not yet been fully made out. Fevers and dysenteries hold the chief rank, but as a class there is much less cholera and dysentery among the officers than among the men.

The mortality of non-commissioned officers is also less than that of the men, and this has sometimes been very marked in cholera epidemics. The exact amount is, however, not known.

Married men show a less mortality than single men, especially from

* Indian Sanitary Report, p. 19.

dysentery and liver disease. It can scarcely be doubted that this is chiefly owing to the better cooking of food by their wives.

Of the different arms, the engineers and artillery are the healthiest; then generally the cavalry, and lastly the infantry.

Causes of Mortality among Europeans.

There are four diseases, or rather groups of diseases, which are the chief causes of mortality, viz. :—

Fevers, paroxysmal and continued.
Cholera.
Bowel complaints, especially dysentery.
Liver diseases.

The mortality by all diseases in every hundred deaths of Europeans serving in the Presidency of Bombay, between 1830 and 1846, was as follows :—*

Dysentery,	28·527
Fevers,	23·054
Cholera,	10·320
Hepatic diseases,	9·597
Diarrhœa,	3·914
Pulmonary diseases,	5·807
Other diseases,	18·697
Lost in calculation,	·084
Total,	100·000

If we take the returns of 1860, 1861, 1862, and 1863, as representing the present causes of mortality in hospitals in India, we find them to be as follows :—

Deaths per 1000 *of Strength.*

Diseases.	Bengal.				Bombay.				Madras.			
	1860.	1861.	1862	1863.	1860.	1861.	1862.	1863.	1860.	1861.	1862.	1863.
Eruptive fevers,	·40	·85	·05	·23	·26	·45	·17	·16	...	·09	·08	...
Paroxysmal fevers,	2·76	1·97	1·86	2·16	2·63	1·92	2·11	·97	1·46	·56	·56	·32
Continued fevers,	2·10	2·29	1·47	1·10	2·90	·90	1·18	·40	1·18	·65	·64	1·27
Dysentery and diarrhœa,	5·92	5·28	3·31	3·64	4·13	5·64	4·38	2·11	2·10	2·42	1·91	2·38
Cholera,	12·46	23·48	8·21	3·69	9·22	3·95	4·63	·65	3·37	2·7	3·67	3·72
Tubercular diseases † (phthisis and hæmoptysis),	2·57	1·89	1·75	2·16	1·58	1.24	1·01	1·05	2·19	0·74	1·43	1·58
Pneumonia, †	·47	·72	·38	·42	·0	·33	·33	·24	·17	·28	·16	·08
Acute bronchitis, †	·28	·34	·25	·19	·37	...	·5	...	·43	·19	·16	·24
Diseases of nervous system, †	3·49	1·75	1·63	1·76	1·66	1·35	1·35	·97	1·31	·84	2·39	1·26
Hepatitis † (acute and chronic) and icterus,	3·75	2·74	2·97	3·26	2.72	3·49	2·69	2·84	3·27	2·70	2·79	3·01
Violent and suicidal deaths (not executions), †	·61	·80	1·39	2·60	2·11	1·69	2·1	1·45	1·02	1·30	1·5	2·61

Taking the average of the four years, and calculating the percentage of each of these causes of deaths, we find the table shows at a glance the important differences in mortality in the three presidencies; in Bengal and Bombay malarious fevers are in greater excess than in Madras; so with

* Sir Ranald Martin—Tropical Climates, p. 94.

† These numbers are all calculated from the returns in the Appendix to Dr Balfour's Report, and do not include the deaths among invalids on passage to England. In 1863, the return for Bombay does not distinguish between acute and chronic bronchitis, so it has been omitted.

"continued fevers," which in all presidencies cause a good deal of mortality. Dysentery is most fatal in Bengal, then in Bombay, and then in Madras. Cholera in the same order, being nearly fourfold as fatal in Bengal as Madras. Diseases of the nervous system are also more fatal in Bengal.

With regard to tuberculosis (phthisis and hæmoptysis), it would seem that more men die, in proportion to strength, in the hospitals in India, than in Canada (see page 552); and in respect of pneumonia (which is rather more frequent in Bengal), it would seem that, taking the mean of the four years (1861–63) in Bengal, the deaths from pneumonia are ·497; in Bombay ·225; in Madras ·172 per 1000 of strength; in England, the mean of five years (1859–63) is ·537, and in Canada ·831. It is singular how closely Bengal approaches to England in this respect; in Bombay and Madras the prevalence is less.

It is at once seen how great a diminution of mortality there would be, if cholera and dysentery could be prevented; and that the prevention is no idle dream, must surely be admitted, after what has been said in the chapter on the Prevention of Disease.

But there are two headings in the table which seem to demand from Indian officers a more thorough investigation. What are those fatal diseases which appear as paroxysmal and continued fevers? The only fatal malarious fevers are the intense remittents, from which troops only suffer in special localities; during a service of two and a-half years in Burmah, where malarious fever was extremely common, I only saw five cases of malignant remittent, of which three were fatal. As a rule, however deeply malarious fever invades the constitution, and however obstinately it clings to it, it is not, in the first instance, a fatal disease; witness the slight mortality in the most malarious country of all our foreign possessions, Demerara. What, then, are the forms of those paroxysmal fevers, which every year kill two or three men in every 1000? If they are malignant remittent, there must be great and unnecessary exposure at some points.

So also with the return of "continued fever;" is this also a severe malarious fever, or typhoid or relapsing fever, both of which occur in India? A complete analysis of the meaning of this heading would be most important.

The mortality from diseases of the nervous system is in part dependent on insolatio and delirium tremens, and probably will be lessened in years to come.

2. *By Invaliding.*—The numbers invalided are not known with any accuracy for a long term of years.

Discharged per 1000 *of Strength.*

Years.	Cavalry and Infantry.			Royal Artillery. All India.
	Bengal.	Bombay.	Madras.	
1860,	7·46	20·42	8·27	9·96
1861,	9·80	43·65	9·84	15·01
1862,	15·32	34·52	19·88	18·83
1863,	18·16	33·01	14·74	...

The great causes of discharge are eye diseases, pulmonary diseases, mental diseases, rheumatism, dysentery, and hepatic disease.

*Mortality of Native Troops.**

Colonel Sykes gives the mortality for 1825–44 as 18 per 1000 of strength for all India, and for Bengal, 17·9; Bombay, 12·9; Madras, 20·95.

In Madras, from 1842 to 1858, the average was 18 per 1000 (Macpherson), of which 6 per 1000 each year were deaths from cholera.

Ewart gives the following numbers (p. 36), per 1000 of strength—Bengal (1826–1852), 13·9; Bombay (1803–1854), 15·8; Madras (1827–1852), 17·5.

Taking successive quinquennial periods, there has been a slight progressive decrease in mortality, but this is less marked than in Europeans.

The excess of mortality is chiefly due to cholera, dysentery, and fever.

Loss of Service of Europeans (Queen's Troops).

Admissions per 1000 *of Strength.*

	Bengal.	Bombay.	Madras.
Admissions, 1838–1856,	2047	2117	1741
,, 1860,	2023	1933	1487
,, 1861,	1954	1756	1254
,, 1863,	1759	1591	1255
Mean daily sick, 1860,	74·89	66·21	62·97
,, ,, 1861,	80·27	73·02	57·64
,, ,, 1862,	...	69·5	61·77
,, ,, 1863,	61·89	64·16	63·62
Mean duration of cases in days, 1860,	13·51	12·50	15·55
Mean duration of cases in days, 1861,	14·99	15·09	16·77
Mean duration of cases in days, 1862,	...	13·95	17·42
Mean duration of cases in days, 1863,	12·84	14·72	18·51

In 1860, a number equal to three regiments in Bengal, and one regiment in each of the other two presidencies, was constantly sick.

The table (p. 591) gives a view of the chief causes of admissions during the last years of which we have the returns, and it is probable that the diagnoses are more certain than in the tables of any former years.

It shows that the diseases of England, pneumonia, bronchitis, pleurisy, &c., are by no means rare in India; and, indeed, I feel pretty sure a more accurate diagnosis will raise the figure. But the chief causes of admissions are paroxysmal fevers, "continued fevers," dysentery, digestive diseases (exclusive of hepatitis and dysentery), venereal, integumentary diseases, and rheumatism. Hepatitis causes few admissions, but much loss of service. Cholera gives few admissions, but a great mortality.

Tuberculosis is by no means absent, and gives, in fact, more admissions than in the West Indies.

With regard to the prevention of these several diseases, enough has been

* Owing to the want of accurate census returns, it is very difficult to know the loss among the Indian civil population. In Calcutta, where the number of inhabitants is pretty well known, the yearly mortality in eleven years fluctuated from 37 to 81 per 1000; the mean being 51 per 1000. The Hindus were less healthy than the Mussulmans. At Delhi, the yearly rate has been placed at 36 per 1000.

said in the chapter on the PREVENTION OF DISEASE, and in the present section. There is no doubt that much may be done, and probably the sickness and mortality will be reduced, if hill stations are used, to the same ratio as in the West Indies.

It is most satisfactory to find that the sickness and mortality are both rapidly falling, owing to the energetic means now being adopted by the Government, and to the increased sanitary powers and improved curative means of the medical officers.

The prevalence of venereal disease demands as much attention in India as in England, but the preventive measures will be much easier. Police regulations and proper surveillance will be more readily enforced, and a larger number of men can be permitted to marry. At present twelve men per company are allowed to marry, and it has been supposed by military officers that 25 per cent. could be so allowed. This is much to be desired; but if it be done, the Government must face certain results; proper quarters must be provided, and places for disposal of the women in times of service. It is also very desirable, for married men, not to move regiments too frequently; and if the plan of giving a regiment two years' service in the hills and one on the plains be adopted, it will put the married people to great expense. Probably it will be found that a longer hill service can be given without injury.

Another result can be foreseen: if the term of Indian service be shortened to ten years, it will be a great inconvenience to the married men to return home, and it is quite clear that a very great number of them will constantly volunteer to remain. This is indeed, perhaps, desirable, as keeping steady married men who know the sort of life in India; but it is not the result contemplated by the plan of frequent reliefs.

Taking the mean of the years 1860, 1861, 1862, and 1863, as probably giving us more trustworthy numbers than earlier periods, we find the following to be the chief causes of admissions:—

European Troops (Annual Average Admissions per 1000 *of Strength).*

DISEASES.	Bengal. 1860–63 (4 years).	Bombay. 1860–63 (4 years).	Madras. 1860–63 (4 years).
Paroxysmal Fevers,	536·	566·27	174·9
Continued Fevers,	178·27	122·55	84·62
Dysentery and Diarrhœa,	145·1	143·92	151·12
Cholera,	19·77	7·22	7·62
Acute Hepatitis,	34·82*	49·21	39·77
Chronic Hepatitis,	25·68*		22·97
Tubercular (Phthisis and Hæmoptysis),	10·02	7·99	14·05
Bronchitis (Acute & Chronic),	44·73	43·29	37·44
Pneumonia,	3·13	1·99	1·59
Pleurisy,	3·74	2·17	2·46
Digestive (Non-Dysenteric),	122·91	113·59	108·6
Enthetic (Venereal),	324	305·17	264·1
Ophthalmia,	63·65	53·27	55
Rheumatism,	75·1	65·55	63·6
Integumentary,	104	104·75	107·3

* Mean of three years.

