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LECTURE

ON

"THE FOOD OF THE SOLDIER,"

BY

SURGEON A. M. DAVIES, ~~M.D.~~,

ARMY MEDICAL STAFF, ASSISTANT PROFESSOR OF HYGIENE AT NETLEY,

ON THURSDAY, NOVEMBER 22, 1888,

IN

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SIR T. CRAWFORD, M.D., K.C.B., Q.H.S.,

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No. X.

Thursday, November 22, 1888.

Sir T. Crawford, M.D., K.C.B., Q.H.S., Director-General of Army Medical Department, in the Chair.

"THE FOOD OF THE SOLDIER."

By Surgeon A. M. Davies, M.D., Army Medical Staff, Assistant Professor of Hygiene at Netley.

Sir Thomas Crawford, Ladies and Gentlemen:—I must begin with a word of apology as to the subject, or rather the scope, of this lecture. When I was honoured with an invitation from the Committee of the Aldershot Military Society to read a paper on the Physical condition of the Soldier, His Rations, Clothing and Occupations, I hoped to be able to deal with the whole of this subject in the compass of an hour's lecture. Shortly afterwards, as most here present are probably aware, a discussion took place in the public press, continued for some time, and evidently exciting a good deal of interest, on the question of Soldiers' Rations. It seemed, therefore, that the subject of the Food of the Soldier required to be dealt with as fully and completely as possible. I have endeavoured to do this, but I have found it quite impossible to do justice in any way to this important question without taking up fully an hour. I feel that I could not deal at all satisfactorily with the other questions of Clothing and Occupations, if I were to make a few hurried observations at the end of the time: and I must accordingly apologize to you for coming short of the full subject of this lecture as set forth in the Résumé.

I.—THE AMOUNT OF FOOD REQUIRED.

General Composition.

1. This is composed of the Government ration, together with what he buys himself. The former consists of 1lb. bread and ¾lb. meat; the latter, of course, varies very much with individual tastes and opportunities, but on a broad average, as computed by the late Dr. Parkes,[1] consists of bread (extra to the Government ration), potatoes, and other vegetables, milk, sugar, salt, coffee, and tea; to these articles may be added in very many cases, either cheese, butter, or bacon.

Principles of Dietetics.—Amounts of Nitrogen and Carbon required daily.

2. Now in order to have any proper idea as to the sufficiency of this diet or the reverse, we must be acquainted with some knowledge of the *Principles of Dietetics*, and to a very brief exposition of these I must now ask your attention.

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[1] Parkes' "Hygiene," 7th Edition, page 516.

In the first place, you are aware that the whole universe, including both animate and inanimate nature, is composed of certain—what are called—Chemical Elements. Those that go to make up the human body are chiefly these:—carbon, nitrogen, oxygen, hydrogen, sulphur, and to a smaller extent several others in the form of mineral substances, termed salts. For our present purpose we need only concern ourselves with the first two of these elementary substances, carbon and nitrogen; it has been shown that, taking a broad average, carbon to the extent of from 4500 to 5000 grains, and nitrogen somewhat over 300 grains, must be taken into the body daily to supply the daily waste of tissue, and in order to prevent loss of weight. This has been shown to be the case by two methods of proof: (1) by calculating out the amounts of these two elements, nitrogen and carbon, excreted by the human body daily on an average, physiologists have determined that about this quantity is *required* to maintain the body in a state of equilibrium; (2) and secondly, it has been found practically, by taking the mean of a large number of dietaries actually in use, as for instance in public institutions, that this amount is *sufficient* to keep the body in a state of health and strength. Taking, therefore, the results of a large number of observations and experiments, it has been found that there is not much discrepancy between the income and expenditure of the body, and we may put this down as the simplest and most elementary fact to be apprehended at starting, that about 300 grains of Nitrogen, or a little over, and between 4500 and 5000 grains of Carbon are required in the food on an average every day. (Proportion of C. to N. as 15 : 1).

Proximate Alimentary Principles.

3. Of course we cannot take in our food in the condition of its ultimate *elements*; and it has been found that there are four classes of substances, or what are called *Proximate Principles*, or *Alimentary Principles*, no one of which can be absent from a person's diet for long without interference with health; it is not sufficient to take in Carbon and Nitrogen simply *as* Carbon and Nitrogen, but they must be arranged with other elements in certain particular ways, in order to secure digestion in, and the consequent nutrition of, the body.

These four classes of Proximate Principles are:—(1) *Albuminoids*, consisting of nitrogenous materials; (2) *Fats*, consisting of carbon, hydrogen, and oxygen; (3) *Carbohydrates*, consisting also of carbon, hydrogen, and oxygen, but the latter are in such proportions as to form one or more molecules of water; (4) *Salts*, *i.e.*, food of inorganic or mineral origin.

The body cannot be kept in health unless the food contains some proportion of each of these four classes of substances. It will be readily understood that the more work there is to be done by the body, the more food is required accordingly; from observation, experiment, and calculation, it has been found that the quantities of these sub-

stances under varying conditions of work that are required by the body are as follows:—

Table 1.

	Rest Diet.	Ordinary Work.	Hard Work.
	oz.	oz.	oz.
Albuminoids	2·5	4·5	6·5
Fats	1	3	5
Carbohydrates	12	14	16
Salts	·5	1	1·5
Total	16	22·5	29

Take the second of these diets, the diet for ordinary work computed by Moleschott, and we have the second great and fundamental datum to go upon, the average amount of each class of aliment that is required under ordinary circumstances, by an ordinary person, viz.: 4·5oz. albuminoids, 3oz. fats, 14oz. carbohydrates, and 1oz. salts, amounting to a total of 22½oz. of chemically dry or water-free food *per diem*. This is computed for a man of average weight, 140 to 150lbs. that is 10 to 11st.

Percentage Composition of Articles of Food.—Amount required.—A Specimen Diet.

4. Though a few articles of food, or what are called *Alimentary Substances*, consist almost entirely of some one Proximate Alimentary Principle, as for instance butter, which contains nearly 90 per cent. of fat, and rice or arrowroot, which contain over 80 per cent. of starch; still, as a rule, we do not take into our bodies these alimentary principles in a simple or uncombined form, but associated with each other in the shape of ordinary articles of food, many of which contain all the classes of proximate principles, though of course in varying proportion.

Some of the commonest and most essential food-stuffs are shown on the diagram with their percentage composition of proximate principles.

Table 2.

PERCENTAGE COMPOSITION OF FOODS.

	Water.	Albu-minoids.	Fats.	Carbo-hydrates.	Salts.
Meat	75	15	8·5	—	1·5
Bread	40	8	1·5	50	1
Flour	15	11	2	70	1
Butter	6	3	90	—	1
Rice	10	5	1	83	·5
Sugar	3	—	—	96	·5
Milk	87	4	3·7	4·7	·7
Eggs	73	13·5	11·5	—	1
Cheese	37	33	25	—	5
Potatoes	75	2	—	20	1

We commenced by saying that the ordinary diet of an average man should contain about 300 grains Nitrogen and 4500 grains Carbon, in round numbers; or if stated in Proximate Principles, should consist of 4·5oz. Albuminoids, 3oz. Fats, 14oz. Carbohydrates, and 1oz. Salts.

Now, what is the simplest way in which this can be provided? About what quantity of what articles of food universally obtainable is required to furnish this standard amount of nutriment?

It may be assumed that *meat*, *bread*, and *cheese* are the articles most likely to be obtainable under ordinary circumstances; and a simple calculation from the table given on the diagram will show what quantity of each is required.

Table 3.

		Albu-minoids.	Fats.	Carbo-hydrates.
	oz.	oz.	oz.	oz.
Meat	9·6	1·44	·816	—
Bread	24	1·92	·36	12
Cheese	4	1·33	1·00	—
		4.69	2·176	12
Butter	1	·033	·88	—
Potatoes	8	·16	·012	1.68
		4·883	3·068	13·68

Nitrogen 340 grains.
Carbon 4635 grains.

Three-quarters of a pound of meat, which gives 9·6oz. after making a deduction of one-fifth for bone, a pound and a half of bread, and a quarter of a pound of cheese—these furnish 4·7oz. Albuminoids, 2·2oz. Fats, and 12oz. Carbohydrates. This, stated in terms of its ultimate elements, represents Nitrogen 325 grains and Carbon 3975 grains. There is, therefore, enough of nitrogenous or albuminoid material, but an insufficiency of Carbon, both in the form of Fats and of Carbohydrates.

An extra ¼lb. of bread would increase the Carbon to 4440 grains, bringing up the Carbohydrates to the proper amount of 14oz.; but it would not perceptibly increase the Fats, and it must be admitted that one pound and three-quarters of bread is rather too large a quantity for an ordinary person to get through with relish in a day. At the same time it would not be desirable to increase the fats by taking a larger quantity of cheese than a quarter of a pound.

But if to our meat, bread, and cheese we add one oz. of butter and half-a-pound of potatoes, we shall make up a total of Albuminoids nearly 5oz., Fats just over 3oz., and Carbohydrates nearly 14oz.; and this is a very close approximation to the standard diet which has been laid down as sufficient and suitable for an ordinary man's ordinary work. Stated as Nitrogen and Carbon this diet gives 340 grains N. and 4635 grains C.

It may be useful to have a definite idea of what this quantity of food really amounts to; and remembering the dictum of Horace that impressions are more readily conveyed to the mind through the eyes than the ears,[2] I have brought with me, and now show you here these amounts of food, viz.:—9½oz. meat, representing the meat of ¾lb. after deducting bone, this will further suffer a loss of about 25 to 30 per cent. in cooking; 1½lb. bread; ¼lb. cheese; 1oz. butter; ½lb. potatoes.

RELATION BETWEEN FOOD AND WORK.

5. The object of the ingestion of food into the body, viewed as a machine, is threefold:—(1) to keep up the animal heat; (2) to maintain the body, *i.e.*, the machine, in a good state of repair; (3) to produce effective work, both muscular and nervous or mental. Helmholtz calculated that, while a steam-engine can only convert one-tenth of the force liberated by combustion of its fuel into work, the human body is able to turn to account twice as much, that is, one-fifth.

Dr. Pavy says in his "Treatise on Food and Dietetics,"—"In the liberation of actual force a complete analogy may be traced between the animal system and a steam-engine. Both are media for the conversion of latent into actual force. In the animal system combustible material is supplied under the form of the various articles of food, and oxygen is taken in by the process of respiration. From the chemical energy due to the combination of these, force is liberated in an active state; and besides manifesting itself as heat, and in other ways pe-

2. Segnius irritant animos demissa per aures Quam quæ sunt oculis subjecta fidelibus.
Horace.

culiar to the animal system, is capable of performing mechanical work."[3]

The doctrine of the "Conservation of Energy" teaches us that nothing is wasted, the latent force or potential energy existing in food —derived originally from the sun—is either converted into actual force, or work done; or else is stored up in the body for future needs.

Now let us try to estimate what this actual work amounts to, that is done by the human body every day. *Work*, or *energy*, is expressed or measured, in Natural Philosophy, as so many tons or pounds raised one foot in height—or if the metrical system be employed, as so many kilogrammes raised one metre; in this country the former method is generally used, though the metrical system has many advantages.

From observations by Professor Haughton of Dublin, on navvies, paviours, and labourers, it appears that about 350 foot-tons of work *per diem* is really hard work—300 foot-tons may be taken as ordinary work, and 400 foot-tons as laborious work; while 500 foot-tons, or anything beyond this, would be extremely laborious.

Now the most effective mode in which the labour of a man can be employed is in lifting his own weight through a height, vertically, for a number of consecutive hours. In ascending a mountain, for instance, the work done, expressed as foot-tons, is found by multiplying the weight of the body, and clothing, and any weight that is carried, in pounds, by the vertical distance of the ascent in feet, and then dividing by 2240, the number of pounds in a ton.

Next to the exertion of lifting his own weight, the simplest mode in which the force of man can be employed is in transporting the weight of his body along a level road. Professor Haughton has calculated that a man walking at about three miles an hour does work equivalent to raising $\frac{1}{20}$ of his weight through the distance walked. Then we have this formula—$\frac{(W + W^1) \times D}{20 + 2240}$ = Foot-tons of work done.

W = weight of body. W^1 = weight of clothing, &c.
D = distance in feet. (1 mile = 5280 feet.)

If the pace is increased, less work is done in the end.

Now taking the weight of a man, say a well-grown soldier, with his clothes, as 160lb., a march of 20 miles, at 3 miles an hour, would, according to this calculation, be equal to 377 foot-tons of work: while if he carried 60lb. in addition (which is nearly the weight a soldier carries in marching order, but without blanket and rations), the work would equal 519 foot-tons, a very extremely hard day's work. But a 10-mile march, carrying 60lb., is equal to 260 foot-tons; and this would be made up to 300 foot-tons, when we count in the necessary fatigues before starting and after the march is over.

3. Pavy.—*op. cit.*—2nd edition, p. 5.

This is the point then to which we have arrived, that a 10 mile march, carrying 60lb., is a fair day's work, being altogether equal to 300 foot-tons.

Without going further into details, which it would be difficult to explain in the short time now available, it may be said that the standard diet of Moleschott, for ordinary work, previously described, contains sufficient potential energy to produce and maintain the animal heat of the body, for the internal work of the heart, and respiratory system, and for the production of external, visible, productive work to the extent of 300 foot-tons, such as a soldier may be called upon to perform.

Now let us, just for one moment, recapitulate and see what we have arrived at, as a basis for our consideration of what a soldier's ration should consist of.

1st. About 300 grains nitrogen and 4500—5000 grains carbon are required daily.

2nd. For ordinary work, the proportions in which the four classes of Proximate Principles should be ingested are albuminoids, 4½oz.; fat, 3oz.; carbohydrates, 14oz.; salts, 1oz.

3rd. Making use of the most ordinary articles of food, a diet to furnish such an amount of nutriment might consist of meat, ¾lb.; bread, 1½lb.; cheese, ¼lb.; butter, 1oz.; potatoes, ½lb.

4th. Work done is estimated and expressed as so many tons raised one foot high, or "foot-tons": 300 foot-tons would constitute a fair day's work: this is about equal to a ten-mile march, carrying 60lb.: and finally the previously mentioned diet is sufficient for such an amount of work.

Practical Application—Composition and Nutritive Value of Soldier's Food.

6. So much for the *Theory of Dietetics*, now for the practical application; and first let us see what the ordinary food of the British soldier consists of, and what is its nutritive value.

Now the soldier's food comes from at least three sources: there is, first, the Government ration, which is the same throughout the kingdom as regards quantity; though as regards quality there may be some difference. Secondly, there is the grocery ration, provided by the company messing, the rate of stoppage of pay varying, generally, between 3d. and 4d. a day: the articles composing this ration differ in different regiments and corps, there being no general regulation as to them. Thirdly, there is the food that the man buys himself, according to his own taste, at the canteen, the coffee shop, the recreation room, or outside barracks. This of course varies very much, but there are certain articles of food which, on enquiry, are found to be particularly in favour and purchased to a considerable extent.

(1) The ration given by Government, free, consists, as we all know, of ¾lb. meat and 1lb. bread. This ¾lb. meat includes bone, which, on an average, should amount to (not more than) one-fifth, *i.e.*, 20 per cent. Deducting ⅕ of 12oz. we have 9·6oz. left. By referring to the

table of the percentage composition of different articles of food, we find the composition to be—

	Albuminoids. oz.	Fats. oz.	Carbohydrates. oz.
Meat, 9·6oz.	1·44	·81	—
Bread	1·28	·24	8·
	2·72	1·05	8·

(2) The composition of the grocery ration varies in different regiments and corps: the daily stoppage for this ranges between 3d. and 4d., and is generally, I believe, 3½d. The articles most usually provided for this are:—bread ½lb.; potatoes 1lb.; other vegetables, ¼lb., but perhaps not quite every day; a sufficiency of tea, coffee, sugar, and milk for both morning and evening meals; condiments, such as salt, pepper, and mustard, for dinner; and, in addition, flour, rice, or oatmeal and fruit, is occasionally provided, according as the mess funds allow any such extra expenditure. In some cases 1oz. of butter is also issued daily, but as far as I am able to discover, this is exceptional and not general.

Let us now take the nutritive value of these articles, as nearly as we can—

	Albuminoids.	Fats.	Carbohydrates
	oz.	oz.	oz.
Bread, 8oz.	·64	·12	4
Potatoes, 16oz.	·32	·02	3·36
Green vegetables, 4oz. ...	·14	·04	·46
Milk, 3¼oz.	·13	·12	·16
Sugar, 1½oz.	—	—	1·29
	1·23	·30	9·27

Adding these two together we have—

	Albuminoids.	Fats.	Carbohydrates.
	oz.	oz.	oz.
Free Ration	2·72	1·05	8
Grocery Ration	1·23	·30	9·27
	3·95	1·35	17·27

This gives 276 grains of Nitrogen, and 4588 grains of Carbon. The amount of Nitrogen is considerably below that in the standard diet, while the Carbon is not far short; but it is given principally in the form of Carbohydrates (*i.e.*, Starch), and not as fat.

It is seen at once that the class of fatty food is very deficient—1⅓oz. instead of 3oz.

(3) That the soldier himself feels this deficiency, and that the theoretical requirement is not only theoretical, but also a practical fact, is shown by the extra articles of food that are most commonly purchased by the men themselves (as far as one is able to judge of the matter, which is one that presents a good deal of difficulty) at the coffee shop, recreation room, or canteen.[4] It appears that cheese, butter, bacon, and preserved meats are the most favourite articles of consumption, together with bread to a small extent, biscuits, fish, and so on. It is hardly possible to determine the amount consumed per head, but probably 1oz. of butter, or 2oz. of bacon, or 2oz. of cheese are about the quantities bought at a time.

The nutritive value of these articles is as follows:—

	Albuminoids.	Fats.	Carbohydrates.
	oz.	oz.	oz.
Cheese, 2oz.	·660	·500	—
Bacon, 2oz.	·176	1·466	—
Butter, 1oz.	·033	·900	—
Mean of the three	·290	·955	—

Probably this last amount of albuminoids and fats might be added to the soldier's diet on five or six days a week. This would give a total nutritive value of Albuminoids 4¼oz., Fats 2oz., and Carbohydrates 17¼oz.

4. I have to express my thanks to Major Hutton and the Officers Commanding 1st Royal Dragoons; Royal Engineer Troops and Companies, Aldershot; 1st Devonshire Regiment; 1st Royal Sussex Regiment; and 1st King's Royal Rifles, for very kindly furnishing me with information on this subject.

Table 4.

PRESENT DIET SCALE.

	Albuminoids.	Fats.	Carbohydrates.
FREE RATION.	oz.	oz.	oz.
Meat, 9·6oz.	1·44	·81	—
Bread, 16oz.	1·28	·24	8
	2·72	1·05	8
GROCERY RATION.			
Bread, 8oz.	·64	·12	4
Potatoes, 16oz.	·32	·02	3·36
Green Vegetables, 4oz.	·14	·04	·46
Milk, 3½oz.	·13	·12	·16
Sugar, 1⅓oz.	—	—	1·29
	1·23	·30	9·27
PRIVATE PURCHASE.			
Cheese, 2oz. or Bacon, 2oz. or Butter 1oz. } Mean of these ...	·29	·955	—
TOTALS.			
Free Ration	2·72	1·05	8
Grocery Ration	1·23	·30	9·27
Private Purchase...	·29	·955	—
	4·24	2·305	17·27

RATIONS OF CONTINENTAL ARMIES.

7. On looking at the table of Rations of Continental Armies,[5] and for the moment taking into consideration only the bread and meat, it is seen that all, with the exception of the Spanish, have over 26oz. of bread, and six out of the fourteen have 30 or more oz., while the British soldier is only provided with 16oz., which he makes up to 24oz., usually out of his own pocket.

On the other hand, the meat ration for the British soldier is 12oz., while the average for the Continental Armies is only 8·7 oz., and only one reaches 11oz.

5. Morache.—"Hygiene Militaire," 2nd edition, 1886.

Table 5.

Soldiers' Rations of European Armies in Ounces Avoirdupois.

	FRENCH.	FRENCH SAILOR AND SOLDIER WHEN AT SEA.	GERMAN — *Smaller Ration.*	GERMAN. — *Larger Ration.*	AUSTRIAN.	BELGIAN	DUTCH.	SWISS.	ITALIAN.	DANISH.	SWEDISH	RUSSIAN	TURKISH
Fresh meat	10·58	10·58	3·8	8.81	9·87	8·81	8·81	11·00	6·34	8·74	5·67	7·054	9·06
Salt meat	—	or 7·054	—	—	or 5·99	—	—	—	—	—	4·09	—	—
Preserved meat ...	—	or 7·054	—	—	—	—	—	—	—	—	—	—	—
Dutch cheese,	—	or 3·527	—	—	—	—	—	—	—	—	—	—	—
Sardines in Oil	—	3·527	—	—	—	—	—	—	—	—	—	—	—
Fish	—	—	—	—	—	—	—	—	—	—	4·01	—	—
Bread	35·27	26·45	26·45	26·45	5·29	27·16	26·45	26·45	32·38	26·45	29·98	—	34·08
Biscuit	—	or 19·40	—	—	or 3·527	—	—	—	—	—	—	—	—
Flour	—	—	—	—	25·18	—	—	—	—	—	·24	34·9	—
Potatoes	—	—	—	70.54	7·76	35·27	2 Litres	—	—	—	—	—	—
Other Fresh Vegt.	3·527	—	—	—	—	—	¼d.	1d.	1d.	—	—	—	·74
Dry Vegetables ...	1.058	4·23	—	or 10·58	—	—	—	—	—	—	—	—	·77
Rice	—	or 2·82	—	or 4·23	—	—	1·763	—	5·29	—	—	—	3·35
Barley	—	—	—	or 5·29	—	—	—	—	—	—	5·6	—	—
Oatmeal	—	—	—	—	4·93	—	—	—	—	—	—	—	—
					Sour Krout 5·29								
Suet	—	—	—	—	1·05	—	·881	—	—	—	—	—	—
Butter	—	·52	—	—	—	·70	—	—	—	—	1·13	—	·33
Oil	—	·282	—	—	—	—	—	—	—	—	—	—	—
Bacon	—	—	—	—	—	·35	1·40 in place of half meat ration in winter.		—	—	—	—	—
Coffee	—	·705	—	—	—	—	—	—	·529	—	—	—	—
Sugar	—	1·763	—	—	—	—	—	—	·7	—	—	—	—
Salt	—	—	—	—	—	—	·7	—	—	·42	—	—	·74

All these rations are deficient in the class of fats.

It is noticeable that vegetables, or vegetable substances, form a considerable portion of the continental rations, and this is an indication to us in what way we may profit by their example. The use of vegetables is more general amongst the lower orders abroad than with us—partly from difference of taste, partly from their greater proficiency in cooking; therefore it seems that an article of food, or a class of foods, that is part of the usual dietary of the country should find a place in the ration of the soldier; in fact, that he should find in the service the sort of food that he has been accustomed to get in civil life, supposing, of course, that this is in itself good and wholesome.

The Soldier's Diet Should Equal Moleschott's Standard Diet.

8. Now I think it will be admitted that the diet of the soldier—even in ordinary peace time at home—should be such as to enable him to do 300 foot-tons of actual mechanical work; that is, should not fall short of the standard ordinary diet of Moleschott that I have already described. The chief reasons for this appear to be:—(1) The soldier is in our army an expensive article, it is the truest economy to bring each one to, and keep each one in, an efficient condition. (2) It may be urged that the class from which recruits are generally taken are not so well fed as the soldier is at present, and that therefore the present soldier's diet, being a considerable improvement on what he has been used to, is plenty. I think this argument in reality tells just in a contrary direction. Supposing you have an ordinary well-nourished young man who has not done any great amount of exercise in the open air before enlistment, you will no doubt find—as indeed has been shown in Colonel Onslow's lecture—that his weight and muscular development improve during the early period of his service. This is due to his improved appetite and digestive powers, together with a fair supply of food—in a considerable degree purchased from his private purse. But supposing you have a man who is ill-nourished and has been living a hand-to-mouth existence for some time past, or who has been for a long time constantly underfed, does it not stand to reason that he requires relatively much more food than the other man to convert him into a strong and effective soldier? (3) The muscular exercise, the regular hours, the open-air life, these all tend to make such a man physically stronger. At the age at which recruits are obtained, the body is still growing and development is progressing. If now we do not give such a man a sufficiency of food we are wearing out our expensive article instead of taking care of it, whereas we have the power of converting him from a possibly very inferior stamp of man physically into a really first-class article, if only we take care that he is well fed as well as well exercised, and well cared for in the ordinary sanitary arrangements of his environment, ventilation,

drainage, &c. This improvement should extend to his mental and moral, as well as physical, condition. A healthy life, moderate work, and a sufficiency of food, together with an absence of that anxiety as to how long they will get work to do, that so many of the working classes labour under; all this must tend to raise a man in his own estimation and increase his self-respect. He will be all round a better sort of man.

That is the point to which I wish to draw your attention; that knowing, as everyone does, that our army is an expensive one, we ought to take every care of each individual unit; that owing to the, generally speaking, healthy life of the soldier, we are not only able to keep him in a good state, but to make much improvement in his condition on joining; but that in order to do this we must see that he has an amply sufficient diet, and not one that is only just enough for bare subsistence.

Proposed Additions to the Present Diet.

9. In what way then can the present ration or diet of the soldier be improved so as to come up to this requirement?

The most striking deficiency, both in the Government ration and in the supplementary grocery ration, is in the class of *fatty* foods. In the free ration he has only just over one ounce, and in his total diet (not reckoning private purchases), only 1½oz. fat, whereas the standard diet should contain not less than 3oz. of this class of Proximate Principle.

The food stuffs which are available to supply this deficiency are butter, bacon, and cheese. Butter contains about 90 per cent. of fat, bacon 75 per cent., and cheese 25 per cent.

1oz. butter	would give	·9oz.	fat.
2oz. bacon	,,	1·5oz.	,,
2oz. cheese	,,	·5oz.	,,

Next to the deficiency in fats the want of nitrogenous matter is most obvious; this may be met by increasing the meat or the bread, or by adding cheese.

If the meat ration were increased from 12oz. to 16oz. *i.e.* by 33 per cent., or one-third, the increase in nutritive principles would be Albuminoids ·48oz., Fats ·27oz.

If the bread were increased from 16oz. to 20oz. *i.e.* by 25 per cent., or one-fourth, this increase would give, Albuminoids ·32oz., Fats ·06oz., Carbohydrates 2oz.

The addition of 2oz. cheese would give ·66oz. Albuminoids, as well as the ·5oz. Fats already noted.

Obviously, as far as Albuminoids go, this latter addition, that of the cheese, is the most valuable.

Table 6.

	Albuminoids.	Fats.	Carbohydrates.
	oz.	oz.	oz.
Meat, 12oz. (= 9·6 without bone) ...	1·440	·816	—
Bread, 16oz.	1·280	·240	8·00
Cheese, 2oz. or Bacon, 2oz. } Average	·418	·983	—
	3·138	2·039	8·00
Bread, 8oz.	·640	·120	4·00
Potatoes, 16oz.	·320	·025	3·36
	4.098	2·184	15·36

Nitrogen, 287 grains. Carbon, 4800 grains.

The cheese is also valuable from the large proportion of fatty matters present, though bacon and butter excel it in this respect.

If now an addition of 2oz. of cheese or 2oz. of bacon is made alternately, and if we suppose the grocery ration to include, as at present, ½lb. bread and 1lb. potatoes, we get the total diet as shown on table 6. This shows a considerable increase in the Fats, and a slight increase in the Albuminoids. It contains 287 grains Nitrogen, and 4800 grains Carbon. There is still deficiency in the fat, which would be made up by 1oz. of butter.

But if both the bacon and cheese are supplied daily the value of the ration is as shown in table 7. This is the nearest approach to a standard diet that I have been able to construct, and this is the diet that I venture to recommend. For reasons to be mentioned presently, I think that the half pound of tea bread together with the potatoes should continue to be furnished, as at present, through the company messing; but by putting the fat-giving foods, cheese and bacon, with the bread and meat of the Government ration, I wish to draw attention to the fact that has often been insisted on before, that fat is every bit as necessary as starchy or nitrogenous food, and that the minimum ration should contain a much larger proportion of this class of aliment than is the case at present.

Table 7.

PROPOSED DIET SCALE.

	Albuminoids.	Fats.	Carbohydrates.
	oz.	oz.	oz.
Meat, 12oz. (9·6oz. without bone) ...	1·440	·816	—
Bread, 16oz.	1·280	·240	8·00
Cheese, 2oz.	·660	·500	—
Bacon, 2oz.	·176	1·466	—
	3·556	3.022	8·00
Bread, 8 oz.	·640	·120	4·00
Potatoes, 16oz.	·320	·025	3·36
	4·516	3·167	15·36

Nitrogen, 315 grains. Carbon, 4915 grains.

REASONS FOR THESE ADDITIONS.

10. Now the principles which are to be considered in constructing a soldier's ration are, I submit, somewhat as follows :—

(1.) The articles composing the ration should be such as the well-to-do labouring classes are accustomed to, so that there should be no violent change in the recruit's food on enlistment (unless for the better).

(2.) The ration should be such a one as can be readily adapted to the exigencies of active service, so that when the soldier takes the field there should be no more breaking of habits and strain on the digestive organs than can be helped. The circumstances of camp life must always at the beginning of a campaign more or less upset the internal economy of the body—that is unavoidable ; but the less this is upset the better, particularly as regards the digestive functions. It is well known that camp diarrhœa is one of the earliest and commonest causes of inefficiency through sickness at the commencement of service in the field, this is largely due to change in the diet, and the more we can assimilate ordinary and field rations the less shall we be liable to this cause of inefficiency.

(3.) Variety should be obtained to as great an extent as is practicable, but perhaps care and attention to the methods of cooking will conduce to this more than a complicated or varying ration.

(4.) The quantity of food should be not just so much as is sufficient for bare subsistence, but should be ample; and the different classes of Alimentary Principles should be present in their proper proportions.

These are the most important points to be considered, I venture to say, in the matter of framing a soldier's dietary; and I think the ration which I have just described will be found to satisfy each and all of these conditions.

Objections Considered.

11. No doubt objections can be made to this proposed ration: I should like to make a few observations by way of anticipation on some that have come under my notice.

(1.) First, it is held by some that, as far as quantity goes, the food at present supplied to the soldier is ample, including both the free ration and what he pays for himself, and that no change is needed, the questions of quality and cooking being left on one side for the present. The writer of a leading article in the *Standard* of 28th August last, holds this view. He writes—"Nor can it be said that the British soldier, as we see him, presents a very lamentable appearance. He is generally stout and ruddy and in good health; his food is more plentiful probably than it was in the position which he relinquished when he took the shilling."

The answer I would make to this is, to point to the table in which the nutritive value of the soldier's food is expressed, and to ask you to compare that with the standard diet that has been agreed upon by physiologists as necessary for ordinary people doing ordinary work; the deficiency is obvious. Supposing this deficiency is made good, it is made good so largely out of the soldier's own pocket that he has little money to spend on anything else but food.

(2) It has been urged that, granting that some addition is necessary, it would be better to increase the soldier's pay, so as to enable him to buy extras according to his taste, rather than give him something more to eat that he may not like.

General Sir Daniel Lysons, in a long and very interesting letter on the subject in the *Morning Post* of October 6th last, takes this view, and comes to the conclusion that, though altogether the soldier is not badly off, still it would be good policy to make our small army as efficient in every way as is possible. He says—"If anything is added to the food of the soldier, I think the best method of giving it would be in the shape of a small money allowance—call it 'supper money' if you like—and let it be added to his messing money and be spent day by day in whatever he likes best. If you give a man extra bread and cheese he may not like it and throw it away, but if you let him get what he likes, he will eat it and thank you into the bargain."

It would no doubt be a measure received with much favour by the men to have an increase of pay to spend as they liked in food; but I venture to think that, if our object is to improve the soldier's physical condition, and not to make the service more popular, that object will be most effectually attained by ensuring that, whatever happens, a sufficiency of good and wholesome food is provided for each man. We cannot put it down his throat, but we can see that it is there for him to eat if he chooses; and if the quality and cooking receive rather more attention than has hitherto been given to these matters, I think we

shall not find the soldier throwing away or wasting his ration. If money is given, what security is there that the young soldier will not rather spend it on drink, or on amusement, or at any rate on eatables that are not of much real nutritive value? Of course if an addition to the pay is made, that can *only* be spent on food, *i.e.*, through the company messing, it is a different matter; but then the soldier would not individually be able to buy what he likes; if he had the liberty we could not be at all sure that he would be buying what would be best for his stomach, though it might please his palate.

(3.) It may be objected that cheese is indigestible. This is quite true, cheese *is* somewhat difficult of digestion; but I think the objection is deprived of its force when we consider that the men, who are to use this diet, are not persons of delicate digestions, but young and vigorous adults; also, that cheese is an article of food to which they have probably been accustomed; and lastly, that the quantity recommended, 2oz., is after all a very moderate portion; and even this need not be consumed all at once.

(4.) It may further be objected that this proposed addition is not enough, and that an increase in the meat ration is absolutely necessary.

To the first part of this I would reply by pointing to the tables of the nutritive values of the present, and of the proposed soldier's diets, on comparing which it will be seen that there would be a very considerable increase in the nutritive value, and that, presuming the soldier to continue purchasing certain articles of food, as he does now, it will furnish a diet that is sufficient for the ordinary requirements of the case.

To the second part of the question, that more meat is absolutely necessary, I should demur altogether. More Nitrogenous or Albuminous food is necessary, without doubt; but that this must needs be in the form of meat is, I think, not at all a certainty. The value of cheese is very great as an Albuminous food; it contains 33 per cent. or one-third of its weight of Albuminous matter; whereas meat of ordinary quality only contains 15 per cent. by weight; that is less than half the quantity present in cheese. In saying, however, that the present meat ration is sufficient, it must be understood that it should be of good average quality, not containing more than 20 per cent. of bone: if this percentage be exceeded the nutritive value of the ration would be insufficient.

Probable Cost.

12. The question of cost can hardly be entered into in this place: but it may be taken that the addition of one penny per head per day to the messing money would furnish the cheese and the bacon on alternate days, and therefore twopence per head per day would furnish both bacon and cheese. This would amount to £1 10s. 5d. per head *per annum* for the addition of either the cheese or the bacon daily, and double this amount, *i.e.*, £3 0s. 10d for the addition of both bacon and cheese daily. If the articles were provided by Government,

instead of the allowance in money, probably there would be a saving of 25 *per cent*.

II.—THE QUALITY OF THE SOLDIER'S FOOD.

Having now considered the question of the quantity of food a soldier ought to get, and the reasons for coming to the conclusion that the present diet is insufficient, having also suggested in what way an improvement may be effected, we now come to the question of the *Quality* of the articles of food with which he is supplied.

And here, to begin with, I think we must admit that the quality need not be of the best so long as it is good: the meat need not be always the prime joints, the bread of the finest and whitest flour, nor the cheese—if cheese be supplied—of a delicate and high-priced character.

But there should be no doubt whatever as to the goodness, genuineness, and wholesomeness of every article.

(1.) *Meat.*—I am not prepared to say that horseflesh is not a nutritive article of food, but it is not beef, and must not be sold as such. So also goat's flesh is wholesome enough, but it is not mutton, and must not be substituted for it.

Short of absolute falsifications such as these, we have the substitution of bull or cow beef for ox beef; or of the flesh of old and worn out, or more or less diseased animals, for that of healthy, well-fed oxen or sheep.

The terms of the contract, if properly complied with, preclude the possibility of such an occurrence. Whether these terms *are* always complied with is, at the very least, a matter open to doubt.

But further, supposing the meat is genuine ox beef, not any way diseased, it may still fall far short of what it ought to be on account of too great proportion of bone or gristle, owing to the poor condition of the animal. The proper proportion of bone is considered to be 20 per cent., or one-fifth of the gross weight; therefore the ration of $\frac{3}{4}$lb. or 12oz. should yield 9·6oz. of meat free from bone. There is a very widespread opinion, or belief, that the soldier does not, as a rule, receive this quantity; or at any rate that there are many days on which he does not; though the gross weight of $\frac{3}{4}$lb. per man is no doubt scaled and handed over to the Quartermaster.

In the French Army 40 per cent. is allowed for bone,[6] but in this country and for average animals, 20 per cent. only is allowed. In the case of some rations, both of beef and mutton, analyzed by the late Professor de Chaumont, at Netley, bone constituted only 17 per cent.[7]

Though general rules may be laid down as to the inspection of meat, I do not think that any really trustworthy opinion can be given as to its quality except by an expert, that is a person who has been trained for, and is constantly engaged in, the work. I do not see how

6. Morache.—*op. cit.*—p. 527.
7. Parkes' "Hygiene,"—7th edition, p. 255.

a board of officers, neither trained for the purpose nor habitually accustomed to compare meat of prime quality, of ordinary, and of indifferent or inferior quality, can give an opinion that is more than a vague general idea. I think that the Commissariat officer in charge of supplies should be held responsible for the good quality and condition of the meat; presuming that no officer would hold such a position unless he had previously undergone the training necessary to fit him for it.