Arrival in India.

The proper time for arrival is at the end of October or beginning of November. It appears to be an almost invariable rule that soldiers on disembarkation in India show a large sick list during the first three or four months. They frequently land in robust health; they have been well fed during the voyage, and have had little exercise, and are often, indeed, too plethoric. The excitement of landing, the new scenes, the welcome, and too great hospitality of comrades, the exercise under unusual conditions of heat, the altered diet, all act unfavourably, and their own excesses add to the evil. As they usually land at the presidencies, they are at once exposed to the influences of these towns, and may suffer very soon from cholera, or malarious fever. In addition to what has been advised elsewhere (p. 602), it is of great importance to fully carry out a measure already commenced by the Government,* viz., not to keep the men longer than absolutely necessary at the presidencies (not for a day if possible), but to move them inland. If it were made a rule to send every fresh corps at once to the hills for two years after landing, it would probably be the means of saving many lives, One difficulty is that the best hill stations are a long way from the sea-ports, but the railways have somewhat lessened that objection.

The advantages of the hills are, not merely the avoidance of malaria, and the excessive high temperature of sea-level or inland plains, but the fact that exercise can be taken freely in a temperature not very different from England. Would it not be possible to use the fine station of Newera Ellia or Horton in Ceylon as a station of transit for Bengal? Madras can use the table-land of the Deccan or the Neilgherry Hills, and Bombay has its stations on the Ghauts.

One more point will require attention in India, and that is the health of the women and children. There has always been a very large mortality of children, and at certain stations of women. For them the transference to the hills is the most important preventive measure, and probably nothing else will do more than slightly lessen the great yearly loss of children.

SECTION IX.

CHINA.

Hong-Kong.

Although the English have occupied Canton, Tientsin in the north, and several other places, yet, as their occupation has been only temporary, it seems unnecessary to describe any other station than Hong-Kong.

Garrison of Hong-Kong about 1000 to 1500, but differing considerably according to the state of affairs in China.

The island is 27 miles in circumference, 10 long, and 8 broad at its widest part.

Geology.—The hills are for the most part of granite and syenite, more or less weathered. In some parts it is disintegrated to a great extent, and clayey beds (laterite) are formed, in which granite boulders may be embedded. Victoria, the chief town, stands on this disintegrated granite. As in all other cases, this weathered and clayey granite is said to be very absorbent of water, and, especially in the wet season, is considered very unhealthy.

* Especially by the Bengal Government since 1856; the men are sent on arrival to Dum-Dum or Chinsurah, and are then sent to the north-west as soon as conveyance can be found.

Climate.—Mean annual temperature, 73° Fahr.; hottest month (July), 86°·25; coldest month (January), 52°·75; amplitude of the yearly fluctuations, 33°·5.

The humidity is considerable, about 10 grains in a cubic foot of air in July, and four in January.

The N.E. monsoon blows from November to April; it is cold, dry, and is usually considered healthy and bracing; but if persons who have suffered from malaria are much exposed to it, it reinduces the paroxysm. The S.W. monsoon blows from May to October; it is hot and damp, and is considered enervating and relaxing. The difference in the thermometer between the two monsoons has been said to be as much as 46°, but this seems excessive.

The rainfall is about 90 inches with the S.W. monsoon.

In addition to Victoria, there are two or three other stations which have been occupied as sanitaria, viz., Stanley, seated on a peninsula on the south end of the island, and about 100 feet above the sea; and Sarivan, 5 miles east of Victoria. Neither station seems to have answered; the barracks are very bad at Stanley, and are exposed too much to the N.E. monsoon, which, at certain times, is cold and wintry; during the S.W. monsoon it is healthy. Sarivan has always been unhealthy, probably from the neighbourhood of rice fields. Since the close of the last war a portion of the mainland, Cowloon, opposite Victoria, has been ceded, and has been occupied by troops. It is said not to be, however, even so healthy as Hong-Kong,* but there are differences of opinion on this point.

Hong-Kong has never, it is said, been considered healthy by the Chinese. The chief causes of unhealthiness appear to be the moist laterite and weathered granite, and the numerous rice fields. Indeed, to the latter cause is ascribed by some (Smart)† the great unhealthiness, especially when the rice fields are drying in October, November, and December.

Local causes of unhealthiness existed till very lately in Victoria. In building the barracks the felspar clay was too much cut into, and, in addition, the access of air was impeded by the proximity of the hills. The S.W. monsoon was entirely shut out. Till lately sewerage was very defective.

Owing probably to these climatic and local causes, for many years after its occupation in 1842, Hong-Kong was excessively unhealthy. Malarious fevers were extremely common, and not only so, but it is now known that typhoid fever has always prevailed there (Becher and Smart). Dysentery has been extremely severe, and has assumed the peculiar form of lientery. This was noticed in the first China war, and appears, more or less, to have continued since. In addition to these diseases, phthisis appears to have been frequent.

There have been of late years such frequent wars in China, that the exact amount of sickness and mortality, due to the climate of Hong-Kong, cannot be well determined. But it is becoming much healthier than in former years, owing to the gradual improvement in sanitary matters which goes on from year to year. In 1865 there was, however, much sickness, owing apparently to overcrowding, and to bad accommodation.

In the Statistical Reports, the troops serving in Hong-Kong, Cowloon, Canton, and Shanghai, are classed together, so that the influence of Hong-Kong *per se* cannot be known.

In the years 1859–62, which include years of war, the admissions in South

* See Report of Surgeon Snell, "Army Medical Report," vol. v. p. 360, for the causes of the unhealthiness of Cowloon.

† "Transactions of the Epid. Soc.," vol. ii. This paper should be consulted for an excellent account of Hong-Kong, and of the diseases among sailors especially.

China averaged 2340, and the deaths 35·49, or, exclusive of violent deaths, 33·35 per 1000 of strength, and there was in addition a large invaliding. In the last-named year (1862) the admissions were 1781, and the deaths (accidents excluded) 23·7 per 1000 of strength. In 1863 the admissions in the stations in South China (Hong-Kong and Cowloon), were at the rate of 2637, and the deaths were 39·03 per 1000 of strength, or, excluding violent deaths, 35·74 per 1000. Paroxysmal fevers gave 671·4 admissions and 2·49 deaths; continued fevers 374 admissions and 2·49 deaths; and dysentery and diarrhœa 208·8 admissions and 10·81 deaths per 1000. It is therefore evident that there must be a vast amount of preventible sickness still to be got rid of.

SECTION X.

AUSTRALIA AND NEW ZEALAND.

Australia.—It seems unnecessary to describe the climate of Australia. The number of troops stationed in Australia (New South Wales, Victoria, Adelaide, and Western Australia) and Tasmania is now small; in 1862 it averaged only 1000 for all the stations. During the years 1859–62 there were in Australia and Tasmania 726 admissions and 15·51 deaths, or, without violent deaths, 14·03 deaths per 1000.

These countries at present are known to be very healthy; this arises in part from the absence or great infrequency of malaria; the exanthemata also are less common and virulent, and phthisis among the civilians is supposed to be infrequent.

Among the troops the chief admissions in 1862 were, in the order of frequency—

Contusio, . .	68 per 1000	Influenza, .	29 per 1000
Gonorrhœa, .	67 „	Drunkenness, .	26 „
Rheumatic, .	49 „	Dyspepsia, .	24 „
Diarrhœa, .	37 „	Phthisis, .	20 „
Phlegmon, .	32 „	Abscesses, .	16 „

and other smaller items, no disease being of any gravity. In 1863 there were 27·9 admissions and 2·54 deaths from "continued fever."

It only requires a glance at these figures to show not only the healthiness of Australia, but that a little individual management and good conduct would remove much of this sickness. There is only one formidable entry, viz., 20 cases of phthisis. Of 17 deaths from disease in 1862, phthisis caused 7, or 41 per cent., of the total deaths from disease. In 1861 it caused 13·2 admissions, and 1·1 death per 1000. In 1860 it caused 8·3 admissions, and 3·7 deaths per 1000; the average of the three years being 3·7 per 1000 living, exclusive of invaliding. In 1862, 46 per 1000 were recommended for discharge, and of these 7 were tuberculous, so that in that year there was a loss from phthisis, per 1000 of strength,—by death, 7; by invaliding, 7; total, 14. This is nearly as much as at home, and so far does not seem to bear out the general impression of the absence of phthisis in Australia. The number of years of observation is, however, small; and the number of cases in 1862 was evidently unusual. In 1863 there were 6 deaths from phthisis and hæmoptysis out of a total of 14, or 7·64 per 1000 of strength; of 100 deaths, tubercular diseases caused 42·8. In addition, 5 invalids were sent home with scrofula and phthisis, or at the rate of 6·34 per 1000 of strength. The total loss from phthisis, hæmoptysis, and scrofula, was 13·98 per 1000 of strength. This experience accords with that of 1862, and so far the Australian climate or mode of life

does not seem very favourable in phthisis. Still, the period of observation is too limited for a safe conclusion.

New Zealand.—The frequent wars in New Zealand render it rather difficult to judge of the effect of the colony on the health of the troops. It has always been considered healthy. In the years 1859–62, there were (men killed in action and other violent deaths being deducted) only 595 admissions and 7·41 deaths per 1000 of strength. In 1862, one regiment (65th) had only 4·78 deaths per 1000 from all causes, an almost unexampled degree of health. In 1863 there were 22·49 deaths per 1000, but 12·46 were in battle, and 2·77 were also other violent deaths, so that the total from disease was only 7·26 per 1000; of these tubercular diseases give 1·73 per 1000. In spite of the hardships of eight months' war, the admissions were only 568.7 per 1000; the ratio constantly sick was only 30·28 per 1000, an extremely small amount for a period of war.

Tubercular diseases cause a mortality of 2 per 1000, including the deaths of invalids on the passage home.

Among the diseases causing admissions, ophthalmia, bronchitis acuta, phlegmon, and abscess, diarrhœa, acute and chronic rheumatism, and "continued fever," give the greatest number of admissions. The latter is probably febricula, as in 1862, among 114 cases, there was not a single death.

CHAPTER IV.

SERVICE ON BOARD SHIP.*

SERVICE on board ship must be divided into three sections, corresponding to three different kinds of service.

1. Transport ships, for the conveyance of healthy soldiers, their wives and children, from place to place, or for conveying small parties of troops in charge of convicts.

2. Transports for conveyance of sick from an army in the field to an hospital in rear, or from a foreign station to a sanitarium, or home. Although the term is a little odd, it is convenient to call these ships Sick Transports.

3. Hospital ships, intended for the reception and treatment of the sick.

SECTION I.

TRANSPORTS FOR HEALTHY TROOPS.