But here we are met by a difficulty which forces itself on us with regard to all articles supplied to Government by contract. What standard is to be taken in judging of the fitness for issue, or the reverse, of a carcase, say of an ox or sheep? Obviously it cannot be expected that the meat should be of prime quality, such as would be sold at a London butcher's at 10d. or 1s. per pound. Then, if not of a prime quality, of what quality should it be? So we are brought to the question, what can be expected for the money? If the lowest possible price is given for the meat, it is of no use to expect it to be of even moderately good quality; all one can claim is, that it should be *genuine*, *i.e.*, what it purports to be, ox-beef or mutton, not bull-beef, horse, or goat, and *wholesome*, *i.e.*, not tainted. But it may often be the flesh of an animal in poor condition, and in that case the soldier may come very far short of his actual 9·6oz. of meat free from bone. What then should be done? Either a definite and improved standard of quality should be insisted on (and, if necessary, a larger price paid), or the gross ration should be increased, so that the nett weight of meat per head should not fall below 9·5oz. Of these two alternatives I think it would be far preferable to raise the standard of quality, and make it a definite matter that the meat should not only be good and wholesome, but also should contain not more than 20 per cent. bone, and the Supply officer should be responsible for this.

(2) *Bread.*—Sir D. Lysons, in his recent letter to the *Morning Post*, says that if you give a man extra bread and cheese, he may not like it and throw it away, and it is a widely expressed opinion that a good deal of the ration bread at present supplied *is* thrown away and wasted. This is certainly a reason for not increasing the bread ration. But it is known that the soldier purchases, and eats, other bread, either through the company messing, or from the canteen or coffee shop, or both, and it has not, as far as I know, been suggested that this extra bread is ever wasted. I am informed that, in one body of troops in this Division, as much as $\frac{1}{4}$lb. of bread per head is thrown away every day, this is ration bread, but then $\frac{1}{2}$lb. of tea bread is bought per head in its place. Evidently, then, there is something in the ration bread that is distasteful, You cannot make good bread unless you have good flour, and although I do not believe in the stories of mouldy bread and rotten meat that one has read in the newspapers, I can well understand that the bread is not what it should be. I do not think the fault lies so much with the baking as with the flour. Samples that I have analyzed have just been not quite bad enough to condemn, just on the borderland between passable and unfit, and I expect this is very gene-

rally the case throughout the country. It is only to be expected that bread made from flour of such a quality would occasionally give cause for complaint. But chemical analysis is not nearly such a good test to apply as one's own common sense, and the evidence of one's eyes and nose and taste. The ration bread may be fairly good for some little time after it is baked; but before many hours have elapsed it often begins to smell slightly sour, to taste unpleasant, and to look the reverse of tempting. No chemical analysis is needed here to prove the inferiority of the bread. Let any one ask himself: What sort of trade would a baker do in any town or village in the kingdom who sold such stuff? There can be no doubt of the answer: If a baker could not provide better bread than this ration bread generally is, he would have to shut up his shop—not even the poorest would buy it.

How is it, then, that the Commissariat can supply nothing better? So long as the lowest tender for flour is universally accepted, so long will it be impossible to provide good bread, and so long will a considerable quantity be wasted, and the soldier compelled to supply the deficiency out of his own pocket.

It would be no good for the authorities to supply an extra bread ration of the quality at present given, it would only be wasted. And even if there were a marked improvement in the Commissariat bread, I still think it would be better for the extra bread that the men eat to be purchased, as at present, through the company messing, by so doing some variety is ensured, even if invidious comparisons are drawn between one sort and the other.

(3) *Cheese.*—Cheese to be eatable must be of fair quality, otherwise it will be thrown away. Cheese was supplied to the troops stationed in Cairo in 1884, but it was so bad that it was often not eaten, and therefore a great part of its cost was wasted. Whether it was of inferior quality to begin with, or whether it deteriorated in keeping, from bad packing or some other cause, I do not know; but when served out to the men at the Citadel, it often smelt so strong that it stank out the barrack-rooms, and had to be put on the barrack roof for several hours, literally "to waste its sweetness on the desert air," and then was very frequently thrown away. Perhaps if some infinitesimally larger sum had been given for the cheese, this great waste would not have occurred.

It is the same in principle with other articles of food that are supplied to the soldier. If the cheapest possible article is always taken, it is impossible that it can always be good, and the result will be, as is the case at present, great waste and considerable discontent. It is useless to recommend the addition of cheese or of bacon to the ration, unless some alteration takes place in the present system of contracting for food supplies to the troops. The regulation is that the lowest tender must be recommended for acceptance unless there be any special reason for its rejection.[8] The prices are accordingly cut down by contractors

8. Commissariat and Transport Regulations, para. 281.

underbidding each other until a figure is reached at which it is out of the question for food of good quality to be supplied with any fair profit to the contractor.

If no modification can be made in this system, then rather than add anything to the ration in kind, it would be better to give a contribution to the messing money, an increase of pay applied exclusively to that purpose of 1d. or 2d. per day, and thus give men, or rather regiments and corps, an opportunity of purchasing according to their tastes. In a properly managed and well looked after mess the different articles of food would be pretty sure to be of fair quality for the price given, and there would be no iron rule of always accepting one contract because it was a farthing cheaper than another.

But to come to this would be to admit the inability of the public authorities to supply food as efficiently as regiments and corps could privately, and virtually to admit the failure of the present contract system. It would also be more expense to the country, undoubtedly, to increase the pay, than to provide an equivalent increase of food.

III.—COOKING.

Although part of the dissatisfaction at present existing in regard to the soldier's food is due to deficiency in its quantity and inferiority in its quality, a good deal is also due to defects in the cooking. Great advances have no doubt been made of late years in this matter, and it has become acknowledged that the subject of cookery is worth attending to, not merely from a gastronomic point of view, to please the palate, but as well from a physiological or dietetic standpoint, to get as much good as possible from the alimentary substances. This end will be attained by rendering the food digestible, and it must not be forgotten that the stimulation of the appetite by the pleasing appearance, taste, and smell of the food is a great aid to this. It is a dictum of Brillet Savarin's, with which every one will agree, that "*Une bonne digestion commence dans la cuisine.*"

Now I think any one who has inspected soldiers' dinners for any length of time must have felt that very often the "*cuisine*" was not the starting point of a "*bonne digestion.*" The great fault lies, I think, in overdoing the meat, and this is the result either of putting on too much heat, or too great a heat for too long a time. In roasting or baking meat, a strong heat should be applied at the beginning to coagulate the meat juices on the outside of the joint, and so prevent the juices of the inside parts escaping and being partly lost, but this having been done, after a short time, varying of course with the size of the joint, the heat should be reduced, otherwise the whole mass of meat becomes dried, toughened, and rendered indigestible. In the case of roasting before an open fire, this can readily be effected by withdrawing the joint to a greater distance from the fire, but in the case of baking in an oven, as is the practice in service cooking, of course the meat cannot be removed from the fire, therefore the heat from the fire must be moderated, and it is from neglecting to do this, or from ignorance how to do it properly, that the meat is so generally overdone. It is not that the juices of the meat are partially lost, because these should be all kept in the baking pan, but the fibre of the meat itself is rendered tough and indigestible, besides which it is tasteless and unappetizing.

The same principle should hold good in boiling, viz.:—to coagulate the juices of the outside of the meat at first by a strong heat, and then to maintain a gentle heat for a prolonged time in order to complete the cooking. The meat should be plunged into boiling water, and this should be kept boiling for five minutes, afterwards a temperature of 160° to 170° Fahrenheit in all that is wanted. The Army cook often keeps up the boiling temperature throughout the whole time nearly, and so converts the meat into a stringy, tasteless, and indigestible mass.

In stewing it is intended that the meat juices should pass into the surrounding water, there should be just sufficient water to cover the meat, and the heat should be only sufficient to allow of gentle simmering, and not to come to the boil.

These are the merest truisms of cookery, and yet how is it that soldiers' dinners so often evidently show that the cooks are either ignorant or neglectful of these elementary principles?

Of course if the meat is faultily cooked, as well as originally of poor quality, the nett result is that it is disliked, and many men will leave it alone, and waste a good deal, and then drink more beer than is good for them to make up for the deficiency in food.

So far I have spoken of meat only, in regard to cooking, but vegetables need proper cooking even more than meat, being in themselves less easily assimilated by the body; underdone potatoes or cabbage are far worse than useless, when taken into the stomach, and this carelessness or ignorance in cooking is responsible for great waste in these valuable items in a soldier's dietary.

Sir D. Lysons has observed that the best use is not made of the bones; and he mentions that the 42nd Highlanders always used to have a bowl of soup every day for each man, which was prepared entirely from the bones. As a writer, however, in the *British Medical Journal* observes (October 27, 1888), "Some allowance must be made for national tastes; the Scotchman always, and the Irishman often, is fond of vegetable soup, to which the Englishman is notoriously indifferent, preferring solid to liquid food." The large amount of nourishment in bones ought not to be wasted, and if soup is not relished or appreciated, they should be used for thickening gravy or some such purpose.

If these few points were really attended to, the cooking would be much better than it is now—no more instruction would be required than is given at present; but the desire to do his best must animate the cook, and if some scheme of rewards could be devised, or of payment by results, or of competition for prizes, something might be done to raise the standard of cooking in the Army above its present level of dull mediocrity, if not something worse.

IV.—MEAL HOURS.

There is one more point to be considered in regard to soldiers' food, and that is, the *Times* of the *Meals*.

And here on two points there is a general agreement of opinion: first, that there should be some refreshment the first thing in the morning; second, that some alteration is required in the present hour for tea.

(1) It is most desirable that the soldier should have a cup of coffee immediately after rising, and before being called upon to go out on parade, or, in fact, do any work. It is not good to work on an empty stomach any more than it is to work on a full one: the stomach of the soldier has generally been empty for several hours before rising—at all events, empty of *food*—and work done under these conditions is particularly exhausting to the body. As we are dealing with young and growing lads generally, and not fully developed adults, this point requires to be borne in mind. It is well also to remember in this connection the old saying that "a hungry man is an angry man." Discipline would be maintained more easily, and in all probability it would be better maintained, especially amongst recruits and men not yet trained to military habits, if there were not an aching void in the interior, which, as we all know, conduces to irritability. Some may consider this a trifling matter; it is trifling in that the state of things can be very easily altered; anything that will not only diminish, but will take away the cause of, insubordination, is worthy of consideration. It would probably not be practicable, and certainly not advisable, to have the breakfast hour so early as 5 o'clock or 6 o'clock; but a cup of coffee, with perhaps a biscuit or bun (as I understand can be had at the Aldershot Cavalry barracks for a penny) could be arranged for with little difficulty. The expense of this might be borne by the company messing.

(2) Breakfast at 8 seems natural and convenient; but it would be a very good thing to make it a more substantial meal than at present. I have ascertained that many men buy bacon for breakfast, and the bacon ration which I have recommended should be eaten at this time—more bread would be eaten, and with more relish. It is important that men should have as good a breakfast as possible, and then with some bread and cheese in their havresacks they would be to a certain extent independent of dinner, and at any rate, not in an exhausted and overdone condition when the dinner hour is unavoidably put off as on field days, or other occasions of special duty. There is this consideration to be borne in mind also, that in the field it may often happen that the mid-day meal has to be omitted altogether; therefore we should not train our soldiers to rely entirely on that mid-day meal for their solid food, as we do at present. The soldier's training should fit him to cope with the rough life that must be his lot on active service: at present he is bound down by stringent regulations, which from the very condition of things must be inapplicable on a campaign: and this present mid-day meal, on which the soldier is forced to rely

almost entirely, is just one of those things which would have to be given up when he actually comes to do his fighting, and so an extra strain is put upon his digestive machinery; if this breaks down, he is no good, he becomes inefficient.

(3) I think therefore that breakfast should be a more substantial meal than at present, so that with a little bread and cheese the soldier *could* carry on until the afternoon. But as a rule it would seem that the dinner hour is best at 1 o'clock, as at present. It is the usual hour for dinner for the labouring classes: it divides the morning from the afternoon work, and it is no doubt the hour the men would choose themselves. But, as there is often work to be done in the afternoon, there is danger lest this dinner should be hurried or cut short. At least one clear hour should be allowed for dinner, and an hour-and-a half would be better. Provision should be made for men's dinners to be kept hot for them when they are unavoidably detained on duty, and it would be an excellent thing if some plan could be devised by which a man could put by his dinner and warm it up again for supper if he is unable from any cause to eat it at the proper hour. Such matters as these should be thought out and managed in regiments and companies and messes. The soldier's canteen is adapted very well for his own private and particular cookery, and on service that is the only cooking utensil he has; nevertheless, instead of teaching him to do all he can with it, and encouraging him to make the best of small materials, the canteen is kept brightly polished, beautifully clean, and perfectly useless.

(4) The tea hour of half-past 4 o'clock comes too soon after the principal meal of the day, so that it often happens that it is neither required nor relished. But there are difficulties in the way of altering it to a later hour. If the men are going out they want to get away as soon as possible, and therefore the tea is hurried on; the cooks also want to get away from the kitchen, so practically it very often comes to be 4 o'clock. If the hour were made 5 o'clock I think that is as late as would be practicable; if it were made later the men would go out without it.

(5) The question of a later evening meal, or supper, is one that is not easy to deal with. Various plans have been suggested. What appears to me to best meet the case is that the cheese ration which I have recommended should be consumed at supper time if the soldier has not previously eaten it at tea, and that all men *in barracks* should have a basin of soup made from the bones of the meat ration. There would be enough tea bread for this meal as well as the 5 o'clock tea. The hour for supper might be varied according to the time of year; perhaps 8 o'clock in winter and 9 o'clock in summer.

The soldier's meals then would consist of—

1. Cup of coffee and bun or biscuit on first rising.
2. Breakfast at 8; coffee, ration bread, and bacon 2oz.
3. Dinner at 1; meat $\frac{3}{4}$lb., potatoes 1lb., ration bread about $\frac{1}{2}$lb.

4. Tea at 5; tea, extra tea bread $\frac{1}{2}$lb., or less, with cheese 2oz., if the man is going out.
5. Supper at 8 or 9, for those who are in barracks; bowl of soup, cheese 2oz., tea bread $\frac{1}{2}$lb. or less.

The provision of a hot meal in the evening would be an inducement to many men to remain in, especially if the weather were bad. During the heat of summer some modification might be made perhaps in the soup, but for much the greater part of the year such a warm meal would be very acceptable.

V.—FIELD RATIONS.

The scale of provisions to be issued during active operations in the field is laid down in paras. 30 and 32 of the Allowance Regulations. It is as follows:—

1lb. fresh, salt, or preserved meat.
$1\frac{1}{4}$lb. bread, or 1lb. biscuit, or 1lb. flour.
$\frac{1}{6}$oz. tea.
$\frac{1}{3}$oz. coffee.
2oz. sugar.
$\frac{1}{2}$oz, salt.
$\frac{1}{36}$oz. pepper.
$\frac{1}{2}$lb. fresh vegetables when procurable,
or 1oz. compressed vegetables.

And at the discretion of the General Officer Commanding on the recommendation of the Medical Officer—

$\frac{1}{16}$ gill lime juice, and $\frac{1}{2}$oz. sugar, on days
when fresh vegetables are not issued.
$\frac{1}{2}$ gill rum.

There are also certain equivalents laid down in case certain articles are not procurable.

This scale is only laid down to be adopted as a guide, and it is stated in para. 30 that "A special scale will be fixed by the Secretary of State according to the climate and circumstances of the expedition." During recent years, as a matter of fact, a special ration has been adopted in each case, but generally speaking not differing widely from the regulation scale.

Time does not permit of the discussion of various field rations that have been proposed at different times. I can only refer to one that I understand has received the approval of the Director-General of the Medical Department, and of a War Office Committee appointed to consider the subject.

The chief points aimed at in framing this ration are:—

1. Variety in each day.
2. The food stuffs are all such as the Commissariat can easily carry.
3. The energy available is calculated on a weekly average, not for each day separately—therefore greater variety can be given.
4. Two scales are provided, Scale A and Scale B, an ordinary and an extraordinary scale; the latter being intended for hard marches, extra fatigues, or actual fighting.

PROPOSED FIELD RATION.

Scale A.—Ordinary Field Ration.

		Sun.	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.
Fresh Meat	lbs.	$\frac{3}{4}$	1	—	$\frac{3}{4}$	1	1	1
Preserved Meat	"	—	—	1	—	—	—	—
Bacon	"	$\frac{1}{4}$	—	—	$\frac{1}{4}$	—	—	—
Bread	"	1	1	1	1	1	1	1
Potatoes or Green Vegetables*	"	1	1	1	1	1	1	1
Rice	oz.	—	—	2	—	2	—	2.
Cheese	"	2	—	—	2	—	—	2
Oatmeal	"	—	—	2	—	2	—	—
Erbswurst	"	—	2	—	—	—	2	—

Daily.

Tea	$\frac{1}{2}$oz.
Coffee	$\frac{1}{3}$ "
Sugar	$2\frac{1}{2}$ "
Salt	$\frac{1}{2}$ "
Pepper	$\frac{1}{36}$ "
Lime Juice	$\frac{1}{2}$ "

Scale B.—Extraordinary Field Ration.

(During active war service, hard marching, or fighting).

In addition daily, Meat	$\frac{1}{4}$lb.
" " Bread	$\frac{1}{4}$lb.
Or, in lieu of bread, Erbswurst ...	2oz.
or, Cheese	2oz.
or, Oatmeal	4oz.
or, Rice	2oz.

CONCLUSION.

To recapitulate very shortly the sum and substance of this paper, what I have attempted to make clear is this—1st, what is the amount of food that is required under ordinary circumstances by men of average weight doing ordinary work. This amount can only be expressed accurately either as so much nitrogen and carbon, or as so much of each of the four classes of Proximate Alimentary Principles. You may take it that there is but little discrepancy of opinion amongst Physiologists in regard to this point: the figures of Moleschott's Standard diet (table 1) may be safely accepted. 2nd, I have tried to show what the present food of the soldier actually consists of, and to point out that, when expressed in terms of the Proximate Principles (and presuming that it is up to a good standard of quality), it is still notably deficient in the class of fatty foods, and to a slight extent falls short in the Albuminoid class, while the Carbohydrates, or starch and sugar, are somewhat in excess. The deficiency in fat was shown to be not merely theoretical, but to be felt by the men themselves, seeing that the chief purchases made by them were of butter, bacon, and cheese. 3rd, starting from these premisses, a diet scale was constructed which would supply these deficiencies, come up to the standard previously laid down, effect no more change than was necessary in the present ration, and finally be of such a kind as would require but little alteration to make it suitable for a field ration on service. The simple addition of 2 oz. of cheese and 2 oz. of bacon appears to meet these requirements. If the quality of the food supplies generally could be improved and maintained at a higher level, even one of these, either cheese or bacon alternately, would be a great addition to the present diet. Whether issued in kind with the free ration, or as a money allowance given to the company messing, matters little. The former plan would be somewhat more economical, but unless the food supplies to the troops are of better quality than at present is the case, the latter would be the more satisfactory.

*Not less than 12oz. potatoes or fresh vegetables (carrots, turnips, &c.) to be given when obtainable; if not, lime juice 1oz. additional, and preserved vegetables or potatoes 2oz., or dried fruit or onions 4oz., or pickles 2oz.

Then, in regard to the quality of the food and the cooking, I have tried to show that improvement was needed to a considerable extent. For the first, this can only be effected by some change in the manner in which the contract system is worked, and some increased responsibility on the officer actually in charge of supplies. For the second, it was suggested that greater interest might be taken in their work by the cooks, if some incentive were given in the way of rewards, or competition for prizes.

On a brief review of the hours of meals, it was suggested that coffee (and perhaps a bun) the first thing in the morning; a more substantial breakfast, to include the proposed addition of bacon; dinner as at present; tea rather later than is now the custom; and supper for men remaining in barracks, to consist of a bowl of soup made from the bones, and the additional cheese; these five meals, so composed, would form an ample and satisfactory dietary; lastly, a sketch was given of a proposed Field Ration, with the points arrived at in its composition.

In conclusion, I feel that I have asked your attention for more than a whole hour, and have after all said little that was novel, and nothing that was in the least exciting. "Let us hear the conclusion of the whole matter." A pennyworth of bacon and a pennyworth of cheese! I am of opinion, however, and for the reasons given, that this addition would be enough: and in comparing the ration of our army with those of Continental armies, we must not forget that our men are so very much better paid that they can well afford to bear a stoppage for the grocery ration as at present. Perhaps, however, to avoid misunderstanding this might be explained to the men more clearly on joining.

It has been said that a soldier must be trained to do three things, to shoot, to do a march, and then fight, and to make the best of everything; obedience and subjection to discipline must also become as second nature to him. The first requirement, to shoot well, is the object of the special training of the soldier. The second thing, the capacity to undergo fatigue, and to have enough staying power and resiliency to be able to fight as well as march, this is the *raison d' être* for the efforts of the Medical Department, and of the whole Service, to maintain and improve the physical condition of the soldier, one aspect of which we have been discussing this afternoon. The third object, to train a soldier to make the best of everything, that is, to be the opposite of the bad workman who finds fault with his tools; to be self reliant; in a word, *to be able to cook his own dinner*; this does not come within the scope of this lecture, but I venture to suggest that at present we do not make enough of this. We are still too much bound down by regulations. The soldier is treated too much like a child in peace time at home to be as thoroughly efficient as he might be on active service. The canteen is kept brightly polished, beautifully clean, and perfectly useless, *because unused*, in the barrack room; in the field he ought to be able to do all his cooking in it. There is too short a time for evolution to work; his adaptation to his environment is faulty, so much the worse for him.

If some such training could be afforded, then it might be said with literal accuracy, that the British soldier could go anywhere and do anything.

DISCUSSION.

Major-General PHILIP SMITH: The first thing that occurs to me is that by the time the carcases are cut up and issued to each man, he has practically only seven ounces instead of nine-and-a-half, and that being the case, I am not sure that proof is supplied that the soldier gets enough meat, which is the real basis of his food. I was extremely glad to hear Dr. Davies recommend butter, as I believe a great deal of the bread which is thrown away is wasted because there is nothing to eat with it. With regard to the hour at which dinner should be served, I think it should be at the end of the day instead of in the middle. This would be beneficial, and permit of more work being done.

Lieutenant-Colonel HARRIS: Don't you think the ration for an ordinary day's work is sufficient? I don't mean, of course, on the occasions of flying columns and field-days, but the ordinary everyday life of a soldier. It is recognized that on flying columns, and such like, a soldier requires more, and an issue is made from the canteens. As we are bound to recognize the necessity for increased food on these occasions, I don't see why we should not give an extra ration generally, say of cheese and bacon.

Colonel SLADE: During a long regimental experience of thirty-one years I have devoted much attention to the question of soldiers' food; my opinion is that one of the chief faults is the large proportion of bone, and no spare meat in the quartermaster's store to supplement the short weight which is bound to be manifest in some messes. With regard to the evening meal, I think the tea meal might be done away with, for it is useless. I think a substantial supper would be more to the point, and I would rather encourage the soldier to spend a little of his money to make his mess surroundings more comfortable. I think the "shop" in the regiment could afford to give a soldier a biscuit and a cup of coffee in the early morning for a halfpenny and still make a profit, and I would advocate a little more encouragement in that direction. There is a committee formed for looking into

the whole of these questions. Considering that foreign armies have a less allowance, but their rations are of a superior quality, the fact is significant. I think we should give more encouragement to coffee shops.

Dr. MYERS: I have always advocated the addition of the constituents which the lecturer's tables show to be lacking—albuminoïds and fats. I sincerely hope that the lecture by Dr. Davies will cause the importance and necessity of these elements in a soldier's diet to be recognized. It has been found that it is not so much the quantity that is complained of but the quality. I think the men do not want more meat, as is popularly supposed, but that they want something else. Cheese has been suggested, and I find it is greatly approved; but some say every man does not like this; some would prefer butter. Although this does not supply albuminoïds it supplies fat, and considered in this light alone a large proportion of bread would be consumed which is now wasted. The way in which the threepence is spent has been mentioned. I think if that threepence were properly spent all our men would get a ration of butter for breakfast; and if we could get butter for the evening meal the soldiers would be satisfied. One ounce of butter would cost a penny at the rate of sixteenpence a pound, and that might come from the grocery ration. With regard to altering the dinner-hour, it would be a very unfortunate thing for the soldier. I cannot imagine a more unpopular proceeding. I cannot think that one private soldier would prefer to have his dinner at half-past four. The middle of the day is his natural hour. "If we had the dinner at four o'clock," one of my men told me, "many of us would be half-drunk at the canteen, and we should not enjoy it at all." The men would feel a craving, and would gratify that craving in the canteen. I hope the idea of a later dinner hour will never be recognized.

Colonel CREALOCK: I once advocated a later dinner hour in my battalion, and tried to make my men agree to it, but there was not one who concurred. We should remember in considering this question, that the habits of Englishmen, Irishmen, and Scotchmen are not all alike, and we ought not to form a hard and fast rule. I think, too, that the question of grocery rations should not be too closely regulated. One regiment will do one thing, and another something else; the matter should be left to the judgment of commanding officers. I must own that, personally, I should like the soldier to have a pound of meat.

Major E. T. H. HUTTON, D.A.A.G.: It happens at the present moment to be my fortunate lot to be associated here with picked detachments of selected soldiers from eight different Infantry regiments, who may be fairly said to be representative, and I have been at some pains to ascertain by a plebiscite their opinion upon several points raised by the lecturer, and which, I venture to think, may be of interest to the audience. The whole of the men are unanimous in favour of early morning coffee as a necessity to ensure good work. Supper not received with favour, as it interferes with men going out in the evening, and supper in place of tea meal is not generally liked for same reason. But an almost unanimous opinion in favour of a dinner at 4-30 or 5 was given, with lunch of bread and cheese at 12-30 or 1. I am told that the whole of a distinguished Cavalry regiment (the 18th Hussars) upon a recent occasion gave their opinion unanimously in favour of a late dinner with a lunch, and it is well known many old Cavalry soldiers now save their dinners till tea time when much pressed with work and prefer bread and cheese and a glass of beer at the canteen in the middle of the day. With regard to the adequacy of the present ration—careful statistics in the 1st Brigade here have shown that about $\frac{1}{4}$lb. of bread per man per diem is thrown away or wasted, on account of the bread becoming at tea time sour and unpalatable; the result is that in nearly every regiment throughout the army at home $\frac{1}{4}$lb. of tea bread per man is purchased, showing that about $\frac{1}{4}$lb. of additional bread per man is wanted by the men themselves. The deductions are, I venture to think, that—(1) the present bread ration is insufficient by at least 4oz., and that it is not made of an adequately good flour. I would suggest that each man have a small loaf similar to those supplied in our prisons. (2) That the dinner meal be changed to 4-30 for Infantry, and to 5-30 or 6 for Cavalry, leaving the exact hour to be fixed by commanding officers according to local circumstances. (3) That a lunch be provided the men of bread and cheese, or basin of soup upon alternate days. The soup made from the bones, heads, tails, &c., of the beasts slaughtered to provide the ration of meat, which are now, I believe, wasted. (4) The messing money now used for tea bread to go to cheese three days per week for the men's lunch. (5) Early coffee is much appreciated and could be easily provided from the balance of messing money from tea bread, aided by the canteen funds of regiments.

Surgeon-General WEBB argued that the difference in the cost of producing a better quality of bread for hospitals, compared with ordinary ration bread, the tenth part of a penny per man, was really a small matter. Experiments had proved that the men did not get their full ¾lb. of meat; he recommended that the groceries be purchased from the canteen instead of various quarters, and thought, from his experience in India, that a later dinner hour would not be agreeable to the men. It was desirable that the cooking should be improved, and that the surroundings of the table should be more comfortable.

Major-General BUCHANAN did not think so much could be purchased out of the soldier's threepence as many imagined. They must not expect too much from it. The difficulty with regard to the bone-soup question was, that exception would be taken to the removal of the bones after issue; and still further exception would be taken to the utilization of the bones after they had been on the table. Soldiers quite understood what were their rights, and stuck up for them, and were quick to appreciate anything done for them. Arrangements should be made by which beer and porter might, without difficulty, be consumed by the men at their dinner instead of afterwards, and this would tend to increase sobriety.

The LECTURER in reply spoke very briefly on account of the lateness of the hour. He was glad to find that the propositions in the paper had, on the whole, met with the approval of the meeting. With regard to the question of putting off the dinner hour he was afraid that the men might spend more time in the canteen, drinking before dinner, to the detriment of their appetites when the dinner hour arrived. It was a curious thing that soldiers should apparently not care for their beer *at* dinner, but prefer it either before or after. But as to the hour of the dinner, and the arrangements for the evening meal, he thought that these and many other matters of practical detail could be much better settled by officers commanding regiments and corps than by a general regulation. In the lecture he had purposely confined himself to the groundwork of the subject, and had abstained from dealing with many practical questions upon which the experienced officers present were able to offer suggestions of much greater value than any which he himself could presume to give.

The CHAIRMAN, in proposing a vote of thanks to Dr. Davies, said: I would like to add one word to what has already been said. I believe the officers of the Aldershot Division are on the right track to find out what is best to be done for the Army at large. Nothing has done more for the advancement of Army matters than education. I don't think you can help forward this or any other subject better than by bringing it before such societies as this. It is from such meetings as yours that much good will accrue to the British soldier, and through the British soldier to the country at large. I think, in addition to the question of the number of foot-tons of work obtainable from a given quantity of food, we should encourage the soldier to learn how to feed himself, and try and do without so much regulating. I certainly believe there is nothing better than a good supper, and I have seen it supplied with advantage. Afternoon tea is simply waste; if that is got rid of and the men put in the way of getting a good supper you will, with little troubles, have done pretty well all that is necessary.

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ROYAL UNITED SERVICE INSTITUTION.

Friday, March 29, 1889.

SIR THOMAS CRAWFORD, M.D., K.C.B., Q.H.S., Director-General, Medical Department of the Army, in the Chair.

THE SOLDIER'S FOOD, WITH REFERENCE TO HEALTH AND EFFICIENCY FOR SERVICE.

By J. LANE NOTTER, B.A., M.D., Surgeon-Major Medical Staff; Professor of Military Hygiene at the Army Medical School, Netley.

I HAVE the honour to speak to you this afternoon on the soldier's food, a subject which has recently received more than ordinary attention from members of the military Service as well as from the public press. And the reason for so much attention having of late being drawn to this subject is not far to seek, if, as I believe, the importance of the food ration of our soldiers has been heightened by the action of the short-service system of enlistment. This system has contributed largely to the youth of the Army.

If we take the effective strength and comparative statement of ages of non-commissioned officers and men of the British Army serving in India from 1876 to 1885 inclusive, the results show an annual average of 769 lads under 19 years of age, and 960 boys between 19 and 20 years of age.

Or, again, we find in the "Army Medical Reports for 1886," that the average age of 73,456 recruits inspected in that year was 19·5 years.

The recruit at 19 years of age has not only to work, but also to grow and develop. "At this most critical period of life," as Sir Wm. Aitken remarks, "recruits can be brought under judicious training, when they ought also to have precisely the amount of exercise and the amount and kind of diet best fitted for them." In the absence of this, there is a thorough breakdown—so important a factor is food in the ultimate development and staying power of the soldier.

It is a universal rule in Nature that where work has to be performed, either by man or animal, the food must be in proportion to the labour. "Food is the source from which muscular force is derived, and hence the supply of food should be in proportion to the amount of work that is to be performed."

Now, work is most conveniently estimated as so many pounds or tons lifted 1 foot high, and for much of our information on this point we are indebted to the Reverend Professor Haughton's experiments. This gentleman has shown that walking on a fairly level road at the rate of about 3 miles an hour is nearly equivalent to raising one-twentieth part of the weight of the body through the distance walked. An easy calculation changes this into weight raised 1 foot, and in this country muscular work is expressed as so many tons lifted 1 foot high. His formula is as follows:—

$$\frac{(W + W') \times D}{20 \times 2{,}240},$$

where W is the weight of the person; W' the weight carried; D the distance walked in feet; 20 the coefficient of traction; and 2,240 the number of pounds in a ton. The result is the number of tons raised 1 foot. (To get the distance in feet multiply 5,280 by the number of miles walked.)

The following table, taken from Parkes' Hygiene, will show the amount of work a soldier performs under special circumstances, assuming him to weigh 160 lbs. with his clothes:—

Kind of exercise.		Work done in tons lifted one foot.
Walking 1 mile	....	18·86
" 2 "	....	37·72
" 10 "	....	188·60
" 20 "	....	377·20
" 1 "	and carrying 60 lbs..	25·93
" 2 "	" " ..	51·86
" 10 "	" " ..	259·30
" 20 "	" " ..	518·60

An average day's work may be roughly stated as equal to 300 tons lifted 1 foot. 400 tons is a hard day's work, and 500 tons an extremely hard day's work which few could keep up continuously.

It is true the soldier has not a 10-mile walk every day, but he has his ordinary drill and gymnastic exercises, along with fatigue duties. His drills are a series of movements that are constrained, and his dress, unfortunately, does not admit of that free play of his muscles which is so essential to their most efficient action. Besides, he is not at liberty to regulate his pace according to his pleasure or condition at the time, and all this is really equivalent to extra labour in its fullest sense.

I have already said that the source from which the force, or in other words the power for muscular movements is derived, is food, and the way in which food acts is concisely stated by Fick as follows:—

"A bundle of muscular fibres may be looked upon as a machine consisting of albuminous material, just as a steam-engine is made of steel, iron, brass, &c. Now, as in the steam-engine coal is burnt in order to produce force, so in the muscular machine fats or the hydrates of carbon are burnt for the same purpose. And in the same manner as the constructive material of the steam-engine (iron, &c.) is worn away and oxidized, so the constructive material of the muscle is worn away." Such is Fick's explanation. Moreover, experiment has now fully established the theory that heat and energy are manifestations of the same force, that the property to convert latent heat into mechanical motion is inherent in the muscles themselves, and that the manifestation of this property is determined through the nervous system. Nervous impulse is converted into muscle impulse, and as a result, mechanical action follows, for the close of the latent period of muscle impulse is succeeded by a wave of contraction.

All the motions of our hands are performed by the contraction of our muscles; they all depend on the property of our muscles to contract if they are excited by our nerves.

Now let me repeat: every manifestation of energy, whether movement, heat, or nervous action, has its origin in food.

I have next to say a few words on food in its chemical relation. Professor Baron von Liebig divided foods into three great classes, and although we no longer accept his interpretation of the way in which the various foods are subsequently split up and utilized in the body, we retain his classification on account of its simplicity, convenience, and practical accuracy.

His classification is—

1. Organic nitrogenous substances.. Albumen, fibrine, gluten, &c.
2. Organic non-nitrogenous substances .. .. } fats } stearine, butter, &c.; starches } wheat flour, &c.
3. Inorganic salts.

1. *The Nitrogenous Substances.*

These, as their name implies, consist of a group in which nitrogen is largely present. They are represented by albumen or white of egg, by the albuminous principles of meat, milk, and blood, and also by the vegetable albumen or gluten of flour, peas, lentils, &c.

Now what is the use of this class in foods? In the first place they readily afford the requisite materials for the construction, maintenance, and repair of those parts whose chemical elements are similar to their own, and especially of the muscles.

It is to these nitrogenous substances that we must look for the repair of the waste of tissue which occurs in the act of muscular contraction, that is, in muscular work of every kind. It is to food from this class that we expect to derive firm muscles, in good condition for active work; and as it is such that we want in the soldier, the supply of such food should be in proportion to the amount of work that is expected from him. It is by means of such food, combined with suitable exercise in the open air, that the bright red appearance of healthy muscle is obtained, but we must always remember that our muscles are fatigued when we use them, we cannot do more than a certain quantity of work during a certain time. Our muscles want repose and time as well as food for restoring their energy and their power.

Secondly, the nitrogenous substances assist in the production and maintenance of heat. Professor Frankland accurately measured the heat produced by burning in oxygen one gramme of albumen, beef, muscle, &c., and from the result calculated the number of heat-units obtainable; a heat unit being equal to one gramme of water raised one degree centigrade. His experiments gave the following results :—

Actual Energy developed by each Substance when Consumed in the Body.

Name of substance, dried.	Heat-units.	Foot-tons of force.
Beef muscle, purified	4,368	5·96
Albumen, purified....................	4,263	5·82

It is then to the chemical oxidation of nitrogenous matter that the nutrition and reformation of their tissues, as well as the production of muscular heat, is due; but please remember that such substances are inadequate to support human life by themselves, and that an animal fed exclusively on such a food would die of starvation.

2. *The Non-Nitrogenous Substances.*

These include *two* classes : first, the *oils and fats*, composed altogether of carbon and hydrogen, with a small proportion of oxygen; and, secondly, the *starches*, such as are contained largely in flour, potato, &c. The former are known as hydro-carbons, the latter as carbo-hydrates. As the heading implies, they have no nitrogen entering into their composition.

The hydrocarbons or fats are represented by butter, suet, dripping, &c., and are contained in more or less quantity in all animal and vegetable food.

Now to what purpose in the animal economy is this class subservient? The first great purpose is the maintenance of heat, and the second is the production of mechanical force. Fats are capable of undergoing direct oxidation, and it is their union with oxygen or their combustion in the muscles which generates the force, which is rendered apparent in locomotion or manual labour; muscular work *can* be done, and frequently is done, on food containing no nitrogen, as on a diet of biscuits of starch and sugar, or starch and fat, but there is a limit to the muscular force which can be exerted under such circumstances.

This class of food can only be digested when used in conjunction with nitrogenous food, for it has been proved by experiment that if animals are fed on fats alone, they soon cease to digest their food, the appetite fails, and they die of starvation. Fat, however, has over

twice the potential energy of the carbohydrates, but it cannot be used alone in their stead, at least, not in temperate and tropical climates, although in very cold regions it is capable of being used in this way. I have seen this in Northern Canada, where enormous quantities of fat were disposed of. And here it may not be out of place to mention that there is a strong presumption in favour of the opinion that "the absence or deficiency of oleaginous matter in a state fit for appropriation by the nutritive processes, is a fertile source of diseased action, especially that of a tuberculous or consumptive character."