At present Government employs a few steam-vessels of its own which convey troops, but the greater part of the transport is carried on by vessels hired at the time. This plan has been much objected to, and as strongly defended. The plan by Government transports is said to be cheaper, and to have the advantage of vessels specially prepared for the service. Considering the great and constant transport which is now necessary, it is difficult to believe that this plan would not be better in all ways.† At present, however, merchant ships which happen to be disengaged are hired for the voyage. They are inspected by Government officers, and such alterations as are necessary are made in them. Before troops are permitted to embark, they are carefully inspected by the principal medical officer and the medical officer in charge, and any man with any disease which may prove injurious during the voyage is kept back. Every man is therefore supposed to embark in perfect health ("Queen's Regulations."—*Embarkation of Troops.*)

* In writing this chapter, I have made use of Dr Wilson's work on "Transports," of Dr Kirwan's "Despatch of Troops by Sea," and of Dr Charles Gordon's "System of Sea Transport for Troops." I have also had the advantage of reading a lecture given by Dr Fyffe at the Army Medical School, and a MS. essay on Transports, by Dr Davidson of the Army Medical School. I have also been allowed to read some sets of regulations for the management of troops at sea, drawn up by officers in command for their own use, and must especially refer to one excellent set of rules drawn up by Major Macpherson, 24th Regiment.

† Could not some of the old wooden ships, now useless and rotting in the Medway or other ports, be used for this purpose? Their crews, being men-of-war sailors, would add to the strength of the navy, and in time of war, when transports would be less wanted, might return to the armed men-of-war. The great advantages which would result from the use of Government transports have been very well and forcibly put by Dr Kirwan (see "Despatch of Troops by Sea," pages 6–12).

Regulations for Transports.

At page 84 of the "Medical Regulations," the principal medical officer at the port of embarkation is ordered to inspect the ship, and to ascertain the tonnage per man;* the height between decks; the cubic space, superficial area, and means of ventilation; the cleanliness of the ship, bilge, and water-closets; that there is sufficient chloride of zinc, and a fumigating apparatus on board; that stoves are provided; that cots, bedding, utensils, and cooking arrangements are sufficient; and that the stoves, water, and medical comforts are good and sufficient.

In the Queen's Regulations (p. 319, *et seq.*, of the pocket edition) the "Duties on Board Ship" are very explicitly stated. This chapter should be very carefully read over, and constantly referred to. As it would be impossible to put in these long directions here, I shall assume that every officer thoroughly knows these regulations. A scheme of diet is ordered (p. 331, pocket edition,† also Medical Regulations, p. 200, for India), additional clothing is given, viz., a canvas tunic or blouse.

Inspection of Transports at the Port of Embarkation.—The Assistant-Quartermaster-General and the Principal Medical Officer make an inspection of all hired transports, as already stated. It is of importance that the medical officer who is to be in charge of the troops should be present, and this should be ordered whenever it can be done; occasionally, however, the medical officer may be with his regiment, and does not see the ship till the men are actually embarking.

The inspection of the ship should be conducted like that of a barrack. A ship is, in fact, a floating barrack.

1. *Amount of Space.*—The measurements on board ship are not always easy, but by attention to the rules at page 132, the various irregular spaces will be determined. No special amount of superficial or cubic space is ordered; this is determined by the tonnage (1 man to 2·7 tons), but this plan is not a good one. The loftier the space between decks and the greater the cubic space the better.

2. *Ventilation.*—Most hired transports have no means of ventilation except opposite ports (which are often obliged to be closed), hatches, and windsails. Windsails are large tubes made of sailcloth closed above, but having on one side a large open mouth or slit. The windsail is tied to a yard or rope, the upper part being some four or six feet above the deck, and the lower open end passing down between decks. The open mouth is turned towards the wind, which then blows down the tube. A great deal of air enters in this way, but it is often badly distributed. The best plan is to close the lower end and to have several lateral openings at different heights (Davidson), and in all directions; it would be well, also, to have the upper of these lateral openings rather smaller than the lower, as the wind will blow more forcibly through the upper holes. Another very good plan is to make the windsail long enough to be carried some way between decks, and not merely, as usual, open at the bottom of the hatches; openings can then be made at intervals in it. Any curves in a windsail should be large, so as to avoid choking, or the calibre should be held open with hoops at this point. The air should be let in near the lower deck, and as far as possible from the outlets.

If a ship has open stern ports, this is a great advantage, but generally there are cabins, or cargo, which block the stern ports from the between-deck.

* The Queen's Regulations order 270 tons (new measurement) for 100 men.

† I believe it is not unlikely that some alteration may be made soon in the diet of troops at sea, especially of those bound to India. I have therefore not made any remarks on the diet scales given in the Queen's and Medical Regulations (p. 331 and p. 200 respectively).

Hatches are always very uncertain means of ventilation; they are also obliged to be closed during stormy weather—in fact, at the time when most of the men are below, and when the ventilation is worst. In bad weather, Dr Davidson suggests the following arrangement:—Suspend a spar a few feet above the main hatch, and let a tarpaulin fold over it like a tent; this can often be kept open at one side, or at both for a time, and closed at once if necessary. In very severe weather, of course, this will not answer. In the smaller hatches a frame of wood or rope can easily be arranged, which the tarpaulin can cover.

But with all care the ventilation between decks is never good with hatches and windsails merely, when the ports are closed. Let any one visit a troop-ship about three hours after the men are in bed, or even a man-of-war: the air is excessively fœtid, very moist, extremely hot, the temperature above the men's heads being sometimes, it is said, 6° or 8° higher than below; and those who go in from the pure air can hardly bear the odour.* The movement of air is extremely small when the ports are closed. At the hatches the hot air gets suddenly cooled, and its ascent is checked. Usually, however, a double current is established in the hatchway, but this is not nearly sufficient.

Other plans must be adopted. Dr Edmond's plan of ventilation is now used in all the emigrant ships, and is being adopted in the Royal Navy. In the case of a steamer, the space round the funnel is encased, and serves as an outlet, or the funnel itself is used; the spaces between the timbers and between-decks are all brought into connection, and the air is led from them by shafts to the central shaft. By this plan, the bilge and hold, as well as the between-decks, are purified (see page 124). If the vessel be not a steamer, there is a stern or central shaft, up which there is, I believe, always a good current.

One argument for Government transports is the possibility of having a good system of this kind ready arranged.

If the hired transport is not thus ventilated, tubes must be arranged at different points leading to the between-decks. Sometimes two tubes (one at each side) have been placed at the fore and two at the after part of the ship; according to the wind, two are outlets and two inlets; there may be a strong current, but the respired air in this way is obliged to pass over a number of persons. It would seem better to fix several tubes along the sides or centre, to cover them with cowls turning to or from the wind, so as thus to have a certain number of inlets and outlets. If it can be done, a narrow central opening along part of the deck, with a low plank at either side to keep out water, and covered by a louver, is a very good plan, and is a very efficient outlet.

M'Kinnell's double tube has been used and well reported upon by some; by others it has not been found so useful. It seems, in fact, better to make use of the wind, on which we can always depend. The hold should be ventilated with tubes as well as the between-decks. If there be cargo, this is very important.

The exact size and number of the tubes has not yet been experimentally determined; probably, as there is a good deal of wind, these need not be so large as in houses on shore, but it is always best to have plenty of them. If necessary, some can be closed. Perhaps a tube of eight inches diameter would do for ten persons, giving five inches to each for inlet and outlet. Of course, hatches, windsails, ports, and tubes should all be in action at the same time.

Tubes running to and feeding the fires (Sutton's plan) can be used. (See page 123.)

* The effect of this bad ventilation on the sailors of the Royal and Merchant Services is very serious. See especially Gavin Milroy's paper before referred to.

Arnott's pump (page 128) is said to be a most useful plan; the ends of the pump, where the fresh air is to flow in, are connected by canvas tubes with the open air, and the discharge outlets are left open, or, if desired, can be connected with a canvas or wooden tube, so that the air may be sent to some distance. But care should be taken not to increase friction. Arnott's pump may be made double, with vertical pistons working on the plank forming the junction of the double pump; if properly made, a child can work the suspended double piston. Other machines of a like kind have been used.

Sometimes propelling and extracting fans or screws are connected with the steam-engine, and air is drawn out or blown in.

Cabins should be ventilated by tubes passing up and opening on deck; they should be recurved, so as to prevent rain or water splashing in. If the cabin lamp is fixed below the opening, a strong current is obtained.

3. *Water supply.*—The tanks should be carefully examined, the quantity determined, and the quality examined. (See chapter on WATER.) If there be a distilling apparatus, this should be examined. In a sailing vessel, small stills should be fixed to the top of the ship's coppers.

Permanganate of potash should always be taken to sea, as well as charcoal and alum.

4. *The food* is inspected as follows:—A cask of salt beef and pork is opened, and the pieces looked at (see page 170). One or two tins of preserved meat are opened; samples of flour, porter, &c., medical comforts, such as beef-tea, arrowroot, &c., are examined. The rules have been already given in the chapter on Food. It is important to take time in this examination; not to slur it over, and especially to test the lemon-juice carefully. If there are many children on board, large stores of arrowroot, preserved milk, and children's farinaceous food, should be laid in.* The cooking apparatus should be next examined, and it should be seen that there are proper means for removing all refuse, which is often allowed to accumulate. For the proportion of medical comforts, lemon-juice, and sugar, and for the rules of diet, &c., see Medical Regulations, pages 199–200; and for the mess and other articles to be provided for the troops, see page 202.

5. *The state of the hold*, spaces between bunkers, bilge, and cargo, if any, should be next seen to; chloride of zinc should be taken to mix with the bilge water.

6. *Arrangements for Washing.*—These are generally very defective on board hired transports; on board Government transports a lavatory might easily be fitted up. A good forcing pump and hose should always be on board, for getting up salt water. At present, in most merchant transports, the arrangements for all these things are most primitive and incomplete. The bucket is still perhaps the only way of getting up water, both from the water-tanks or sea.

7. *The closets* are usually fixed on either side, in front of the forehatchways or in the head. If women are on board, one should be kept for them and for the children. The opening should be just below the water-line. It has been suggested to have a double set of latrines, and only to use those on the leeward side (Kirwan). This seems a good suggestion. Considering that everything passes into the sea, it might be supposed that nothing would be easier

* In several cases in which there occurred a large mortality of children, during voyages, &c., in which the symptoms are recorded, it will be found that gastro-intestinal affections and tabes were the causes of the sickness and mortality. The mesenteric glands are evidently injured by the passage through the glands of half-digested and unwholesome food. The kind of food and cooking on ship board generally account for the sickness of children, if the exanthemata are not present.

than to keep the closets and head clean, but this is not the case, owing to the usual deficiency of water; it is usually considered sufficient to haul up the water in buckets and to pour it down; instead of this, force-pumps should be used; they can be so made as to be worked most easily, and with a proper distribution of the water all round the rim of the seat, the places can be kept quite clean. The closets and shafts are often made of wood, but wood gets excessively foul; they must be of zinc. Sometimes the soil is allowed to fall against the side of the ship, which soon gets impregnated, and if a port-hole is near, foul air drifts in. A metal plate should lie against the side, and be scraped every now and then, or if this cannot be done, a piece of wood, which should be cleaned from time to time.

8. *The medicine chest* is next examined (see Medical Regulations, pages 203–214).

Duties during the Voyage.