Of the invalids passing through the Royal Victoria Hospital, Netley, *under* three years' service, the majority are discharged, *first* from pulmonary consumption; *secondly*, from heart disease, and I believe there is reason to suspect that these diseases are at least favoured by an injudiciously arranged diet, as I shall show hereafter.

I mentioned as a subdivision of this second great class the carbohydrates or starches, which are derived solely from the vegetable kingdom, such as wheat flour, arrowroot, potato, &c. In their natural state, *i.e.*, as starch, they are never absorbed into the blood; they require as a preliminary condition to undergo the process of digestion, whereby they are changed into sugar and they are closely allied to the hydrocarbons or fats. These two substances are subservient to the same purposes in the animal economy, but must be each used in proper proportion. We cannot, as yet, assign to each its independent or relative value, but we know by direct experiment that, though so closely allied, they are not interchangeable, and that one cannot always replace the other. Such, then, are the general uses of the non-nitrogenous elements, they produce fat, and by oxidation, heat and mechanical energy.

3. *The Inorganic Salts.*

Under this head are included chiefly sodic chloride, or common salt, potassic chloride, calcic carbonate, &c., and sulphur, all entering with a certain percentage of water into the composition of some of the more complex principles of food already considered. With the exception of water and common salt these substances are contained in sufficient proportion in the preceding groups, and do not require to be separately supplemented.

Salts probably assist in the oxidation of matter, whether effete or otherwise, when increased energy is demanded, and the solvent power of salt over albuminous compounds is perhaps another reason why it is so largely used, but I must acknowledge that the precise mode in which salts act has not yet been ascertained.

Before leaving this part of my subject, I must not omit to refer to the necessity of fresh vegetables as an article of diet.

These vegetables belong chemically to the carbo-hydrates, but act differently. They contain oxygen in excess of that required to form water; the invariable consequence of the omission of them is soon followed by the development of the condition known as "scurvy," while they are among our best remedies for the cure of these affections.

Having thus briefly considered the general principles of diet, I shall now pass on to the consideration of the soldier's diet in detail, which forms the chief object of this paper. You will remember that when speaking of the soldier's work I considered it as equivalent to 300 foot-tons daily; now we ought to estimate his food in connection with the amount of work he is called upon to perform, and I shall, therefore, give a few standard diets to enable us to compare the soldier's diet with the quantity of food required. The food necessary in actual repose is, according to Playfair, as follows:—

	Ounces.	
Albuminates............	2·0	Nitrogen, 138 grains.
Fats	0·5	Carbon, 2,969 grains.
Carbo-hydrates	12·0	Salts, 219 grains.
Salts..................	0·5	
Total water-free food	15·0	

Calculating the potential energy in foot-tons, we have—

Albuminates	337 foot-tons.
Fats..................	140 ,,
Carbo-hydrates	1,816 ,,
Total........	2,293

It is doubtful if this is even a subsistence diet. Dr. Parkes considered a man would lose weight on it.

Moleschott has given a standard diet for a man in ordinary work. It is as follows, and is based on the amount required for 300 foot-tons of productive work:—

	Ounces.	
Albuminates	4·59	Nitrogen, 315 grains.
Fats..................	2·96	Carbon, 4,734 grains.
Carbo-hydrates	14·26	Salts, 463 grains.
Salts..................	1·06	
Total water-free food..	22·87	

For any laborious work, and for active service in the field, this diet should be increased to the following quantities:—

	Ounces.	
Albuminates............	6·5	Nitrogen, 455 grains.
Fats	4·0	Carbon, 5,990 grains.
Carbo-hydrates	17·0	Salts, 568 grains.
Salts..................	1·3	
Total water-free food..	28·8	

Proximate aliment.	Absolute rest.		Ordinary work = 300 foot-tons.		Hard work, or active service in the field.	
	Ounces.		Ounces.		Ounces.	
Albuminoids............	2·0	Nitrogen, 138 grains.	4·59	Nitrogen, 315 grains.	6·5	Nitrogen, 455 grains.
Fats..................	0·5	Carbon, 2,969 grains.	2·96	Carbon, 4,734 grains.	4·0	Carbon, 5,990 grains.
Carbo-hydrates	12·0	Salts, 219 grains.	14·26	Salts, 463 grains.	17·0	Salts, 568 grains.
Salts	0·5		1·06		1·3	
Total water-free food......	15·0		22·87		28·8	

These would yield of potential energy—

	Absolute rest.	Ordinary work.	Hard work.
Albuminates..........	337 foot-tons.	784 foot-tons.	1,124 foot-tons.
Fats..................	140 ,,	1,118 ,,	1,512 ,,
Carbo-hydrates........	1,816 ,,	1,967 ,,	2,346 ,,
Total foot-tons..........	2,293	3,869	4,982

These may be accepted as standard diets. For peace-time at home, and for growing men, that for 300 foot-tons of active work may be taken. The diet contains the amount of aliment necessary for a man weighing about 10 stone. It gives him 22·87 ounces of water-free food. Perhaps it may be desirable that I should here explain what is meant by water-free food. Every alimentary substance, flesh, fish, bread, vegetables, and the like, contains a certain amount of water.

In meat the water is	75 per cent.
In potatoes the water is	74 ,,
In bread the water is..........	40 ,,
In cabbage the water is........	91 ,,

In mixed food the water may be taken at 50 per cent., so that a man getting 22·87 water-free food would really receive 45·74 ounces of ordinary food.

In addition to this, a man requires 50 ounces or so of water, in some shape or form; this is the usual range, but the exact quantity varies with the size and activity of the individual.

I have placed in this table the percentage composition of some of the ordinary articles of food one is likely to meet with in the Service.

Percentage Composition of Foods.

Articles.	Water.	Albuminates.	Fats.	Carbo-hydrates.	Salts.
Meat	75·0	15·0	8·4	..	1·6
Pork..................	39·0	9·8	48·9	..	2·3
Bacon	15·0	8·8	73·3	..	2·9
Fish..................	78·0	18·1	2·9	..	1·0
Bread	40·0	8·0	1·5	49·2	1·3
Potatoes	74·0	2·0	0·16	21·0	1·0
Flour	15·0	11·0	2·0	70·3	1·7
Rice..................	10·0	5·0	0·8	83·2	0·5
Milk..................	86·8	4·0	3·7	4·8	0·7
Butter..................	6·0	3·3	88·0	..	2·7
Oatmeal	15·0	12·6	5·6	63·0	3·0

And now to summarize what I have just said. A soldier's ration should consist, at least, of nitrogen 315 grains, of carbon 4,700 to 5,000 grains daily, and in the following proportions:—albuminoids, 4½ ounces; fats, 3 ounces; carbo-hydrates, 15 ounces; and salts, 1 ounce. This would yield productive work equal to 300 foot-tons, after providing for the internal heat and the work of the body itself, which latter may be taken together as equal to 260 foot-tons.

I should deem it unnecessary to mention in this place the sources from which the soldier draws his food, if it were not that to do so will help my explanation of the nutrient value of his diet.

In the first place, he draws from the Government ¾ lb. of meat and 1 lb. of bread.

Secondly. By payment of 3½*d.* per diem he gets his grocery ration, usually excellent, and fully worth the money.

Thirdly. These are his individual purchases, and it is hard to determine this uncertain quantity.

The grocery ration is not the same in all regiments, and latterly a complete change has taken place in many.

Taking that which is usually supplied, we may, I think, accept the following as a fair sample of the soldier's ration, including the Government ration and his grocery ration, but excluding his private purchases:—

Articles.	Quantity taken daily in ounces and tenths of ounces.	Water.	Nitrogenous substances.	Fat.	Carbo-hydrates.	Salts.	Water-free food.
Meat	12 ozs., of which one-fifth is bone.	7·20	1·44	0·81	..	0·15	2·24
Bread	24	9·60	1·92	0·36	11·81	0·31	14·40
Potatoes	16	11·84	0·32	0·02	3·36	0·02	3·72
Vegetables	8	7·28	0·14	0·04	0·46	0·06	0·70
Milk	3·25	2·82	0·15	0·12	0·16	0·02	0·43
Sugar	1·33	0·04	..	..	1·29	..	1·29
Salts	0·25	..	..	..	..	0·25	0·25
Coffee	0·33	..	..	..	..	..	..
Tea	0·16	..	..	..	..	..	..
Total quantity	65·32	38·78	3·95	1·35	17·08	0·81	23·19

Nitrogen = 276 grains.
Carbon = 4,588 grains.
Salts = 354 grains.

This gives a total of 23·19 ounces of water-free food. The potential energy of this diet is—

Albuminates	673	foot-tons.
Fats	510	,,
Carbo-hydrates	2,357	,,
Total	3,540	

Comparing this with the standard diet, we find a deficiency of 11·5 per cent. in the albuminates, of 54 per cent. in the fats, and more than 23 per cent. in the salts, whilst the carbo-hydrates are 19 per cent. in excess.

This is very short of the standard diet, and is most important when we look to its source. As a result of this deficiency in the albuminates and in the fats, increased work is required from the carbo-hydrates, and this the system does not readily adapt itself to. In the standard diet, 20 per cent. of the potential energy is due to the albuminates, 29 per cent. to the fats, and 51 per cent. to the carbo-hydrates. Whereas in the soldier's ration, 19 per cent. is due to the albuminates, only 14 per cent. to the fats, and as much as 68 per cent. to the carbo-hydrates.

Now let us compare this with the diet issued to Continental armies.

In Continental armies we find that, with the exception of the Austrian Army, all have over 26 ounces of bread, and six have 30 ounces or more. The meat ration of the Continental armies is on an average only 7½ ounces, the Swiss Army being the highest with 11 ounces.

Soldiers' Rations of European Armies in Ounces Avoirdupois.

	French.	German. Smaller ration.	German. Larger ration.	Austrian.	Belgian.	Dutch.	Swiss.	Italian.	Danish.	Swedish.	Russian.	Turkish.
Fresh meat	10·58	3·8	8·81	9·87	8·81	8·81	11·00	6·34	8·74	5·67	7·054	9·06
Salt meat	..	..	..	or 5·99	..	..	..	..	..	4·09	..	..
Preserved meat	..	..	..	..	..	..	..	..	..	..	..	..
Dutch cheese, sardines in oil	..	..	..	..	..	..	..	..	..	..	..	..
Fish	..	..	..	..	..	..	..	..	..	4·01	..	..
Bread	35·27	26·45	26·45	5·29	27·16	26·45	26·45	32·38	26·45	29·98	..	34·08
Biscuit	..	..	..	or 3·527	..	..	..	..	..	..	..	..
Flour	..	..	..	25·18	..	..	..	..	..	0·24	34·9	..
Potatoes	..	..	70·54	7·76	35·27	2 litres	..	..	..	..	..	..
Other fresh vegetables.	3·527	..	..	..	..	½d.	1d.	1d.	..	..	..	0·74
Dry vegetables	1·058	..	or 10·58	..	..	..	..	..	..	..	..	0·77
Rice	..	..	or 4·23	..	..	1·763	..	5·29	..	..	..	3·35
Barley	..	..	or 5·29	..	..	..	..	..	..	5·6	..	..
Oatmeal	..	..	..	4·93	..	..	..	..	..	..	..	..
			Sour Krout	5·29								
Suet	..	..	..	1·05	..	0·881	..	..	..	..	..	..
Butter	..	..	..	..	0·70	..	..	..	..	1·13	..	0·33
Oil	..	..	..	..	..	..	..	..	..	..	..	..
Bacon	..	..	..	..	0·35	1·40 in place of half meat ration in winter.		..	..	..	..	..
Coffee	..	..	..	..	..	..	..	0·529	..	..	..	..
Sugar	..	..	..	..	..	..	..	0·7	..	..	..	..
Salt	..	..	..	..	..	0·7	..	..	0·42	..	..	0·74

In all these armies there is a deficiency in fats, while the carbohydrates are in excess. This is particularly the case in the German Austrian, and Russian armies, where there is a marked deficiency of nitrogen and a too great preponderance of starchy matters, a diet which is unequal to the support of men in health during active service.

The large amount of vegetables used in Continental armies is worthy of remark, and the taste for this class of food is doubtless increased by the foreign methods of cooking, which are so far superior in many ways to ours.

Lately, Colonel Burnett, commanding the 1st Battalion Royal Irish Rifles, has, in a memorandum addressed to the Quartermaster-General, made some most valuable suggestions, with a view of improving the diet and comfort of the soldier. I am indebted to his kindness for copies of his books, and for very many valuable hints. Colonel Burnett was the first Officer, I believe, who considered that the nutriment of bone, which really forms one-fifth of the soldier's meat ration, should be made use of.

Now, the nutritive value of bones may be reckoned at one-third that of beef in carbon, and at one-sixth in nitrogen.

Colonel Burnett has had the wisdom to ignore the prejudice which exists among certain classes of the English people against any food that is not solid—always excepting beer and wine, which they suppose to be particularly strengthening as well as stimulating. Hence liquid foods are despised and rejected.

Such people constantly say that they have had no food, when in reality they have partaken freely of milk, beef tea, or beer; and yet it was not always so. It is not so long ago that the agricultural labourer, at least in the South of England, used to have broth for breakfast, broth again for dinner, followed by more substantial food, and broth with bread again for supper.

But since the great increase in wages and the cheapening of food in this country, broth has gone out of fashion, and the British workman has got to consider himself well fed only when he can procure for himself a pound of beefsteak, with a modicum of white bread, and beer *ad lib.* The soldier now has much the same ideas, but he should be taught better, and Colonel Burnett deserves the best thanks of the Army for his endeavours in this direction.

In his memorandum, Colonel Burnett mentions that his stock for soup is made from bullocks' heads, and I have carefully calculated the nutritive value of this part of the ox. I find that an average bullock's head weighs 19 lbs. 9 ozs.; that the amount of meat on it, fit for soup, is 9 lbs. 4½ ozs., and the bones fit for soup, 9 lbs. 2 ozs. The bone and gristle from the nose and the parings, which I thought would not be used, weigh 1 lb. 2½ ozs. In a bullock's head we have then 18 lbs. 6 ozs., one-half of which is meat, available for making soup.

There is an expression used I should like to explain. Some speak of "bone soup" as if it contained no nourishment. Now, such is not the case. Bones make most palatable soup, and yield much nutriment.

The following is the composition of bones, in the ordinary beef ration, analysed at Netley.

Analysis of Bone.

		Constituents of Albuminates.	
Water	12·1	Digestible albuminates	10·3
Albuminates	24·5	Peptones	1·9
Fat	11·0	Extractives	1·0
Ash	48·6		
Loss	3·8	Total useful	13·2
		Indigestible albuminates	11·3
	100·00		
		Total	24·5

I have very carefully calculated out the value of the dietary which Colonel Burnett has arranged, and find it as follows:—

Colonel Burnett's Scale.

	Albu-minoids.	Fats.	Carbo-hydrates.	Nitrogen.	Carbon.
	Ounces.	Ounces.	Ounces.	Grains.	Grains.
Breakfast	0·9922	1·2400	5·2663	69·454	1637·6
Dinner: Soup	0·9126	0·2992	1·2227	63·882	531·2
Dinner: Meal, &c.	2·1657	0·9073	6·0503	151·599	1937·7
Dinner: Pudding and pie	0·1765	0·3238	1·1282	12·355	365·2
Supper	1·0401	0·4676	5·2867	72·807	1395·3
Total	5·2871	3·2379	18·9542	370·097	5867·0

In this scale, we have—

Albuminates	5¼ ounces.
Fats	3¼ „
Carbo-hydrates	19·0 „
Nitrogen	370 grains.
Carbon	5,867 „

The potential energy from this diet is equal to 4,742 foot tons.

I gave Colonel Burnett the results of a previous analysis of his system, pointing out that it had only one fault—deficiency in fats, and suggesting that he should endeavour to remedy this by adding one ounce of fat in the form of butter, suet, dripping, or the like, to each ration, and he at once adopted that suggestion, and the above is his amended scale.

This result is achieved without one penny extra expense to the State or to the private soldier. This diet is ample, it provides for 400 foot tons of productive work. Now, this, in more concrete terms, means

that a soldier, whose weight with his clothes is 160 lbs., can carry 60 lbs. of ammunition and walk a distance of 15¾ miles on this food, which is ample to provide the mechanical energy for such a march. I have no better solution to offer than Colonel Burnett has given. He has shown how the soldier may be fed both economically and well. It has been argued that prices are low at Mullingar—of this I know nothing. I take it to be the duty of the medical Officers to say whether food is sufficient in quantity and good in quality, or whether it is not. And if it is both these, and properly cooked, they have no further advice to offer.

I beg to quote here one or two extracts from Colonel Burnett's letter to me.

"A singular thing," he says, "about the new system is, that it has been found to increase the soldier's meat ration at dinner. Since I first started making soup from the bones, I have had them weighed, and at first found that the proportion of bone averaged between ⅕ and ⅙ per man, but now the proportion of bone is found to be ⅐, ⅛, and even ⅑.

"The explanation of this is that when bullocks' or sheep's heads are not procurable (which is frequently the case) the companies purchase shins from the meat store to make their supper stews with, and in this way dispose of a considerable portion of bone which would otherwise have to be issued with the men's rations. It will be apparent in this way that the men's actual meat ration has been virtually increased, and a test will clearly prove the truth of this. The prices in the grocery book will probably appear low, and may give the impression that the articles are not of good quality; but I would assure you that they are excellent, and the prices have been arrived at by my insisting on the contractor supplying the canteen on the lowest possible prices at which I found they could be got. From the canteen I have them issued at cost price, on the principle that as they form part of the soldier's daily ration, no one has any right to make a profit on them."

"Another objection to my system which has cropped up, and which I think it right to refute, is that in large garrison towns there are so many attractions outside barracks, the men would not stop in for their suppers.

"The same might be said of the present tea meal, and yet it is provided. To make my plan work, I allow the men to fix their own supper hour, which they do, and in this way I find that almost to a man they wait for their suppers (which are attractive enough to induce them to wait), and go out afterwards."

"Anyway, if a good supper is provided, even if the men do not wait for it, it cannot be said that the State has not done its duty towards them. A great thing is to get the men to eat their suppers, and I am convinced this can be brought about by allowing them to have a voice in the matter of arrangements, &c."

The ordinary diet of the soldier is, unless the greatest supervision be taken, quite insufficient, and it should be our aim to provide him with food that shall furnish him with enough force for the work required of him, and also of sufficient variety to prevent the occurrence of scurvy. It must be remembered that two points are now well established without doubt:—1. That man can live on vegetable food only, provided it contains nitrogenous matter, fat, and starch in due proportions. 2. That man cannot live and keep well on cooked meats alone, he requires the addition of starch. If a man is in good health the balance between the amount of nitrogen injested and ejested is fairly evenly kept, but if the amount of nitrogen be diminished below the proper standard, debility follows, with emaciation, the result of rapid destruction of tissue. If under such circumstances exercise be continued, then, as muscles while in action appropriate nitrogen, this nitrogen must be supplied by food, or be taken from some other part of the body. In other words, in the absence of a proper supply of food, the active muscles feed on those less actively employed. Perhaps this is one of the reasons why so many young soldiers break down in our Army from that irritable condition of the heart known as "the soldier's heart."

Sir William Aitken tells us that "recent observations have shown that the greatest amount of growth of the heart takes place at from 18 to 25 years of age, so that up to the 25th year of life the heart has not matured in growth."

The heart is in constant action, and requires a large supply of nitrogen for repairing the waste that continually occurs, and this is lessened by the voluntary muscles being exercised, when sufficient provision is not made for the supply by food. Another point, or error, I should say, rectified by Colonel Burnett's scale is the sameness in the dietary of soldiers. This monotony, which has been more or less a constant factor, causes the appetite to lessen, whence the health soon suffers.

A monotonous diet probably contributes, although in a minor degree, to produce the bodily condition known as scurvy, and no condition is so prejudicial to an army in the field as this one. Every Medical Officer, nay, every Commanding Officer, knows what this means; how scorbutic dysentery runs riot; how the dangers from typhus, from cholera, and from typhoid fever are increased one hundred fold.

As to other causes of this dire disease, we know little except that it follows upon a deprivation of fresh vegetables, and upon a diet in which the nitrogenous elements is insufficient. Where vegetables are not to be had, lime-juice must be given; its good effects are too widely known to need further comment.

Returning now for a moment to the quantity of food that should be allowed to our soldiers, I desire to insist on the fact that Nature is a liberal, even a lavish, mother. When left to herself, she sows several hundred times more seed for her crops than men sow for theirs, and she gives infinitely more nourishment, animal and vegetable, than they require or can consume.

Nature is not always right. She is certainly not always economical; but is it wise for us to depart from her methods to too large an extent? Certainly we should no more stint our soldiers from whom we want

activity and energy, than we should stint a steam engine of fuel when we want steam. Some men eat more than others at all periods of their lives, but it is an almost universal rule that young and growing animals eat and require more food than those whose growth is complete. Hence the younger a regiment or an army, the more food it will require, and as our Army is now a very young one, it needs more food than was required when its average age was greater. If men get abundant food, they do not require stimulants, which is only, as far as beer is concerned, another form of food, bad in many ways, but seductive for various reasons. A wise Government should not leave so important a matter as the feeding of its soldiers to the chance of its being properly considered by a raw recruit.

The Government should, I think, provide the soldier with a full and complete diet, composed of meat, bread, vegetables, and condiments, all in due proportion. Government should likewise secure the proper cooking and serving of the food, and then the soldier might be safely depended on to do justice to his fare. As to the hours at which he should partake of his meals, we must remember that it is totally unsuited to the ideas and habits of the working classes of this country to have late dinners. The dinner hour should be, as heretofore, between 12 and 1 o'clock, but there should be a warm and substantial supper at about 6 or 7 o'clock. In fact the soldier should be fed just as the agricultural labourer used to be fed, in the days when there were agricultural labourers, viz., upon three meals a day:—

Breakfast between	7 and 8.
Dinner between	12 and 1.
Supper between	6 and 7.

In addition he should have a cup of coffee, and if possible a biscuit, before being called upon to do any unusually early work: it is not safe to send a young lad to work without food; the work is then specially exhausting to him, and he is more prone to be attacked by sickness under such conditions than if he had had some food. Perhaps this might be provided for out of the canteen funds. Also a fixed time should be allowed for each meal. I have known cavalry regiments in which the men had only ten minutes or a quarter of an hour to swallow their breakfast. This is decidedly wrong, and I am certain if Commanding Officers were aware how very injurious it is to hasten men and work them like this, they would not allow it. Not less than half an hour should be given for breakfast, and this should be *at the meal*. The time spent in going to or returning from their duties should not be included in this period.

Formerly, when the soldier was older, the need for all this attention to his food was not so great as it is now, but the neglect of it was often attended by its natural consequences, drink, ill-health, and shortened life. As regards alcoholic liquors, especially in India, the State should, I think, give the soldier less help than it does. Soldiers do not want encouragement to drink strong drink, but rather the contrary. The spirit ration is certainly a mistake. Some think that good liquor is harmless, and that only the inferior kinds are capable of upsetting the stomach and brain. This is a fallacy. Alcohol interferes with the oxidation of the muscles, and with the power to repair their waste; in short it impedes their nutrition. As Sir Lyon Playfair says, "The wayward gait of the drunkard under the influence of alcohol is probably the result of a similar obstacle to change." All liquor, then, in excess is injurious, even if it be of the oldest and best.

It is a question whether it would not be better that ration bread should be made from whole meal than from refined flour, whole meal being more rich in nitrogen and fat than refined flour. The bread should be thoroughly well baked, and not eaten too fresh. At Netley the bread is baked in 2 lb. loaves, and a batch of 800 lbs. of dough is worked up into 398 loaves. Of these 4 are corner loaves, with four sides of crust out of the six; 16 are side loaves with three sides of crust out of the six; and 318 are inside loaves, with only two sides (top and bottom) of crust.

An inside loaf (two sides crust) gives about 16 per cent. of crust and 86 per cent. of crumb. An outside loaf with four sides crust gives 31 per cent. of crust and 69 per cent. of crumb. Taking the mean of all the batch of bread, we get of crust, 18·12 per cent.; of crumb, 81·88 per cent. The percentage of water-free solids in the crust is 90, in the crumb it is 63.

Now it is evident from these figures that the soldier does not get his proper due when the bread is baked in such large batches, or when the baking is insufficient. He then does not obtain anything like his proper proportion, and as this crust contains more nitrogen, he loses this, as well as in the weight.

In smaller batches the bread would keep far better, and it would also be much more nourishing if it were properly baked. Some change is needed in this respect. I do not think many of us would be content to get our bread each day with only the top and the bottom of the loaf crust, and this is one reason why so much of the soldier's bread finds its way into the refuse tubs.

I have made very many analyses of flour, and my experience is that the Government get good flour of its kind: it contains but a small proportion of water, and is rich in gluten. The great fault lies in the baking; often bitter yeast is used, and in the course of fermentation an acid is formed, in other words, the bread turns sour before it is issued. The acid of crust is 0·009 per cent., and the acid of crumb is 0·049 per cent., or about five and a half times more acid in the crumb than in the crust, which is another reason why there should be less difference between these two parts of a loaf. If bread does go sour, the excess of acidity is in the crumb. The crust also has great influence on the weight of a loaf, as it prevents evaporation, and when there is much crust, the entire loaf yields a less percentage of water.

Another supply which is frequently of very inferior quality is milk. I think it is probable that many of the anomalous cases of fevers which are seen from time to time might be traced to this source.

The death-rate at home from enteric fever is higher among soldiers than in the same class in civil life, although the soldier is living in many respects under far more favourable conditions.

If we take the total enteric fever death-rate for the Army in the United Kingdom, we find this to 0·31 per 1,000 of strength, as compared with 0·28 among the males in the total population between the ages of 15 and 45 years; this is 0·03 above the civil population. On turning to Sir Charles Cameron's report on the Royal Barracks, Dublin, he states, "in most cases the supply," that is of milk, "proved to be of very bad quality." Adulteration with water ranged from 13 to 56 per cent. in the Royal Barracks, and from 15 to 50 per cent. at other barracks. This adulteration was not confined to the milk supplied to the men.

In the supply to the Officers' mess 19 per cent. of water was added, and a specimen of milk retailed in the barracks was found to be adulterated with 38 per cent. of added water. I am afraid Dublin is not the only place where such adulteration exists. Apart from depriving the men of a portion of their food, there is the danger of introducing specific disease through an adulterated milk supply. Some system should be adopted to secure a pure and wholesome supply—even at greater cost. The milk should be delivered in bulk and samples taken and tested, as is the practice, I believe, in many large institutions in civil life.

I now come to the question of meat supply, and this for the Army is a difficult one.

When the executive branch of the Army Service Corps buy their own cattle and kill them there is no difficulty in the matter, but when the contractor steps in, who often has secured his contract at so low a figure as to allow himself only a very small margin for profit, then the door is open for every sort of abuse. The remedy provided by the State for the protection of the soldier becomes under such circumstances an almost useless one. A board of Officers assembles to pronounce whether the meat is fit or otherwise, and this they are ordered to do although they have received no training and cannot reasonably be expected to judge between different kinds of meat.

The means or tests of determining the quality of meat are imperfect at their best. Of course any one can tell whether meat is stale or putrid, but it is an exceedingly difficult question to decide whether a certain issue is too fat or too lean, or whether it contains too much bone, this being a question of degree, and there being no fixed standard. It is still more difficult to say whether a given specimen of meat has come from a bull or an old cow, from an animal that has died by acute disease, or from being choked by a piece of turnip. I have heard it said, although I cannot vouch for its being true, that there is a class of butchers who deal especially in meat from cattle which have not been killed in the usual way. This is a most important point, and we hope to instruct the young Medical Officers who join at Netley how to perform this duty of inspecting meat, so that they may be able to give advice on it when called on to do so. Unfortunately, it is only of late years that any attention has been devoted to the influence on health of the flesh of diseased animals when used as food.

Professor Gamgee states that several cases of illness have come under his observation, produced by the use of the flesh of animals suffering from inflammatory diseases; and the Registrar-General for Scotland tells us that the mortality from carbuncular diseases has greatly increased since pleuro-pneumonia became an endemic disease among its herds.

It is a question whether at home pork might not be issued as a ration once a week, say, on Sunday. This is really a soldier's food. On certain occasions he gets it, on board ship for instance, as part of his ration, and he enjoys it. Married soldiers, who purchase their own food, constantly buy it. Why should it be denied to the unmarried soldier on home service? It contains a very large percentage of fat, just what his diet is generally deficient in. It is well worthy of trial, but care should be taken that the meat is sound and properly cooked.

In all meat supply the standard of quality should be raised. Meat is frequently on the borderland between good and bad, and it is impossible to condemn it as "unfit for issue." Yet no one would dream of purchasing such a supply for his own use. The animal should have been in good condition and the quality of meat the best; bone should never exceed 20 per cent.

I cannot help thinking that by always taking the lowest contract, temptation is offered unscrupulous dealers to palm off bad meat on the soldier. We know that prices are so cut down by the contractors tendering so low and risking any loss to obtain a contract, that it is out of the question for them to supply food of really good quality and also allow of a margin for fair profit. It also has the effect of preventing honest men from undertaking this work, which, by the stringent use of this rule, almost of necessity falls to the dishonest speculators.

The quality of meat is to be judged of by the character of the pulp or enclosed substance. The toughness depends on the connective tissue, which is most abundant in the ill-fed, ill-bred, and old animals. Young and quickly fed animals have more water and fat in their flesh, whilst older and well-fed animals have flesh of a firmer touch and fuller flavour, which is richer in nitrogen. All Officers in a regiment should be instructed in the terms of the contracts. If they did know them and really understood what the State requires, it would in a great measure dispose of the difficulties that so often are met with.

And now I come to the not least important point to notice—the cooking. Much of the inferiority of the soldiers' food is due to defects in this respect. Considering how very important the subject is, it is surprising that the soldier is not instructed in the art of cooking, and I venture to say that this knowledge would prove far more useful to him on a campaign than proficiency in decimals or any other arithmetical fractions. Every soldier should be taught to cook his own food; it would not be difficult to do so, and the saving in waste

would well repay the trouble. At present the duty seems to be performed in a perfunctory manner—as a duty—and until some inducement is offered by increased payment, I am afraid it is hopeless to look for much improvement in this matter.

Those who have much more knowledge and experience than I have, complain that the present system is extravagant and wasteful. However this may be, the quantities of the articles used on certain occasions appear too large. To take one single item: flour for meat pies, say, for 60 men, is put down at 15 lbs.; it is found that 10 lbs. is ample. This latter forms a light thin crust, and allows the meat being properly cooked, in place of its being sodden and hard.

The object in cooking should be to render the meat more easy of digestion, but this, it is very evident, may be prevented if the cooking be so bad as to cause the meat to become a hardened solid mass, devoid of nutritive juices.

Time will not permit me to say more. It is only in these later days that even men of science realize the fact that the human body has to be fed with appropriate food and not be overworked; that whilst it may from one point of view be regarded as the highest integration of the physical, chemical, and other forces, it is subject to much the same laws and rules as are the other bodies of the higher animal series, and that if we wish to keep in health, we must conform to these rules.

General Sir ARTHUR HERBERT, K.C.B.: Mr. Chairman and gentlemen, having throughout the whole course of my career taken a great interest in cooking and in the food for the soldier, and having had the instructional kitchen at Aldershot under me when it started, I cannot quite agree with the lecturer that no attention has been paid to the food of the soldier, and that the cooking is as deficient as he wishes to make out.[1] The lecturer says that there is no variety in the food of the soldier. If he will look at the instructions that are given to the cooks, and at the

[1] I happened yesterday to have received a letter from an Officer who takes interest in the welfare of his corps, which shows that where attention is paid to the messing the men are well fed.

The following is a list of the meals taken from the messing book of a corps in Scotland:—

Breakfast, 8 A.M.	Dinner, 1 P.M.	Afternoon tea, 5 P.M.	Supper from 8 to 8.30.
March 10th, porridge	Sea pies, plum pudding.....	Every day..	Pea soup.
" 11th, tea, 2½ oz. cheese	Irish stew and cabbage.....	..	Potato soup.
" 12th, porridge	Meat pies and dumplings	..	Scotch broth.
" 13th, tea, 5 oz. saveloy	Sea pies and plum pudding ..	..	Lentil soup.
" 14th, porridge	Baked meat and peas.......	..	Pea soup.
" 15th, tea, liver and bacon	Meat pies and dough nuts ..	..	Potato soup.
" 16th, porridge	Baked meat and peas.......	..	Scotch broth.

dietary in a regiment well commanded, he will see that the cook is obliged to show that the food is varied every day. I have inspected fourteen to twenty regiments in a season, and if the food had not varied the Commanding Officer would have been called upon for his reasons for having disobeyed the orders. I agree that in many regiments there is great carelessness, and that the soldier does not get as much food, or as varied, as he ought to receive. But, why is that? It is from want of supervision. If there is proper supervision, if the Officers do their duty, if the sergeants do their duty, without additional expense, the men have as good food as they can desire. When I commanded a brigade at Aldershot, I was on a Committee appointed to devise the best manner of cooking for the Army, and we tried experiments in two regiments. At first, the men objected to curries and certain other dishes we introduced; they wanted to have merely roast and boiled. I gave an order to go on with the system under trial, and after a month's time the men came round, and were delighted with the new modes of cooking. But I will tell you what occurs. When I commanded in Dublin, there were two regiments in the garrison; the one was well commanded, the cooking well looked after, and the charge for excellent messing was only 3*d.*; the other regiment paid 3½*d.* The one regiment had as much as they could eat; they had an admirable system, which without extra expense gave the men even what the lecturer has so ably suggested as being required, viz., suppers. Each man, instead of having tea, was given a ticket every morning by the pay-sergeant of his company, and for that ticket he could have at any time between 6 and 8.30 soup or tea, whenever he came home, in the recreation room, which was a most admirably managed institution. If he was out, and did not come in till too late, his ticket was available again for the next day, so that he could have a double share when he wished. The lecturer objects to the dress of the soldier. Having had the arrangement, under the Commander-in-Chief, of the dress of the soldier for some years, I am at a loss to know what fault he has to find with it. I beg to inform him that Dr. Parkes, who was a great friend of mine, was consulted about the service dress, and Dr. Parkes agreed most thoroughly that the patrol jacket, worn now in marching order, is about the best dress a soldier could wear. There is no army in Europe, and I have visited them all, that has a dress so loose or so convenient, or so easy round the neck. The Italian Army has a rolled collar, but it is hooked up tightly. The Prussian Army has a stiff and high collar, and so has the Russian. I cannot go into the fats and the salts, and that part of the lecture, because, as I do not understand chemistry, I take for granted the lecturer is perfectly right in what he has said on this subject. The question is whether additional expense must be incurred to feed the Army, and I think he agrees that with proper care and supervision the soldier can be well fed without going to any additional expense, or reducing the Army. And it must be remembered if we go to the expense of adding a quarter of a pound to the soldier's meat ration the number of men will be reduced, because the country will not consent to add to the Estimates. I have been on full-pay serving with soldiers for forty-eight years, and I have never in any well-commanded regiment met with any outbreak of scurvy produced by the food the men received. The state of the milk supplied to the Royal Barracks, Dublin, has been referred to. I resided in the Royal Barracks when in command of the garrison, and during that time the medical Officers were good enough constantly to inspect the milk, and constantly to have it analysed, and, therefore, if great adulteration exists, and no doubt it does from what the lecturer has said, it is from want of care and supervision on the part of the Officers. Contractors manage to deceive, and to do you, just as well when you kill your own cattle, as they do when the meat is supplied by contract. When commanding at the Curragh some years, we thought ourselves very sharp, and I had all the animals inspected the day before they were killed; yet complaints came to me that the meat was not up to the quality that it ought to be. I went down myself and saw the animals. I found them in excellent order; the next day I went round, and I found that the meat was far from what it ought to have been. It was afterwards discovered that the contractor, by bribing two of the non-commissioned officers, was in the habit of taking the good animals out of the depôt after they had been inspected by the Board and by the Commissariat Officer, and during the night substituting old cows, which were killed and served out to the soldiers. There is

another little mistake that the lecturer made. The lowest contract is not always taken. Having for a number of years had to do with these contracts, I know that the Director of Contracts does not always take the lowest tender, if he has good cause to know or to believe that the person tendering lowest has been complained of, or has not given satisfaction. I have constantly had ration meat, and I have found the ration meat was not at all bad; in fact, the mutton issued at Aldershot was far better than the mutton I could buy in the town.

Brigade-Surgeon MYERS: Having served thirty years with the Army, though not nearly so long as Sir Arthur Herbert, I can say that the food has considerably improved since he devoted so much time and labour in watching over the interests of the soldier, both as to its quality and to the mode of cooking, and I think it is now universally accepted that it depends very much on the Commanding Officers of regiments how that food is supplied. With regard to the system adopted by Colonel Burnett, there does not appear to me to be anything specially novel in it, and there surely is nothing new in the fact that considerable nourishment can be obtained from bone when used for soup. The fact, however, that bullocks' heads can be purchased in the distant parts of Ireland for 1*s.* cannot apply to a large garrison like London, where the average price is 4*s.* to 5*s.* From the remarks of Sir Arthur Herbert it is obvious that many Commanding Officers have interested themselves in this question of the soldier's food of late years, and have done much also in promoting the soldier's interest in this matter, though, perhaps, such a systematic arrangement as Colonel Burnett's has not been adopted. With regard to bread, I do not agree with the lecturer, that the flour is of good quality. I have been told by Officers who have to deal with this matter that they cannot make good bread with bad flour, and certainly one baker to whom I showed a sample of flour the other day told me he thought it was very poor. I am, however, no judge of flour myself. There is one point with regard to the contractor. I certainly thought I was always instructed that the lowest contract had to be accepted: in fact I think I have seen it printed that the lowest contract must be accepted. Perhaps this has been altered in recent years. I should like to know is it or is it not a fact that a contract for food supplies may be rejected, and that the contractor may have to give up his contract in consequence, and yet in the following year he may again put in a tender, and if this is the lowest it is again accepted? I believe I know of a case in which that was done after one contract was rejected. Surely if a contractor's supplies are bad, and his contract is consequently rejected, he ought not to be allowed to tender again for some years. It seems to me that in such a case the contractor's name ought to be put down in a black book. With regard to the supply of meat, I can only say whilst I was in Dublin, where I believe the cattle were brought from Kerry alive, and were inspected by veterinary inspectors, the meat was far better than I have seen it at any other stations. I may also say I have heard, and now I believe it may be true, that at one station—not Dublin—cattle, after being passed, had been driven out at one gate, and old cattle driven in at the other, but until supported by what Sir Arthur Herbert has stated, I could not have believed it possible. Of course management may do a great deal, but chemistry proves one thing, the necessity of certain foods, and I think you cannot get over this fact, that with regard to the food supplies of the Army there is a deficiency of one important element, and that is fat. It is quite clear from these chemical analyses before us that fat is wanted, and really is a necessity. Now I have asked many soldiers, rather hoping that they would hold an opinion contrary to my own, if the meat supplied was sufficient: but if I have asked "Which would you rather have, a quarter of a lb. of meat, or butter?" they would say "butter." If I have asked them if they would prefer cheese to a quarter of a lb. of meat, they would say "cheese." The general rule is to say that they think they have enough meat if the quality were better. I know a regiment at this moment that has established small messes where the men can arrange their own grocery rations. They have messes of about twelve, and one of the chief things they get for themselves is butter. They buy it for their breakfast and tea. The only alteration is that the bread is diminished by a quarter of a lb. They like the plan immensely. Therefore we see what is wanted is an addition of butter to the food of the soldier. It not only supplies him with fat, but it does another thing, it saves great waste in the bread. You cannot expect soldiers to eat dry bread for their tea; it is wasted, they throw it away; but if you give them a small portion of butter the bread is eaten, and consequently you supply them not only with the fat necessary, but also with good food that would be otherwise wasted. I therefore think it very important that a supply of butter should be added to the ration of the soldier. The grocery ration probably can be done more with than it is in many regiments, but surely not more than in the regiment which Sir Arthur Herbert spoke about.

Major FERGUSON, Rifle Brigade: I am sure that all present have listened to the lecture with great interest, and it is very satisfactory to find that science confirms practical experience in so many respects. Ever since I have been in the Army I have been in the habit of hearing that the ration was sufficient for the old soldier, but insufficient for the young soldier. The bread used to be thrown away by the old soldier, and very often picked up by the young, but the meat ration especially I have always understood was found insufficient for the young soldier. Now they are all young together, and, therefore what was formerly only true of a certain proportion of the Army is now virtually true of the whole. I cannot speak from recent experience at home, because I have been serving the last five years in Ceylon, where the meat ration was 1¼ lbs., certainly not of such good quality as meat at home, but the ration of meat was the best in the island, and the system was that recommended by the lecturer. The cattle were inspected, they were bought alive, the meat was not supplied after the animal had been killed. The Commissariat Officer inspected the meat every night. Proper precautions were taken to prevent fraud, and I do not think under the system it was possible for a dishonest contractor to make away with good beasts and replace them with those of inferior quality. There was one point the lecturer hardly touched on, and, I think, a very important one, and that is the connection between insufficient food and drink. I am sure the reason why men drink so much in the Army is mainly that they feel the want of food in the evening. It was very true what the lecturer said, that the working classes do eat, as a rule, a supper in some shape or form: their principal meals are the midday meal and the evening meal. Of course there is one other reason why men drink in the evening, and that is because they very often do not know what to do with themselves. I know in very many cases the one idea of pleasure to a soldier is to resort to the canteen in the evening, but if he was not empty, if he had not a sensation of "sinking," he would not drink so much, and he would not get drunk. I am in the presence of many scientific authorities, and therefore I speak with diffidence, but I think I am right in saying men very seldom get drunk in connection with a meal, and that delirium tremens would be almost unknown if men would not drink on an empty stomach. The drunkenness in the Army I think is mainly due to men going to the canteen and boozing, filling themselves with beer to make up for the deficiency of food. The evening meal at present, everybody knows, is a perfect humbug. I earnestly hope that such an evening meal as the lecturer indicated, from 6 to 7 o'clock—the hour being optional with the men—will be given. Of course we shall be met with the assertion that it would involve very great expense, but I am prepared to contend that in the long run it would be the truest economy. If the country will be generous in this matter it will be repaid with interest: we shall have far less drunkenness; and everybody knows what follows upon drunkenness—disease, hospitals filled, men less efficient in peace-time and not to be depended upon in war. It is not only the effect on the soldier whilst serving that is so serious, but the effect on the nation generally. We are sending discharged men back into civil life every year in thousands. What is the effect which they produce on the general community? I do not wish to inflict a temperance lecture on this audience, but I was talking on the subject of excessive drinking in the Army to an Officer who has just given up the command of a regiment, and although he did not quite agree with me in some respects, when I said "I am afraid we are sending back discharged men every year in great numbers who, to say the least of it, are not a benefit to the community," he said, "Nine-tenths of them are men addicted to drink." I will add no more, except to repeat an earnest hope that it will be found possible to give the soldier an evening meal which will keep him in barracks and tend to make him drink less.

Colonel C. J. BURNETT, Royal Irish Rifles: I should not have risen to address the

meeting at all, except for the remark of one speaker in which he insinuated that I had advertized myself by publishing a letter containing my views on the ration question. I had nothing whatever to do with publishing that letter; it did not rest in my hands. I was simply working in the interests of the State and of the soldier, and I thought I was only doing my duty in letting the authorities who had asked me the question know exactly the truth of the experiments that I had carried out. I do not know hardly a soul in this room, but any man who knows me will tell you that is not my character. I have no wish to hold myself up as a mentor or teacher. I know there are regiments as good as my own in the Service; I know there are many Officers who have the same sense of duty that I hope I have; therefore, why would I set myself up to teach men who many of them are as good as myself! What I have done was solely in the interest of the State, and in the interest of the soldier. I was asked a straightforward question, and I gave a straightforward answer. I have been blamed, I know, for doing that; I have been told that I spoke before the time. I have been told that if it had not been for me the soldier would probably have got his extra quarter of a pound of meat. Why was I to hold my tongue, was I to prevaricate? I could not have held my tongue, because the report had to go in; I hope I could not prevaricate, I had to tell the truth, and I told it. There is a question about bullocks' heads—I assure you I am perfectly sick of hearing about bullocks' heads. You need not have a bullock's head to give a man a good supper. There are many other things which you can get if you study local surroundings, and I am sure that there are many regiments that have studied local surroundings, and have not confined themselves to bullocks' heads only. I do not care if I never see a bullocks' head, I can get other things which answer the purpose of the soldier, and suit equally well. I have a detachment at Sligo, where bullocks' heads cost 3*s*. 6*d*. each—they are not, of course, used, other things are got. All that has to be done is to exercise close and constant supervision; watch carefully over the interests of your men, see that what he gets he gets in the cheapest and the best market, and get as close to the source of supply as you can. See that what goes to the cook-house the soldier gets, because there is no doubt that pilfering does go on, and pilfering will go on unless you exercise close and constant supervision. You may have a very fine grocery book which will answer all the requirements of science, but it does not fill the soldier's stomach. The last speaker but one said there was great difficulty in supplying fat. The soldier has a great repugnance to fat. As a rule, he likes butter, bacon, and dripping. Now, I can tell that gentleman how certainly a very large proportion of fat can be procured free of any expense to the soldier. I took the trouble for some time to superintend personally the saving of the dripping in my cook-houses. I gave the result to the lecturer, which I have no doubt he will gladly show. I found, on an average, I had considerably over 100 lbs. weight of dripping a week; that amount of dripping enabled me to give a free issue of 2 ozs. a man to the whole battalion once a week, and to supply them with suet for their plum puddings, for their pie-crust, and for their fish pies. Again, people have objected that Mullingar is a cheap place. So it is to a certain extent, but there are many cheaper. Vegetables are dearer in Mullingar than they are in almost every part of England, that is to say turnips, carrots, celery, and that sort. We used to get in England a pound for ½*d*., in Ireland you pay one penny for them. Onions we get in England at ½*d*. a pound, in Ireland they are 1¼*d*. Potatoes we have to pay 5*d*. a stone for, but if you ask in Mullingar from certain departments you will find that they are paying 8*d*. for almost the same potato. Milk, of course, is cheaper in Ireland, but when you have preserved Swiss milk for 4½*d*. you can make three quarts of very good milk, and can be perfectly certain it will be free from the adulteration which the lecturer has pointed out. American bacon costs the same everywhere, so do preserved meats and dried fish. As regards fresh fish Mulllingar is very badly situated, but we get it. There was another question about the meat. I do not think that the Government do wrong in accepting a low contract. The terms of the contract are very plain and distinct; the meat must be good, wholesome, and well-fed. If a man contracts to supply that class of meat, he should be made to supply it. It is not the fault of the Government or of the person who drew up the contract, it is the fault of the man who receives it. I say the Commanding Officer is to blame if he takes bad meat, and you may depend upon it if Commanding Officers would not take bad meat, the price of meat will go up, and the contractor will give the class that he has guaranteed to supply. There is an excellent substitute for butter in the shape of margerine, which can be procured at $10\frac{1}{2}d.$ per pound.

Dr. BALFOUR: I wish to call attention to an error in the paper with reference to the general greater prevalence of typhoid fever in the Army than in civil life. The author has forgotten in his calculation the marked difference in the age distribution of the men—that in civil life there is a much larger proportion between thirty and forty-five than there is in the Army, but when a man reaches thirty he has very nearly passed the limits within which typhoid fever generally prevails. To estimate it properly it ought to be calculated upon an age distribution in civil life corresponding with that of the Army. There is another point to which I should like to call attention, and that is the necessity for a more careful inspection of all stores delivered for the use of the soldier. When I was at Netley, I had at that time 400 men of the Army Hospital Corps who were being drilled and trained. I looked very carefully to the supplies furnished for them, and I found the coffee which was supplied for their breakfast contained 40 per cent. of chicory. I objected to it, and through the Control Department, then the Supply Department, of the hospital, I got the contractor to furnish the coffee in the bean, roasted. After one or two bags of coffee had come in, I found that he was sending in coffee beans in which there was scarcely any substance at all; it was almost simply the shell of the bean. Of course, I condemned it, and then he threatened to revert to the supply of it ground, which was what he contracted for. I merely called his attention to the penalty for adulteration, and during the remainder of the time I was there we got an extremely good coffee bean supplied for the men. I may also mention with regard to the tricks of contractors that one day we found some meat which had been sent in for the use of the hospital, and condemned, was being quietly smuggled in through the back door to be supplied again. I had it immediately seized; I sent for the Health Officer of the district, and had it condemned and buried, and I do not think the butcher tried the trick over again. The importance of attention to cooking cannot be over-estimated. When I was appointed to the Duke of York's School, I found the boys in a very low state of health. One of the first things I did was to attend to their dieting. I found the cooking was as disgraceful as it possibly could be. In the course of twelve months, with an increase to the amount of food supplied to the boys of only 2 ozs. a week, I got them into thoroughly good condition, and it was, I believe, very much the result of two things, first, that I introduced more variety into the dietary, and next that I took care that it was most thoroughly and efficiently cooked.

Surgeon-General MASSEY: With regard to the 4 lb. loaves, I may state that the Committee recommended that they should be 2 lb. loaves. I do not wish to enter into this matter at all, because being on the Committee I may be supposed probably to say things that I ought not, and to give the opinions of the Committee. But that is one point, that these 4 lb. loaves have now been made into 2 lb. loaves, and the cost of that has been 5,000*l.* a year.

Lieutenant-General Sir R. HUME, K.C.B.: The great value of this lecture, apart from its inherent ability, is that it tends to show the public the interest that is taken in the well-being of the soldier. I think the more care that is taken of the soldier after he has enlisted, the better. The lecture we have had to-day, and the discussion that is following it, will have a very great effect on many people outside, who really are entirely ignorant of what is done with the soldier after he has enlisted. Since I have been unemployed, in a military sense, I have had the opportunity of meeting many more people out of the military track than I ever did before, and it is astonishing the utter ignorance that prevails through nearly the whole of the English nation as to the social state of the soldier after his enlistment: they really seem to know nothing about it. Therefore, I think this lecture to-day, in continuation of the many lectures that take place here on different military subjects, will be a most valuable one. With regard to some of the things the lecturer has stated: in the first place I can quite understand his remark about cooking; what he wishes is, that the knowledge of cooking should be more general and not confined to the trained cooks, who, I must say, are admirable. It would

certainly be a very great thing if individual soldiers were more trained in cooking. But then there are so many things they have to be trained in nowadays that they really have not got time for everything, and you must delegate the cooking in a regiment, as far as I can see, to a certain number of trained men. Of course, the more you can extend the education the better. I was at Portsmouth a short time ago with my old regiment (55th, now 2nd Border Regiment), and the Quartermaster, who was Quartermaster in my time, took me to the cook-house, and to see the men's dinners, with great pride, because, he said, "We used to think in your time that we cooked pretty well, but I think you will see a great change for the better now," and I did. I saw the men getting fed in such a way as they never had been in my time, although I thought they were not badly cared for then. There is not the slightest doubt that there has been a great improvement in the cooking. With regard to the things that are not supplied by the Government, of course, as Colonel Burnett said, you must depend on your local supply entirely. All these are details which are carried out by Officers commanding regiments. With reference to the Officer who spoke a short time before Colonel Burnett, I did not understand him to wish to say anything at all offensive to Colonel Burnett, but what it struck me he meant was, that this is a point which is attended to by many Commanding Officers. I do not think it was meant to say that Colonel Burnett had thrust himself before the public in any way, but it was merely remarking that it was not confined to one Officer. With respect to the whole subject before the meeting, I do not think that there is any of greater importance, or, as I said before, whose consideration will have a better effect on the outer public, and through the outer public on the Army, than the question we have discussed now. The Army is now getting out of its very young soldier state, and it appears to me that the rules for enlistment and for service now, if they are looked at, will be found very different from what they were eight or nine years ago. Many soldiers now have an opportunity of becoming old soldiers, which they had not then, and I am glad to see, as far as I can understand, that the time of service of the men in the Army is gradually returning to a much longer period than it was some few years ago, therefore, we have not got to legislate entirely for a short service army, and I heard my old sergeant-major tell the Commander-in-Chief and the Quartermaster-General at Portsmouth the other day, when the Commander-in-Chief asked him about the meat ration: "The meat ration is entirely sufficient for the old soldier, but for the growing boys it is not sufficient." There was a remark made by an Officer about the excessive drinking in the Army. Now, from my experience in the Army and my experience of civil life, I do not think that drinking in the Army is in excess of drinking in civil life; but I think the amount of drinking *detected* in the Army is excessive in comparison with what is detected in civil life. This has always been my opinion, and I am very glad to have an opportunity of saying so to-day. I feel very much obliged to the lecturer for his paper, which I have no doubt will be of great use to many of us individually, as well as to the Service generally.

Major FERGUSON: I can assure General Hume I was not thinking of his regiment or of my own in adverting to the much drinking. I have only just come home from abroad, and I spoke more of regiments I have seen abroad, but, if I may take the opportunity of saying so, I did have the pleasure of seeing General Hume's old regiment the other day arrive in Portsmouth, and 300 total abstainers sat down to a tea, so that I know that his is a singularly sober regiment.

Brigade-Surgeon MAUNSELL: With regard to the bread supplied to the soldier, particularly at Aldershot, I should like to say a few words. Within the last few months 2-lb. loaves have been supplied to the soldier. These loaves are formed like cottage loaves, so that there is crust all round, the consequence is the bread is excellent. I attended before the Committee the other day and brought up two of the loaves, hospital bread and ration bread. I showed them to the Ration Committee, of which Surgeon-General Massey is a member. This bread was very good, in fact, you cannot get better bread. I eat the hospital bread myself always. The ration bread is not so palatable as the hospital bread, because it is made from seconds flour. The difference in the price of the two breads is $\frac{1}{10}d.$ per lb., and I think if ration bread were made from hospital bread flour, it would cost about 5,000*l.* a year more. I think if the bread were made in 2-lb. loaves, as it is at Aldershot, that you could not get better bread, and the men eat it all. As an illustration of the difference in the bread now and what it was some months ago, I may say that from a battalion in Aldershot some time ago, 100 lbs. weight of bread was taken away in the swill-tub. I traced that bread from the swill-tub to the farmer who bought the swill, and I have seen strings of unbroken loaves in the swill-tub at this farmer's; he was feeding his pigs on the bread. I have also found in the farmer's yard a lot of baker's bread, which was taken away in the swill, which seemed to prove that the bread was wasted very much in the barracks. Therefore, I say, the purchase of bread out of the grocery money is not necessary. With regard to the cooking, I very often go round the kitchens, and I find at Aldershot, in the Central Infantry Block, where the cook's class is, the infantry regiment is fed much better than any other regiment in camp. The cooking is better and more varied. The King's Royal Rifles who are there now have a most excellent messing. Three days ago I saw their dinner. They had curries which were as good as could be. I then went up to the huts in the South Camp and looked at the dinners there, and the cooking was nothing like so good. There are two reasons for this: the first is they have not sufficient fuel, and the second is that they have not cooking arrangements enough to vary the dinners. Something has been said about the dress of the soldier. I think Sir Arthur Herbert said the soldier was very well clothed. I am sorry to differ from him. The civilian when he presents himself as a recruit wears clothing weighing from 7 to 11 lbs. 8 ozs. He comes in as a recruit, and we put him into a suit of clothing which weighs as low as 4 lbs. 8 ozs. Now I have weighed the clothing of recruits who come up to the Cambridge Hospital, young soldiers; the last clothing I weighed was in October, 1888, and one suit of clothing weighed 4 lbs. 8 ozs. (date of issue 1.9.87), another 5 lbs. 1 oz. (date of issue 1.6.88).

Sir ARTHUR HERBERT: What clothing had he?

Brigade-Surgeon MAUNSELL: A serge suit.

Sir ARTHUR HERBERT: They do not wear serge clothing in England at all.

Brigade-Surgeon MAUNSELL: That is what they come to hospital in.

Sir ARTHUR HERBERT: A line soldier?

Brigade-Surgeon MAUNSELL: A line soldier: he wears a kersey. This was a soldier of the Yorkshire Regiment. It does not much matter what you call it, but that is the weight of it. The correspondence is in the hands of Sir Evelyn Wood at present. It astonished me when I compared the civilian's clothing when he comes up to enlist and the clothing of the soldier as he presents himself at the hospital. The articles of clothing weighed were his kersey, his shirt, and his trousers.

The CHAIRMAN: I think I must ask you to remember that we are talking about rations, not about clothing.

Surgeon-Major NOTTER: I have very few words to say in reply. First as to clothing. What I meant to say was that the continual movement in working-men with the chest exposed was far and away less exhausting work than it would be if tied up in a collar such as we have now nearly lost, but not quite. Where there is free play of all the muscles the work done is far and away less than in the constrained position of ordinary drill. I did not want in the least to reflect upon the clothing, which for a soldier I believe is as good as it could be. In the same way as to monotony of diet, my remarks did not apply to the present day. I spoke more of monotony of diet in the past, and I did not mean to single out Colonel Burnett's system as being exceptional, but as showing the change that had latterly come over regiments, the interest Commanding Officers as a whole had taken in the subject of the soldier's food, and the results which had followed from their close attention to the matter. As regards the lowest contract, I may be mistaken, but I think it is in the "Commissariat Manual." I have not got it here.

Sir ARTHUR HERBERT: The Commissariat do not take the contracts, it is the Director of Contracts. All contracts of meat are made by the Director of Contracts. In the Commissariat you are quite right, but all contracts for meat in England are made by the Director of Contracts.

Surgeon-Major NOTTER: I did not mean meat alone, I meant contracts for flour, groceries, and for supplies in general, and I think there is a paragraph in the "Commissariat Manual," that is what made me say it. I think I showed pretty

clearly that there is ample fat in the diet given, 3 ozs. of fat in the day. There are actually 4,700 foot-tons of potential energy in that diet, and it is utterly unnecessary to supplement that with butter or anything else. I have also a statement here of the amount of dripping which was saved in February in the cook-house of the Royal Irish Rifles, Colonel Burnett's regiment; 378 lbs. 10 ozs. were saved during the month and distributed; this gave over an ounce of fat per man daily, and raised the fat up to the scale we have here, which is ample for every purpose. What Sir Robert Hume has said is quite true, the young soldier does not drink. I have had ample opportunity of seeing this. I was in camp where there were upwards of 3,000 of these young soldiers, and it really was the exception to find it. The young soldier spends his money upon food, as a rule, and not upon drink. The Army is a sober army as an army, I take it. Brigade-Surgeon Maunsell has simply followed up the principle that I suggested about the bread. Everyone knows the old bread, which had only tops and bottoms, of which the bottom was harder than a board, and the bottom generally went into the swill-tub. My object was that there should be a regular proportion between crust and crumb, which should as nearly as possible assimilate to what we get in civil life. I advocate no extraordinary change in the meat ration; the meat ration if properly used is ample, and there is no necessity to put the country to the expense of extra food for the soldier.

The CHAIRMAN (Sir T. Crawford): Gentlemen, as time is running very fast to the period at which the debates usually close, I will not trouble you with any general remarks with regard to the ration. There is one great advantage in these lectures, particularly when given by gentlemen who understand the scientific principles upon which men should be fed, that it does diffuse a certain amount of scientific information throughout a broad audience, and that is particularly the case with everything stated in this theatre. We have, fortunately, an exceedingly well-managed Journal, through which some admirable papers from time to time find their way into the hands of the whole of the Army, and it is a great advantage that this subject in particular should be dealt with here in a scientific as well as in a practical sense, and that it should find a record in the Journal. I would like to say one or two things in regard to the paper, as I am like some of the speakers who have addressed you this evening, not without some experience in the Army in this as well as in other matters, and in other countries as well as in this. I agree with those who have said it is essential to feed the young soldier well. I agree also that the ration in the main is sufficient, provided it be of good quality, and I thoroughly endorse what Sir Arthur Herbert and others have said, that it is in the hands of the Officers of the Army to secure that for the soldier without a penny more expense to the State. I agree also in everything that has been said about cooking. The Army is enormously indebted to Sir Arthur Herbert and others, who have taken an interest in establishing the School of Cookery, and managing it, at Aldershot, and I am only sorry that a suggestion of my own that all these depôts at home should have a first-class cook on their establishment was not carried out. I think it is one of the essential requisites of depôts of regiments at home that their kitchens and their cooking establishments should be unquestionably of the very best. I think also with regard to the distribution of meals, that if the soldier had three good meals at properly regulated hours, he would have all that the soldier really requires, and that he may have that Colonel Burnett has shown by his practical way of dealing with this question. I am sure the Army at large, and the audience in this theatre, will agree with me in saying that Colonel Burnett's agitation of this question, and the practical way in which he has looked at it has done a vast amount of good, but I do not think anybody would think for a moment that the idea of advertizing himself has had anything whatever to do with Colonel Burnett. The fact is his letter was so good that the Commander-in-Chief could not do otherwise than publish it for the Army, and the publication of that letter, and the discussion that has resulted from it, and the practical steps taken in consequence of its promulgation have already done much good in the direction in which reform is needed. With these very brief and cursory remarks I will ask you to bear with me while I propose a vote of thanks to the lecturer. I am sure we are indebted to any gentleman who will take the trouble of writing out a carefully prepared paper and laying it before such an audience as this. I will take it for granted that you carry this resolution by acclamation.

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ADDRESS

DELIVERED ON THE 3rd FEBRUARY, 1890

ON THE OCCASION OF THE

PRESENTATION OF PRIZES

AT THE ARMY MEDICAL SCHOOL AT NETLEY

BY

JOHN SYER BRISTOWE, M.D., LL.D., F.R.S.

Senior Censor of the Royal College of Physicians and
Senior Physician to St. Thomas's Hospital

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AN ADDRESS.

MEMBERS OF THE SENATE, LADIES AND GENTLEMEN,

I have to express my very sincere thanks for the honour conferred upon me by the invitation to take part in to-day's ceremonial, and the real pleasure it gives me to visit this great School, to make or renew acquaintance with its distinguished professors, and to distribute the prizes to the successful probationers of the Session just concluded. The only drawback to my happiness is that I am not an orator, and cannot therefore adequately fulfil the duty I have undertaken, or give that pleasure to my auditors which I should like to give, and has been given by many of my predecessors in this chair.

I am afraid I must be getting old (though the older we get the more old age seems to recede from us), for I was a young physician at the time of the Crimean war, the sanitary disasters of which led to the establishment of the Netley School of Military Medicine. I had just been appointed one of the assistant physicians to St. Thomas's Hospital, and was its demonstrator of morbid anatomy, and was applied to, as other young civilian physicians and surgeons were, to go out to the East, and take part in the medical treatment of the sick and wounded. I did not accept the offer, and very shortly afterwards I was asked by Sir James Clark to become a candidate for the post of pathologist, which was subsequently given to the late

Dr. Lyons, with whom was associated Dr., now Sir William, Aitken. Whether, if I had become a candidate, I should have been successful in my candidature I cannot, of course, say, but domestic difficulties stood in my way, and again I had to decline. I have no doubt it was best as it was, and that more good work was done for science and for the country by these eminent men than would have been done by your humble servant. I mention these facts to show that I was not unfamiliar with the shortcomings and the needs of the army medical service at that time, and to explain the interest I felt in the foundation of this magnificent institution, and my deep sense of the valuable services it has rendered, and still renders, to the army medical service, to the army, and to the country.

This is not the time, the place, or the occasion to discuss the causes of the failure of the sanitary management of the Crimean war, or to apportion blame. I am not learned in the hygienic history of campaigns. But we know that sanitary science is only of recent growth, and that even as applied to the circumstances of the civil population, it was in its earliest infancy at the time referred to. There can be no doubt that (though the health of their armies must always have been a subject of deep concern to great commanders, and to the medical officers attached to them) sanitation, in the modern sense of the term, was little understood or practised down to the time of the Crimean war, and such experiences as those of that campaign were previously only too common, and but little heeded. The Crimean war was, so far as I know, the first war in which newspaper correspondents were tolerated. They were, indeed, allowed almost complete freedom, to go where they liked, to hear what they could of what was going on, to transmit full narratives of what they saw or

imagined, and even to criticise adversely both military operations and those who guided them, and to mar or make reputations. There is but little doubt that their proceedings were in many respects injurious to the immediate prospects of the allies, and tended to prolong the war and render its issue doubtful. On the other hand, it is certain that their graphic descriptions of the sufferings of the soldiers during the terrible winter spent before Sebastopol were largely instrumental in rousing the indignation of the country at the lamentable shortcomings of the sanitary organisation and provisions of its model army, and its sympathy with the victims, and in compelling the government of the day to take vigorous and unwonted measures to promote the comfort and cure of the sick and wounded, and the health of all. It was to further these ends that many civil physicians and surgeons were sent out to the East to aid the army medical staff in the performance of their overwhelming duties, and that Miss Nightingale, with her band of trained nurses, started on that errand of mercy whose success has made her name immortal.

The Crimean war was an important epoch in the history of practical medicine. For, though we may admit that the education of nurses and the elevation of their calling had already made some progress, and that hygiene was already engaging the serious attention of thoughtful men, both in the profession and out of it, it is certain that the Crimean experience gave an important impetus to the development of both of these branches of sanitary medicine.

It will be recollected that shortly after the conclusion of the war a national testimonial was presented to Miss Nightingale for her distinguished and beneficent services; and that this testimonial was devoted, in part, to the establishment of the Nightingale School for Nurses at St. Thomas's Hospital, which institution is not only active and flourishing, but also through its pupils and its example may be regarded, in a sense, as the parent of all the similar Nursing Schools which are now scattered over the civilised world. The establishment of this School was the most important and far-reaching measure ever taken in the interests of the nursing profession, and the nursed public, and was one of the most valuable consequences of the Crimean war. The second of the two important consequences above referred to was the establishment of this School, of which it is my privilege to be the guest to-day, for the purpose of insuring that young medical men shall enter the army, not only well up in medicine and the collateral sciences, as they may be learnt at our civil medical schools, but also well-trained in those special duties and requirements, especially hygiene, which experience has shown to be essential for the full mental equipment of the military surgeon.

Medicine is a large subject, and grows day by day. When I first joined the profession (I scarcely like to think how many years ago), it was altogether a different thing from what it is at the present time. There were many great physicians and surgeons then as there are now; and their greatness consisted then, as greatness consists now, in large acquaintance with the accumulated medical and surgical knowledge of the time; in rich experience of disease; in readiness of resource and skill in treatment, according to existing lights; and in the earnest and successful investigation of the hidden secrets of health and disease, the discovery of which places those who follow on a higher level and in a clearer atmosphere than themselves. At the time I speak of the practice of auscultation was in

its early childhood; neither the laryngoscope nor the ophthalmoscope had been invented; the thermometer was never used to ascertain the temperature of the body; anæsthetics were introduced during the period of my pupilage; the fact that specific infectious febrile disorders are due to the ravages of specific living organisms had not been discovered, and the antiseptic treatment of wounds which followed was in the womb of the future; physiology and pathology, though much had been done in them, were far from that high phase of development which they have now attained; and sanitary science and preventive medicine were only just emerging from the darkness. You know what all this means. Medicine during the last forty or fifty years, owing partly to the rapid progress of collateral sciences, and their application to medicine, and partly to the continuous and close study of the causation, processes, symptoms, and treatment of disease, by innumerable enthusiastic observers, has undergone a revolution. Diseases of the eye, which now demand the exclusive services of a whole host of specialists, were little understood; diseases of the throat and ear, with few exceptions, were unrecognised; diseases of the nervous system, which now seem almost innumerable, were nearly all included under a few well-known names, such as apoplexy, epilepsy, hemiplegia, paraplegia, shaking palsy, chorea, tetanus, neuralgia, and hysteria; a whole host of obscure diseases, formerly wholly overlooked, have, as it were, sprung into existence, among others, Addison's disease, hæmoglobinuria, pernicious anæmia, leucocythæmia, exophthalmic goitre, myxœdema, and acromegale; the causation and natural history of epidemic and infectious diseases, and the nature of tumours, have been largely and successfully investigated; the introduction of anæsthetics and of antiseptic treatment have, between them, not only rendered operations infinitely safer than they were in former times, but have led to the constant employment of surgical measures with success in cases in which formerly operations would never have been dreamt of, and would almost certainly have been fatal; while sanitary science and preventive medicine have been sweeping away malaria, have been limiting the spread of cholera and the incidence of enteric fever and typhus, have been exerting a favourable influence over the fatality of tuberculosis, scarlet fever and the like, have been discovering protective measures against the occurrence of hydrophobia and certain other diseases, have diminished the death-rate and lengthened by several years the average duration of life, and have revolutionised our views and practice with respect to the housing of the people and the sanitary arrangements of their dwellings, to the construction of infirmaries and hospitals, and to the management of the sick and injured.

The object of my last few remarks has been to show how great has been the advance in all branches of medicine since I entered on my hospital studies, and even since the time of the Crimean war, and how vast an area the science of medicine now covers, and to suggest how difficult, if not impossible, it is for any one man to become fully acquainted with every part of it, and how wise, therefore, and far-seeing Lord Herbert and his coadjutors were when they founded this great School to supplement for those entering the medical service of the army the education furnished by the ordinary schools of medicine. For a medical officer in the army is likely to be very differently circumstanced from his civil brother. A medical man in civil practice, if he be a so-called consultant, does, or should, limit his practice to medicine, surgery, or midwifery, and often limits it to the

diseases of a particular organ, as the eye, ear, throat, skin, or to particular groups of organs, such as those within the thorax, or those within the abdomen. If he be a so-called general practitioner, he attends to everything that comes before him, it is true, but if in difficulty or doubt, or overweighted with responsibility, he calls to his aid some other medical man, who has, or is supposed to have, special knowledge or special skill. If he be an officer of health, he probably devotes himself exclusively to the duties of his office. But a military surgeon cannot limit himself to a particular line of practice, nor, when in need, can he always call in some consultant and divide responsibility with him. He may at any moment be required to act as an officer of health, to practise as a physician or as a surgeon, or in any of the specialities of practice which are the sole occupation of many men of the highest eminence. He has to be armed at all points, and ready for any emergency.

This School has now been in existence for thirty years, and all medical officers who have entered the military service since its foundation have had, after a selective examination, to undergo the further special course of training which it provides. It is obvious, therefore, that the army medical officers of to-day are a much better and more completely educated class than were those of former days; and that they do constitute a highly educated body of medical men, a body of which the country has reason to be proud, will be generally admitted even outside these walls. But though the general level of education is doubtless much higher than it formerly was, and the present body of medical officers are, as a class, far ahead of their predecessors, it must not be forgotten that in the benighted times of old there were yet many great army surgeons who towered head and shoulders above their comrades, who could at least hold their own among the best of their successors, and that it is largely to such men, who (if they were not taught as young doctors are taught now) taught themselves and became great in spite of relatively defective training, that Netley owes its origin and its successful career.

I will now address myself to the probationers. I am not one of those who look upon examinations and prize-getting as the great aim and end of existence. Nor do I think that examinations are generally adequate tests of candidates' capacity or knowledge, or that the highest rewards are necessarily in all cases given to the best men. Nevertheless examinations are necessary, and undoubtedly the average of good men is higher among those who obtain honours or prizes than among those who are below them. I very sincerely congratulate you who have won prizes on the present occasion, and, if I do not speak quite so enthusiastically of your eminent merits, of your profound knowledge, of your moral excellence, and of the superhuman efforts you have made to attain your enviable position, as it is sometimes the custom to speak, it is not because I fail to appreciate your success, or to feel so far emulous of you as to wish that, had I been young enough to compete, I might have been victorious in the struggle. I have a very distinct recollection of one occasion, when some prizes I had gained were being awarded to me in public, that I happened to be introduced to the chairman by a great orator, who laid on his praises so thickly and in such glowing language, that (though I should doubtless have swallowed with great complacency a little delicate flattery) I could not help feeling how absurdly disproportionate the praises were to my deserts; that he did not mean what he

said, and what a fool I looked, and perhaps was. I shall not err in that direction. I repeat that I do congratulate you very heartily on the prizes you have gained. And I congratulate you, both because in the several competitions you have secured the highest place in the examination, and because, as the result of your successful efforts, you have had awarded to you prizes which, from their associations, you will always feel it a special honour and satisfaction to have obtained.

Though some of you have been successful, there are others of you, and a larger number, who have competed and failed. Well, gentlemen, I have no doubt that you also have done your duty, and have deserved success. Perhaps you have been disappointed. If so, let me try and comfort you. Prizes are excellent things in their way, and have a real legitimate value. But there are some men who only strive to win prizes, and, having won them, do nothing more. I confess I have no great sympathy with mere pot-hunters, whether in mental or corporeal athletics. Again, success in obtaining prizes proves many things in a man's favour, but it does not prove that he possesses in a high degree any of those higher qualities of manhood which make men great and successful in life. A man who wins prizes shows therein that he is capable of systematic work, and of acquiring knowledge, and that he has the power of reproducing this acquired knowledge readily and in an intelligible form. His handwriting, too, must be legible. Perhaps you will allow me to interrupt my argument by an anecdote. Some years ago, when I was one of the examiners in medicine to the London University, the examiners were sitting, under the presidency of the late Dr. B. W. Carpenter, engaged in making their awards, when one or two of them complained bitterly of the unintelligible writing of some of the candidates. Dr. Carpenter acquiesced, and said, 'I recollect when I was examiner, one candidate's writing was so hard to read, that I cut out groups of words, and at the ensuing *vivâ voce* handed them to him for his interpretation of the hieroglyphics. I need scarcely say he could not decipher them.' After a short pause, I remarked quietly that I could confirm Dr. Carpenter's story, for that I happened to have been the unfortunate culprit. Of course I sympathise with the bad writers. But, to resume, it does not necessarily follow that a prize-winner has originality of mind or poetic fancy, is capable of minute and careful observation and plodding industry or of profound thought, is endowed with perseverance and energy of character, the love of truth or other high moral attributes, or that he possesses in a pre-eminent degree any of the qualities which go to the formation of a pioneer or discoverer in science or philosophy, a great writer, or a leader of men. You know, I daresay, the anecdote told of some Cambridge don (I am sorry to confess that I have forgotten names) who congratulated a competitor in the mathematical tripos, who had been expected to obtain the senior wranglership but had failed, on having won the most distinguished place in the honour list. Of course the candidate thought the don was only chaffing him, and replied demurely that he had only got the second place. 'True,' replied his interlocutor, 'but you have obtained the position which was formerly obtained by so-and-so, so-and-so, and myself,' naming three of the greatest mathematicians of this century.

I congratulate you on your connection with this great School. One of the real pleasures of life is to be able to look back with love and pride and reverence on the school or college at which one has been educated, and all these feelings will no doubt for you cluster about this place.