The health and comfort of the troops during the voyage depend entirely on the commanding officer and the medical officer.*

The Queen's Regulations are so full and clear, that to a certain extent the work must be done in a particular way. These regulations must be followed to the letter. But, of course, there should be a certain system and order in carrying out both the word and spirit of these regulations. The system usually adopted is something of this kind. Before embarkation the men are told off in messes of six, and the various articles of the sea-kit are allotted. Whenever practicable, troops should be on board 36 hours before sailing; their berths are allotted and packs hung up; arms put in the racks; sea-kit arranged, &c. Troops are then told off, three watches each, commanded by a subaltern, who is in charge of the deck; a guard of a certain strength is ordered, and sentries are placed over the hatchways, cook-houses, forecastle, &c. A certain number of men are told off as cooks, and others (one to each mess) as swabbers. A portion of the between-decks is fixed as an hospital, if this has not been done; a portion is assigned to the women and children, and screened off. At reveillèe, troops and women and children turn out, fold hammocks, and take them on deck, if the weather permit; the hammocks are stowed away by the swabbers till evening. Before, however, the bedding is brought up, the upper deck is washed by the watch. The men remain on deck, except the swabbers, who clean the between-decks, thoroughly ventilate, &c.

Directly they are on deck, the washing of the men begins; two large tubs are fixed on the forecastle; in many ships the men get buckets of water thrown over them, and if one or two good force pumps and hose are on board, every man could be *douched*. The men wash, comb, and brush their heads every morning. After washing, the men parade for inspection by a serjeant, who sees that the hands, arms, face, and feet are clean. The men's breakfasts are then served; after breakfast is cleared away, there are parade and drills; or, according to circumstances, fatigue duties. Twice a-week there are washing parades for clothes; the washing should be done early, and the clothes hung up to dry. A soldier is expected to shave and to have a clean shirt twice a-week at least (Queen's Regulations, clause 19).

If the troops are very numerous, it may be necessary to divide them into two or more sets for washing both persons and clothes, and to have different days.

* My first service in the army, as a young assistant-surgeon just gazetted, was starting from Gravesend with troops to India. Never did a man set off in more perfect ignorance of what he had to do. Happily we had an excellent commanding officer who had made many voyages, and the next in command (now a most distinguished officer) was a thorough soldier. I can truly say my first sanitary lessons were learned from them.

If there are women and children on board, one day is set apart for their thorough bathing, a screen being put up on deck. For washing, a certain quantity of marine soap is issued, but it is said to be insufficient. Dr Kirwan states that 8lb per head for a voyage for four months is the proper quantity. During the day the troops are encouraged to take exercise and amusements. The men bathe when there is no danger of sharks, a sail being let down for those who cannot swim. At night two watches go below, one watch remains on deck. The men are strictly forbidden to sleep on deck (Queen's Regulations, para. 41 of the chapter on Duties on Board Ship).

There are one or two points which must be noticed. The turning out of the women and children is essential, but it should not be done till after the men have washed; about 9 o'clock is a good time. Especially during the first few days after starting, when the women are sea-sick, the medical officer is often implored to speak to the officer in command to permit them to remain below. But it is always better to get them up, even for their own good, and this should be explained to them. Without necessity, therefore, from decided illness, the medical officer should refuse the request.

The swabbing between decks is done by scraping, rubbing, and sweeping; not by washing, unless the weather is dry, and then only once a-week. This is a very important rule; in fact, it would be well to avoid washing altogether, except in the very heat of the tropics. If there are berths, the lower boards should be removed now and then, so that every place may be cleaned.

The watch remain on deck at night, but do not sleep; although, of course, they have no duties to keep them awake. They are relieved every four hours. This is the only clause in the Queen's Regulations,* of which I greatly doubt the propriety. There is no harm in sleeping on deck when the weather permits, but, on the contrary, the greatest good. I paid particular attention to this point in India, and never found any man injured; there may be heavy dew, but a blanket keeps this off completely, and it does no harm. The pure sea air is infinitely better than the hot foul atmosphere between decks. I have made many inquiries from friends who have had far more experience lately of troops at sea than I have, and I have found they all approved of the men sleeping on deck when the weather permits. It is much to be wished that the reason for this order should be again investigated.

Again, under the present system, the watch in the pure night air are suddenly sent below into the stifling atmosphere, and the relief watch are transferred from below to the colder moving air on deck; the transition in either case has its dangers.

The rule should be to allow, in the fine warm weather, every man to sleep on deck if he pleases, as long as the working of the ship is not interfered with. In the trades, where sometimes a rope is not touched for hours, the decks might be crowded. It would be well to leave this matter to the discretion of the commanding officer and surgeon.

The issue of lemon-juice is commenced 10 days after the men have been at sea. A serjeant sees that each man drinks his share.

Duties of the Medical Officer.—As on shore, he is charged to look after every point connected with the health of the men, and to mention such points as are necessary to the commanding officer. On board ship, as everywhere, the medical officer is under the orders of the commanding officer, but sensible suggestions are always welcome.

* Clause 41.—"Officers to pay the strictest attention to prevent the men sleeping on deck in warm weather, which they are very apt to do. This practice is generally productive of fevers and fluxes." I cannot think there is a moment's doubt of the entire incorrectness of the last sentence.

On first going on board, the medical officer should see that the hospital or "sick bay" is properly arranged. The best place for the sick-bay is the best ventilated part, where there is not too much passage. If near the hatchways, there is no quiet. Ventilating tubes, &c., should be put in. A closet must always be provided, discharging into the sea, as well as patent close-stools.

Then the kit of medical comforts, medicines, and instruments should be gone over, and everything placed in order.

The daily duties are these :—attendance at the sick-bay ; reception of sick ; preparation of morning state for the commanding officer.

Attendance at morning parade (Queen's Regulations, clause 44), to observe any appearance of disease.

Also, for the first three weeks, health inspections should be held for the detection of venereal. It is best to hold two the first week ; one three days after starting, so as to catch the disease at its very commencement.

For the first fortnight every child should be seen daily, to detect the first sign of scarlet fever, measles, or hooping-cough.

After the parades, the between-decks should be visited. By that time they will have been swabbed out. They should be carefully inspected and occasionally fumigated with nitrous acid and chlorine* (see page 84).

In the sick-bay, if there are many patients, chlorine should be continually disengaged by means of the chlorine water. The bedding should be occasionally inspected, especially that of the women and children.

The rations should be looked at from time to time ; they are always inspected by the orderly officer, and the medical officer is sure to be referred to if there is any complaint.

Inspect the latrines and the cook-houses regularly twice daily,—morning and evening.

Take care that the bilge-water is pumped out whenever practicable ; every day should be the rule.

If any specific disease appears on board, the most active measures must be taken to fumigate, isolate, &c. (see chapter on the PREVENTION OF DISEASES).

If diarrhœa appear, look to the water first, then to the latrines, then to the bilge, then to food, as the possible causes. Take special care to cleanse the latrines, as the disease may be communicable.

With regard especially to salt meat, see page 177 for the cooking of salt meat, and for the possibility of converting it into fresh meat by dialysis. Almost any skin or membrane will do as a dialyser.

In the cooking of the preserved vegetables, remember the use of the permanganate of potash, if there be any smell ; or if there is none of the permanganate, of chloride of lime.

The administration of the lemon-juice should be carefully looked after. Every man should be seen to drink his allowance.

Duties on Disembarkation.

Usually the men are landed in excellent health, but almost always there is a large amount of sickness the first month after landing. This arises from personal irregularities, and the medical officer, before arriving at the port, should spend some time in talking to the men, and pointing out the inevitable consequences of misconduct and foolish irregularity. Intemperance especially

* The Queen's Regulations (clause 39) order for chlorine—common salt four ounces ; one ounce oxide manganese ; sulphuric acid one fluid ounce (which is nearly two ounces by weight) ; water two fluid ounces ; the pipkin is to be placed in a vessel of hot sand.

is the grand cause of disease. The men on landing are placed in a position of temptation on account of the ill-judged hospitality and welcome of their comrades at the station, who think it necessary to show their pleasure at meeting by doing their best to make their friends ill. If a medical officer has been attentive during a long voyage, he will be sure to have acquired much influence with the men by the time they arrive at their journey's end. He should use this power for their good (see page 592).

SECTION II.

TRANSPORTS FOR SICK TROOPS.

No specific regulations are laid down with respect to these ships, but it would be very desirable to have some set rules with respect to space, diet, and fittings. At present the diet, especially of invalids, is not good. The invalids from India, landed at Netley, show not infrequently, Dr Maclean informs us, symptoms of scurvy. In respect of fittings, the use of swinging cots for feeble men, and well-arranged closets for dysenteric cases, are very important. So also with the cooking; the coarse ship cooking is a great trial to many patients. If there is need of Government transports for healthy men, the necessity is still greater for sick men.*

The general rules for transports are to be attended to here, with, of course, such relaxations and modifications as the state of the sick suggests. As far as possible, the sick should be treated on deck in fine weather, a good awning and a comfortable part of the deck being appropriated to them. I believe that it would be a good plan not to send home sick officers and men in the same ship, but to have officers' ships, so as to give up the poop to the men in the ships which carried them. This division would be a gain to both.

In time of war, sick transports are largely used to carry troops to hospitals in rear. For this purpose good roomy steamers must be chosen. For economy's sake, they will generally be large, and probably with two decks ; they should never have more, and indeed a single deck is better. But if with two decks, each space should be separately ventilated by tubes, so as, as far as possible, to prevent passage of foul air from the lower to the upper deck. All the worst cases should be on the upper deck, especially surgical cases.

The decks of these vessels should be as clear as possible, so that men can be treated on deck. An apparatus should be arranged for hoisting men on deck from below.

It has been proposed to fit these ships with iron bedsteads, and no doubt this gives the men more space ; but a better plan still would probably be to have short iron rods, to which every cot could be suspended. The sick men might be carried in their cots on board, and again removed. If the rods are made about 14 inches high, and bent in at the top so as to form a hook, a cot is hung easily, and will swing. There is space enough below to put a close-stool or pan under the man without stirring him, if a flap is left open in the canvas, and a hole left in the thin mattress.

Fixed berths are not so good, but some must be provided. Some cots can swing from the top, and some men can be in hammocks. Probably every sick transport should have all these, viz., iron bedsteads at some points fastened

* Formerly, when the late Dr Scott was out of town, I used to take his duties of Examining Physician to the East India Company. One of these duties was to read the journals of the medical officers returning with troops. In these journals the system of bringing home invalids was very frequently strongly commented on and condemned ; yet it has very little improved, if at all, since those days.

to the deck, iron standards for swinging cots, cots swinging from the roof, low berths, and hammocks.

In these sick transports the kits and clothes must be stowed away; and as they are often very dirty and offensive, and sometimes carry the poison of typhus and other diseases, the place where they are put should be constantly fumigated with nitrous and sulphurous acid alternately. Robert Jackson mentions that dirty clothes and bedding may be soon washed sweet by mixing oatmeal with salt water.

Directly a sick transport has landed the sick, the whole place should be thoroughly washed and scraped, then the walls and ceiling should be lime-washed, and the between decks constantly fumigated till the very moment when fresh sick embark.