You have here entered into friendly competition with men of your own age and standing, with whom, if all goes well, you will keep up friendly relations, and with whom you will in later years probably again enter into friendly competition. You have here been taught much that will be of inestimable value to you in your future careers, and which would probably have been unattainable for you elsewhere. You have here been the pupils of men of the highest eminence in the profession of medicine, who will always take an interest in your welfare, and by whom, in the coming years, you will feel it an ever-growing honour to have been taught and held in regard. And you have here a Hospital and School already ennobled by the many able students it has sent forth into the world, and hallowed by the memory of the great and good men who have contributed, by their genius and their good work, to raise them to their present state of excellence, of whom some—alas!—have joined their fathers, of whom some happily survive to enjoy their well-earned repose.

I also congratulate you, gentlemen, on your choice of the military service, and none the less that I never had any inclination to go into it. It has its drawbacks no doubt. But all pursuits have their drawbacks, which those alone who follow them fully recognise. But it has its advantages. The duties you have to perform are patriotic and beneficent, and should bring to you, who do them well, the grateful recognition of your country, and the grateful thanks of those whom it will be your privilege to shield from pestilence, and to relieve or cure when suffering from disease or wounds. You will probably have occasion to visit various parts of the world, and thus to experience, and enjoy, possibly suffer, much interesting variety of life, and to enlarge your acquaintance with men and things.

You will probably have the opportunity, if scientifically disposed, of investigating the diseases and epidemiology of foreign countries, or, if your inclination takes you that way, of pursuing, in unbeaten or little frequented tracks, botanical, biological, and other such inquiries, and thus of adding to the store of knowledge, and of acquiring, as many of your predecessors have done, a distinguished reputation in some branch of scientific research. Or, contenting yourselves with the simple practice of your profession, you may still attain, by the mere conscientious discharge of your onerous duties, the not unenviable position of a leading practitioner in the best sense of the term. But in addition, although in the army service you cannot hope to get the large incomes which many civil practitioners earn, you enjoy a better prospect, provided you do not faint by the way, of obtaining posts which it is a high honour and privilege to hold, and which also bring distinctions. I can hardly venture to wish that you may hereafter all become Directors General of the Medical Department, or even Professors at Netley. But I trust that some of you may be, and that all may achieve distinction, and that you may rival in the distant future the eminence of your present leaders, and thus help to perpetuate the high character of the service to which you belong.

Finally, gentlemen, I venture to congratulate you on living at the present time, rather than in that millennium which, unless the signs of the times are (as I hope) misleading, seems rapidly approaching. For what is happening? By the study and practice of hygiene and preventive medicine we are now checking all kinds of diseases and prolonging life; and, if things go on as they have been going on, before long there will be no diseases left for

medical men to treat, and every one will die of old age. From this cause, and from others which we need not discuss, populations are rapidly increasing throughout the world; and, apparently, before long, all the waste places in Central Asia, Africa, America, and Australia will be at least as thickly populated as England is at the present time. With increasing population all the wild animals and vegetables which make the world interesting will have disappeared, and only animals and plants used for food will be preserved. Teetotallers will have it all their own way; and not a glass of grog or a pint of beer, to cheer one's spirits or for one's stomach's sake, will be obtainable for love or money. All foods and drinks will be forbidden unless they be chemically pure and free from taint or suspicion of disease, and possibly treated antiseptically. The spirit of trades unionism will prevail, and no one in any trade or profession will be allowed to work more than say four to five hours a day, and then only in a leisurely fashion, so that the weaker brethren may not be handicapped in the work of life by their weakness or laziness and scientific and literary men, and doctors also, I suppose, will have to limit their work to the measure of the feeblest intellects and bodies among them. There will be no unknown countries to explore; no new discoveries to make. Life will be monotonous and dreary; passed in the midst of uninteresting neighbours; sustained on wholesome but unvaried and unappetising foods; without premature deaths, pestilences, or famines, or battles, or other conditions of risk or excitement which (though they bring sorrow) are also the conditions which call into active life all our latent virtues, all that is god-like in us, and are the main incentives to poetry and art and all that raises man above the brutes and makes life worth living. Well, in such times (which medical men are largely contributing to bring to pass) what will be left to medical men to do, save to hunt after stray bacilli, and to resume their association with the barbers? Whatever betides, we must do our duty, and our duty is to battle with disease and save life. But, for all that, I would rather live in the present age, and, for your happiness' sake, would rather you should live in it, than in the future as it pictures itself to my mind.

Gentlemen, probationers, I wish you happiness and success in the careers you have chosen, and health and long life to enjoy them.

And to you, gentlemen of the Senate, ladies and gentlemen, who have done me the honour of listening to my words, I offer my sincere thanks for your patience and long-suffering under the infliction.

Spottiswoode & Co. Printers, New-street Square London.

PLEA FOR A REFORM

OF THE

UNIVERSITY TEACHING IN SCOTLAND.

Submitted to the Scottish Universities Commission.

BY

JAMES FINLAYSON, M.D., GLASGOW,

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GLASGOW:
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1890.

PLEA FOR A REFORM

OF THE

UNIVERSITY TEACHING IN SCOTLAND.

To the SCOTTISH UNIVERSITIES COMMISSION.

My Lords and Gentlemen,

In the agitation for University Reform in Scotland I have not, hitherto, taken any share. The nature of my work makes me unwilling to take part in disputation and agitation, if I feel free to avoid them. The subject of University Reform, however, has now passed on to the stage of judicial and administrative action, and the Commission have announced their readiness to receive printed statements of a general or special nature.

I have felt impelled to submit to them views which I have long entertained. I fear my proposals may be as distasteful to many of those claiming to be advanced University Reformers as to the most conservative of the Professorial party; but I am glad to find that they are growing in favour in certain influential quarters. My views on our Scottish University system are based on experience, observation, and inquiry extending over some thirty years. Inquiry was not limited either to one Faculty or to one University.

It may be difficult for the Commission to get opinions on such subjects from those who are sufficiently well informed as to the *actual working* of the University system, and are, at the same time, free from the bias arising from their own personal interests as teachers, within or outside the Universities. My opportunities of inquiry have been considerable, and my position as a clinical teacher in the Glasgow Western Infirmary can scarcely be supposed to have biassed my judgment; if it has, the bias is in the direction of the interest of the student rather than of the teacher.

I have tried, as far as possible, to discuss the various questions on their merits, apart from any personalities. If I refer to Glasgow University more frequently and pointedly, this obviously arises from local circumstances. I am well aware that those in the Universities, from whose views I differ, may honestly consider that their methods are the best.

The subject to which I have applied myself in this paper is a limited one, but it vitally affects our whole University system: I venture, therefore, to request for this proposed Reform the earnest consideration of the Commission.

I am,

My Lords and Gentlemen,

Your obedient Servant,

JAMES FINLAYSON.

2 Woodside Place,
Glasgow, *March, 1890.*

I.

ABOLITION OF COMPULSORY ATTENDANCE ON SYSTEMATIC LECTURES.

The most urgent reform in the teaching of our Scottish Universities resolves itself into an adequate recognition of the existence of the Printing Press. The *Ordinances* are still based on the old notion of students being required to listen to lectures, as if this were the only orthodox way of acquiring systematic knowledge. In the medical faculty the minimum number of these is prescribed by the *Ordinances*, 100 lectures for one subject and 50 for another, according to some obscure estimate of their relative importance. In the days of manuscript literature we can understand the paramount importance of lectures; the professors in the University had access to MSS.; they could decipher them and compare and select, presenting to their hearers the results. Even after books began to be printed, great importance attached to lectures; books were dear and scarce, they were in various languages which the professor might read; and from Latin, Greek, Arabic, or Hebrew texts he might, according to his diligence and ability, present to his pupils, in the form of lectures, a more or less valuable digest in their own language, as well as his own ideas on the subject. With the development of cheap printing all this is changed, but our antiquated university system of teaching refuses to recognise this obvious fact. The lectures must still go on; the Scottish University student is supposed to be incapable of learning in any other way. Even the manuscript period lingers in certain classes as a curious survival, and MS. copies of the professor's lectures have been known to be bought and sold; relative prices of these are far from being regarded as an index of the comparative value of the matter in the lectures; the monetary value of the MS. copy turns not on this but on "fixity of tenure" or exact repetition by the professor, year after year, of the words noted. The student can, in such a case, realise the full price he paid for the MS. by selling it to his successor!

Occasionally a professor's lectures are found to be valuable enough to justify their being printed and published; but the Scottish University Ordinances are inexorable: the student has to pay so many guineas for the class, has to go bodily to the class-room so as to attend the regulation number of lectures, although these may be practically identical with those in a printed volume which can be bought for a fraction of the fee. Under these circumstances academical etiquette permits the student to listen without the farce of pretending to take notes. Etiquette can scarcely excuse (although it may understand) a student's sleeping through a lecture which he knows he can, and indeed must, subsequently read at home, whether he listens or not.

Such conditions of study imposed by the *Ordinances*, as if essential to learning, seem in these times almost incredible; the results are ruinous as regards the time of the student, and, in other respects, are apt to be equally disastrous and demoralising to the teacher and the taught.

Some maintain that a course of professorial lectures has a value apart from the mere information conveyed; that daily contact with academical teaching slowly evolves

in the student some of that philosophic method and culture which are presumed to exist in the teacher, and are of so much greater value than any mere stores of knowledge. This influence must be very subtle, for, during the translation of a classical author, it can operate simultaneously on hundreds of students; its potency also is such that daily contact with the professor himself may be unnecessary, and he may only "gleam upon the sight" of the enraptured students at intervals of a week or longer. All this is, indeed, possible, although rather difficult of verification. What *can* be proved is that during such academic prelections many students, in various classes, have employed their time in reading novels, poems, and other forms of literature. No doubt it may be argued that this may conduce to the culture of the student, and undoubtedly it may; but it scarcely seems desirable for the University Ordinances to secure this leisure for reading, by enforcing compulsory attendance on systematic lectures. When the noise in the class is too great, of course reading becomes impossible, and other forms of "culture" have to be devised; but I draw a veil over the pursuit of mathematics by the study of the geometrical arrangement of the squares of a draught board!

Some may exclaim—Would you abolish lectures? Is it not generally admitted, that the "personal instruction of a living man"* is more than the teaching of a dead book? May a lecturer not illustrate his teaching in a way impossible in a book? May not an accomplished lecturer gather from foreign and scarce books, or recent periodicals at home and abroad, matter for his lecture just as in the days of MSS., so as to anticipate the slower, although perhaps safer digests to be found in published books?

In reply, I do not in the least recommend the abolition of lectures as a means of teaching and learning. In many practical and experimental subjects they may be regarded

* See Note (*A*).

as essential in one form or another; no one can learn chemistry properly, for example, by merely reading a book. In almost every subject, indeed, lecturing may be regarded as permissible and perhaps as more or less desirable, according to the ability of the lecturer and the appropriateness of his methods. What I contend against is the principle of *compulsion* applied by the *Ordinances* to the student, in forcing him to attend *systematic* lectures which might as well be read by him. With regard to what may be called practical classes or practical subjects the case is different and will be dealt with subsequently. Why compel a student, with perhaps a single class, to consume probably an hour in walking to and from the University, and to consume another hour in the class-room listening to a systematic lecture, say on Conveyancing or Materia Medica, when exactly similar information may be obtained in a book at a much less cost than the class fee incurred? Nay, further, the conscientious student may feel bound to spoil his evening in writing out his notes, although these have been taken down, as he well knows, by an inexperienced listener, with all sorts of unknown names and references, which must almost inevitably, in many cases, be wrongly noted. The lectures on such subjects, which he listens to, are themselves almost necessarily compiled from printed books. If very successful, and if prepared by a man of reputation, these same lectures may be subsequently printed, but only after very thorough revision, not only of the professor's MS., but also of the proof sheets, with verifications of the dates, formulæ, references, &c. Why not give the inexperienced student the benefit of all this revision? Why expect him, following imperfectly, while wildly trying to take notes of the speaker's words, to write down details with any accuracy, when the professor well knows how much care in revising his own MS., and in revising the proof sheets, would be required from an expert like himself, before he could venture to publish

these same lectures? How much simpler to give the student a presumably correct text, instead of letting him take notes which must almost inevitably be full of errors—errors which would be still more glaring and numerous were it not that in transcription they can sometimes be corrected by comparison with printed books to which he may have access.

An interesting and curious confirmation of these ideas is afforded by the action of a professor in a Scottish University. Some five or six years ago, a group of students engaged one of their number, who was an expert shorthand writer, to take down the professor's lecture in the class-room, write it out at home, and reproduce it by one of the methods for multiplying MS. copies. These were distributed next day, or as soon as possible, to the subscribers only. They had thus a full report by which to check their own notes. The professor objected to these copies being made, on the ground that they might be represented as containing what he had said in his lecture, and that he could feel no confidence that they were correct, unless he revised them himself. Errors in students' notes, from want of the lecturer's revision, are, apparently, trifling matters when they affect the students only; but when they might possibly affect the professor's reputation the case is different! At his request, the reproductions of the shorthand notes were discontinued, and he promised to supply some such thing in a printed form, duly corrected, a project only carried to the first fasciculus.

The advocates of systematic lectures delight to recall their pleasure in listening to certain men of genius under whom they have studied. This, however, is no more an argument in favour of this method of teaching than recounting all the poor, incompetent, or antiquated lecturers, would be an argument against it. If the matter were to be decided on this plea, I fear the men of genius, who can give brilliant lectures, must always be in a small minority. But it is the *method*, not the men, we must consider. I would certainly be in favour of universities allowing, and indeed encouraging, men of genius to lecture, if they are so disposed; and when they do lecture, no doubt they will obtain an audience, not necessarily large, but at least appreciative; and so the influence of the teacher and the taught will be mutually beneficial. What, it may be asked, is the result of *compelling* students to attend lectures by professors fairly to be classed as men of genius, or at least of eminent ability? Is it always mutually beneficial? Many of the students may not be in a state of preparedness for the teaching of such men; but let them be compelled, for university purposes, to listen to what they think they do not require, and to what, at least, they cannot appreciate, and we may have the mournful spectacle of such disturbance and riot that the whole class of students—the prepared and the unprepared—are made daily to waste an hour; and, on the other side, the teacher's spirit may be quite broken. If wise in his generation, the professor may learn, sooner or later, to degrade his teaching to a level suitable for a crowd of students forced into his class-room by the compulsory *Ordinances* of his University.

Abolish compulsion, and the gifted lecturer would be no longer hampered by groups of rowdy students driven like sheep into his fold; for these would scarcely pay three or four guineas for the privilege of making a disturbance. His audience might be smaller, at least it would be more select; but the highest benefits of the "personal instruction of a living man" would become possible. If, on the other hand, the professor is *not* gifted as a teacher, his occupation as such would be gone, and he would at least have the satisfaction of knowing that his inaptitude was not wasting the time of the students.

Some say that this idea of non-compulsion is all very well for the good students, but what of the others? Well, what of the others? What of those who fail to pass their professional examinations, say in Law or Medicine? In the first professional examination in Medicine (in Chemistry,

Botany, and Zoology), there is always a large percentage of rejections—30 to 40 or 50 per cent, or more, I believe.* Let us remember that these rejected students have all conformed to the *Ordinances*, and have attended their regulation number of lectures, so that our present system is confessedly far from securing the adequate teaching of the inferior grade of students. But of the 30, 40 or 50 per cent rejected, it is well known that many, probably most, subsequently succeed in passing; the University authorities themselves subsequently admit that they have learned their subjects. But how have they learned? Has it been by taking their 100 lectures, or their 50 lectures, again and again, till the knowledge has been forced, by regulation method, into their dull ears? By no means. That is not how such a student hopes to learn and to pass. The rejected student is not usually a genius, but neither is he a fool. He knows that it is by reading, and perhaps by tutorial classes, with practical demonstrations and personal examinations that he can surmount the difficulty. Might not the same means—reading, practical work, and tutorial classes—have *obviated* the difficulty, with the attendant humiliation, loss of time, and dislocation of the due order of his studies?

The good students can probably take care of themselves under almost any system; the inferior grade of students, who have been once or twice rejected, learn for themselves that the method of acquiring systematic knowledge, suitable for them, is *not* by listening to courses of lectures year after year; and the University, by subsequently passing a large proportion of them, practically endorses their view of the case.

* See Note (*B*).

II.

PRACTICAL CLASSES AND PRACTICAL INSTRUCTION.

For the purpose of graduation compulsory attendance on certain *practical* classes may be insisted on, without involving any contradiction of the arguments which point to the abolition of compulsion in the systematic classes. Possibly in the future new developments may arise; but, at present, we know that certain subjects can only be learned in special laboratories or classes; and, therefore, evidence of attendance at places where it is known that there are means of learning these practical subjects may reasonably be insisted on.

Owing to the cost and variety of instruments employed, or the nature of the material required for the study, it may be obvious that it is virtually impossible for a young man to learn certain subjects without the aid of properly equipped laboratories and guides. Astronomy, various departments of Physics, Chemistry, Mineralogy, Zoology, Anatomy, Physiology, Pathology, Clinical Medicine and Surgery, and various other subjects may be grouped here. We know, for example, that the law forbids the study of human anatomy, except in certain licensed places, and that the study of patients labouring under disease can scarcely be legally pursued by an unqualified student, except in some infirmary or hospital: moreover, the morbid material for pathological work cannot be counted on elsewhere. The student *must* attend at these places so as to learn; and thus it may be fair to demand proof of such attendance before admitting him to examination. The presumption that he cannot train himself privately is so very great that there is no hardship in requiring from him evidence of such attendance. In other cases, it is the expense of the instruments and appliances which may at once convince us that reading

and private study are inadequate to supply the student with a real knowledge of such subjects as Astronomy, Physics, Physiology, and Chemistry. In some subjects both difficulties exist. It is, therefore, by no contradictory policy that practical instruction might be made compulsory, and systematic classes optional.

Practical classes ought, indeed, to be the main care of the University authorities. The buildings, the wealth, the resources, and the teaching power of the University should be freely appropriated for them; for it is here, precisely, that books fail to educate the students. No doubt students in practical classes frequently require a little systematic instruction or guidance in order to enable them to profit by the opportunities afforded them: the day is probably not far distant when systematic lecturing, in many subjects, will be almost abandoned, except in so far as required for practical instruction. The importance of this element in education is everywhere recognised and largely acted on. Indeed, it is the growth of this practical teaching which, in Medicine at least, has made the necessity for reform, in the way of restricting systematic lecturing, so clamant. At present it is almost universally admitted that the medical student is overburdened by classes, lectures,* and examinations. I am in the habit of saying, in my clinique, that our medical students are kept so busy attending classes, and preparing for examinations, that they have not time to learn their profession! The mere extension of the medical curriculum for another year, so much advocated of late, will scarcely lessen the pressure materially; for crowds of subjects are waiting for this extension, and will at once fill it up. The real contest for the student's time is between practical work and systematic lectures. The *Ordinances* make the systematic lectures compulsory, leaving, in many cases, the practical work optional. A due recognition of the development of teaching would seem to call for a reversal of this policy, so that, as in Paris,

* See Note (*C*).

the practical should be compulsory, and the systematic optional.* Or, if the *Ordinances* made attendance on *either* one *or* the other sufficient, the result would no doubt be to assimilate or combine the courses: the practical course would contain enough of systematic instruction to make it intelligible; the systematic course, in many subjects, would only survive, in competition with the practical, if it became itself essentially demonstrative and practical in character.

I am fortunate in being able to adduce the action taken by the Glasgow University five years ago in support of these views. Pathology has not yet a professor or lecturer within that University, an anomaly which the University Commission will no doubt correct. The subject, however, is very efficiently taught in Glasgow; I have no hesitation in saying that the teaching compares favourably with that of any subject within the University, or with the pathological teaching of any school in the kingdom. The *Ordinances* require 100 lectures for a systematic course; but the pathologist to the Glasgow Western Infirmary, who is a recognised "extra-academical lecturer" on the subject, soon perceived that a practical course was essential for the instruction of the students. In addition, therefore, to his winter course of 100 systematic lectures he long ago began a summer course of 50 demonstrations or lessons in practical pathological work. The fee for the winter course of qualifying lectures was £3, 3s., as approved, no doubt, by the University Court when they granted recognition. The fee for the summer class, as a purely optional one, was fixed by the lecturer himself at £3, 3s.; a sum exactly the same as the analogous course of practical physiology within the Glasgow University. In view of the large number of microscopes and other expensive instruments required, and in view of the necessity of remunerating skilled assistants or tutors for their aid in conducting such a class, the amount of the fee for this practical class could

* See Note (*D*).

scarcely be called excessive. The members of the Senate of Glasgow University, however, were sorry to see their students overtaxed in their time by attending two courses of pathology, winter and summer, systematic and practical; for the students, finding the value of the practical course, and realising its necessity, nearly all took both. The members of the Senate were also grieved to see the students overtaxed in their purse by paying two fees, or £6, 6s. in all, for their pathological instruction. They could not but admit the importance of the subject, nor could they deny the necessity of the practical instruction if the subject were really to be taught. They felt, however, very keenly for the overburdened student; for although the Glasgow University had absolutely nothing to do with the course of pathology at the Glasgow Western Infirmary, except to recognise the lecturer or to refuse to recognise him, the Senate felt constrained to request, and to bring such pressure as virtually to compel, the Lecturer to compress his two courses of 150 lectures into one of 100 lectures, of which 50 were to consist of practical instruction; he was further to space out the 100 lectures over the winter and summer, and to reduce the fee for this conjoined and compressed course to £4, 4s. in all. The Senate, through the Clerk, then expressed itself as satisfied.

To me this plan seems in many respects admirable, although some inconvenience was created by running the class through both winter and summer terms. The practical class, optional so far as the *Ordinances* are concerned, is thus made compulsory; the merely systematic lectures are curtailed in number; the period during which the student is kept *en rapport* with the pathological department and its material is extended; and the fee is reduced to two-thirds of its former amount.

It is somewhat curious that this reforming spirit in the Glasgow University was limited to the Pathology Class at the Western Infirmary. There are other medical classes *within* this University, with their compulsory systematic lectures and their optional practical courses, having separate fees for each, exactly as in the case of Pathology. Surely Reform, like Charity, should begin at home. Is it possible that the fact of the teacher of Pathology having no seat in the Senate could account for this class only being selected for compression? It is to be hoped that the University Commission may mete out to the professors the same measure which they have themselves meted to an "extra-academical lecturer." If the reform is carried a little farther, so much the better. This action of the Glasgow Professors, unprejudiced by personal considerations, has shown the right direction for even more sweeping reforms.

I do not speak in detail of other practical classes; but it is obvious that practical instruction in various departments of Physics—Electricity for example—must be as important as in the case of the medical department already referred to, regarding which I can speak with confidence.

For securing practical instruction, it is not always essential that the student should join a formal class created for the purpose. I will keep here to medical matters, simply because I can speak confidently from familiarity with them, although, no doubt, similar conditions exist in other departments also. Thus, Certificates of Practical Midwifery are already recognised by the *Ordinances*, as proof of practical experience. In the same way, the candidate for graduation ought also to be made to produce evidence of a study of fever cases, seeing that sanitary legislation tends to remove such patients from general hospitals. The regulation of "King and Queen's College of Physicians in Ireland" might be followed in this respect, which requires three months' attendance at a fever hospital, and records from daily personal observation, of "at least five cases of fever, to the satisfaction of the attending clinical physician, as attested by his signature." It might be well to insist, in the same way, on evidence

that the student had actually reported medical cases in the medical wards, and had actually served as dresser in the surgical wards, to a *definite number of patients* duly certified. In crowded clinical hospitals or wards, University Professors have been known to certify clinical clerks as such, for reporting one or two cases, and dressers for attending to *one half of a bed!* The student would need to seek elsewhere than in such crowded wards or hospitals the necessary certificates, and so quantities of unused clinical material, in the same town or in other parts of the country, would be eagerly sought out; the necessity of obtaining such certificates (at present not required) would stimulate those fortunate enough to be appointed to a due discharge of their duties, which at present are often imperfectly performed, because there is no necessity for the student to satisfy the physician or surgeon under whom he acts, if, as is too likely, he finds the pressure of compulsory attendance at classes and examinations too great a strain on his time.

A guarantee for the student's practical instruction may be attained in yet another way, when it is felt unwise to increase the number of compulsory practical classes; and that is by making the *examinations practical* in all departments where practical knowledge is desired. We may be sure that the students would not neglect practical instruction, by means of classes or otherwise, in specialties like those of the Ear, Eye, and Throat, if they knew that they were liable to be called on actually to examine with the mirror cases of this class, so as to arrive at a reasonable diagnosis. After considerable inquiry, I have never heard of students being examined in this way for degrees at Glasgow University: need we wonder that, in the pressure of compulsory systematic classes, these important subjects are so much neglected by our overtaxed students?

It is sometimes argued, even, that practical examinations might be carried out so thoroughly as to render it unnecessary to insist on attendance on practical classes any more than on systematic. This is quite true; but the examinations on the subjects, in the Medical Faculty at least, would require to be conducted not only by men of experience and standing, but with a comprehensiveness and elaboration hitherto unpractised. This *complete testing* of the student would involve an enormous expenditure of time and money; for the range and duration of the examination must be very great, if the candidate is to be tested in such a thorough manner as to render proof of attendance on practical instruction superfluous. Even with such proof, the expense and trouble of a good examination for medical degrees are very great, and it seems a pity to incur all this for the testing of those who, if unprepared by practical instruction previously, are almost certain to fail. Although this practical and financial difficulty could be overcome, it would be very doubtful policy for the Scottish Universities Commission to introduce such a complete revolution in the granting of medical degrees; even the London University, which has gone farthest in this direction, still insists on evidence from its medical graduates of some attendance at the Medical Schools, although no doubt it is very liberal in the choice it allows. If reforms are to be stable, they should be introduced gradually, and only extended as experience warrants: hence no such complete changes are advocated here.

III.

TUTORIAL CLASSES.

Closely allied to practical instruction is the Tutorial Class.

Indeed, it is scarcely possible to carry on practical teaching unless the teacher himself or his assistants act as tutors, dealing with limited numbers, going round questioning and supervising the student in his work. In

this way we get the "personal instruction of a living man," but in a very different sense of the word "personal" from that in the quotation already made. It is the person of the lecturer which is emphasised in the systematic course; in the tutorial, it is the person of the student. Which is to be the more important in the future of our Universities?

Although allied to, and often combined or almost identified with, practical instruction, the tutorial method stands out in marked contrast to the systematic lecturing system; in subjects such as languages, mathematics, logic, and some others, where practical tuition, as understood in scientific subjects, scarcely comes into play, we may fairly regard the tutorial as the analogue of the practical class. If in science the practical instruction is the department of paramount importance, in languages, mathematics, &c., it is the tutorial which requires the earnest attention of the Commission. Enormous classes in such subjects, taught by one man, are simply scandalous, and constitute a disgrace to our native country. When I was in the Junior Latin Class in Glasgow University, in 1856-57, the late Prof. Ramsay stated, while giving his prizes, that this class was remarkable as being the *largest* he had ever had, but that he did not know that it was remarkable in any other respect! The caustic wit of the professor was well known, and we unfortunate students regarded the remark as a piece of sarcastic humour; but perhaps the professor's acute intellect and wider experience noted a close connection between the largeness of the class and the mediocrity of its scholarship. At that time the class, however large in his eyes, was a mere fraction of the size it has since attained. Even in 1876-77 the returns to the Universities Commission showed 504 students of Humanity for one professor; the subsequent figures will no doubt be submitted to the present Commission.

I do not object here, any more than in the scientific subjects, to lectures being permitted; or indeed to any mode of conducting his class which the professor chooses to adopt. As before, what is objected to is the principle of *compulsion* applied so as to waste the students' time; for this is the inevitable result when a teacher attempts the impossible task of instructing a crowd of students, who present various degrees of knowledge or ignorance of the subjects referred to.

In the scientific subjects there are, as we have seen, reasons for making attendance at practical classes compulsory; these reasons do not apply to the departments under consideration. It seems a fair compromise to give the student a *choice* between hearing lectures delivered to a class, of any size it may happen to be, and taking a tutorial class where the "personal instruction of a living man" might operate on the individual pupil, and where the state of proficiency, and the degree of progress, of the students might, to some extent, be kept in view.

In the scientific subjects also there is great room for the tutorial method, even apart from its combination with more directly practical work, or with museum demonstrations. Many students would no doubt feel that tutorial instruction, conjoined with the use of recognised text-books, could carry them on more quickly and surely than any mere listening to lectures. Speaking without special knowledge, although not without inquiry, it seems to me probable that certain legal subjects could be best dealt with by such a combination; for by questioning the student it could be seen how far he grasped the principles and the details laid before him; and this method would tend to cultivate in him that accuracy of thought and lucidity of expression which are so much required in legal practice. In philosophy and political economy much might also be done in this same way.

IV.

EXAMINATIONS FOR DEGREES IN THEIR RELATION TO UNIVERSITY TEACHING.

It is vain to protect the student from compulsory attendance on professorial classes if, while aspiring to a degree, he is left to the tender mercies of an examining board consisting mainly of the professors whose prelections he may have chosen to pass by. Students are driven not only to take, but to repeat, classes, both practical and systematic, by regard to other things than University Ordinances. It is idle to deny the existence of a wide-spread terror of neglecting certain professorial classes, or to explain it away as based on pure imagination; in some quarters there is unquestionably room for grave complaint. If the matter is doubted, the Commission have only—with closed doors, and in such a way as to prevent the chance of recognition—to examine a group of University students. A few recent graduates, delivered from the fear of their University, could, perhaps, be got to give evidence more openly if desired. Let the Commission publicly announce their desire for evidence on this point, with the above precautions, and no doubt it can be obtained; if, indeed, the Commissioners profess to require any formal evidence of what is matter of public notoriety, and can be easily verified.

How is this evil, or in any case this *chance* of evil, to be averted? By the nature of the Examining Board and the nature of the Examination. A reliable and impartial Examining Board is an absolute necessity. It must be clearly understood, moreover, that the examination is to be on the SUBJECT, and not necessarily, or even presumably, on the "Professor's lectures." It is generally felt by the students that the latter form the real subjects of examination for their degrees, and so (quite apart from the notion of undue influence) they naturally feel the danger of any neglect of the one thing needful. It is not always easy to get authoritative proof of the correctness of such a notion, for in any utterances intended for the public, it is often repudiated, disguised, explained away, or minimised. Fortunately, however, the *Glasgow University Calendar* for 1889-90, p. 155, gives what is wanted. In its statements of the "books and subjects" for the "Law Examination for degrees of LL.B. and B.L.," we find—"In the Law of Scotland—Bell's Principles of the Law of Scotland AND THE PROFESSOR'S LECTURES." Truly a remarkable statement as to the subject of an examination for academical degrees, especially with "two additional examiners" ostentatiously announced to examine the students,—on a "professor's lectures" which they can scarcely be imagined to have heard or read themselves! *Ex uno disce omnes.* But we are not limited to one. In Logic, Moral Philosophy, and English Literature, the "Professor's Lectures" figure again as the subjects of examination for a degree in Arts. (See same *Calendar*, pp. 118, 119). In the case of Moral Philosophy we have, further, the triviality of the examination being on the Professor's Lectures during the session when the student attended the class! One need have no scruple in speaking freely in this case, where the ability of the Professor and the value of his prelections are universally admitted; but how the non-professorial examiner is to examine remains obscure. Is he to base his examination, and his judgment of the results, on what he *imagines* the Professor *ought* to have taught on the subjects taken up? Or, is the announcement an academical way of intimating that such examiners are mere ornamental figureheads? Need we wonder that students take for granted, throughout, that the examinations for their degrees are to be on "the Professor's lectures"?

If the first thing, therefore, is to secure that the Examining Board shall be impartially constituted, the

second is to see that the student shall be examined upon the subjects, or the portions of the subjects, duly announced, and not upon the unpublished lectures of any professor, however distinguished. There is surely some distinction between the testing for an academical degree and a class examination.

The next thing is to secure that the examinations, whenever possible, shall be of a practical character—that things shall be done and instruments used, as in the work of life. Not that a student is to describe from a book, or from the notes of his professor's lectures, how things are to be done, but that he should do the things himself: analyse samples of water and air, for example, if this is the matter on hand, and not merely give an account, however lucid, of the most approved methods of doing so. By this plan of examination the practical education of the candidate would almost certainly be secured without any very elaborate regulations, as already explained in speaking of practical classes. A student would seldom venture to go up for an examination in Chemistry, Physics, or Medicine, if he knew that he would be called on to do quantitative analyses, to determine the resistance of a battery, or to examine a patient with the ophthalmoscope, the laryngoscope, or the otoscope, unless he had previously taken pains to learn how to do these things by practising the processes again and again.

V.

INCREASE OF TEACHING POWER.

Extension of the teaching power necessitated by the addition of new subjects, the subdivision of others, or by changes made in the curriculum for degrees in Arts and in Science, need not be alluded to here, as it is not within the scope of this communication to discuss these important subjects; the Commission will no doubt deal fully with them.

If, however, the teaching is to be developed in the direction of practical and tutorial classes, a great addition to the teaching staff must be made in one way or other. If the organisation is to be really efficient, and capable of correcting, automatically as it were, any abuses from inefficient, careless, or antiquated teachers, those in charge of the practical and tutorial classes must be placed on an independent footing, and not be mere assistants of the professors. The professors, indeed, in managing their classes in their own way, may be allowed to have as many assistants working under them and according to their direction, as they choose to pay for, always, of course, subject to some general approval of the University Court. Whether the additional independent teachers are to be Lecturers within the University or "Extra-academical Lecturers," recognised as such (as already developed, although inadequately, in the Faculty of Medicine*), or whether they are to be teachers in affiliated Colleges, must be decided by the Commission according to some general policy modified by local circumstances and varying, it may be, in different faculties.

Many young graduates, whether holding scholarships from the University or not, might be found willing and anxious to try to make a position and reputation for themselves as teachers, with such scant encouragement as might be afforded by some small endowment, or even by the free use of class-rooms, with, of course, the fees accruing from their students, at least in certain departments or under certain circumstances. The UNIVERSITY, by retaining or attracting such men to aid its teaching, would be keeping up the old meaning of its name.

Under no circumstances, however, should this new class of teachers be kept under the domination of the professors to do the revising of class exercises and work of that kind; for the essence of the reforms proposed consists in their being allowed to strike out new methods

* See Note (*E*).

of tuition, as occasion arises, suited to the subjects taught and to the size of their classes. If in important scientific subjects we had, for example, a Professor, as at present, to manage his class as he pleases, with a second recognised teacher of some kind, in the practical department, and another conducting a tutorial class, there would be a choice of teachers, and a certain stimulus to do the best for the student's education. Many students might take a course under two of these teachers, instead of two courses under one as at present.

In Languages, Mathematics, &c., there would be room for several recognised teachers of tutorial classes, according to the objects aimed at by the students, or their degree of proficiency. One tutorial class might succeed because it aimed at carrying forward the good students, and another because it aimed at bringing up those who were deficient. Of course some check must be found to keep tutorial classes limited in their size, or we might find such teachers repeating, under the false name of a tutorial class, the error which it is wished to correct.

It may be objected that no good men would apply for recognition as tutorial teachers, or teachers of practical classes, unless sure of being adequately paid. Experience in the Faculty of Medicine indicates the contrary. If the applicants are not known to be good men, or have not the appliances for teaching, of course they should not be recognised; if there are no applicants, or if those who do apply do not obtain recognition, they will not disturb the professors' present arrangements, and things will at least be no worse than they are. But if good applicants do come forward, on what encouragement the University can afford to offer, then from the numbers drained off to their tutorial classes the University teaching may be improved, not only as regards the members of these tutorial classes, but also as regards the members of the professor's class itself, from the diminution of the crowds of students whom he and his assistants are struggling to educate.

The great opposition likely to be raised to any such proposal will probably be based on the fear of its proving too successful in attracting both teachers and students.

VI.

MUSEUMS AND LIBRARIES.

If practical instruction is ever to take the position it deserves in University teaching, the condition and administration of our Museums require serious attention. The educational value of such collections has been but little developed. The recent address of Mr. Jonathan Hutchinson on this subject is most suggestive (see *British Medical Journal*, 1888, vol. ii, p. 1257). Museums for the education of students have to be constructed, equipped, and managed on different principles from others. By the use of printed labels, with the necessary explanations and diagrams or drawings, the influence of museums in education might be greatly vivified, especially if tutorial classes, or occasional demonstrations on specified subjects were held there by the professors or other lecturers. In the case of Materia Medica, for example, this is clearly the proper method of learning for the student; but the museum, in that case, must be one with specimens actually available for the student to handle while reading up the descriptions; this need not interfere with the more elegant specimens kept separately for the admiration of the professor and his class. The combination of the tutorial method, by questioning and demonstrating, would greatly assist the students.

In Pathology also, the influence of a properly equipped museum, with adequate descriptions, notes, and illustrations, would be invaluable; mere numbers and letters referring to a catalogue are inadequate; the student should have actual printed labels with adequate descriptions. Occasional demonstrations to small groups of

students, to encourage them to study the series of specimens for themselves, might well take the place of some of the systematic lectures.

In Natural History, Geology, and Mineralogy, the Museum is already openly recognised as an important educational instrument; but great advances might be made if recognised teachers, in special departments, could be induced or permitted to demonstrate and expound parts of the collection to a limited number of persons anxious to learn the subject.

Even apart from special study, it is possible that the opening of the general Museums to the body of students, in all the faculties, might have a certain educational influence, which in a few instances might develop into something better. At present the admission of students to the Hunterian Museum in Glasgow, three times a session, each with two friends, makes it partake of the character of a show; and it is little wonder if the general body of the students regard it as such.

In various other departments of study, collections of specimens, models, instruments, &c., might be utilised for practical instruction as indicated above.