SECTION III.

HOSPITAL SHIPS.

These are ships intended for the reception and treatment of the sick,—floating hospitals, in short. Whenever operations are undertaken along a seaboard, and especially when a force is moving, and places for fixed hospitals cannot be assigned, they are indispensable. They at once relieve the army from a very heavy encumbrance, and, by the prompt attendance which can be given to the sick, save many lives. They should always be organised at the commencement of a campaign.

However convenient, and indeed necessary, they are, it must be clearly understood that they are not equal to an hospital on shore. It is impossible to ventilate and clean them thoroughly. The space is small between decks. The wood gets impregnated with effluvia, and even sometimes the bilge is contaminated. I have been informed by Dr Becher, late pathologist in China, that even in the very best of the hospitals used there, it was quite clear that in every wound there was evidence of a slight gangrenous tendency. In fact, it is perhaps impossible to prevent this.

The principle of separation should be carried out in these ships. One ship for wounded men, another for fevers, a third for mixed cases. In fine weather the sick should be treated on deck under awnings. The between-decks must be thoroughly ventilated, and all measures of fumigation, frequent lime-washing, &c., must be constantly employed. Charcoal, also, in substance should be largely used, and is, in fact, quite indispensable. Warming by stoves must be used in damp and cold weather, and, if so, advantage should be taken of this source of heat, and of all lights, to improve ventilation.

Ships of one deck are better than two; but as they will hold a very small number of sick, two decks must be used. But not more than two decks should be used; and if there be a third or orlop deck, it should be kept for stores. Sometimes, if there are two decks, the upper deck is used for officers and the lower for troops, but the reverse arrangement should be adopted.

The ventilation of the between-decks, in addition to Edmond's plan, should be carried on by tubes, which, if the central shaft is acting, will be all inlets, and can be so arranged as to cause good distribution of the air.

In an hospital ship the offices are the same as in a land hospital—ablution-room, surgery, purveyor's store, bakehouse, laundry, pack-store. In the Army Medical Report for 1859 is a description, with plans, of the hospital ships Mauritius and Melbourne, equipped by Dr Mapleton for service in China; this paper should be referred to, as it gives a very good account of the arrangements.

The fittings of an hospital ship should be as few and simple as possible, and invariably of iron. Tables should be small, and on thin iron legs. Swinging cots (as noticed in the former section) are indispensable for wounded men, and the appliances for the receiving and removing the excreta of dysenteric and febrile patients must be carefully attended to. Berths should not be of wood, but of iron bars, which are much more easily laid bare and cleaned.

The supply of distilled drinking water should be as large as possible, and a good distilling apparatus should be on board, whether the vessel be a steamer or not.

The laundry arrangements are most important, and I believe it would be a good plan to have a small ship converted entirely into a laundry. It would not only wash for the sick, but for the healthy men also. So also a separate ship for a bakery is an important point, so as to have no baking on board the hospital ship.

On board the hospital ship there should be constant fumigation; lime-washing, whenever any part of the hospital can be cleaned for a day or two, and, in fact, every other precaution taken which can be thought of to make the floating hospital equally clean, dry, well aërated and pure, as an hospital on shore.

On board hospital ships it is often easy to arrange for sea-bathing and douching; it should never be forgotten what important curative means these are.

In case pyæmia and erysipelas, or hospital gangrene occur, the cases must be treated on deck, no matter how bad the weather may be. Good awnings to protect from wind and rain can be put up.

If cows or goats are kept on board to supply milk, their stalls must be kept thoroughly cleaned. But generally it is better to obtain milk from the shore.

CHAPTER V.

WAR.

THE trade of the soldier is war. For war, he is selected, maintained, and taught. As a force at the command of a government, the army is also an agent for maintaining public order; but this is a minor object, and only occasionally called for, when the civil power is incompetent.

In theory, an army should be so trained for war as to be ready to take the field at literally a moment's notice. The various parts composing it should be so organised that, almost as quickly as the telegram flies, they can be brought together at any point, prompt to commence those combined actions by which a body of men are moved, fed, clothed, kept supplied with munitions of war, maintained in health or cured if sick, and ready to undertake all the engineering, mechanical, and strategical and tactical movements which constitute the art of war.

That an organisation so perfect shall be carried out, it is necessary that all its parts shall be equally efficient; if one fails, the whole machine breaks down. The strength of a chain is the strength of its weakest link, and this may be said with equal truth of an army. Commissariat, transport, medical, and engineering appliances are as essential as the arts of tactics and strategy. It is a narrow and a dangerous view which sees in war merely the movements of the soldier, without recognising the less seen agencies which insure that the soldier shall be armed, fed, clothed, healthy, and vigorous.

During peace, the soldier is trained for war. What is meant by training for war? Not merely that the soldier shall be taught to use his weapons with effect, and to act his part in that machine, where something of mechanical accuracy is imprinted on human beings, but that he shall also know how to meet and individually cope with the various conditions of war, which differ so much from those of peace.

It is in the nature of war to reinduce a sort of barbarism. The arts and appliances of peace, which tend, almost without our care, to shelter, and clothe, and feed us, disappear. The man reverts in part to his pristine condition, and often must minister as he best may to his own wants. No doubt, the State will aid him in this; but it is impossible to do so as completely as in peace. Often, indeed, an army in war has maintained itself in complete independence of its base of supplies, and in almost every campaign there is more or less of this independence of action.

In peace, the soldier, as far as clothing, feeding, shelter, and cleanliness are concerned, is almost reduced to the condition of a passive agent. Everything is done for him, and all the appliances of science are brought into play to

save labour and to lessen cost. Is this the proper plan? Looking to the conditions of war, ought not a soldier to be considered in the light of an emigrant, who may suddenly be called upon to quit the appliances of civilised life, and who must depend on himself and his own powers for the means of comfort, and even subsistence?

There is a general impression that the English soldier, when placed in unaccustomed circumstances, can do nothing for himself, and is helpless. If so, it is not the fault of the man, but of the system; which reduces him to such a state. That it is not the fault of the man is shown by the fact that, however helpless the English soldier may appear to be in the first campaign, he subsequently becomes as clever in providing for himself as any man. The Crimean war did not perhaps last long enough to show this, but the Peninsular war proved it. The soldier there learned to cook, to house himself, to shelter himself from the weather when he had no house, to keep himself clean, and to mend and make his clothes. Was it not the power of doing these things, as well as the mere knowledge of movements and arms, which made the Duke of Wellington say that his army could go anywhere and do anything? And the wars at the Cape and in New Zealand have shown that the present race of soldiers, when removed from the appliances of civilised life, have not lost this power of adaptation.

The English soldier is not helpless; he is simply untrained in these things, and so long as he is untrained, however perfect he may be in drill and manœuvre, he is not fit for war. The campaign itself must not be his tutor; it must be in the mimic campaigns of peace, in which the stern realities of war are imitated, that the soldier must be trained. Our present field-days represent the very acme and culminating point of war; the few bright moments when the long marches and the wearisome guards are rewarded by the wild excitement of battle; but the more common conditions of the campaign ought also to find their parallel. Since the Crimean war, much has been done to instruct the soldier in the minor arts of war. The establishment of camps has to some extent familiarised him with tent life; the flying columns which go out from Aldershot show him something of the life of the bivouac, and the training in cooking which Lord Herbert ordered, is teaching him how to prepare his food. It requires only an extension of this system to make the soldier familiarised with the chief conditions of the life in campaigns.

A campaign can never be successful unless the men are healthy. How are men to be trained so as to start in a campaign in a healthy condition, and to be able to bear the manifold trials of war? The answer may be given under three heads—

1. Preparation for war during peace.
2. Entry on war.
3. Actual service in war.

SECTION I.

PREPARATION FOR WAR DURING PEACE.

The various conditions of war, which are different from those of peace, are—

1. *Exposure to the Weather.*—It is a constant observation that men who have led out-door lives are far more healthy in war than men whose occupations have kept them in houses. The soldier's life should be, therefore, an out-door one. This can only be done properly by keeping him in tents during the summer. It would be well, in fact, to tent the whole army from the

middle of May to the end of October every year. The expense should be looked on as a necessary part of the military establishments. Wooden huts are too like ordinary barracks. As the soldier has often to sleep out in war, he should be accustomed to this also in peace; warm summer nights being first selected to train him. It will soon be found that he will very soon acquire the power of resistance to cold. This plan also will test the utility of his clothes.* It has been found by experiment that, by careful training, even delicate persons can bear sleeping out at night, even in tolerably cold weather, without injury, provided there be no rain. At the latter end of the summer it would be well to expose the men even to rainy nights, their clothes being adapted for this by the supply of waterproofs.

It may be thought that training of this kind is needless, and that it may be left to the campaign to accustom the men to exposure, but this is not the case; a number of men are rendered inefficient at the commencement of a campaign simply by the unaccustomed exposure.

2. *Tent and Camp Life.*—The pitching, striking, and cleansing of tents, (see page 308); the digging trenches round the tents, and providing for general surface drainage; the arrangement of the interior of the tent, &c., should all be carefully taught. So also the camp life of the campaign should be closely imitated. A place being taken up for the camp, and if there be any prevailing wind, the front of the camp being turned to the wind, dry paths should be constructed between the different parts; latrines should be dug in rear of the stables, and not too near the kitchen, and *en échelon* with the camp; each latrine should be a trench twenty to fifty feet long, according to the size of the camp, ten deep and two wide at the top, and three at the bottom. The earth thrown out should be arranged on three sides. It should be screened by branches of trees, and earth should be thrown in every day. When four feet from the surface, it should be filled in and another dug, the earth of the old one being raised like a mound to mark the spot. Close to it an urinal should be constructed, of a sloping channel paved as well as it can be, and leading into the latrines, or of a tub which can be emptied into it, and, as far as possible, men should be prevented from passing the urine round their tents.

A corps of scavengers should be immediately organised to clean away all surface filth, and to attend to the latrines and urinals. All refuse must be completely removed; it is often a good plan to burn it. Both in peace and war, encamping ground should be often changed, and an old camp should never be occupied. (For erection of huts, see page 301).

In addition to tents, the men should be taught, if possible, to house themselves. Huts of wattle should be run up, or wooden sheds of some kind. In war, men soon learn to house themselves. Luscombe† gives the following account of the huts in the Peninsula:—

"A cork tree or evergreen oak with wide-spreading branches was chosen; a lower branch was nearly cut through, so as to allow the extreme points to drop to the ground. Other branches were then cut from adjoining trees and fixed in a circle in the ground, through the branch, on which their upper branches rested. Smaller branches were then interwoven to thicken the walls, and the inside was lined with the broom-plant, which was thatched in. The

* In reference to what was said (p. 381) of the great importance of a hood to the greatcoat for men who sleep out at night, an old observation of Donald Monro is of interest. He states that in 1760 the greater health enjoyed by the Austrian Hussars over other troops, was owing to the half-boots, and the large cloaks with hoods carried by these men.—*On the Means of Preserving the Health of the Army.* (2d edit. 1780, p. 7.)

† On the Means of Preserving the Health of Soldiers, 1821, p. 107.

door of the hut was put due east, so that the sun might pass over it before it reached the horizon."