Not a few students have found in the past that the great advantage of their University Course turned upon their association with some of the better minds of their fellow-students, and upon their introduction to the master minds of the past and the present, whose works are preserved in University Libraries. These great advantages have induced many a student to look with leniency on any faults in the provision for his scholastic course.

What is to be said of a University which deliberately and intentionally secludes its Catalogue of literary treasures from the body of students for whom it exists? I am ashamed to say that this is the policy of our University in Glasgow in recent years. When I knew the University Library first, there was no dearth of Catalogues and

Supplements. The difficulty then was their abundance! But I well remember experiencing the sensation of a new power of acquiring knowledge when, by means of subject-catalogues or indexes in the old library, I felt that I could ferret out works by authors whose names were till then unknown to me. The mere looking up of a good catalogue has always seemed to me a lesson in literature.

For years I wondered when we were to see the new *Glasgow University Catalogue*, which I had heard of as costing so much in time and money, which was to supersede all the old supplements, and do much more. At length I discovered that it was no part of this University's policy to favour the students with even a distant sight of this implement of instruction. The Catalogue was for the use of the librarians, and for the benefit of the professors! No doubt, through the personal courtesy of the librarians, one like myself had access to it; indeed, I have received so much attention from the librarian and his assistants, that it is with great reluctance I feel impelled to make complaints. The complaints are, however, against the methods, not the men who administer them to the best of their ability. The state of matters seemed to me so amazing that I made personal representations to three of the professors, whom I knew sufficiently to venture to approach. Two of them evidently did not believe that my statement was true! The third knew it all, as well as I did, but was inclined to justify the policy, or at least was unwilling to condemn it.

This action as to the library is indeed, in a sense, perfectly consonant with the University policy elsewhere. The subjects for examination in degrees are regarded, as already shown, as being practically synonymous with the "Professor's Lectures." If books are required, they will be enumerated and recommended by the professor, and the student can ask for them, and get them if they are there. What more simple? As for any student searching out literature for himself in any subject the idea is too ridiculous!

Indeed, if the thing were encouraged or permitted, it might only lead to a neglect of the subject, or, at least, of what is the same thing—the "Professor's Lectures"!

Curious to gauge the state of the students' minds (not merely in the Medical faculty), I have tried for some years to inquire how many of them had ever *seen* the catalogue of the library of what is called their "*Alma* (!) *Mater.*" Many of them—such is the profound ignorance thus cultivated in the University student—thought that the library was managed without any catalogue at all; others had understood that some such thing was contemplated. Scarcely any had seen it, far less been in the way of looking for anything in it. Some three years ago, after much agitation on the subject in the General Council, a so-called "Students' Catalogue," "selected from the General Catalogue," was issued, consisting of about 130 quarto pages, with "abridged titles," only aiming at giving English books, and limiting itself to the last fifty years or so. In the preface the students are informed that "students and graduates engaged in special research will, on application, have access to the classified catalogues." This is all very well; but the seclusion of the "General Catalogue" of their library from the body of the students is not likely to cultivate the spirit of "special research." The catalogue ought to stand prominently in the library as an indication to all students, the youngest as well as the most advanced, of the stores of knowledge waiting for them, which they may, now or hereafter, desire to search. The barest principles of justice demand that those who have the *right* to use a library should also have free access to the catalogue of its contents. The merited neglect with which this poor "Students' Catalogue" has been received by those for whom it was intended is held, I believe, by the authorities to justify their view that the students have no interest in the real catalogue of their library.*

The educational influence of this policy on the student is

* See Note (*F*).

disastrous, and its pernicious effect can scarcely fail to react on the professorial teaching.

I am glad to learn that the authorities of Edinburgh University, at the present moment, have at least aspirations after the issuing of a Catalogue of their Library, and so their policy must be based on different ideas from those accepted by the Glasgow professors, of which it is to be hoped they have a monopoly.

Museums and Libraries are classed here together; and, indeed, a Library may be regarded, in one sense, as a museum of books. As in the case of other Museums, demonstrations of special groups of books might be made from time to time. The bibliographical treasures in the library of the Hunterian Museum in Glasgow might be utilised for those interested in ancient literature and early printing. Some guidance to the methods of modern bibliographical research might be afforded to others, so that the means of contending with the increasing stores of books, and especially of our periodical literature, might not be utterly unknown. For when all is said and done, we must admit that the best education only places the student in a position to carry on his own education.

VII.

CHANGES IN ORDINANCES.

The representatives of the Scottish Universities, when urged to institute reforms in the teaching, often fall back on the fixity of methods imposed on them by the *Ordinances*. Thus, to take a recent instance, in the discussion in the General Medical Council on the absurd extent to which systematic lectures were carried in Scotland, Sir William Turner is reported to have "pointed out that the number of lectures in the Scotch Universities was fixed by statute, and it would not be easy to

modify their arrangements" (*Brit. Med. Journal*, 1889, vol. i, p. 136). Of course, the word should be "Ordinance," as "Statute" is apt to be misleading; but the second statement is undoubtedly true. Difficult, indeed, it is to change an *Ordinance*, but not impossible; many *Ordinances* have been altered, and the Edinburgh University has succeeded in adding three courses (Practical Physiology, Practical Pathology, and Practical Pharmacy) to those enumerated in the original *Ordinances*, as compulsory for graduation in medicine. However difficult it may be to get compulsory courses added, it would, no doubt, be ten times more difficult to get them abolished or curtailed, and I am not aware of a single instance of this having been done, or even seriously proposed, in any of the Scottish Universities. The Commission should, therefore, in framing new *Ordinances* bear this in mind. Not only have arrears of reform accumulated, for the last thirty years, urgently requiring to be dealt with now, but great flexibility in the new arrangements should be aimed at, so as to prevent this same appeal to the *Ordinances*, as a bar to necessary reforms in the future. For any alterations in the future will be about as difficult, apparently, as in the past, so far as the new Act is concerned.

Limiting my remarks entirely to changes indicated by the considerations adduced in this paper, and deliberately omitting all reference to the urgent matters of adequate entrance examinations and alternative courses for degrees in Science and Arts, I would say that the following are important.

I. Attendance on certain *practical* classes, varying, of course, for different degrees, should be made compulsory; sufficient precautions should be taken that the certificates relate to really practical instruction, and not to mere lecturing with demonstrations.

II. Attendance on all *systematic* lectures should be entirely voluntary as regards the various courses for degrees.

III. A choice of teachers in each subject, if such can be obtained, should be provided or permitted, by the appointment of recognised lecturers within the University, or by the recognition in some way of lectures outside the University, or by the affiliation of Colleges. In particular, teachers of tutorial classes in languages, &c., and of practical classes in scientific subjects, should receive every encouragement, compatible with the resources of the University, so as to induce good men to apply for recognition.

IV. Attendance on a Systematic, or on a Practical, or on a Tutorial Class should count equally as fulfilling the requirements of the prescribed course, except in those cases where the Practical Classes are made compulsory, in which case they, at least, must be taken.

V. Examinations for degrees should be on the SUBJECTS duly specified; and the Examining Boards should be so constituted as not to be dominated by the Professors, or by a group of teachers of any kind.

VI. The management of the Museums and Libraries should be made to fit in with the other machinery for the education of the students, and certain Professors or Lecturers within the University should have the right to utilise them in their teaching.

These statements may seem too general and vague. The following draft illustrates their application to the curriculum for medical degrees, as to which only I can speak with the confidence arising from familiarity. For other degrees similar schemes could be drawn up. In some cases the Tutorial Classes would be relatively more important, just as the Practical are in others. In framing the *Ordinances* for medical degrees, the Commission have a free hand. The General Medical Council only insists on a preliminary examination and on four years of study thereafter. Even these requirements are expressed in the form of "Recommendations;" some of these "Recommendations" are at present quite ignored by the Scottish Universities.*

* See Note (*G*).

PRACTICAL CLASSES OR COURSES OF INSTRUCTION PROPOSED AS COMPULSORY FOR GRADUATION IN MEDICINE.

I. PRACTICAL ANATOMY.—Twelve months. Certificates to be produced, showing that the student has dissected all the various "parts" of the human body.

II. PATHOLOGY.—(*a.*) Practical Pathology. Three months.

(*b.*) Six months' attendance at the Pathological department of some Hospital where instruction is given, with demonstrations, at least twice a week, of morbid parts.

(*c.*) Certificate that the student has performed two *post-mortem* examinations on the human subject, and made reports thereon, under the supervision of some of the medical officers of an Infirmary, Workhouse, or other Institution.

III. ATTENDANCE AND INSTRUCTION AT A GENERAL HOSPITAL.—The Hospital must contain at least eighty beds, and regular instruction must be given. Two years' attendance.

(*a.*) The attendance of the student to be strictly ascertained, and certified by the Physicians and Surgeons in whose department the student works, from time to time, and who are thus responsible for his instruction. "Clinical Lectures," so called (which are often mere systematic lectures with a thin disguise), to be given or not at the discretion of the teachers.

(*b.*) Certificates of having reported six cases in the Medical Wards to the satisfaction of the Physicians, and Certificates of having acted as Dresser to six indoor cases to the satisfaction of the Surgeons; such Certificates may be given by any Hospital Physician or Surgeon who is recognised as a Teacher by any University in the United Kingdom in any of the departments of medical study.

(*c.*) Certificates of six months' attendance on the out-patient department of some recognised Hospital or Dispensary.

IV. ATTENDANCE AT A FEVER HOSPITAL (or at Fever Wards): Three months; also a Certificate that the student has reported, from personal observation, the course of five fever cases to the satisfaction of the Physician in charge.

V. Attendance at a Lunatic Asylum where Clinical instruction and demonstrations are given: Three months.

VI. Practical Midwifery.—"Attendance for three months on the indoor practice of a Lying-in Hospital, or presence at not less than twelve labours, at least three of which must be conducted personally by the candidate under the direct supervision of a Registered Practitioner." (See *Glasgow University Ordinance*, of 28th May 1889, *Calendar* for 1889-90, p. 371. This is in accordance with the General Medical Council's recommendation.)

[Any great accumulation of practical classes is to be avoided, and so this list is limited to the above subjects. Instruction in Vaccination and in Practical Pharmacy may be secured by insisting on certificates from registered medical practitioners in the one case, and from registered pharmaceutical chemists in the other; so-called "classes" in these two subjects have not proved such a success as to warrant their being instituted as compulsory. Instruction in such specialties as Eye, Ear, Throat, and Skin diseases may be safely left to be ensured by thoroughly practical examinations, without specifying the conditions of study; enforcing such conditions definitely, really tends to hamper practical instruction, from the accumulation of students at one time in a class. The specialties named are all particularly well adapted for the application of practical tests. Of course, they should be specified as coming under the department of Surgery at the examination in the first three cases, and under Medicine in the last; and examiners competent to deal with these subjects should be on the Examining Board.]

For the other departments of medical study, at present required by the *Ordinances*, no great changes seem called for, provided it be understood that one Systematic, or one Practical, or one Tutorial Class, may count equally as representing these subjects.

A few changes are, however, generally acknowledged to be desirable.

The classes of Materia Medica and Therapeutics should be separated, each having *not more* than a three months' course, and

attendance on either the one or the other qualifying for graduation.

The classes of Midwifery and Gynæcology should also be separated, each having a three months' course. Gynæcology—Systematic or Practical—should be made compulsory. Practical Midwifery is already compulsory, and so, according to the plan proposed in this paper, the systematic class ought to be optional. Most students will take their Practical Midwifery at the Hospital, and sufficient systematic instruction ought to be given there to enable the student to make a *beginning* at practical work, after which he can judge for himself whether lectures or reading will serve his purpose best.

The farce of pretending to include the Diseases of Children in the Midwifery Course should cease. If the student wishes to learn, he must go to the *Cliniques* where children are seen: the clinical examination in Medicine should include, occasionally, cases of children's diseases, so as to secure the attention of the student to this important subject.

In Anatomy and General Pathology the student would only take the systematic lectures if he desired to do so.

In Chemistry, Botany, Natural History, Physiology, Surgery, Materia Medica, and Gynæcology, the choice would be between Systematic, Practical, or Tutorial Classes; and in Medicine, Medical Jurisprudence, and Therapeutics, between a systematic and a tutorial course.

It is, no doubt, an open question, and one requiring the grave consideration of the Commission, whether Chemistry, Botany, and Natural History, should remain in the purely medical curriculum at all; or whether a sufficient knowledge of these subjects, for the medical student's requirements, might not be secured by including them in the preliminary examination, adding, perhaps, to the curriculum a new and special course of Chemistry in its relationship to Medicine. In illustrating the plan of the curriculum here advocated, these courses are retained as at present; the subject is difficult, and the decision will depend largely on whether the Commission extend the period of medical study to five years instead of four as at present; if only four years are fixed for the medical course, they should undoubtedly be removed.

It is not the purpose of this paper to discuss financial questions, although, in view of the extension of the teaching power here advocated, this subject is of the utmost importance. The total revenues in many of the classes are large, and might well bear some distribution.* A proposal to raise the fees for the classes, in some of the faculties, has often been entertained; but it seems to me that if, without any such increase, the annual matriculation fee for the University had simply a guinea added to it, a substantial fund of about £2,000 each, for Edinburgh and Glasgow at least, might be obtained for administration by the University, in the fitting up of laboratories, and in the payment of teachers for practical or tutorial classes in the various Faculties. Another plan naturally suggests itself—viz., levying a percentage for General University Purposes (say 10 per cent) on the gross amount of the fees in each class. Other plans could also be devised, for it is obviously absurd that, with overflowing classes and rich professorships, the general funds of the University itself should be starved.

Those graduates who have obtained important Bursaries, Scholarships and Fellowships, might very properly be required to assist in the University teaching, allowing them, of course, in addition, any fees accruing from their classes.

* See Note (*H*).

NOTES.

(*A.*) "*Personal instruction of a living man.*"

See Address by Dr. W. T. Gairdner, *Lectures, Books, and Practical Teaching*: Glasgow, 1877, p. 10. This address contains an able and interesting defence of Lectures. The author, however, also says: "I have, indeed, in my time known and attended lectures which were nothing but articulate text-books; and of such lectures it might very well be said that they were neither better nor worse than text-books; or, if anything, worse, seeing that they cost the labour of listening and transcription, while the text-book is procurable for a moderate sum in the very words of the author, and is always at hand for consultation. Of lectures constructed on this plan I am no apologist." Why should the gifted author of the Address have been *compelled* to take such lectures?

(*B.*) *Rejections at First Professional Examination in Medicine.*

The General Medical Council give the following returns for 1888:—

University of Edinburgh, .	221 rejected,	286 passed.
University of Glasgow, .	120 ,,	105 ,,

(C.) *Students overburdened by Lectures.*

The General Medical Council recognise this by their formal 'Recommendation," at present in force, of 26th May 1888—"That in order to afford due time for clinical work it is desirable that the number of systematic lectures be restricted."

The subject was partially discussed at the meeting of the Council on 31st May 1889, and will no doubt be taken up fully next May.

(D.) *Paris M.D. Regulations.*

In the "Report (*ad interim*) by the Education Committee on Clinical Work and Systematic Lectures," submitted to the General Medical Council on 31st May 1889, we find—"The system followed in Paris is: (1) The period of study previous to the final examination is four years; (2) Strict rules for enforcing hospital work during the last two years of study, three forenoon hours given up to that work, and no lectures during these hours; (3) Practical courses in the various subjects compulsory, and attendance carefully enforced; (4) The lectures in no course given oftener than twice a week, and attendance on all lectures entirely voluntary."

It is a noteworthy fact that Dr. Struthers, till lately Professor of Anatomy in Aberdeen, has declared strongly in favour of this system. At the discussion in the General Medical Council he is reported to have said that "he wished to draw special attention to the system adopted in Paris, which he regarded as the perfection of education" (*Lancet*, 1889, vol. i, p. 1,143). When we remember that Dr. Struthers has spent a lifetime as a lecturer himself, surrounded by lecturers both in Edinburgh and Aberdeen, including many of the most celebrated men of their time, his opinion acquires a special value.

In Glasgow, the class hours, as arranged by the University, do not permit of the students attending the out-patient department at the Infirmary at the very period of their course when they could profit most by this, although certificates of such attendance are required by the regulations (Contrast last clause of No. 2 of the Paris regulations above).

(E.) *Inadequate Recognition at present of Extra-academical Courses for Graduation in Medicine.*

According to the *Ordinances*, following the Act of 1858, the student was allowed to take "four of the departments of medical study" in the classes of recognised extra-academical teachers. In Glasgow University, at that time, this was really a very fair allowance. Out of twelve classes in the University he was allowed to take four with recognised private teachers if he desired to do so. Not that this really was of any use to the student; for the University of Glasgow steadily refused to recognise any such teachers in Glasgow till 1875. Nevertheless the generous scope of the *Ordinances* in this respect is plain: the Commission of 1858 were not responsible for the action of the Glasgow University Court. It is to be observed that at that time a student could, *theoretically*, take four classes outside the University apart from Clinical Medicine and Surgery and Pathological demonstrations, all which could only be had at the Infirmary. At the present day, if the student takes his *qualifying courses* of Clinical Medicine and Surgery with some of the Hospital Physicians and Surgeons who are not Professors, as was common or almost universal about 1858, he is actually allowed to take only *one* class outside the University. By some curious reasoning the course of Pathology is reckoned an outside course, although there is no inside course on this subject in Glasgow. Hence, as the student *must* take Pathology, this reduces his available courses outside the University to three; and with Clinical Medicine and Surgery, formerly open to be taken from any of the Hospital staff, we have other two deducted, reducing the student's liberty to *one* course outside the University, *instead of four*, as intended by the Ordinances for Glasgow University, for at that time no Professorships existed in these departments. This interpretation of the University Ordinances *may* be legal: certainly, as regards Pathology, it seems strained. In any case there is clearly a violation of the spirit of the *Ordinances*, which the present Commission will, no doubt, correct. Indeed, with the lapse of thirty years, instead of this retrograde policy, a great extension in this direction is now indicated.

(*F.*) *Glasgow University Library and its "General Catalogue."*

This is really an admirable catalogue. It has been prepared and printed at a great expenditure of time and money. The plan adopted is that of printed slips, each having an author's name with the title of the book, &c. These slips are pasted into large paper volumes, with spaces left for additions, so that it may be kept up to date. A large number of such volumes are of course, required. So far as I am aware, only one copy of this catalogue has been made up; but, if the students' interest in their Library had been kept in view, another copy, with the slips pasted on muslin or some durable material, might have been prepared for their use, without any risk of the Librarian's copy being damaged by them. In discussing the matter, one is met with the objection that such a catalogue would be so run after by the students as to make it useless for consultation; and again, by the other objection, that the students would not care to look at it. These reasons are mutually destructive. The fact, no doubt, is that comparatively few students would desire to consult it often; but the very size of such a catalogue, as thus arranged, favours, as every one knows who has seen such catalogues, simultaneous consultation by a considerable number of persons, if there did happen to be numerous searchers after knowledge.

In the Library arrangements, little provision has been made for the purposes of consultation on the premises by the students, who, being only allowed to take home two (or four) volumes, might desire, at special times, to consult other works there. The want of such provision is, of course, quite in harmony with the want of access to their Catalogue; but neither can be justified. Even for those who do consult the Library now, on the premises, the arrangements are deficient, as the situation selected for this purpose exposes them to constant interruption by passers by; it is admirably situated for the mere looking up of references and the like, but for the purpose of quiet reading or note making, a suitable room should be provided, properly warmed, and free from this disturbance.

(*G.*) *Recommendations of the General Medical Council not Adopted by the Scottish Universities.*

Hygiene and Mental Diseases are not compulsory courses, nor is the student specially examined in them, for his M.B. degree, as recommended.

The study of fevers recommended has not yet been made compulsory.

Recommendation No. 21:—"In order to afford due time for Clinical work, it is desirable that the number of systematic lectures be restricted." No attempt has been made to conform to this, unless we reckon the action of Glasgow University, in the case of Pathology (see p. 15), as an anticipation of this Recommendation. It is to be hoped that the Commission will insist on this reform.

(*H.*) *Large Emoluments of Certain Chairs.*

According to a Parliamentary return, issued 19th February, 1890, the emoluments of the Professors of Mathematics, Greek, and Humanity, in the University of Glasgow, during the three years from 1886 to 1889, varied from £1,512 (Greek, during 1888-89) to £1,890 (Mathematics during 1886-87). These are large sums, when we remember that they refer to six months' work in the year, and that substantial pensions have hitherto been awarded to the Professors in case of inability from age or infirmity.

GLASGOW: PRINTED BY ALEX. MACDOUGALL.

THE

BRITISH ARMY IN EGYPT.

A MEDICO-STATISTICAL SKETCH.

BY

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FELLOW OF THE ROYAL COLLEGE OF SURGEONS, AND MEMBER OF THE ROYAL COLLEGE OF PHYSICIANS, IRELAND:
SENIOR MEDICAL OFFICER, ALEXANDRIA.

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AUTHORITIES.

First Campaign.—Wilson—Walshe—*Revue des deux Mondes.*

Later Campaigns.—Campaign of the Cataracts, Sir W. F. Butler—Desert and River Columns, Wilson, Brackenbury—Army Medical Reports—Six Years with Army of Occupation, Author.

INTRODUCTION.

OUR FIRST CAMPAIGN IN EGYPT.

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OUR FIRST CAMPAIGN IN EGYPT.

At the commencement of the year 1800 a fine army of some 15,000 men, under the command of Sir Ralph Abercrombie, had been collected at Gibraltar with the view of retaking Egypt from the French. On the 23rd October orders were issued for the expedition to start. On 3rd November, Admiral Lord Keith sailed with part of the expedition for Minorca, while the remainder, under Sir Ralph Abercrombie, followed, proceeding direct to Malta, where they arrived on 30th November. A fortnight later, Lord Keith's arrival reunited the expeditionary force. The troops were disembarked for the purpose of being inspected, and the ships ordered to be cleaned. 500 Maltese were enlisted at Malta, and on the 20th December the expedition set out in two divisions for Asia Minor, of the harbours of which very little was known. The harbour of Rhodes was found unsuitable to large ships of war. Lord Keith coasted along until he came to the Bay of Marmorice, which was a fine open basin, approachable only by a narrow channel, and which, lying among high hills, was completely sheltered from storms, already making themselves unpleasant on the coast. Here the sick were at once landed, and shortly afterwards the troops were disembarked, and the infantry practised in manœuvring, while the cavalry were awaiting their horses. Many difficulties now began. Fresh provisions could not be obtained, though goats' flesh and poultry were procured by the officers at exorbitant prices, and the horses furnished by the Turks were so bad, that out of several hundred only two hundred were found fit for cavalry; and, to complete their misfortunes, on the 8th and 9th February, a storm of terrible fury raged over the camp—the hailstones, as big as walnuts, lying two feet deep—the torrents from the mountains sweeping everything before them—while, to add to the foregoing, the horses broke loose, and much exposure of the troops to the vicissitudes of climate resulted. On the 20th February, the day previous to re-embarkation, there was present and fit for duty 14,895, including 803 sick, sick absent 911, making a total of 16,599. Included in those present and fit for duty were the N. C. officers and men sent to the service of the different departments, regarding which Lieutenant-Colonel Wilson (author of the History of the Campaign) remarks:—"The British service was then the only one in Europe where the commissariat, medical, and civil departments had not their distinct followers;" and this with a sick-rate of 10·3 per cent. absent and present.

On the 23rd the fleet sailed, and it was creditable to the discipline of the troops that they left Marmorice Bay without a single complaint being preferred against them.

The voyage was prosperous, and on the 26th they fell in with a convoy from England. On the 1st March they sighted the coast near Arabs' Tower, in small transports about 250 tons each, and on the morning of the 2nd anchored in Aboukir Bay, without so much as a decent map of the country, and a much under-estimate of the force of the enemy, who, under Menou, were able to put in the field 18,000 men, and leave 10,000 to garrison Cairo and Alexandria, with the enormous advantage of acting on interior lines.

The Turks had not yet recovered from their defeat at Heliopolis, where 50,000 of them, under the Grand Vizier, had been defeated by barely a fourth of their number, while the forces at Sir Ralph Abercrombie's disposal consisted of 15,463 infantry, 472 cavalry, and 578 artillery, incumbered by 999 sick present; a total of 17,512 of all ranks. The French, about 2,000 strong, occupied a position of great strength close to the shore of Aboukir Bay, disposed along the summit of a ridge of sand a mile long, concave, and rising in the centre about 200 feet. At three o'clock on the morning of the 8th March the signal for attack was hoisted, and by 9 a.m. the long line of 150 boats sprang forward through the hail of bullets and grape which tore through them until the shore was reached, and the heights carried with a loss of 500 of all ranks. Before evening the whole force was landed.

The troops disembarked with sixty rounds of ammunition and two spare flints per man, packs on, and carrying three days' bread and three days' pork ready cooked. Each individual had his canteen full of water; the same quantity of bread and meat was

landed in charge of the respective quarter-masters. The officers were only allowed such articles as they could carry themselves. The general hospital stores were landed after the troops, and a proportion of the general hospital staff was attached in the first instance to each brigade, and only such orderlies were taken from the brigade as were absolutely necessary. Regimental surgeons were allowed one orderly each to carry the regimental field-case of instruments. As soon as the troops were landed, the sick of each regiment embarked in transports, and were collected into one of these vessels under the care of the assistant-surgeon, who had to report himself and the state of the men in his charge to the Inspector-General of Hospitals (Mr. Young) on board H. M. ship "Niger." Where there was only one medical officer present with a regiment this duty was assigned to a careful non-commissioned officer. Regiments embarked in men-of-war left their sick under the care of the surgeon of the ship, who received the allowance established in such cases. When necessary, a small proportion of orderly men, selected from convalescents, were left with the sick. Regiments that had women with them were directed to employ them as nurses in lieu of orderly men. Officers were enjoined to employ every means and use every precaution in their power for the preservation of the health of the troops under their command. The most exact discipline was to be enforced, and the most rigid economy in the consumption of provisions, fuel, and water, so as to diminish as much as possible the labour of the soldier. These orders were issued from on board H. M. ship "Kent," Marmorice Bay, February 16th, 1801.

It was further ordered that men going on all detached duties, or duties of fatigue, were to carry with them provisions ready cooked. Only one day's allowance of spirits was issued to the troops, and the canteens were to be filled with water previous to marching. After landing the army was employed in digging for water, which was always found where date trees grew. Before the troops marched from the heights of Aboukir an hospital was established on the beach.

In a skirmish, on 10th March, 20 Corsician Rangers and the surgeon of the corps (Mr. Smith) were captured by a sudden rush of the French cavalry. Large numbers had already died of a "bad type of fever;" later on, dysentery and blindness made great ravages amongst them, having had nothing to drink but bad water; their boots and clothing worn out, tents unsuitable to the climate, and large arrears of pay—yet not a man was guilty of the smallest excess.

On 8th March, in action with the French, they lost 4 officers killed and 29 wounded; 98 men killed, 489 wounded, and 53 missing. On the 13th, at Mandara, 8 officers were killed, 71 wounded; non-commissioned officers and men, 152 killed, 1,045 wounded.

At the battle of Alexandria, fought on 21st March, the British left rested on Lake Madieh, the centre was behind some low sand-hills, and the right in the Roman palace or Fort, near where Ramleh Hospital is now situated, in which were placed two guns. Here 10 officers were killed, 60 wounded, 3 missing; 233 non-commissioned officers and men were killed, 1,133 wounded, 29 missing. It is on record that "the English tents were torn to pieces by the shot, and thousands of brass balls were lying glistening in the sand; several officers' servants had been killed in the tents, and miraculous escapes of the sick lying in them were told; nevertheless our soldiers—surrounded, partly broken, and without ammunition—continued the conflict. The small mosque in the village close by was the head-quarters of a field hospital, and to it Sir Ralph Abercrombie was borne when wounded." After this the camp was moved to within four miles of Alexandria, not far in front. On 30th March, nine days after the battle of 21st, up to which date, from landing, 488 had been killed and 2,593 rank and file wounded, the actual state of the army was as below. The figures are interesting, as showing the respective sick rates of the regiments composing the force, and how unequal must have been the duties of the regimental surgeons:—

RANK AND FILE.

—	Regiment	Fit for Duty	Sick Present	Sick Absent	Total
	INFANTRY				
Brigade of Guards (Ludlow's)	Coldstream Guards .	647	44	159	850
	3rd Regiment of Guards	544	62	256	862
1st Brigade (Coote's)	54th, 1st Batt. .	460	151	27	658
	54th, 2nd Batt. .	362	115	90	576
	Marines .	380	79	—	459
2nd Brigade (Craddock's)	8th Regiment .	361	74	36	471
	13th " .	375	260	74	710
	18th " .	359	88	29	476
	90th " .	438	270	25	743
3rd Brigade (Earl of Cavan's)	27th " 2nd Batt.	534	41	53	628
	50th " .	407	86	23	516
	79th " .	572	102	48	722
4th Brigade (Doyle's)	2nd " Queen's	513	36	23	572
	30th " .	359	42	9	420
	44th " .	220	68	7	295
	89th " .	341	48	8	397
5th, or Foreign Brig. (Stewart's)	Stewart's .	707	187	31	925
	De Rolles' .	402	110	22	534
	Dillon's .	385	140	21	546
Reserve (Moore's)	23rd Regiment .	362	116	53	531
	28th " .	488	128	28	594
	42nd " .	466	300	16	872
	58th " .	357	110	18	485
	40th " Flank Compy.	186	41	—	227
	Corsican Rangers .	168	44	—	213
	Staff Corps .	82	3	5	90
	92nd Regt., detached to Aboukir .	373	119	51	543
	General Total .	11,156	3,082	1,182	15,463

TABLE—*continued.*

—	Regiment	Fit for Duty	Sick Present	Sick Absent	Total
	CAVALRY.				
(French's)	11th Light Dragoons .	49	3	—	52
(French's)	12th „ .	428	74	—	502
(French's)	20th „ .	406	32	—	438
(French's)	Hornpesch's .	125	12	—	137
	General Total .	1,008	121	—	1,129
	ARTILLERY.				
	Rank and File .	475	98	5	578
	Gunners and Drivers .	58	13	—	71

On 9th April, General Menou marched towards Rhamanieh, but was attacked by Doyle's Brigade, to which 560 French surrendered. This brigade was afterwards detached to Cairo. On 1st September letters of capitulation were signed by the French, and at eleven o'clock the Grenadier company of the 30th, and other regiments, with colours flying and bands playing, marched into Alexandria in three columns; at noon the French flag was hauled down; 10,528 of the enemy surrendered, including 1,387 sick, but excluding 238 officers and attendants of the General Hospital. The population then numbered about 6,000. On the 14th, the 1st division of the French army embarked from Aboukir for France in high spirits.

During the action at Rhamanieh the French fired occasionally at a mosque near the village where the wounded were placed. It is related that as the surgeon of the 89th was dressing them, a cannon ball broke through the dome, whirled round it, and fell on to his back without doing him the smallest injury. At the final attack on Alexandria the surgeon on board one of the French gunboats was killed, his assistant losing both legs. The medicine chest, containing a good many dollars, floated ashore and became a prize to the 54th. Previous to the surrender, General Menou, in a letter, thanked General Hutchinson "for the humanity shown to his wounded officers and soldiers by the British surgeons."

Major-General Hutchinson's March to Cairo.—On 4th May this officer advanced from Rosetta to Resembal. The effective strength of his army assembled at El Hamid was:—

Cavalry - - - - - -	300
Infantry - - - - - -	4,000
Artillery - - - - - -	112
	4,412

with about 4,000 Turks. On 7th, Fouah (the ancient capital of Egypt) was reached. On 9th, the French were attacked at Rhamanieh. The plague raged in this village; sickness was already beginning to break out amongst the men, who up to this time had carried everything themselves. In the dgerms (boats), taken from the French at Rhamanieh, the knapsacks and stores were now placed, and afterwards carried by water as the column advanced towards Cairo. The inhabitants beheld with wonder the British column following the Ottoman troops in regular order, and preserving the strictest discipline, the soldiers only asking for water. On 11th May they again advanced, halting, after a march of twelve miles, on the bank of the Nile at Shihaghite. The sirocco or khamsin wind, blowing the whole day, parched the men almost to suffocation. On 12th, they marched to Kaffa Handeig, the sirocco still continuing; halted 13th, and moved to Shabour on 14th, where they captured a valuable convoy from the French, containing, among other things, wine, spirits, and £5,000. On 15th, marched and encamped between Zowoff and Zaontal Bahar; 16th, marched to Algam, overpowered by the heat and their exertions; 17th, fought the action of El Kanka; 18th, marched to Menouf; 21st, to Birchamp, a sirocco blowing and the thermometer 120° in the shade. Several horses and camels died, but towards evening the wind changed to the north-west, and it became cool again. Left camp on 27th, and on 1st June were at Mishlei—the delay in the march was owing to a want of commissariat supplies; 4th, marched to Lochmas; 5th, Verdain—ten miles. Sickness had now alarmingly increased; already 1,000 were sent back to Rosetta, and in two days a hospital camp had to be established at the point of the Delta, where the Nile divided into two branches at Exhoue. On 9th, were at Burtos; 15th, Tinash; 16th, Shubra-Cairo, forty-three days after leaving Rosetta; 19th, crossed the Nile; and on 21st, advanced to within a mile and a half of Giza. On 22nd, a flag of truce was sent out by the French

General; 26th, definite articles were agreed to; and on 27th, capitulation signed; and following day, Fort Soulkowfski (present abattoir on road to Abbasseyah) taken possession of by the 30th Regiment, and the Gate of Giza by the Grenadiers of the line. The army was very sickly, and the heat of the weather and advance of the season when the Nile overflows, were now all anxious considerations.

Col. Wilson, who accompanied the column, wrote:—"Certainly no troops had ever shown more resolution, patience, and spirit. The duties of the officers and men had been more severe, yet they bore every hardship without a murmur, and, although four months in arrears of pay, never were guilty of the smallest excess. Dysentery and blindness had made great ravages, and they had little shelter from the burning heat of the sun; their tents offered no resistance to the rays, but rather concentrated their force. Frequently they were obliged to drink only water, and, wanting shoes, had to travel on the fiery soil and on the prickly furzes which covered the surface. All the departments of the army showed the utmost zeal. When, on 6th July, the Grand Vizier came to review the army, it is stated that he was 'delighted at the appearance of the English troops,' who, *notwithstanding their rags*, formed a very martial parade. The Scotch regiments, from being *sans-culottes*, particularly excited his wonder."

On 14th July, General Hutchinson presented the officers of each English regiment with a puncheon of Sicilian wine (Marsala), which was stated to have proved a most agreeable donation; for many of them had not tasted a drop of any kind since leaving Alexandria.

"Never, indeed," writes Colonel Wilson, "had an army before been so abstemious, and consequently so well conducted."

On 13th, the French totally evacuated Giza, under General Belliard (13,012, including 800 sick; in addition were 760 native auxiliaries and 82 employés), and the allied army began their return march to Rosetta. The Turks preceded, the British followed the French, who had flanking parties of their own cavalry, the Mamelukes and English cavalry closing the rear. The sick were carried in the dgerms, 300 of which were alone required for the French sick and baggage.

The following return showed the disposal of the French army in Egypt up to date of leaving Aboukir for France:—

Killed in different actions and died of wounds -	3,000
Prisoners taken in different battles, convoys, &c.	3,500
Garrison of Cairo embarked - - -	13,672
Garrison of Alexandria - - -	10,582
Soldiers dead of the plague and other maladies since landing of the English - -	1,500
	32,156

Killed, wounded, and missing of the British army during the campaign in Egypt, 8th March to 14th September, 1801:—

	Killed	Wounded	Missing
Officers -	22	108	7
Quartermasters -	1	1	1
Sergeants -	20	149	2
Drummers -	2	17	1
Rank and File -	505	2,723	75

Mr. Thomas Young, Inspector-General of Military Hospitals, has left behind the following "Return of Sick":—

1. Sick with army on surrender of Cairo—
   (*a*) With their respective regiments before Giza 346
   (*b*) In hospital encampment at the point of Delta, under direction of a Field-Inspector - 454
   800

2. Left the army at different times during its march to Cairo—
   (*a*) At encampment at point of Delta previous to army taking up a position before Giza 838
   (*b*) Sent to General Hospital, Rosetta - 284
   1,122

N.B.—838 includes 454 in hospital encampment at point of Delta. Out of this 838, at point of Delta, 73 died, and 311 recovered and were sent back to duty.

3. (*a*) Sick of the French army at surrender of Cairo 1,800
   (*b*) Taken ill on their march down to Rosetta - 500
   2,300

4. Number of plague patients between 12th April and 26th August, 1801, being the periods of the first appearance and termination of the disease—
   (*a*) Admitted - - - - - 380
   (*b*) Died - - - - - 173
   (*c*) Recovered - - - - - 207

The deaths chiefly fell on the orderlies and nurses and other servants of the hospitals. One staff apothecary, the surgeon of the 1st Battalion, 27th Regiment of foot, and three hospital mates, died of the disease.

(*a*) Number of totally blind - - -	160
(*b*) Lost one eye - - - -	200
	360

The whole sick of the army and those remaining at the Delta were sent down to Rosetta previous to the army returning to the encampment at El Hamid.

According to the 14th Article of the Convention for the Evacuation of Egypt—

"The French sick who could not bear removal shall be placed in hospitals, and be attended by French medical officers and attendants until they recover, when they shall be sent to France. The expense while in hospital to be borne by the French Government."

In the march to Cairo, while the men of the English column suffered from extreme thirst the Turks had always an abundance of water, owing to the custom of having a water-carrier attached to each company with a horse and mussack, from which every man as he passed helped himself.

The following despatch, dated Horse Guards, 18th May, 1801, was received by General Hutchinson :—

"His Majesty desires it may be most solemnly and most forcibly impressed on the consideration of every part of the army that it has been a strict observance of order, discipline, and military system which has given its full energy to the native valour of the troops. . . . The illustrious example of their commander (Sir Ralph Abercrombie) cannot fail to have made an indelible impression on the gallant troops at whose head, crowned with victory and glory, he terminated his honourable career. His steady observance of discipline, his ever-watchful attention to the health and want of his troops, the persevering and unconquerable spirit which has marked his military career, the splendour of his actions in the field, and the heroism of his death, was worthy of the consideration of all who desire, like him, a life of honour and a death of glory."

Some other incidents of the campaign are also interesting and instructive.

His Majesty's 86th Regiment, at end of 1800, embarked on

board Sir Home Popham's fleet in order to take Suez from the French. They were nearly three months beating up the Red Sea, and did not arrive at their destination until the end of April, when they landed and occupied Suez. The regiment had suffered much from fever and had many deaths; nevertheless, under the command of Colonel Lloyd, on 7th June they started to join Major-General Hutchinson's army at Cairo. Three pints of water were allowed to each man. The temperature in the tents was then 109°, at 11 p.m. 94°. The first march was 11 miles. The tents were pitched during the day. Next day as many men as possible were carried on camels. At 2 a.m. a south wind blew, and raised the temperature to 116°. Half-way a supply of Madeira wine was served out, there being very little water left, and that very bad. On 9th June they reached the springs, where 8 out of the 17 who had fallen out joined. On 10th reached Major-General Stewart's Division at Cairo, 405 strong, after a march of 75 miles. On arrival the men were in a terrible condition from the heat. They had received as rations but a small supply of biscuit since leaving Suez. The plague had compelled them to burn their uniforms, and they had lost almost everything but their arms, knapsacks, belts, and discipline. They were said to have been a fine body of men, mostly old soldiers.

The 68th Regiment, which had also come from Bombay, but chiefly composed of boys, on the passage to Suez lost half from fever, and continued so unhealthy that they had to be sent back, being unable to undergo the hardships of the campaign.

On 8th June Sir David Baird arrived at Cossir, on the Red Sea, from India, and in a short time collected 5,000 camels, and established depots of provisions, and dug wells at different points to Kenneh on the Nile. By latter end of July his army (5,226 rank and file) had assembled—a grand total of 7,546 persons, including sick. Some companies of the 61st had landed at Cossir on 10th July, and although sixteen weeks on board transports (the regiment exceeded 900 men), so good were the arrangements they are stated to have had only "one sick man." On 30th Colonel Carruthers left with 600 of the 61st for Kenneh, 120 miles (8 marches, averaging from 9 to 19 miles each). Wells had been dug by the Sepoys. The water was brackish, but caused no ill effects except at Cossir. Camels carried water and provisions; the former was flavoured with vinegar, and the mixture found to be a good one for thirst-quenching purposes. The men marched at night to avoid the heat (110 to 115 degrees by day). Thirst and an almost irresistible oppression from sleep were mostly suffered from, as also the slowness of the marching and its duration—8 to 10 hours. The desert was generally of a very hard, gravelly soil, with a very uneven surface; but the cannon, drawn by bullocks, passed with facility. The men were not allowed to straggle, and took as much rest as possible at the end of each march. In the morning, half a pint of wine, and a ration of rice cooked the evening previous, was issued, and the canteens filled with the water in which the rice had been boiled. Just before each march half a pint of wine, with some rice-water, was given. They were confined to their tents during the day. Two gallons of water, for each man, with an allowance for leakage, was sent in the mussachs. Fresh meat was issued at the third and sixth stations. At the next station to the Nile the Arabs sold milk, eggs, and poultry in plenty, and very cheap. On 29th the column arrived at Kenneh with the loss of only a drummer-boy, strict orders having been given to leave no men behind, but bring those who fell out on camels. Water-kegs were found to withstand the heat much better than the mussachs, which frequently gave way, leading to much distress.

General Baird's Division finally reached Rosetta on 31st August, but too late to take an active part in the campaign. It was related of them—"Never were finer men seen than those which composed this force, and no soldiers could possibly be in finer order." They had sailed down the Nile by divisions from Kenneh in dgerms (500 miles), in ten days, the heat in the boats being over 100°.

Desgenettes was chief physician to the French army. The inspection of his hospitals, in which were upwards of 2,000 sick, elicited the warmest admiration. The French at first had more than two-thirds of their army affected with ophthalmia; and during their short stay 160 of our men became totally blind, and 200 lost the sight of one eye. The arid and burning desert, reflection of the soil, heat of the air, and checked perspiration, were believed to have been the causes. Opium was found the best application. Assaleni asserted that he found by observation in the French army that on a battalion infected with the plague leaving its cantonment for another, the distemper ceased, and that no one having communication with it was exposed to the smallest danger, and that the relieving battalion if it quitted the camp shortly did not show any malignant symptoms. Several of the men who

escaped from the plague hospital at Jaffa into the desert returned in three days perfectly recovered, and all those who could be removed from the crowded hospital became convalescent.

The principal cause of dysentery amongst the English troops was believed to have been checked perspiration, the soldiers crowding into the Nile when their bodies were pouring out moisture. At night a damp air also chilled those who did not secure themselves by covering; and during the march to Cairo frequently 50 men a day were seized with this malady and obliged to leave the army. It was found that those sent back to Rosetta or on board ship very soon recovered, the sea air again bracing the system, which had been much relaxed by heat. Flannel shirts and cloth pantaloons were recommended instead of the long gaiter and breeches then worn; as the soldiers, wearied with marching, at night, for the sake of ease and rest, removed the former and exposed the legs and knees to chill. The food of the country was stated to have been indigestible, poor, and bad. Thirty soldiers were drowned bathing in the Nile on the march to Cairo. Prickly heat appears to have caused much annoyance during the rising of the Nile. Among the French at Cairo venereal was very prevalent. In the military operations before Alexandria dysentery caused the greater number of deaths; then liver disease, the plague, fever, and miscellaneous affections. There was a very small mortality from lung disease, and less from sunstroke.

Among the diseases enumerated as endemic at the time were—leprosy, elephantiasis (very common), hernia especially frequent. Syphilis of the most malignant kind, dropsy, sore heads, worms, and liver complaints, were also of very frequent occurence. Among the minor plagues were rats, insects, and fleas—the last in such enormous quantities that in twelve hours clean linen would become covered with spots of blood—lice, mosquitoes, gnats, scorpions, centipedes, and locusts added their quota.

In 1882, eighty-one years later, in less than six weeks (27th July to 4th September), 781 officers, 63 warrant officers, 20,885 non-commissioned officers and men, and 5,487 horses were conveyed to Egypt in 46 steam-vessels, traversing the distance from England in less than a fortnight, instead of wandering for months about the Mediterranean in crowded and wretched transports—a force very nearly the same as embarked under the command of Sir Ralph Abercrombie in 1801. There were very few sick, a perfect knowledge of the country and its resources; and the men, instead of being tightly buttoned up in coatees with stiff leather stocks, cumbrous accoutrements a heavy chako, tight breeches and gaiters—and existing, for the most part, on salt pork and inferior biscuit, bad water, and living in tents unsuitable to the climate—were placed in the most favourable sanitary conditions as to dress, food, and housing, with an abundant hospital staff and many luxuries wholly unknown to their predecessors. During the campaign, from 17th July to October 9th, out of an average strength of 13,013 non-commissioned officers and men, 7,590 were admitted to hospital, and only 232 died—viz., 134 from disease, 5 from accident, and 93 killed in action or died of wounds. Continued fevers and diseases of the digestive system were the chief factors of mortality. Diseases of the digestive system, of the eye, and continued fever, accounted for more than one-half of the admissions; but ophthalmia, which caused such serious losses to our army in 1801, never assumed the severe and aggravated form leading to sloughing or ulceration of the cornea, escape of the aqueous humour, and disorganisation of the eyeball; nor was the affection followed by chronic and intractable forms of granular lids so common after the campaign of 1801.

With the army were 163 medical officers. 2 bearer companies, 8 field hospitals, 29 nursing sisters, 828 Army Hospital Corps, and 1 company C. and T. Corps. Hospitals at Cyprus and Gozo for 800 beds. In the field hospitals provision for 12 per cent. of sick and wounded; in the base hospitals, 6 per cent. An hospital ship accommodated 200, and its tender 60, besides there were transports capable of being utilised. At Alexandria there was also hospital accommodation for 400 sick.

The medical staff of the French army embarked at Toulon consisted of 800 surgeons, under Baron Larrey, in addition to the habitual medical officers of each regiment. Three divisions of ambulances had been organised, one for each wing of the army and one for the centre. The first French wounded were taken care of in a convent of Capuchin friars at Alexandria; 1,900 were wounded at the battle near Ramleh, 21st March, including six generals. All the primary amputations on the field there were successful, though carried out under a shower of bullets. In less than a month 1,000 of the wounded returned to their respective regiments cured. Ophthalmia first showed itself in their army at Cairo; some 3,000 soldiers were afflicted with it. Bleeding in the neck, application of leeches to the temple, baths for the feet,

with the use of decoctions of emollient substances for the parts affected, combined at discretion with purgatives and bitters, constituted the remedy ordered to be used. Many of the French wounded died of tetanus, Baron Larrey's remedy for which was extract of opium combined with camphor and nitrate of purified potash, and amputation of the limb when a wound of the extremities was the cause. The plague first showed itself in Alexandria, Damietta, and Mansura. It was characterised by buboes or carbuncular abscesses in the groin and armpits. When it ceased at Cairo a yellow fever usurped its place. Camel's meat and horse-flesh had frequently to be made into soup for their sick—in the absence of butcher's meat it proved a powerful restorative. Primary amputation on the battle-field proved the most successful. The many fatigues and privations under a burning sun excited liver complaint, which degenerated into abscesses, which were freely evacuated by puncture through the abdomen. Many of the soldiers contracted leprosy from sleeping on infected mattresses and eating unclean food, also contracted elephantiasis. 3,000 scorbutic patients were admitted into the hospitals at Alexandria. In the summer of 1799, on their way to Salhieh, they suffered much from the khamsin—many died from its suffocating blast. Baron Larrey thought the plague highly contagious.

Each demi-brigade of the French army in Egypt in 1800 was composed of three battalions, very unequal in strength from having recruited blacks from Africa. Averaged 1,200 each; 300 each regiment of cavalry:—

Artillery à pied et a cheval, Regiment de Dromadaires, 7th Regt. de Hussars, 22nd de Chasseurs à Cheval; Dragoons—3rd, 14th, 18th, 15th, 20th; demi-brigades d'infanterie légére et tirailleurs—2nd, 4th, 21st, 22nd; demi-brigades de Ligne, et Infanterie de Bataille—9th, 13th, 18th, 25th, 32nd, 51st, 61st, 69th, 75th, 85th, 88th; Regt. de Grenadier Grecs, Corps de Cophts, Syrians, Mamelukes—Gardes à pied et à cheval de General-in-Chef—corps de genie, sapeurs, et soldats de marine; generals of division, 7; generals of brigade, 16.

The demi-brigades had been formed from the old Royal Grenadiers and provincial regiments, which had been suppressed 26th February, 1793, each having a battalion of one of the old royal regiments, with two battalions of volunteers. Of the 36,000 combatants who left Toulon 4,000 had been left at Malta under General Vaubois. The fleet of 400 vessels had reached Alexandria

3rd July, the army disembarking at Fort Marabout, with, for provisions, only a few cattle, salt meat, Vin de Provence and brandy, biscuit and dried vegetables, but no means provided for cooking or dressing the provisions. Colonel Roussillon, who served in the ranks of the 32nd Demi-brigade—one of the most famous in the army, formed from the 1st battalion of the Regiment of Médoc and two battalions of volunteers of Herault—and who, in the campaigns of the Alps, Italy, the Tyrol, Egypt, Austria, Germany, Poland, Spain and France, rose to the rank of lieutenant-colonel in 1813 after 22 campaigns, 74 combats, and 6 wounds, says that on the march to Cairo, commencing 8th July, the heat of the day was insupportable, the nights very cold, very little and bad water obtainable, the inhabitants hideous and miserable. They arrived at Bisket, 10th, Damanhour, 11th, Ramanieh, 12th, when they reached the Nile, and were joined by the fleet of boats from Rosetta. On the 13th the army rested after bathing in the Nile, where many were mutilated by crocodiles. The same improvidence occurred—the biscuit was wasted, the bread failed. After suffering all the horrors of thirst the men were sinking from hunger in the midst of immense quantities of wheat, but with no means to grind it into flour—no ovens, no wood—to make into bread. They subsisted chiefly on water-melons. The army marched in square in five divisions, each of three demi-brigades, commanded by Dessaix, Regnier, Kléber, Ménon, and Bon—the dismounted cavalry, ambulances, administration, *savans*, and baggage in the centre of each square, bivouacking by divisions in squares and in *échelon*. The squares were formed of six ranks—the artillery at the angles. The first action with the Mamelukes was fought at the village of Chebiss; on the dead the soldiers found much gold, precious stones, and magnificent arms. On 20th they arrived at the village of Orkan, from which the Pyramids could be seen. At 6 a.m. on 21st came in sight of the camp of the Mamelukes, formed of tents and pavilions of all colours, surmounted by banners as in the Crusades, the minarets of Cairo in the background. The brilliant and varied cavalry of the enemy covered the plain in a single line, two or three feet between each horseman. They were defeated after a fierce conflict at the village of Embabah, a great quantity of rich armour, beautiful horses sumptuously harnessed, silver and gold, falling to the victors, who entered Cairo 23rd, described then as very grand, but badly built, the streets narrow, without pavement, very filthy. The population miserable and

wretched; the Mamelukes living in great houses filled with women, their principal luxuries beautiful women, horses, and handsome armour. He estimated the population as 600,000, including many Jews, Christians of all Churches, some European merchants, but the greater majority Mussulmen. The negligence of the inhabitants was such that if an animal died in the streets it was left *in situ* until completely dried up. Only the houses of the poor were open to the exterior, the windows latticed, the largest raised in terraces; the city crowded with mosques; the houses of the villagers constructed of sun-dried bricks.

At first the French troops were regularly supplied with beef or mutton, rice or lentils, wheaten bread hot, always mixed with dourrah, but always badly baked for want of wood. Epidemic ophthalmia soon began to spread, and numerous natives were encountered with bandages on the eyes. The army *suffered much during its first year of sojourn*, as did the French Crusaders under Louis XI. The 32nd Demi-Brigade garrisoned the Citadel described as "more ancient in appearance than Cairo itself." When 12,000 or 13,000 men were despatched to Syria (winter 1798-99) a battalion of the 32nd and the 69th remained to garrison Cairo, the forts of Birket-el-Hadjii and Belbeis forming the line of communication, Dessaix, with a division of 2,500 men, covered Upper Egypt, General Dugua guarded the Delta, and General Marmont commanded at Alexandria. It took eleven days to reach El-Arish, part of the time on half rations; reaching there half famished, the army had to subsist on the camels and donkeys. They suffered much from dysentery, and would have perished were it not for the capture of a convoy of provisions. On 9th March the garrison, 1,300 men, capitulated. Colonel Rousillon writes—"The expedition to Syria had commenced with fatigue and privation, which explained the epidemics which too quickly assailed the army." Arriving at Jaffa 3rd March, 1799, they found the town surrounded with a great wall, flanked with towers, as in the time of the Crusades. It was at this place that the French contracted the germs of the plague. They arrived before St. Jean d'Arc 18th March, the ancient Ptolemais. The last assault was given 16th May, after a futile siege of two months. Napoleon in his retreat left a terrible trace of his passage, and was much embarrassed by his wounded. He had lost by attacks of the enemy and disease more than a third of his effective force, and had to carry 1,200 wounded through a desert of 80 leagues. Stretchers had to be made with branches of trees, the wounded and sick being distributed in groups of eight soldiers, four carrying the wounded in turn, the other four each two muskets. The camels of the staff and different corps were turned into ambulance transports for the wounded who had not suffered amputation. All exposed to a Syrian sun suffered much, and those who marched, from fatigue in addition to thirst and hunger. Upon all the plague exercised its frightful ravages. At Jaffa had been established a general hospital, upon which had been evacuated all the plague cases who, besides many who had been amputated and seriously wounded, were abandoned. The retreat was described as horrible, many men and almost all the animals perished, and a great number of the sick and wounded were left *en route*, the Bedouins terminating their sufferings. On the 7th June the advanced guard arrived at Cairo, the army followed in a miserable state, reduced to one-half in four months. Later on the plague attacked Cairo, when the civil population were stated to have lost 80,000 in 40 days. The French expedition to Egypt lasted three years, three months, and nine days. Colonel Roussillon estimated that of the 36,000 sent there a fourth only were able-bodied after their numerous losses by combats, climate, and the plague—the latter disease causing greater loss than a single campaign.—*Revue des deux Mondes*, 1st and 15th August, 1890.

The definite treaty of peace between France and England was signed at Amiens on 27th March, 1802. In the October following Lord Cavan left Egypt, and was succeeded in the command of Alexandria by Major-General Sir John Stuart, and Egypt was finally evacuated by the British upon 12th March, 1803. Mehemet Ali, born in Macedonia in 1769, now became Viceroy of Egypt. He entrapped and destroyed the turbulent Mameluke leaders at the Citadel Cairo, 1st March, 1811; conquered Kordofan in 1821. In 1830 he received from the Porte the government of Candia, afterwards invaded Syria, and in 1839 defeated the Turks on the plains of Nizeeb, and was afterwards confirmed in the viceroyalty of Egypt as a fief of the Ottoman Empire, hereditary to the family. He died at Cairo in 1839.

After the expulsion of the French the Turkish garrison consisted of 3,000 at Damietta, 2,000 at Rosetta, and 20,000 at Cairo, the British garrisoning Alexandria until 1803.

When on 2nd September, 1801, the French lines were occupied and taken possession of by Major-General Craddock, the day was

extremely fine, and the British and Turkish flags were hoisted together. Alexandria, once the capital of the commercial world, was then a desolate heap of ruins, the part which bore the name of the "new town" little better than a common Turkish village—the only decent houses being those of the European consuls, all between which and the old Saracen walls was nothing more than heaps of rubbish of every kind, the remains of beautiful marble and granite pillars mixed and confounded with the miserable remains of Arab dwellings. The noble cisterns choked up with sand and rubbish—there was only fresh water in the cisterns for twenty days. The garrison had been greatly reduced and weakened by excessive fatigue. the bad quality and scantiness of their food—17 very lean horses killed daily—bad water, no spirits or wine, with bread chiefly made from rice. Medicines, the mere necessaries for the sick, and proper food for the scorbutic became exhausted.

On 13th September the state of the English army in camp before Alexandria was as follows:—

Division of Major-General Craddock, Brigadier-Generals Doyle and Stewart—Royals, 13th, 30th, 44th, 18th, 89th, Chasseurs Britanniques, Watteville's, Dragoons, Artillery, Engineers—

Field officers	- -		14
Captains	- - -		48
Subalterns	- - -		128
Staff	- - -		36
Sergeants	- - -		271
Drummers	- - -		131
Rank and file, fit for duty	-	3,090	4,332
Do. sick present	-	367	
Do. do. absent	-	637	
Do. on command	-	238	

Major-General Coote's division, to westward of the town, Brigadier-Generals Ludlow, Cavan, Blake—Coldstreams, 3rd Guards, 25th, 1–27th, 2–27th, 24th, 26th, 1–54th, 2–54th, 1–20th, 2–20th, Ancient Irish, Rifle Corps—

Field officers	- -	30
Captains	- - -	48
Subalterns	- - -	171
Staff	- -	52
Sergeants	- - -	466
Drummers	- - -	195

Rank and file, fit for duty	5,534	7,253
Sick present	668	
Do. absent	784	
On command	267	

Major-General Moore's division to eastward of the town, Brigadiers-General Stuart, Hope, and Oakes—Regiments 50th, Stuart's, De Roll's, Dillon's, 8th, 79th, 90th, 92nd, Queen's, 23rd, 28th, 42nd, 58th, 40th, Corsican Rangers, Staff Corps, Hompesch's—

Field officers		30
Captains		58
Subalterns		219
Staff		70
Sergeants		506
Drummers		240
Rank and file, fit for duty	6,149	7,998
Do. sick present	1,109	
Do. do. absent	686	
Do. on command	54	
Grand Total, Fit for duty	15,028	
Sick present	2,141	2,982, or 19·8 per cent.
Do. absent	841	
On command	552	

Cavalry.—11th, 12th, 22nd, and 26th Light Dragoons; field officers, 4; captains, 11; subalterns, 37; staff, 13. N. C. officers—quartermasters, 20; sergeants, 84; trumpeters, 23; rank and file, fit for duty, 1,090; sick present, 244; sick absent, 37; on command, 294. Total, 1,665.

Artillery.—Field officer, 1; captains, 9; subalterns, 15; staff, 7; sergeants, 11; drummers, 8; rank and file, fit for duty, 229; sick present, 67; sick absent, 16; on command, 146. Total, 458.

State of Sir David Baird's Indian contingent, Camp El Hamid, 5th October:—

Lieutenant-colonels, 9; majors, 6; captains, 41; lieutenants, 101; ensigns, 17; staff-paymasters, 2; adjutants, 6; quartermasters, 5; surgeons, 3; assistant-surgeons, 14; subadars, 25; jemedars 28. N. C. officers—conductors, 5; sergeants, 331; drummers, 120—

Rank and file, fit for duty	3,489
Sick present	936
Do. hospital	96
On command	461
Total,	5,009

Lascars.—Officers—syrangs, 6; 1st Tindals, 16; 2nd Tindals, 18; fit for duty, 356; sick present, 36; sick in hospital, 8. Total, 400.

Alterations since disembarkation:—

Joined	4
Died	197
Discharged	5
Deserted	29
Invalided	31

Medical Staff:—Inspector of Hospitals, W. R. Shapter; Apothecary, A. L. Emerson; Surgeon, John Foreman; Hospital Mates, W. J. Price, A. White, J. Rice; Purveyor, Richard Moss; Deputy-Purveyor, W. Hyam.

2nd Battalion, Dorset Regiment, in Camp before Alexandria, 15th September, 1801.

Field-officers, 4; captains, 5; subalterns, 14; staff, 4; sergeants, 77; drummers, 12; rank and file fit for duty, 397; sick present, 34; sick absent, 74; on command, 17. Total, 522; total sick, 108; percentage, 19.

1st Battalion, Dorset Regiment, in Garrison, Cairo, 15th September, 1890.

Field-officers, 3; captains and subalterns, 13; N. C. officers, rank and file, 807; sick present, 64. Percentage, 7·9

MODERN ALEXANDRIA AND CAIRO.

MODERN ALEXANDRIA AND CAIRO.

MEDICO-STATISTICAL SKETCH

OF

MODERN ALEXANDRIA AND CAIRO.

ALEXANDRIA.

When Alexander the Great, after his conquest of Syria, had advanced into Egypt, and by the taking of Memphis secured the possession of the country, he founded Alexandria B.C. 332, 12 miles from the Canopic mouth of the Nile, which up to then had been alone open to foreigners, principally Greeks. Strabo, who visited the city 24 years B.C., found Lake Mareotis fed by several canals from the Nile, by which much merchandise was imported. He noticed the then salubrity of the air, which he attributed to its peninsular situation and to the opportune rising of the Nile, which filled the lake in the summer season and prevented its becoming marshy by evaporation, while the north wind passing over so much sea secured an agreeable temperature in summer. He found the city intersected with spacious streets, through which horses and chariots passed freely, and its temples, public buildings, and palaces occupied nearly a third of the whole extent. In the suburbs were many gardens and tombs, with apartments set apart for the embalming of the dead. The circumference of the ancient city was said by Pliny to be 15 miles—in magnificence only inferior to Rome. Through it flowed the lucrative trade of Arabia and India. Its population, under the Ptolemies and Cæsars, numbered 500,000, including many slaves. Its school of learning and library had a world-wide renown, but at the commencement of the 3rd century it begun to wane; yet when Amrú, Omar's lieutenant, took it A.D. 641, after a siege of 14 months, he found there still 4,000 palaces, a like number of baths, 400 places of amusement, and 12,000 gardens, and one quarter occupied by 40,000 Jews. In 1777 its Turkish population had dwindled to 6,000 souls, little changed when the French garrison, 10,582 strong, surrendered to the British in 1801; but soon after Mehemet Ali began to rule Egypt new buildings sprung up in every direction, the European quarter became developed, and in 1835 its population had increased to 35,000. To-day it is 249,000, with an annual mortality of 48·9 per 1,000, a fine harbour and many handsome public and private buildings, few traces remaining of the bombardment of 1882. It is the favourite summer residence of his Highness the Khedive, whose palace is at Ras-el-Teen, on the ancient island of Pharos.

Several ancient writers—Diodorus, Strabo, Quintus Curtius, and Celsus—speak of the climate of Alexandria as having been healthy in their time, with a temperature both cool and salubrious, attributed to the admission of the Nile water into Lake Mareotis. The climate in the winter is agreeable, as a rule, but oftentimes cold from tempestuous weather and rain, which falls occasionally from October to February. These sudden changes are very trying when one is not properly clothed. The average rainfall per annum is 7¾ inches, the extremes recorded being 11¼ and 2¾ inches. The temperature ranges from 55° Fahrenheit—the mean for January—to 88° Fahrenheit—the mean for August. The thermometer in the shade seldom ranges above 86°, very rarely reaches 95° or falls below 50°. The prevailing N.W. wind is cool but damp, especially in the months of July, August, September, and October, when the relative humidity is high. The S.E. wind, which blows across the lake or foul foreshores, is said to be unhealthy and productive of fever, and sometimes offensive from decaying animal and vegetable matter left exposed as the Nile or lake-water falls. This wind in the spring turns into a dry, hot, disagreeable "*khamsin*," which blows for several days at a time at irregular intervals during April, May, and June; on such occasions the relative humidity falls as low as 26 per cent., and the temperature in the shade rises as high as 110°. At this period eye affections are more prevalent, especially among women and children, owing to the glare and fine dust, but they are readily amenable to treatment in a darkened room by means of strict attention to cleanliness, isolation, and astringent collyria.

In the market ample supplies of fish, meat, fowls, bread, fruit, and vegetables are exposed for sale. The Greek islands supply

game, the harbour oysters, and Italy wine—pure, full-bodied, and not expensive. The oke (2¾ lbs.) is the standard weight, and the piastre (2½d.) the current coin. For water the city depends upon the Mahmoodeyeh Canal, opened in 1820, which taps the Rosetta branch of the Nile at the village of Atfeh, 50 miles distant. It receives many impurities from the villages along its banks, has a slow current, is navigable, but the water is filtered prior to distribution at the waterworks, and in most houses afterwards passes through porous zeers and charcoal filters; in barracks and hospitals boiling is used as an additional precaution. When so treated it is clear, odourless, agreeable to the palate, neutral, about 1 grain to the gallon of lime, ·5 of chlorine, 2 of sulphuric acid, with no traces of ammonia, nitric or nitrous acid, or phosphoric acid. Total hardness, 2·45. A litre of Nile water analysed at Cairo by Ismalan on July 10th, when the river was rising, gave the following result:—

Total organic matters . . .	0·1810
Lime	0·0582
Magnesia	0·0315
Chloride of sodium . . .	0·0146
Acid, sulphuric	0·0102
,, phosphoric	nil
Sesqui-oxide of iron . . .	0·0215
Matters in suspension . . .	2·1700
Calcined inorganic residue . .	1·9950

The suspended matters were matters coloured by chlorophyll, confervæ, diatoms, desmidiaceæ, daphnia, when becoming putrid bacterium termo. Wells are now seldom used, but those in the town are very impure, containing much lime, chlorine, and marked indications of sulphuric, phosphoric, and nitric acids.

A Commission appointed by his Excellency Rias Pasha to consider the question of the improvement of the water-supply to the town of Alexandria met on Feb. 3rd, 1889, and decided to recommend that all drains running into the Mahmoodeyeh Canal from the villages along the banks should be closed, and that fresh outlets for the drains should be made to discharge on the land side; that strict orders should be given to the inhabitants along the banks to cease making the canal the receptacle for every description of rubbish and filth, and that these orders should be enforced by severe punishment if disregarded; that carcases of animals should be promptly removed when seen in the canal, and that it should be systematically patrolled under the direction of the irrigation department, who, on their part, would open the lock at Kafr Dawar once every ten days in order to allow a good flush of fresh water to come in from the Katatheh Canal. It was hoped that by these measures danger to health might be avoided, and a fair water supply ensured during the period of abnormally low Nile.

In the neighbourhood of Ramleh, a much-frequented suburb of Alexandria, and summer resort of many Europeans from Cairo, the soil consists of a recent tertiary light-coloured sand, and a sandy limestone, composed chiefly of broken fragments of shells (condylia). Alexandria is founded on an alluvium and permeable sand, much saturated in parts with sewage, leakages from cesspits, and badly-formed drains. During the year 1888 no less than 472 human corpses were found in the Nile. The quality of the water (especially when the river is low) is sometimes complained of. Pestilential emanations from the sewers in certain quarters occur with the increasing temperature, and at the fall of the year, when their contents are stirred up by heavy rain. Goats, buffaloes, and cows yield a supply of milk no doubt frequently adulterated with such water. Aerated water is much drunk by the better classes, a piastre a siphon. In one of the principal manufactories I found the water carefully filtered, but cheaper kinds are not so well prepared. Cigarette shops and brasseries, or inferior liquor shops, abound, and are much frequented. Black coffee is largely partaken of by all classes. Such are the general conditions influencing health in this seaport town, one of Egypt's health-resorts.

The common diseases are typhoid, simple continued and mild intermittent fevers, small-pox, conjunctivitis, diarrhœa, dysentery, venereal, various skin affections, hepatitis, and abscess of the liver, cholera and the plague at rare intervals. Venereal is very common among both the native and European prostitute class. Judged by observation in our military hospitals, the prevailing type is the soft chancre, often accompanied by buboes, in the warm and relaxing weather slow to heal. Iodoform, carbolic oil, and boracic lint, with supporting treatment, afford the best results with the latter. For the indurated chancre and its sequelæ mercury is given with good effect. Tertiary syphilis is rarely seen.

The following statistics afford some idea of the diseases of the station, and of the work performed by the medical staff of the military hospital at Alexandria from the date of its being opened,

February 3rd, 1883, to July 27th, 1888, a little over five years:—

Admitted, - - -	10,779
Died, - - - -	164
Invalided for discharge, - -	95
Invalided for change, - -	719
Discharged to duty, - -	9,801

244 officers were treated in hospital, 8 died, and 44 were invalided for change of climate. Mortality to cases treated, all classes, 1·47 per cent. The more important admissions were venereal, 2,779; fevers, 1,683; diarrhœa, 810; cutaneous diseases, 555; dysentery, 441; debility, 365; eye affections, 343; dyspepsia, 209; jaundice, 206, rheumatism, 206; bronchitis, 207; hepatic disease, 142; heart, 124; tonsillitis, 118; phthisis pulmonalis, 51; pneumonia, 49; tænia solium, 31; mental disease, 27; delirium tremens, 22; malignant cholera, 14; sunstroke, 9; scarlet fever, 1. Enteric fever accounted for 84 deaths, 21·37 per cent. of the cases treated; cholera, 11; pneumonia, 10, or 1 in 5; dysentery, 8, or 1·80 per cent. of those treated; hepatic disease, 5; phthisis pulmonalis, 4; heart disease, 2. There were 566 admissions for wounds and injuries.

The varieties of venereal disease were:—

Primary venereal sores, - -	1,635
Gonorrhœa, - - -	897
Secondary, - - -	247

And of fevers—

Simple continued, - -	820
Febricula, - - -	239
Enteric, - - - -	393
Ague, - - - -	196
Remittent, - - -	35

The regiments from Suakim and up Nile imported many cases of fever, dysentery, and rheumatism—men who had undergone much hardship, exposure, and frequent movement, inseparable from military service in the field. Of the very few admissions for small-pox none occurred in 1886 or 1888, and the one under treatment in 1887 was imported. In 1886 the sick of 30 different corps were treated in the hospital; the maximal strength of the garrison was then 3,410; number of beds equipped 415. The dry-earth system was in operation in hospital and barracks, and all enteric stools were disinfected, placed in closed receptacles, and removed beyond reach of danger.

Of these fevers, enteric (endemic in Cairo and Alexandria, and associated, outside barracks, with defective methods of getting rid of the excretions) was the most important and the most fatal, affecting most newly-arrived corps, subject to, for the first time, local morbific influences. The greater majority of those attacked were under twenty-five years of age. The greater heat of the frontier stations added much to the difficulty of treatment, and increased the mortality to, in some cases , 38 per cent. of those attacked. The mortality and liability to attack decreased with service in Egypt. A remarkable example—the 1st Yorkshire regiment, which, on return to Alexandria in 1887, after a sojourn of three years in the country, and exposure at Assuan, had only one admission, and no deaths—pointing to acclimatisation as a preventive. Medical officers have noted the frequency with which the large gut was affected, and the prevalence of dysenteric symptoms following upon or mixed up with those proper to typhoid.

They have classed the ætiology of cases occurring up Nile under various heads:—(*a*) Germs carried up river from Cairo—fourteen days to reach the first cataract at Assuan. Some of the patients being found in the second week of the fever on arrival, with rose spots; (*b*) comparative youth of the soldiers; (*c*) foul drinking water from the Nile, which was used as a latrine by natives on the banks, for washing purposes, making gingerpop and lemonade sold to soldiers, the latter not making use of boiled and filtered water; (*d*) typhoid stools passed into Nile; (*e*) troops following the banks whose soil was freely impregnated with feculent matter; (*f*) difficulty of personal cleanliness on service; (*g*) monotony of diet; (*h*) badly cooked food; (*i*) fatigue and anxiety of mind, with depression; (*j*) rapid changes of temperature, great heat in day, cold wind at night; (*k*) impure milk. The onset was found to be often very invidious; diarrhœa by no means constant, 1 in 10 or more constipated, and in one-third no rose spots. Hypostatic congestion of back part of lung a frequent complication, increasing head symptoms, with increasing heat. Epistaxis not of frequent occurrence; and hæmorrhage from the bowel, when present, a grave symptom. Relapses proper, not common, but recrudescences frequent. The mortality would have not been so high had all doubtful cases of continued fever, diarrhœa, or febricula of over twenty days' duration been included. In the hospital at Alexandria the mortality of simple continued and enteric fever combined was

7 per cent.; the mortality for all fevers treated—viz., 1,683—was 5 per cent.

The temperature chart of 393 cases diagnosticated as enteric showed considerable variety, but may be grouped under six heads:—(1) Abortive cases reaching to normal on fourteenth day. (2) Fevers of twenty-one days' duration. (3) Fevers of thirty-one days' duration. (4) Marked vacillations or remissions from commencement to close. (5) Irregular temperature. (6) High temperature prolonged by recrudescences. The second and third were more or less typical charts.

Beyond the fact of there being a greater frequency of dysenteric lesions the *post mortem* appearances were similar to what has been observed in India and other tropical and semi-tropical countries. The mesenteric glands were always enlarged and softened; the spleen was more or less enlarged, softened and congested, and full of dark fluid blood; the small intestine was congested, principally at its lower end, with Peyer's glands in various stages of infiltration and ulceration. The diseased solitary glands were sometimes the more prominent lesion. The ulceration was generally most marked at the ileo-cæcal valve. The condition of the large intestine varied. The specific lesions of enteric fever were therefore well marked. A mixed treatment—mineral acids and quinine, symptomatic, antifebrin, aconite, antipyretic mixtures, digitalis, occasional baths, tepid or cold sponging, the ice cap, cooling drinks, milk, concentrated beef or chicken tea, milk and soda water, and the recognised treatment of complications. During convalescence a gradual approach to more solid food; alcoholic stimulants when indications of failing heart were present.

Of thirty cases treated in 1888 the following were the more interesting particulars:—

Age—completed 18 years	-	1	Under twenty-five years 25
" 19 "	-	2	
" 20 "	-	5	
" 21 "	-	5	
" 22 "	-	5	
" 23 "	-	5	
" 24 "	-	2	
" 26 " and upwards		5	
Service in Egypt—			
Under 1 year	- -	28	
" 2 "	- -	2	

Days under treatment of recovered cases—

30 and under 35			-	2
35	„	40	-	1
40	„	45	-	3
50	„	55	-	3
55	„	60	-	1
60	„	70	-	6
70	„	80	-	4
80	„	90	-	3
92 days		-	-	1
139 „		-	-	1

Duration of fatal cases—15, 40, 32, 16, 11, 17 and 9 days.
Average duration of cases—56·2 days in hospital.
Temperature on admission—

100° and under 101° Fahr.				2
101°	„	102° „	-	5
102°	„	103° „	-	4
103°	„	104° „	-	12
104°	„	105° „	-	6
105·2°	-	-	-	1

Maximal temperature reached—

102° and under 103°			-	2
103°	„	104°	-	3
104°	„	105°	-	14
105°	„	106°	-	11

The relapses with an intervening apyrexical period, 3; recrudescences, 7. Eruption in five cases very profuse, on abdomen especially; about a third of other cases not observed. In six cases only did the temperature continue above normal beyond the 31st day—viz., to the 33rd, 36th, 41st, 44th, 48th, and 68th day. In 5 the symptoms abated about the end of a fortnight. All the patients returned to duty in Egypt except one invalided for change to England for debility after a stay in hospital of 139 days.