This hut was very cool during the day, but *very cold* at night, and thus "very prejudicial to health."

Underground huts are sometimes used; they are, however, dangerous; they are often damp, and are difficult of ventilation. In cold, dry countries, however, they are warm, and the Turks have constantly used them in campaigns in winter on the Danube. They have, however, frequently suffered from typhus. If used, there should be two openings besides the chimney, so as to allow a current of air; and a spot should be chosen where it is least likely water will gravitate. But underground huts are always to be discouraged if any substitutes can be found. Sometimes the side of a hill is cut into, and the open top covered with boards and earth. This is as bad as an underground hut.

Tents should not be placed in an excavation, but, if too cold, a wall of stones or earth should be built, and the tent placed on it. When sleeping out, the men should be taught to use every inequality of the ground as a protection against cold winds; it is astonishing what protection even a slight elevation gives.

3. *Cooking of Food.*—No doubt, in future wars, all governments will endeavour to supply prepared and cooked food (see page 225), so as to lessen the cost of transport and the labour of the soldier. But as this cannot always be depended upon, the soldier must be trained to cook his ordinary rations. This should not be done for him; he ought to do it himself merely with the appliances he would have in war, viz., his camp kettle, canteen, and tin plate.

The camp kitchen is made simply of a round or square hole, sunk half a foot to a foot in the ground; the fire is fed with air by a small channel cut in the ground for some little distance. This channel should be covered in with turf or stones, and by proper management the draught to the fire can be increased or lessened; if the fire itself be more or less covered with a stone, or tin plate, or turf, the fuel can be economised. The fire can be used for boiling, or for baking in the canteen; the fire being then taken out, or the embers heaped round the sides, and the top closed or nearly so. If a camp is more permanent, Captain Grant's plan (page 290) should be imitated, the central chimney being made of planks. But everything should be done by the men themselves.

At the commencement of a campaign many men lose flesh and strength from the food being badly cooked and indigestible.

In the Peninsular war the men became admirable cooks. At first very large camp-kettles, intended for half a company, were used, and were carried on horses. They did not answer, and the men left them behind. Afterwards smaller camp-kettles were supplied, one for each mess of six or eight. Luscombe mentions that the supply of salt was found to be a very important point; he says, he had no idea of the value of this condiment till he saw the way in which the men saved every little particle; without it, in fact, animal and even vegetable food is unsavoury.

It may be a question whether the present canteen might not be improved; it should not be soldered. No soldered articles do in war; the solder melts, and cannot be replaced. Many years ago a very portable cooking tin was sold in shops in London; it would hold a pint of water, which could be boiled by lighting a comparatively small piece of brown paper, placed in an outer casing, and slowly supplied with air. The objection to any articles of this kind is the weight.

In the Crimea some camp stoves, invented or improved by Soyer, were

used. Such things are very useful in camps of position, but are not always forthcoming in rapid movements.

The different kinds of camp cooking to be taught are stewing, boiling, and making soup, making tea and coffee, cooking preserved vegetables, making cakes of flour, and oatmeal porridge.

4. *Water Supply.*—As impure water is a great cause of sickness in war, the soldier should be taught how to recognise impurity, and how to use the simple methods of purification with charcoal, alum, tea, boiling, &c. (See chapter on WATER.)

5. *Mending Clothes.*—Every soldier carries a hold-all, but many cannot use it properly. It may be suggested whether, in the workshops which are now being established, it would not be well to let every recruit have a month's practice in repairing clothes, and especially boots; simple plans of repair being selected if it be possible.

6. *Cleanliness.*—In war a source of disease is the want of cleanliness. Very soon the person and clothes get covered with lice; all the garments, outer as well as under, get impregnated with sweat, and become very filthy. The best generals have always been very careful on this point, and have had frequent washing parades. As washing clothes is really an art, the soldier should be taught to do it, not by machinery, but in the rude fashion he must practise during war. Clothes can be partially cleaned by drying and beating. (See page 372.)

The hair should be cut short. In the absence of water for washing, the best plan is the small-tooth comb, to keep the hair free from vermin, and it may be a question whether one should not be supplied to every soldier.

Washing the whole body in cold water, whenever it can be done, is not only bracing and invigorating, but strengthens it against vicissitudes of weather, and against dysentery.*

SECTION II.

ENTRY ON WAR.

When actual war commences some further steps become necessary.

All experience shows that men under twenty or twenty-one years of age cannot bear the fatigues of war.† If possible, then, all men below twenty-one, or at any rate below twenty, should be held back from the campaign, and formed into depots, whence they may be draughted for active service on occasion. Of course every means should be taken during their service at the depots to strengthen and harden them.

All weakly men should also be held back, and every man thus retained should come under the surgeon's superintendence, not in hospital, but while doing his duty.

The men who are about to enter on the campaign should at once commence a more severe training, especially by marches with weights. If there be time to do it, this should be carried to an extent even greater than will be demanded in war, in the manner of the Romans, who trained their soldiers so severely in peace that war was a relief. The rules given in marches

* Both Donald Monro and Lind notice this.

† The examples are numerous, but the following are often quoted. In 1805 the French army broke up at Boulogne, and marched 400 leagues (French) to fight at Austerlitz; the youngest soldier was twenty-two years old; they left scarcely any sick or wounded *en route*. In 1809 the French marched from the German provinces to Vienna; not half the army were aged twenty years; the hospitals were filled with sick. In 1813 and 1814 the despatches of Napoleon are filled with complaints of the "boys," who were sent him, and who died in multitudes by the road side and in the hospitals.

about sore feet, and the means of preventing those and other evils, should be attended to (see page 361, *et seq.*) at this time.

Certain changes in the food of the men should be made.

The exertions of war, bodily and mental, are often very great, and demand an increased quantity of food, especially in the nitrogenous and fatty elements; an increased amount of meat and bread, with the addition of fat bacon, cheese, and peas or beans, should be given, so as to bring the daily amount of nitrogen to 400 grains, and of carbon to 5000 or 6000 grains daily, or, in other words, 6 ounces of albuminates (= 400 grains of nitrogen and about 1400 grains of carbon), 3 ounces of fats (= 1137 grains of carbon, and about 14 ounces of carbo-hydrates (= 2702 grains of carbon). The salts also must be increased, and it would be well to do this by adding chloride of potassium, phosphate of soda, and perhaps a little citrate of iron to the culinary salt. During the war, make every effort to get bread and flour supplied in lieu of biscuit (see page 196), and to supply red wine (page 241).

As one of the perils of war is the occurrence of scurvy, the supply of fresh vegetables should be increased; if these at all fail during the campaign, the preserved vegetables must be issued, and the other precautions taken (see pages 463–466). Considering the benefit apparently derived in Captain Cook's voyages from wort made from malt, it might be worth while to try the effect of introducing this as a beverage; it can be readily made.

Donald Monro mentions that at Bremen, in 1762, when no vegetables could be got, and fresh meat was dear, and scurvy broke out, infusion of horse-radish was found to be useful. Spruce beer was also used. The concentrated foods should also be largely stored, so that the troops can be supplied on excursions or in emergencies, and the men should be taught how to cook them, and especially in the case of the compressed vegetables.

SECTION III.

ACTUAL WAR.*

Experience has showed in hundreds of campaigns that there is a large amount of sickness. The almost universality of this proves that, with every care, the conditions of war are unfavourable to health. The strenuous exertions, the broken rest, the exposure to cold and wet, the scanty, ill-cooked, or

* *Sanitary Rules of the Romans during War.*

Vegetius (*De Re Militari*, lib. iii. cap. 2) says the Romans took great care that the men should be well supplied with good water, good provisions, firewood, sufficient quantity of wine, vinegar, and salt. They endeavoured to keep their armies in good health by due attention—

1. To Situation; avoiding marshes and dry uncovered ground in summer; in having tents; frequently changing camps in summer and *autumn*.
2. To the Water; for bad water was considered to be very productive of diseases.
3. To the Seasons; not exposing men to heat. In winter, taking particular care that the men never were in want of firewood or of clothing.
4. To Food and Medicine; the officers saw that the men had their regular meals, and were well looked after by the commissariat.
5. To Exercise; by keeping the troops during the day-time in constant exercise; in dry weather in the open air; in time of rain or snow under cover; for exercise was believed to do a great deal more for the preservation of health than the art of physic.

The Præfectus-Castrorum (Quartermaster-General), an officer of high rank in the Roman army, looked after the sick, and provided everything required by the surgeons. Both Livy and Tacitus mention that the commanding officers used to visit the sick and wounded soldiers, to inquire if they were well taken care of.

Rules of the Macedonians.—The only notice, I believe, of the means by which Alexander the Great preserved so wonderfully the health of his small army, is a statement that he frequently changed his encamping grounds (Quintus Curtius, lib. v. 32). This great soldier must certainly have been acquainted with the art of Hygiene.

unwholesome food, the bad water, and the foul and overcrowded camps and tents, account for the amount of disease.

The amount of illness varies with the nature of the campaign and the genius of the commander.

If records can be trusted, it would seem that the English have been more unhealthy than the French in their wars, but there is no great trust to be placed in war statistics. In the Peninsula, the mean daily number of sick was never below 12 per cent., except for a short time, in the lines of Torres Vedras, when it fell to 9 or 10. Sometimes it amounted to 15, 20, or 25 per cent. In the Crimea, the immense sickness of the first winter is but too well remembered.

Army Medical Regulations.

Before an army takes the field, the Director-General may appoint a medical officer to act as Field-Inspector under the principal medical officer, but not to act as sanitary officer (p. 69). The Director-General prepares lists of all medicines, stores, &c. (p. 69). The amount of transport and of stores is laid down (pp. 69–77).

Before an army takes the field, the Director-General, on requirement by the War Office, gives an account of everything in the proposed scene of operations which may affect the health of the men (p. 82). He appoints a sanitary officer to be attached to the Quartermaster-General's department (p. 82). He issues instructions to the principal medical officer and sanitary officer on all matters connected with rations, clothing, shelter, precautions for preventing disease, &c. (p. 82).

The sanitary officer inspects all proposed encamping ground, quarters, &c., and supervises the sanitary arrangements of all camps, towns, hospitals, &c. (p. 83). The principal medical officer advises the Commander of the Forces on all matters affecting health, such as rations, shelter, clothing, &c., and may, with the sanction of the Commander of the Forces, issue instructions on such matters to the medical officers (p. 84).

The sanitary officer inspects the camp daily; accompanies the Quartermaster-General on the march, and gives his advice on all sanitary points (p. 85). He is supplied with information to aid him in his work from all principal medical officers of general hospitals, divisions, and brigades in the field (p. 85). He transmits a weekly sanitary report to the principal medical officer (p. 85).

Causes of Sickness and Mortality in War.

The chief causes of sickness and mortality in the English army have been in order of fatality—

1. Diseases arising from improper and insufficient food, viz., general feebleness and increased liability to malarious fevers, dysentery, bronchitis, &c., and actual production of scurvy and scorbutic dysentery.
2. Malarious disease from unhealthy sites.
3. Catarrhs, bronchitis, pleurisy, pneumonia, rheumatism, dysentery (?), produced by inclemencies of weather.
4. Spotted typhus, kept up and spread (if not produced) by overcrowding and uncleanliness.
5. Contagious dysentery, arising from foul camps and latrines.
6. Typhoid and perhaps other fevers, produced by foul camps.
7. Exhaustion and debility, produced by excessive fatigue—a very great predisposing cause of almost all other diseases.
8. Cholera, in India especially, and in Turkey.

9. Yellow fever in the West Indian campaigns.
10. Plague in Egypt.
11. The exanthemata occasionally.
12. Ophthalmia.
13. Venereal diseases.

Of these diseases the most fatal have been scorbutic dysentery and typhus. It is indeed curious to see how invariably in all wars the scorbutic taint occurs, and frequently in how early a period of the campaign it can be detected. There almost seems to be something in the fatigues and anxieties of war which assists its development. It frequently complicates every other disease, impresses on them a peculiar character, and renders them very intractable to treatment. This is the case with dysentery, typhoid fever, malarious fever, and spotted typhus. With the last disease, especially, it has intimate relations, and contributes apparently to its propagation by rendering the frame more easily attacked by the specific poison.

One of the most important preventive measures to be adopted in war is the prophylactic treatment of scurvy. But with a full knowledge of this, the disease cannot always be avoided. The Federal Americans were fully aware of the necessity of combating it, and made immense efforts to do so. They did not succeed, and so marked and so general was the scorbutic taint in their army, that its combinations with typhoid fever and malaria have been looked upon as new diseases.

If scurvy could be prevented, every other war disease would be comparatively trifling. Inflammations from exposure, exhaustion from fatigue, and gastro-intestinal affections from improper food and atmospheric vicissitudes, would still occur; but the ravages of typhus, typhoid fever, malaria, and dysentery, would be trifling and easily prevented.

To prevent scurvy, then, is one of the most important measures.

If scurvy be absent, typhus fever is readily treated; isolation and the freest ventilation are certain to stop it. The only great danger would be in a besieged and crowded fortress. In such a case it may be beyond control, but early recognition and prompt isolation, as far as it can be done, and as free ventilation as possible, may perhaps stop it. It is in such cases that we should freely use the nitrous acid fumes and other disinfectant vapours.

Typhoid fever and contagious dysentery, in the same way, ought with certainty to be prevented in a camp. The first case, even, should make us take urgent measures for the cleansing of latrines, or, better still, the closing of all the old and the opening of fresh ones. But the best plan of all is to shift the encamping ground, and we should remember the old Roman maxim, based doubtless on observation of typhoid fevers, that this must be done more often in the autumn.

The exanthemata, measles, and scarlet fever, sometimes spread largely, through an army; the only plan is to separate all cases, and send them one day's march on the flank of the army, if it can be done, not in the direction of the line of supplies.

Plague probably demands the same measures as typhus.

The measures for cholera have been already sufficiently noted (p. 448).

The diseases of exposure can be hardly avoided, but may be lessened by warm clothes and waterproof outer coverings. Flannel should be used next the skin all over the trunk and extremities, and is indispensable. One of the most important means to enable troops to stand inclemencies of weather, and indeed all fatigues, is hot food. Coffee and tea are the best, and hot spirits and water, though useful as an occasional measure, are much inferior, if indeed they do any good at all apart from the warmth (see page 247.) But the

supply of *hot* food in war should be carefully attended to, especially in the case of breakfast, after which men will undergo without harm great exposure and fatigue.

It is unnecessary to enter at greater length into the measures to prevent the diseases of war, for the proper plans have been all enumerated previously. We may conclude only that much can be done to prevent disease, but we must also remember that the course of campaigns sometimes is too violent and overpowering for our efforts, and wars, like revolutions, will never be made with rose-water.

Recapitulation of the Duties of a Sanitary Officer during War.

To go forward with the officers of the quartermaster's department, to choose the camping ground (see pages 278–9); arrange for surface drainage; if necessarily in a malarious place, make use of all obstacles, as hills, trees, &c., to throw off the malaria from the tents; place the tents with the openings from the malarious quarter. If possible, never take low hills (100 to 250 feet) above marshy plains. Arrange for the water supply, and for the service of the men, animals, and washing (see page 47). As soon as possible, fix the sites for the latrines; have them dug out, and make dry paths to them. As soon as the tents are pitched, visit the whole camp, and see that the external ventilation is not blocked in any way, and that the tents are as far off each other as can be permitted. Assign their work to the scavengers, and mark out the places of deposit for refuse. The daily inspection should include all these points, as well as the inspection of the food and cooking and of the slaughter-houses. If the camp be a large one, a certain portion should be selected every day for the careful inspection of the individual tents, but it should be made in no certain order, that the men may not prepare specially for the inspection.

A set of rules should be drawn up for the men, pointing out the necessity of ventilation, cleanliness of their persons, tents, and ground around them, and ordering the measures which are to be adopted. This will have to be promulgated by the general in command.

In the daily work, a certain order and routine should be followed, so that nothing shall be overlooked.

The sanitary officer of a large camp can never perform his duties without the most unremitting support from the regimental medical officers, who are the sanitary officers of their regiments. Not only must they inspect their own regimental camps, but by an immediate report to the sanitary officer of any disease which can possibly be traced to some camp impurity, they should render it possible for the commencing evil, of whatever kind, to be detected and checked.

As early as possible every morning the number of men reported sick from each regiment should be made known, and a calculation made of sick to strength, and then, if any regiment showed any excess of sick, the sanitary state of its camp should be specially and thoroughly investigated.

*Hospitals in War.**

With an army in the field hospitals are of several kinds.

* Sir James M'Grigor, in the Peninsula, established divisional hospitals in front, and convalescent hospitals in the rear, where the men were received *en route* to the depôt. Although he does not describe his system fully in his paper in the Medico-Chirurgical Transactions (vol. vi.), it is evident from his Autobiography that his constant practice was to send off the sick as soon as possible. This is shown by his narrative of the retreat from Burgos, when he saved Lord Wellington from the mortification of abandoning his sick and wounded to the enemy. In this section I have merely enumerated the hospitals and considered them from a hygienic point of view. My colleague, Professor Longmore, in the work on Military Surgery which will be shortly published, will detail at length the means of transport of the sick and wounded, and other important matters of the kind.

* Improvements are, I understand, to be made in the ventilation of the hospital marquee.

1. *Regimental Hospitals.*—These are purposely kept as small as possible; they are intended merely to receive the men when they are first reported sick, and to treat the slightest cases. But it is most important to keep the regiment free from sick men, and any man who is likely to be ill for several days should be sent to the hospitals in rear.

2. *Division Hospitals* are small general hospitals under the charge of a staff-surgeon and staff assistant-surgeon. They are intended especially for emergencies, such as wounded men in action, and should be kept as empty as possible for this purpose; still, sometimes they must be used for urgent medical patients who are too ill, or attacked too suddenly, to be sent to the hospital in rear; or if the hospital in rear is at some distance, they are used as receiving houses. Both regimental and division hospitals move with the force, and are best made of tents. The tents should be large, and thoroughly ventilated. The present hospital marquee might be improved (see page 302).* It is now quite certain that good tents are much better than any buildings which can be got.

3. In rear of the army is the *Field General Hospital*, which receives all the sick and wounded who can be transported from the front. The exact position of this hospital depends on the campaign and country. It is put as near to the army as it can be, regard being had to the safety of the men and the necessity of supply of hospital stores. The Austrian experience seems to be in favour of making it of tents, moving it up with the army. It must be of great advantage to have it made of tents; they have all the advantage of separate houses both as to ventilation and separation of patients; have excellent ventilation, if well made; can be shifted from ground to ground or place to place; erysipelas and hospital gangrene are extremely rare in them (p. 457).

In the general hospital classification of patients is of extreme importance, and this can be more easily managed by tents or wooden huts than in any other way. Surgical cases must be kept separate; on no account must they ever be put with fever cases. This was a Peninsula rule of Sir James M'Grigor, and should never be forgotten. The fever cases (if admitted), both typhus and typhoid, should be by themselves, and ophthalmic cases must also be isolated. There may be more admixture of other diseases.

4. In rear, again, of the Field General Hospital, other hospitals intended for lingering cases, for half-cured wounds, all cases of severe inflammations which can be moved, rheumatism, phthisis, fever cases, &c., and men requiring change of air, must be organised. These may be at some distance in rear, but connected either with a railway or by water carriage. It is of great importance to keep continually sending patients from the division and general hospitals with the army to the hospitals in rear. It is not only to keep the hospitals in front empty for emergencies, and to facilitate all movements of the army, but it has a great effect on the army itself. A great hospital full of sick is a disheartening spectacle, and often damps the spirit of the bravest men. The whole army is higher in hope and spirits when the sick are removed, as was shown remarkably by the Austrian experience of 1859. The sick themselves are greatly benefited by the removal; the change of scene, of air, of ideas, has itself a marvellous effect, and this is another great reason for constantly evacuating the sick from the hospitals in front.

The men who are reported for hospital in war must be divided into several classes:—

1. Slightly wounded should be treated in the regimental or division hospitals, and then return to duty.

2. Severely wounded at first in the division hospitals, then sent to the general hospital, and then to the rear, as convalescence is always long.

3. Slight colds, diarrhœa, &c., treated in the regimental hospitals.

4. Severer colds, bronchitis, pleurisy, pneumonia, dysentery, &c., should be sent at once to the general hospital, and then to the rear as soon as they can move with safety.

5. Typhus fever at once to the hospitals in rear, if possible without entering the field general hospital.

6. Typhoid cases, also, should be sent to the rear, and, in fact, all severe cases. The field general hospital should be always almost empty, and ready for emergencies.

These hospitals in rear may be even two to three days' journey off, if conveyance be by water, or one or two days if by rail. Sick and wounded men bear movement wonderfully well with proper appliances, and are often indeed benefited.*

The proper position for these hospitals, at the base of operations, must be fixed by the commander of the forces at the commencement of a campaign, as he alone will know what point will be the base of supplies, and it is of importance to have these great hospitals near the large stores which are collected for a campaign.

It seems now quite clear that these hospitals should not be the ordinary buildings of the country adapted as hospitals. Such a measure seldom succeeds, and the mere adaptation is expensive, though probably always imperfect.† Churches should never be taken, as they are not only cold, but often damp, and there are often exhalations from vaults.

The French, Austrian, and American experience is in favour of having the hospitals in rear made of tents or wooden huts. The huts are perhaps the best, especially if the winter be cold. They have been very largely used by the Federal Americans, who have entirely given up converting old buildings into hospitals. The best huts which were used in the Russian war of 1854–56 were those erected at Renkioi from Mr Brunel's design; each held fifty men in four rows. This plan, however, is not so good a one as having only two rows of beds. Hammond‡ states that in the American war the best size has been found to be a ward for fifty men with two rows of beds; length of ward, 175 feet; width, 25 feet; height, 14 feet; superficial area per man, 87 feet; cubic space per man, 1200 feet. Ventilation is by the ridge, an opening 10 inches wide, running the whole length, and by openings below, which can be more or less closed by sliding doors. Some of the American hospitals hold from 2000 to 2800 beds.§ It is probable, however, that smaller wards (for 25 men) would be better.

An hospital constructed of such huts can be of any size, but there must be several kitchens and laundries if it be very large. If space permit, however, it seems desirable to have rather a congeries of smaller hospitals of 500 beds each, separated by half a mile of distance, than one large hospital.

* On this and other points of the like kind, see Report on Hygiene, in the "Army Medical Report for 1862," pp. 349, 350.

† Donald Monro says that, in 1760, the houses in Germany taken for the sick were improved by taking away the stoves and putting in open fire-places. In the Peninsula, the Duke of Wellington appeared to have a dread of fever attacking the army. Luscombe tells us that the Duke asked the principal medical officer every day as to the appearance of fever. He also improved the hospitals by ordering open fire-places.—*Luscombe*, p. 6.

‡ On Hygiene, p. 355.

§ See Report on Hygiene, in the Army Medical Report for 1862, p. 345, *et seq.*, for a fuller description.

The arrangement of the huts must be made according to the principles already laid down (p. 301). Dr Hammond writes thus of these hospitals:—

"It will, perhaps, not be out of place again to insist on the great advantages of these temporary field hospitals over those located in permanent buildings in towns. Nothing is better for the sick and wounded, winter and summer, than a tent or a ridge-ventilated hut. The experience gained during the present war establishes this point beyond the possibility of a doubt. Cases of erysipelas or of hospital gangrene occurring in the old buildings, which were at one time unavoidably used as hospitals, but which are now almost displaced for the ridge-ventilated pavilions, immediately commenced to get well as soon as removed to the tents. But in one instance that has come to my knowledge has hospital gangrene originated in a wooden pavilion hospital, and in no instance, as far as I am aware, in a tent. Hospital gangrene has been exceedingly rare in all our hospitals, but two or three hundred cases occurring among the many wounded, amounting to over 100,000 of the loyal and rebel troops which have been treated in them. Again, wounds heal more rapidly in them, for the reason that the full benefit of the fresh air and the light are obtained. Even in fractures the beneficial effects are to be remarked." ("On Hygiene," p. 397).

Baron Larrey, in his useful work,* describes the plans adopted by the French in the Italian war of 1859. At Constantinople, during the Crimean war, the French were apparently very well installed; the best buildings in Constantinople were assigned to them, and they were arranged with all the accuracy of organisation which distinguishes the French. The results were not, however, favourable, especially in the spring of 1856, when typhus spread through many of the hospitals, and caused great mortality.† Taught by this experience, in 1859 the French distributed their sick in small hospitals whenever they could find a building, and in this way the extension of the specific diseases was entirely stopped.

To sum up, the hygiene of field hospitals in war (the rules are derived from our own Crimean experience, and that of the wars which have taken place since) is as follows:—The movable field hospitals (regimental, division, and general, in rear) to be made of tents; the tents being constructed of good size, thoroughly ventilated, the flaps being able to be raised so as almost, if desired, to make the tent into an awning.

The ground round the tents to be thoroughly drained, kept very clean, and replaced from time to time. The tent floor to be covered with clean, and, if possible, *dried* earth, or charcoal, and to be then covered with a waterproof cloth, or boarded, if the camp be one of position. In either case the greatest care must be taken that the ground does not get soaked and filthy. Every now and then (if possible every ten days or so) the tents should be shifted a little.

If it can be done, the sick should be raised off the ground. Iron bedsteads are cumbrous, but small iron pegs stuck in the ground might carry a sort of cot or hammock. The advantage of a plan of this kind is, that by means of

* Notice sur l'Hygiéne des Hopitaux Militaires, 1862.

† Larrey mentions some good instances of the effects of overcrowding. At Rami-Tchifflick, the hospital was fixed for 900 by the surgeon in charge, who allowed no more; it remained healthy. His successor increased the beds to 1200 and then to 1400. Typhus became most severe, and spared no one (ni infirmiers, ni sœurs, ni médécins). In the hospital at Pera there was the same mistake, and the same results. Typhus caused fifty per cent. of the deaths. At the hospital of the Ecole Militaire no crowding was permitted, and typhus caused only ten per cent. of the deaths. In the French ambulances in the Crimea the same facts were noticed. Double and treble numbers were crowded into some, and they were ravaged by typhus; others were not allowed to be crowded, and had little typhus.

holes in the sacking, wounded men can have the close-stool without much movement. For fever cases it permits a free movement of air under the patient.

The stationary general hospitals in rear should be of tents or wooden huts, but never of converted buildings, or of hospitals used by other nations. Here, of course, iron bedsteads, and all the appurtenances of a regular hospital, are brought into play.

Whenever practicable, the rear hospital should have water-closets and sewers. At Renkioi, in Turkey, Mr Brunel supplied square wooden sewers about fifteen inches to the side; they were tarred inside, and acted most admirably, without leakage, for fifteen months, till the end of the war. The water-closets (Jenning's simple syphon), arranged with a small water-box below the cistern to economise water, never got out of order, and, in fact, the drainage of the hospital was literally perfect. I have little doubt such well-tarred wooden sewers would last two or three years.

There is one danger about wooden hospitals, viz., that of fire. The huts should, therefore, on this ground alone, be widely separated; each hut should have, about ten feet from it, an iron box for refuse. Wooden boxes do not answer, as in the winter live cinders get thrown in, and there is danger of fire. These boxes should be emptied every morning by the scavengers. Water must be laid into every ward.

The arrangement of the buildings is a simple matter, but must partly be determined by the ground. Long open lines are the best. An hospital of this kind, completely prepared in England, can be put up at a very rapid rate, supposing there be no great amount of earth-work, and that the supply of water and of outlet for sewage be convenient. So that, if commenced at once at the beginning of a campaign, accommodation would soon be provided.

If tents be used for the hospital in rear, they should be much larger than those of the movable hospitals.

Laundry Establishment.

This part of an hospital must be organised as early, and as perfectly, as possible. The different parts must be sent out from England, viz., boiler, drying-closet, washing-machines, and wringing-machines. The washing in war can never be properly done by the people among whom the war is carried on. Every appliance to save labour must be used, and after calculating what amount of laundry work has to be done for a presumed number of sick, just twice the amount of apparatus should be sent out, partly to insure against breakage, partly to meet moments of great pressure. The drying-closet, especially, is a most important part of the laundry.*

Amount of Hospital Accommodation.

This must not be less than for 25 per cent. of the force, with reserve tents in rear in case of need.

Cemeteries in war must be as far removed as possible; the graves dug deep, and peat charcoal thrown in if it can be procured. Lime is generally used instead, but is not quite so good. If charcoal cannot be got, lime must be used. If the army is warring on the sea-coast, burial in the sea is the safest plan.

* A very good laundry was organised for Renkioi hospital during the Crimean war, but although calculated on a liberal scale, it could hardly keep pace with the work at times. Mr Hooper, the superintendent, at the end of the war, devised a movable laundry, carrying boiler, drying-closet, and washing-machine. The idea was that this should accompany the troops on a march. A small waggon would wash for a large body of men or for an hospital. A plan of this kind would be very useful for moving field hospitals. (See "Report on Renkioi Hospital," by the Author, 1856.)

Flying Hospitals.

For moving columns and excursions, flying hospitals are organised. Medical comforts, concentrated foods, wine, brandy, dressing instruments, bedding, &c., and perhaps tents, are carried in light carts, or on mules, or camels. If it can be done, an old recommendation of Donald Monro seems useful, viz., that a baker with flour should accompany, and even a butcher with live stock; but since the use of concentrated foods, the last is perhaps less needed.

Sanitary Duties connected with a War Hospital.

In addition to the usual sanitary duties of an hospital, there are one or two points which require particular attention in the field.

The first of these is the possible conveyance of disease by the exceedingly dirty clothes, which may perhaps have been worn for weeks even, without removal, in the hard times of war. Typhus, especially, can be carried in this way.

To provide for this, every hospital should have a tent or building for the reception of the clothes; here they should be sorted, freely exposed to air, and the dirty flannels or other filthy clothes picked out. Some of these are so bad that they should at once be burnt, and the principal medical officer, at the beginning of a campaign, should have authority given him to do this, and to replace the articles from the public store.

The articles which are not so bad should be cleansed. The cleansing is best done in the following way:—If the hospital have a laundry and drying-closet, they should be put first in the drying-closet for an hour, and the heat carried as high as possible, above, if it can be, 240° Fahr. Then they should be transferred into the fumigation box; this is simply a tin-lined box or large chest. The clothes are put in this, and sulphur placed above them is set on fire, care being taken not to burn the clothes; or nitrous acid fumes should be used. After an hour's detention in the fumigating box they should be removed to the soaking tubs. These are large tubs with pure water, put in a shed or tent outside the laundry. A little chloride of lime can be added to the water. They should soak here for 24 hours, and then go into the laundry and be washed as usual. This plan, and especially the heating and fumigation, will also kill lice, which often swarm in such numbers.

Another point of importance is to bathe the men as soon as possible. The baths of a war hospital at the base of operations should be on a large scale, and the means for getting hot water equally large. The men's heads, if lousy, should be washed with a little weak carbolic acid, which kills the lice at once. The smell is not agreeable, but that is no of real consequence.

In a war hospital, also, the use of charcoal in the wards, charcoal dressings, the employment of disinfectants of all kinds, is more necessary than in a common hospital.

As a matter of diet, there should be a large use in the diet of antiscorbutic food, vegetables, &c., and antiscorbutic drinks should be in every ward, to be taken *ad libitum*—citric acid and sugar, cream of tartar, &c. The bread must be very good, and of the finest flour, for the dysenteric cases.

Sieges.

The sanitary duties during sieges are often difficult. Water is often scarce; disposal of sewage not easy, and the usual modes of disposal of the dead cannot, perhaps, be made use of. (For precautions about water, see page 47.) If sewage is not washed away, and if there is no convenient plan of removing it by hand, it must be burnt. Mixing it with gunpowder may be adopted if there is no straw or other combustible material to put with it.

If food threaten to run short, the medical officer should remember how easily Dr Morgan's process of salting meat can be applied (see page 166), and in this way cattle or horses which are killed for want of forage, or are shot in action, can be preserved. For sieges, as vegetables are sure to fall short, a very ample supply of lemon-juice, and of citric acid, citrates, and cream of tartar, should be laid in, and distributed largely.

One other point should be brought to the notice of the general in command. In times of pressure, every man who can be discharged from the hospital is sent to the front. This cannot always be avoided. But when there is less pressure, the men should go from the rear hospitals to a depôt, and while there should still be considered under medical treatment, so that they may not too soon be subjected to the hardships of war. They should, in fact, be subjected again to a sort of training, as if they were just entering on the war. If this is not done, a number of sickly or half-cured men get into the ranks, who may break down in a moment of emergency, and cause great difficulty to the general in command. Some officers think that a man should either be in hospital or at his full duty; this seems to me a misapprehension both of the facts and of the best way of meeting them. To transfer a man just cured, from the comforts of an hospital at once to the front, is to run great danger. A depôt, which should be a sort of convalescent hospital, though not under that term, is the proper place to thoroughly strengthen the man just recovered for the arduous work before him.

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