Among those who recovered, dysentery occurred during convalescence in two, bronchitis in one, and debility in another.

Fatal cases—(1.) Age twenty-two; service four years; in Egypt two months; in hospital fifteen days. Temperature on admission 103·2°, maximum, 105°; eruption doubtful; tongue dry and furred; much diarrhœa in first week; considerable hæmorrhage; much abdominal tenderness; high temperature not influenced by antipyretics (antifebrin, &c.). *Post mortem*—Lower end of ileum

ulcerated; perforation; mesenteric glands enlarged; spleen 24 ozs.; large intestine congested.

(2.) Age eighteen; service three years; in Egypt seven months; in hospital 40 days. Temperature on admission, 104·2°; maximal temperature, 105°; no diarrhœa; chest symptoms; hæmorrhage from bowels. *Post mortem*—Small intestine full of blood clots; congested; glands enlarged; solitary glands of large intestine ulcerated and punched out; spleen enlarged 18 ozs.; lungs congested.

(3.) Age twenty-six; service eight years; in Egypt eight months; in hospital thirty-two days. Temperature on admission, 101°; maximal temperature, 105°; loose motions, followed by profuse diarrhœa; base of left lung congested; considerable hæmorrhage. *Post mortem*—Spleen enlarged, softened 8 ozs.; fourteen ulcerated patches in ileum; solitary glands enlarged; perforation in two ulcers.

(4.) Age twenty-one; service three years; in Egypt ten months; in hospital eleven days. Temperature on admission, 102°; maximal temperature, 105°; diarrhœa; motions light yellow; no abdominal pain or tenderness. *Post mortem*—Lungs somewhat congested; spleen 6½ ozs.; three ulcers in small intestine, one perforated; glands enlarged; large intestine congested, indurated, pigmented.

(5.) Age twenty-one; service two years; in Egypt eleven months; in hospital seventeen days. Temperature on admission, 103·4°; maximal temperature, 105°; violent headache; delirium on admission; tongue dry and hard; much diarrhœa later on. *Post mortem*—Brain congested, much effusion of serum on surface; lungs congested; spleen softened, 7½ ozs.; sixteen ulcers in ileum; six patches of livid congestion in large intestine.

(6.) Age twenty-one; service three years; in Egypt eleven months; in hospital nine days. Temperature on admission, 104·4°; maximal temperature, 105°; tongue furred; no abdominal pain. *Post mortem*—Lungs congested; spleen enlarged; softened, 19 ozs.; Peyer's patches enlarged; twenty three ulcers in various stages in small intestine, one perforated; large intestine much congested.

The very serious complications in these cases were hæmorrhage, perforation, or brain congestion, and effusion.

With regard to treatment, we have yet to find a specific for this fever. I think it may be regarded as an established fact, now, that high temperature, minus infection, does not produce that serious degeneration formerly attributed to it, and that we must seek in the infection process and the ptomaïn intoxication resulting from it, those deleterious effects upon the vital organs which undermine the system and eventually cause death in enteric fever, pure antipyretic medicines reduce the temperature, but do not stimulate the nervous system, do not relieve the delirium, or increase the flow of urine. In a serious fever of specific origin they have no permanent effect, except when malaria complicates the disease where quinine is useful. Viney has confirmed Vogel's observations that after cold baths have reduced the fever there has been a rapid increase of weight. Cold so applied being a true afebrile remedy, while antipyretics are simply antithermic. It is still held by very high authorities that the cold bath treatment combats best the effect of the infective and toxic agencies, the reflex stimulus aroused by the shock to the peripheral nerve endings reacting on the nerve-centres which furnish innervation for circulation, respiration, digestion, tissue formation, and excretion, that the system is enabled to tide over the dangers which would come from failure of those functions—the simple cooling effect on the blood occupying a secondary though not unimportant office. In tropical and semi-tropical countries where the system is already enervated by constant heat, this treatment, when circumstances admit of its being systematically adopted, should prove the most beneficial and the nearest approach to a specific for typhoid, and reduce the mortality from 21·7 per cent.—that of 11,124 cases collected by Brand and treated on the expectant method—to 3 or 4 per cent. That this is possible the following statistics quoted by Vogel appear to prove, in a temperate climate :—

Source	Treatment	Number of Cases	Percentage of Mortality
Military Hospital, Munich. 1841–68 - - -	Expectant - -	5,488	20·7
1868–71 - - -	Intermediate, with water	2,841	12·2
1875–81 - - -	Baths and antipyretics -	702	7·6
1880 - - -	Strict cold baths -	428	2·7
1882–87 - - -	Ditto - - -	141	3·5

while the result of cases treated before the fifth day are even more satisfactory.

CAIRO.

The capital of Egypt is situated in latitude 30° 6′, east longitude 31° 26′, on the right or E. bank of the Nile, in the sloping plain lying between that river and a projecting angle of the Mokattan Hills, 180 miles by water from Alexandria, a route now seldom travelled, and 131 miles by rail, sped over by express in three and a half hours. Two express and two ordinary trains leave daily from Moharrem Bey Station. It was constructed in 1855, the first ever made in the East, and passes *en route* Ramleh, Damanhoor, occupying the site of the ancient Roman Hermopolis Parva, where close by Napoleon was nearly taken prisoner by the Mamelukes in 1798, Kafr-ez-Zyat, where the Delta is entered, with its amazing fertility; Tantah, celebrated for its fairs, each of which lasts eight days; Benha, noted for its orange groves and ruins of the old town of Athribis, yielding from time to time objects of Roman or Greek date. After passing Toukh station, about seven miles from Cairo, the first glimpse of the Pyramids may be seen to the south-west. On arrival omnibuses from the different hotels—Shepherd's, The New, Angleterre, Continental, Royal, &c.—meet the train, and numerous two-horse carriages and donkeys. Shepherd's Hotel, situated in the Esbekeeyeh, is the oldest and most frequented by English and American visitors. The New Hotel is better situated, and under new management this year. Hôtel du Nil, in a main street off the Mooskee, is chiefly favoured by Germans, Hôtel Royal by French, and the Angleterre and Continental by English visitors. The charges average sixteen shillings a day. There are also the "pensions"—Victoria, Maison Fink, &c. Lodgings are not easily procured, and are expensive. There are two clubs, the Khedivial and Sporting, the latter mostly military. Carriages cost £1 a day, one fanc or four piastres the set down.

If health is a chief object, Egypt can be reached by a long sea voyage—the most economical, the Papayanni or Moss Steamers from Liverpool to Alexandria. The former call at Lisbon, Algiers, and Malta *en route*—both are well found. The fare is £14; return ticket, £24. The fares by the P. and O. and Orient lines are somewhat higher, the passage quicker, and the steamers larger. The boats of the latter touch at Naples. Egypt may be reached in a week *viâ* Marseilles, or Venice. The steamers of the Rubattino line, starting from Genoa weekly, coast along the shores of Italy in view of some very beautiful and varied scenery, including the lovely Bay of Naples. On the return voyage an all-round trip can be taken to the coast of Syria, Acre, Jerusalem, Joppa, Damascus, Constantinople, Smyrna, Salonica, the Ionian Islands, Athens—all places of historic interest. Messrs. Papayanni issue return tickets from Liverpool, Lisbon, Algiers, Malta, Alexandria, Beyrout in Syria, Alexandretta, Limasol, Larnaca, and return for £30, a trip of about seven weeks; Messrs. Moss also.

From October to April is the best season for a residence in Egypt for those who intend to do the whole Nile voyage, but the best months are November, December, January, February and March, when the cool and dry north winds prevail. It is too cold to travel in Syria before April.

The mean annual temperature of Cairo is about 71° F. From the peculiar dryness of the atmosphere it is more susceptible of sudden changes, the thermometer often indicating variations of 12° F. between morning and mid-day, and as much between mid-day and evening. The early morning is invariably cool, but after two or three hours continues warm until sunset, when it rapidly cools. It seldom falls to 40° F. Fogs prevail during the first two months after the receding of the Nile. The coldest months are December and January; the hottest, August and September. The latter is especially disagreeable and moist. The humidity is principally controlled by the rise and fall of the Nile. Evening fogs descend quickly as the sun goes down, and in certain localities, at this season, malarious fevers prevail. The desert air is dry and bracing, but at night, during the winter, piercingly cold. The summer season extends from April to the end of September, and is ushered in by stormy, equinoctial winds, followed by the hot south Khamsin wind, at the sound of which visitors quickly depart. By the end of June the Nile begins to rise at Cairo, and reaches its maximum by the middle of September. As the river falls unhealthy exhalations arise in the delta, giving rise to ophthalmia, dysentery, diarrhœa, and ague. By the middle of November the river has retired within its banks. The average summer temperature is about 85° F. The winter, which begins in October and ends in March, is attractive to invalids owing to its genial and uniform temperature. Rain seldom falls at Cairo—five or six showers during the winter months.

The climate of Cairo and the Upper Nile is generally advocated as being beneficial in phthisical and bronchial affections, chronic disease of the mucous membranes, congestive disease of the abdominal viscera, nervous exhaustion, debilitated circulation from progressive disease of the heart, especially when attending advancing years, scrofulous disease of every kind, and especially in the early stage of phthisis indicated by general delicacy of constitution, when the invalid, by regulating his movements, may command an almost uniform condition of daily climate for several months—first, by a short stay at Cairo, then by following the seasons as he proceeds up Nile to a climate where the heat is just sufficient to allow time to spend much of the day in the open air, returning to Cairo in March, and leaving about the middle of April, after a short stay at Alexandria, where the air is much cooler; finally, reaching home in the early summer months. In winter warm clothing is essential, and flannel should be always worn next the skin.

The Nile water, when well filtered, is agreeable, and is best flavoured by light Bordeaux and Rhine wines. The head should be well protected, the chill taken off the bath by the addition of warm water, and heavy foreign dishes avoided; sleeping in draughts should be avoided, and bedrooms on the ground floor.

From Khartoum to the sea the Nile flows a distance of more than 1,800 miles, at an average rate of about 3 miles an hour, increased to $4\frac{1}{2}$ miles at the height of the inundation, varying in breadth from 350 yards at Silsilis to $\frac{3}{4}$ mile above Cairo, passing six cataracts, the first met north at Assouan. An average rise during the height of the inundation at Cairo is 26 feet. The deposit, when dry, resembles pottery from the silica it contains. Regnault gives its composition as 11·0 water, 9·0 carbon, 6·0 oxide of iron, 4·0 silica, 4·0 carbonate of magnesium, 18·0 carbonate of calcium, 48·0 alumen. At Cairo and southwards to between Edfoo and Hayar Silsilis, the hills at either side of the river are formed of mummulite or magnesian limestone—a hard, white stone full of fossils. Beyond Edfoo this is replaced by Nubian sandstone; through this, at Assouan, primitive red granite (syanite) crops up. In the neighbourhood of Cairo there are several varieties in the nature of the strata, such as the "Red Mountain," a silicious red gritstone, and the so-called petrified forest, a tract in the limestone desert covered with fragments of fossil wood. In the Mokattan hills innumerable varieties of petrified shell-fish are found. From the quarries of Toora and Masarah came the limestone blocks of which the Pyramids are made.

The Egyptian Flora consists of about 1,300 specimens, of which indigenous plants constitute the largest proportion; the desert species alone number 250. The ordinary European vegetables are easily obtained in Cairo. Most of the trees were known to the ancients, but the lebbekh acacia, with which nearly all the avenues round Cairo are planted, is a recent acquisition, and very valuable from the agreeable shade it affords.

The various elements of the motley population of Cairo may be divided into the Moslem, or Arab Egyptians; the Christian Egyptians, or Copts; the countrymen, or Fellaheen, and members of the wandering tribes—Bedasheen, Nubians, Abyssinians, Negroes, Turks, Levantines, Armenian Jews, Bedouins, and representatives from every European nationality, whose picturesque dresses are interesting to the new arrival, and add much to the scenic effect.

The first of the Fatemites in Egypt, Aboo Tummeem, built old Cairo, or Fostat, in A.D. 969, and it has ever since been the chief city. The Great Mosque of El Hakim was built A.D. 1003. In 1176 the Frank Crusaders attacked, and partly burnt Cairo, but Saladin quickly erected fortifications which still remain. About the same time that his dynasty came to an end, A.D. 1249, the French King, Louis IX., was taken prisoner in Egypt.

The town is upon the site of the Roman fortress of Babylon whose solid walls and strong round towers still bear evidence to its former strength, and account for its having defied the attacks of the western invaders for seven months. In this was quartered one of the three Roman legions, which formed the garrison of Egypt from B.C. 30 (time of Augustus) to Heraclius, A.D. 640, when, conquered by Omar, Egypt ceased to be a Roman province. In A.D. 973 the new city became the capital. Cairo was the residence of the Khalif, and capital of his dominions, until the overthrow of the Mameluke sovereignty in Egypt by Sultan Selim in 1517. It then became the capital of the Turkish province of Egypt. Modern Cairo is about three miles in length, by two in breadth, and occupies an area of about three square miles exclusive of the new Ismaileeyeh quarter. The old Frank quarter is now called the Mooskee—it was here that the first Franks who opened shops in Cairo were permitted to reside in the reign of Saladin. The other quarters are the Esbekeeyeh, Abdeen, and Ismaileeyeh, the

last containing the more modern and fashionable houses. Notwithstanding western encroachments, Cairo has not quite lost its thoroughly Oriental character to the stranger—"full of romance, of picturesque wonders, of strange sights, strange noises, and strange smells."

At the time of the French expedition in 1797 the population was estimated at 260,000. By 1880, including the suburbs of Boolak and Old Cairo, it had increased to 370,000, roughly divided thus:—

Native Moslems - - -	260,000
Native Copts - - -	25 000
Abyssinians, Nubians, &c. - -	25,000
Turks - - - -	10,000
Jews, Levantines, &c. - -	30,000
Europeans - - - -	25,000

The population in 1882, 374,838, including 21,650 Europeans. The most numerous classes of the population are the porters, then the vendors of eatables, glaziers, boatmen on the Nile, donkey and camel-drivers, water-carriers, coffee-house keepers, barbers, goldsmiths, chicken-rearers, hotel-keepers, potters, &c., &c. Its chief objects of interest are the Pyramids—a short drive of seven miles, the Boulec Museum, Coptic churches, numerous mosques, and the Citadel, from which a lovely panorama extends for many miles. The Citadel was built by Saladin in 1166, of stone brought from the small pyramids of Geezeh, and where the massacre of the Mamelukes took place by order of Mohammed Ali on March 1st 1811.

The average birth-rate of Cairo, from six years' observation, was 51·8; more than a third of the native children born there die before they have lived twelve months, and more than half born are dead before they reach their fifth year. In 1887 the average death-rate in Cairo was 46·84; during the cholera year of 1883 it rose to 63·98. It has been stated that there were 224,000 cases of preventable disease in Cairo. The infant mortality is alarmingly high during the four hottest months—more than a third of the deaths are due to diarrhœa. During the year about 16,500 natives died at all ages; in more than 6,500 cases the deaths were due to diarrhœa, including a few cases of dysentery and typhoid fever. The principal causes are summer heat, impure food, impure water, and impure air—mostly the result of contamination with human sewage—milk, ice, and other liquids poisoned by filthy water, or vessels washed in dirty water. It is calculated that there are in Cairo 54,000 houses; those not supplied by the Water Company are dependent upon wells or underground cisterns, filled at high Nile by infiltration or the Khaliz—an open drain which receives the contents of all cesspools along its banks, and from which the natives do not hesitate to drink. The wells are surrounded by soil blackened by sewage. The Cairo Water Company supplies upon an average about 68 litres per head, which includes the watering of the streets, against London, which is supplied with about 224 litres per head, and Paris, 177. The water is pumped up from the Nile to the pumping-station at Boolak, and thence to the filter-beds at Abbasseeyeh, whence it is distributed to the town. The Nile receives many pollutions, especially when low, when the current is insignificant—less than three inches per second; these, undoubtedly, react upon the water supply.

The desert air round Cairo is probably the purest in the world, but that of Cairo, with its crowded streets, its unclean habits, and its underground honeycomb of cesspools, has a marked cesspool smell, especially noticeable in the autumn months. A combination of sulphuretted hydrogen, ammonia, and a fœtid organic vapour, either itself the cause of disease or the carrier of the germs of typhus, diphtheria, and dysentery—sapping the health of the population, which becomes anæmic and wanting in health and energy, the children who survive looking pale and unhealthy. At low Nile the water is about 18 feet below the ground surface at Cairo, rising at high Nile to within 5 feet, and during an exceptional flood to within 2 feet of the surface.

When cholera occurred in 1883, it was first reported in the capital on July 16th. Up to 1886 European and native houses alike contained closet, kitchen, bath, or laundry, draining directly without any trap into a porous cesspool, either beneath the house or in its immediate vicinity. The cesspool odour pervaded the house when windows and doors were closed, mosquitoes were numerous, and many preventable outbreaks of typhoid fever occurred among the susceptible inhabitants. Many improvements have been made since then under the guiding influence of Dr. Greene Pacha, Director-General of Public Health.

In 1887 122 admissions for enteric fever occurred at the Citadel Hospital, with 30 deaths, and 9 at Abbasseeyeh, with 1 death—a

considerable increase in the ratios of admissions and mortality as compared with the preceding year, which the medical officer in charge attributed to the local insanitary conditions, the unusually high Nile, and its rapid fall. When the Nile was at its height and began to fall the greatest number of admissions occurred—viz., 23 in September, 30 in October, and 12 in November. As the river rose it percolated the soil, disturbed the filth in the ground, and also the contents of the cesspools in which Cairo abounded, pressing the insanitary material to the surface, and under the hot sun causing poisonous emanations to rise into the air. There was also a higher ratio for simple continued fever, the admissions increasing with the rise of the Nile, falling somewhat when the river was at its height, increasing again when the river began to fall, and after a time falling steadily as the waters subsided. Of the total 1,092 admissions, 785 were at the Citadel Hospital, which the medical officer in charge thought was largely due to the local insanitary conditions, as in enteric fever, intensified by the unusually high Nile. A very large proportion came from Kasr-el-Nil Barracks on the left bank of the river, the ground in the vicinity of which was "little better than a fœtid swamp at the falling of the river." The native and European civilian population was affected similarly as the troops.

The Welsh regiment was quartered in Kasr-el-Nil Barracks for ten months, Abbasseeyeh two months, with small detachments at Assouan and Assiout:—

Average annual strength - -	776
Admissions into hospital - -	1,290
Deaths - - - -	16
Invalided home - - -	13
Average number constantly sick -	71·60

during this unhealthy year quartered on the banks of the Nile; average duration of each case of sickness, 20·11 days. The Hussars, quartered at Abbasseeyeh, away from Nile emanations, and exposed to the desert air during twelve months, had only 334 admissions out of an annual average strength of 368, no deaths, and but 8 invalids—a marked contrast. The troops in the Citadel, 300 feet above sea-level, the barracks freely exposed to prevailing wind, well ventilated, drainage good, no cesspool, water supply satisfactory, were also healthier.

There were, during this year, in the Egyptian command, with a very small force on the frontier of picked men, twenty-two years of age, and relieved every six weeks—

Average annual strength	5,272
Admissions	5,821
Deaths	81
Invalided	141
Average daily sick	365·19
Average constantly sick per 1,000	60·26

The more important diseases in order of frequency of occurrence were—

Simple continued fevers	1,092	Deaths *nil*
Diseases of digestive system	632	,, 7
,, generative system	624	,, *nil*
Gonorrhœa	428	,, ,,
Diseases of the skin	305	,, ,,
Diseases of the eye	257	,, ,,
Dysentery	230	,, 5
Primary syphilis	208	,, ,,
Diseases of lymphatic and glandular systems	180	,, ,,
Secondary syphilis	173	,, ,,
Enteric fever	157	,, 37
Diseases of the connective tissues	157	,, ,,
Malarial fevers	126	,, ,,
Debility	117	,, ,,
Respiratory diseases	107	,, 3

All others were under 100 admissions each. Rheumatism accounted for 77 admissions and 1 death; tubercular diseases, 11 admissions and 4 deaths; parasitic diseases, 21; alcoholism, 34, and 1 death; there were no admissions for scurvy. Nervous diseases, 17 admissions and 3 deaths; small-pox, 26, and 4 deaths; other eruptive fevers, 32—27 of which were scarlet fever cases, a mild epidemic of which broke out amongst the troops in October. The source of infection could not be traced.

The chief cause of mortality was enteric fever, 37; digestive diseases, 7; dysentery, 5; small-pox. 4; circulatory system, 4; respiratory, 3; nervous diseases, 3; tubercular diseases, 4; alcoholism, rheumatism, poisons, 1 each; general injuries, 4; bowel 6. Total, 80.

Rates per 1,000:—	Admissions	1,271·9
	Deaths	36·88
	Invalided	83·80
	Constantly sick	74·17

Of the 257 admissions for diseases of the eye, it became necessary to invalid only 2; only 1 was finally discharged as unfit—a very satisfactory result compared with more ancient history. Nearly all the admissions were due to conjunctivitis of a mild type.

The Citadel Hospital was opened as a general hospital in 1882, and from that date until December 31st, 1888, there passed through the hands of its medical staff—24,477 sick; 342 died; 1·4 per cent.

Year	Average Strength	Average Daily Sick	Admitted	Died	Enteric Admissions	Enteric Deaths	S. C. F. Admissions	S. C. F. Deaths
1882	3,701	276	1,555	56	143	36	321	2
1883	3,480	226	3,722	67	130	18	392	0
1884	3,342	230	4,210	28	60	13	407	0
1885	3,505	287	4,883	56	104	28	417	1
1886	3,456	292	4,543	46	62	17	474	0
1887	2,674	211	3,273	53	122	30	785	0
1888	2,183	138	2,291	36	65	14	392	0
Total	22,341	1,660	24,477	342	686	156	3,188	3

Averages for Seven Years.

Average Annual Strength	3,191
,, Daily Sick	237
,, Annual Admissions	3,497
,, ,, Deaths	48
,, ,, Enteric Admissions	98
,, ,, Enteric Deaths	22
,, ,, S. C. F. Admissions	455
,, ,, S. C. F. Deaths	0·43
Percentage of Enteric Deaths to Cases Treated	22·8

Extending over a period of 7 years, this may be looked upon as the normal rate of deaths under all methods of treatment—2·8 per cent. more than at Alexandria. In 1888 there were 392 cases of simple continued fever admitted, but no deaths. Enteric fever, 65 admitted, 14 died; ratio per cent., 7; mortality, 21·54.

January 1st to July 31st, 1889.

	Admitted	Died	Ratio per cent.
Enteric fever - -	20	3	15
Simple continued fever -	20	0	0
August.			
Enteric fever - -	28	4	14·29
Simple continued fever -	107	0	0

The first detachment of troops proceeded "up Nile" on July 8th, and the operations ceased on the 12th of the following month. The increased admissions in August are thus accounted for. This influence was most felt in the period dating from August 2nd to September 23rd; for then we received 52 cases of enteric, only one had not been "up Nile." Of this number only 7 died, though the type of fever was severe—a mortality to cases treated of 13·46 per cent.—very low for Egypt, and considering that several were admitted in a late stage of the disease. Thirty-nine cases were from the 2nd R. I. Rifles, a corps which suffered much from its short trip up the river. The K. O. S. Borderers, who left later and never reached Assiout, yielded only 3 admissions. In these 52 cases there were two undoubted second attacks, and one long case, a gunner, had liver abscess as a sequence.

It may not be uninteresting to note the general line of treatment. The use of quinine as an antipyretic was not attempted, and little given at all. Dietary—Milk diluted with one-third lime-water, beef-tea, brandy given mostly in all cases about the 10th day, sponging with tepid water twice daily, or oftener, antifebrin given when the fever was high, but only if the patient was robust; mustard sinapisms to abdomen if there was pain or tympanites; if more than four motions in 24 hours, sulphuric acid mixture; if there was constipation, ℥ii. to ℥v. of castor-oil; light clothing over body, keeping the feet warm; quinine when convalescing. The average duration of death cases was 13·5 days; of recovered, 62.

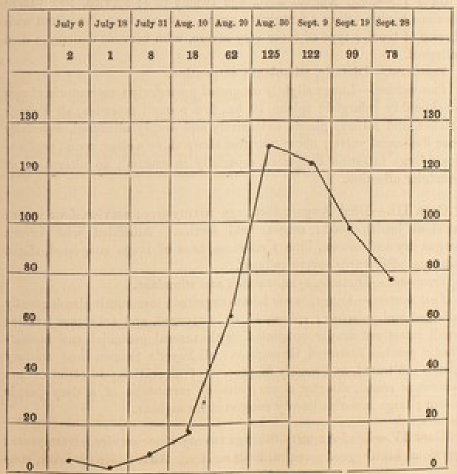
A very large proportion of the admissions at Cairo were over 21 years of age, although the minimum for the troops proceeding "up Nile" was 20, and there were many serving of that age. Of the 7 fatal cases, 1 was 29, another 25, 3 had completed 24 years, 1 was 23, and 1 was 22.

I asked a private of the 2nd R. I. Rifles on his discharge

from hospital (age 25, service in Egypt $1\frac{9}{12}$ years, and who had simple continued fever at Alexandria) what he thought gave him enteric fever, and how he got there? He replied that he went by train to Assiout, went in barges towed by steamers as far as Assouan, was in them four days. He became ill eight days after arriving at the latter station, and went to hospital. Thought it was the Nile water, as the porter was too hot to drink. The barges were covered, and there were no bad smells. His regiment left on July 8th, 503 strong, and from that date to September 27th had 201 admissions to hospital and 7 deaths—6 enteric, and 1 abscess of liver. They returned on August 12th to Abbasseeyeh, where they joined the companies from Alexandria.

The following shows the gradual rise and decline of sick ineffectiveness as the effects of the trip up Nile began to be felt and wore off—twelve weeks:—

Remaining in Citadel Hospital—2nd Royal Irish Rifles.



The prevailing diseases, dysentery and diarrhœa, fevers and venereal—some of the latter carried up in a period of incubation.

The following brief notes of the seven fatal cases of enteric in the 2nd R. I. Rifles, all contracted "up river," give the leading features and *post-mortem* appearances of this type of fever:—

Case I.—Died August 22nd, age twenty-three; service, three years; previous health good; origin, field service. Admitted with high fever, brown tongue, great weakness, diarrhœa, rose spots on abdomen, rapid pulse.

Treatment.—Tepid sponging, ice to head, brandy and egg, beef-tea, milk, sedatives to procure sleep.

Post mortem.—Lungs considerably congested; mesenteric glands enlarged; spleen, 9 oz., friable, dark, jelly-like; small intestine, lower two-thirds in a state of extreme congestion, approaching ulceration; large intestine much congested.

Case II.—Died August 23rd, age twenty-two; service, two years; previous health, ailing a fortnight; origin, field service. Admitted with abscess of tonsil; type of fever very severe, with nervous delirium; died collapsed.

Treatment.—Dietetic, stimulant; turpentine.

Post mortem.—Lungs slightly congested posteriorly; mesenteric glands considerably enlarged; spleen, 10 oz., firm; small intestine, all Peyer's patches, and solitary glands extensively and deeply ulcerated, especially near ileo-cæcal valve; about four feet above valve a clear, round perforation; large intestine congested, especially in cæcum; no ulceration or glandular affection.

Case III.—Died August 23rd, age twenty-five; service, four years; previous health good; origin, field service. Admitted with fever; tongue dry and brown, iliac tenderness, base of lungs congested, slight delirium, afterwards severe collapse.

Treatment.—Dietetic, symptomatic, and stimulant.

Post mortem.—Lungs, lower lobes congested; mesenteric glands greatly enlarged and softened; spleen, 15 oz., engorged, and substance friable; small intestines deeply congested, with several petechial and hæmorrhagic patches scattered throughout; all Peyer's patches and solitary glands infiltrated, and mostly in process of ulceration; in caput cæcum numerous round, sloughy ulcers; mucous membrane of a deep purple colour; large intestine deeply congested throughout.

Case IV.—Died August 30th, age twenty-nine; service, eleven years; previous health good; origin, field service. Admitted with fever, considerable nervous excitability, diarrhœa, abdominal tenderness, rose rash, sense, "status typhosus."

Treatment.—Dietetic, stimulant, small doses of antifebrin.

Post mortem.—Lungs, bases congested; mesenteric glands enlarged and matted together; spleen, 21 oz., very much softened and friable; small intestines, Peyer's patches and solitary glands extensively ulcerated; towards lower end of ileum very deep; 2 feet 6 inches lower end of small intestine deeply congested; numerous patches of superficial hæmorrhage; large intestine congested, especially in cæcum.

Case V.—Died September 19th, age twenty-three years; service, five years; previous health good; origin, field service. Admitted with high fever, furred and flabby tongue, considerable prostration, characteristic diarrhœa, doubtful spots, delirium, persistent high temperature, great gastric irritability, hæmorrhage.

Treatment.—Symptomatic, stimulant, turpentine, bismuth, gallic acid, opium, astringent.

Post mortem.—Lungs, hypostatic congestion; mesenteric glands enlarged; spleen, 16 oz., substance friable; small intestines healthy to ileum, where all Peyer's and most of solitary glands were deeply ulcerated, some presenting point of hæmorrhage; large intestine, one very deep and bleeding ulcer in caput cæcum, some few smaller.

Case VI.—Died September 17th, age twenty-four years; service, five years; previous health good; origin, field service. Admitted with high fever, diarrhœa, dry brown tongue, delirium, cerebral symptoms.

Treatment.—Diaphoretics, antifebrin, frequent sponging, &c.

Post mortem.—Lungs, right much congested, left at base; mesenteric glands greatly enlarged and softened; spleen, 8 oz., deeply congested, soft, friable; small intestine deeply congested throughout; cæcum congested and ulcerated; all Peyer's patches and solitary glands congested, some ulcerated; large intestine, several large sloughy ulcers lower part of ascending colon; mucous membrane of a deep purple colour.

Case VII.—Died September 17th, age twenty-two years; service, four years; previous health indifferent; origin, field service. Admitted with bronchitis, pneumonia, frequent cough, diarrhœa, hæmorrhage.

Treatment.— Poultices, expectorant, stimulant, turpentine, astringent.

Post mortem.—Lungs congested; mesenteric glands greatly enlarged, softened, friable; spleen, 9 oz., healthy; small intestine congested throughout, with many ulcers; large intestine congested throughout.

Such was the Nile enteric fever of 1889. In the same year at Alexandria, up to October 19th, 14 cases were treated, with 2 deaths—a mortality of 14·4 per cent. Quinine was not made use of. but the German and American abortive and antiseptic system adopted, with attention to diet. In both the fatal cases the disease was probably contracted at Cairo, from which the patients had arrived not long previous to admission. Age, twenty and twenty-three respectively. Death occurred on the fifth day in the first, of ambulatory typhoid, judged by the condition of the intestines and spleen; in the second, in a relapse from perforation, after a stay of nearly three months in hospital. Spleen enlarged, congested, 19 and 17 oz.; mesenteric glands enlarged; small intestines extensively diseased, and large intestine congested. In the first, 14 ulcers in various stages; in the other, between 20 and 30. There was a very marked similarity in the *post-mortem* appearances, although the one was a primary attack, and the other a very distinct relapse.

Summary of Medical Statistics, Garrison of Alexandria, 1883–1889.

Year	Strength	Admissions	Deaths	Invalided	Remarks
'83	1,310	1,817	32	111	
'84	1,211	1,477	22	68	During Suakim and up Nile expeditions.
'85	2,360	3,145	51	408	
'86	1,891	2,561	46	181	
'87	1,108	1,090	11	21	
'88	1,061	1,090	10	25	
'89	1,082	902	6	31	
	10,023	12,082	178	845	

Table II.

Year	Ratio per 1,000 Admissions	Deaths	Invalided	Constantly non-effective from sickness	Average duration of each case of sickness
'83	1,378·4	24·40	84·70	143·22	20·90
'84	1,219·6	18·17	56·15	113·34	27·80
'85	1,332·2	21·61	172·8	200·00	29·20
'86	1,354·3	24·30	96·0	174·77	24·90
'87	983·75	9·92	18·95	76·49	25·61
'88	1,027·	9·42	23·56	73·96	24·77
'89	883·6	5·54	28·65	60·83	24·41

Yearly Average, Alexandria.

7 Years	1,168·40	16·19	68·68	120·37	25·37

Young and Old Soldiers.

Under 20	20 to 24	25 to 29	30 to 34	35 to 39	40 and upwards
576	4,977	2,999	795	340	98

Officers.

Aggregate strength	Admitted	Died	Invalided	Ratio per 1,000 Admissions	Deaths
332	244	9	45	735	27

Women.

184	131	4	0	912	22

Children.

281	191	18	0	680	63

Admissions by Months, N. C. Officers and Privates.

Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
623	677	698	945	1,167	1,623	1,681	1,419	709	912	770	758

Mortality by Months.

7	4	4	7	13	26	23	32	20	15	9	8

Vaccinations and Re-Vaccinations.

Total	Perfect	Mortified	Failed
407	57	167	194

Regiments which had Served a Year each at Alexandria.

Year	Corps	Arrived in country	Average strength	Admissions	Deaths	Invalided	Constantly sick
'83	D. C. Lt. Inf.	27/4/82	712	1,094	21	34	73·04
'87	1st Yorks.	10/5/86	705	858	4	13	54·45
'88	2nd R. I. Rifles	9/1/88	770	894	10	17	57·13

Three Seasoned Corps with Previous Service in Egypt.

'89	2nd R. I. Rifles	9/1/88 Gibraltar	929	823	6	28	55·06
	1st Dorset	18/7/89 Malta					
	1st Yorks.	5/9/89 Cypyrus					

Medical Staff Corps.

Year	Officers, M. S.	N. C. Officers and privates	Admitted to hospital	Died	Invalided	Constantly sick
'83	8	80	65	1	8	4·85
'84	11	45	36	"	3	2·81
'85	7	73	99	"	27	5·20
'86	17	59	45	"	4	5·61
'87	9	45	21	"	2	1·51
'88	7	35	23	"	"	1·32
'89	5	25	16	"	"	1·00

Average, Yearly.

—	9	51·7	43·4	0·14	6·5	3·19

Royal Artillery, Fort Kom-el-Dik.

Year	Average Strength	Admitted	Died	Invalided	Constantly Sick	Ratio per 1,000: Admissions	Ratio per 1,000: Death
'83	70	137	4	12	13·21	1,957	57
'84	118	133	2	8	11·75	1,270	17
'85	113	122	3	14	18·59	1,079	26
'86	116	92	3	5	7·72	788	25·5
'87	87	81	2	3	7·17	919	23
'88	58	53	"	2	2·94	914	0
'89	51	32	"	"	2·84	625	0
Average, 7 Years.							
—	87	93	2	6·3	9·17	1,079	21·2
Infantry at Ras-el-Teen.							
—	774	914	13	23	57·42	1,182	16·8

Admissions and Deaths from Enteric Fever—Garrison, 1883–89.

Year	Average Strength	Admissions	Deaths	Ratio per 1,000: Admissions	Ratio per 1,000: Deaths	Remarks
'83	1,310	54	11	41·2	8·4	After Campaign of 1882.
'84	1,211	65	14	53·7	11·5	Mostly imported by regiments from Suakim and "Up Nile."
'85	2,360	122	28	51·7	11·9	
'86	1,891	134	29	70·9	15·5	
'87	1,108	6	1	5·4	·90	Regiment seasoned up Nile.
'88	1,061	30	6	28·2	5·6	Newly arrived corps.
'89	1,082	14	2	12·7	1·8	All seasoned corps—2 deaths, imported cases from Cairo.

Mortality to Cases Treated.

Brand, 11,124 cases on expectant method, -	- 21·7 per cent.
Bengal Presidency, 83 to 88, average mortality	- 28·5 "
Egyptian Command, 2,480 cases, 1882-'89 -	- 24·33 "

PREVAILING DISEASES, 1882–89.

Venereal, 3,862; fevers, 1,831; injuries, 886; diarrhœa, 782; skin affections, 569; dysentery, 533; liver, 493; lung, 433; debility, 375; eye, 376; inflammation connective tissue, 322; dyspepsia, 216; throat, 202; heart, 138; alcohol, 69; worms, 39.

Total deaths to admissions, 1·4 per cent.; invaliding to admissions, 6·71 per cent.

1889.

Admissions, 194·40, and deaths, 3·88 per 1,000 less than in army at home and abroad, 1887. Invaliding, 6·90 higher, but 9·15 lower than in army, 1877–86. No deaths from enteric fever contracted at the station.

GENERAL SANITARY CONDITIONS.

Hospital accommodation, 500 to 128 beds; cubic space, barracks, 750; huts, 740; cells, 1,000; guard-rooms, 750; hospital, 1,317 to 2,545. Floor space, barracks, 60 superficial feet each; huts, 58; cells, 78; guard-rooms, 60; hospital, 90 to 125.

RATIONS.

Fresh meat, 1 lb.; bread, 1 lb.; tea, $\frac{1}{3}$ oz.; coffee, $\frac{1}{3}$ oz.; sugar, $2\frac{1}{4}$ oz.; salt, $\frac{1}{2}$ oz.; pepper, $\frac{1}{36}$ oz.; regimentally, 1 lb. potatoes and 4 oz. vegetables daily.

CLOTHING.

Winter, serge and cloth, helmets and khakee; summer, 15th May to 15th October, underclothing flannel, cholera belts, worsted or cotton socks.

DUTIES.

Guards, parades, fatigues, route-marching in winter; military training, musketry by companies at Mex Camp by the sea, spring and autumn. Bathing parades twice a week in summer. Reveille to 8 a.m., 5 p.m. to retreat; reveille sounds at 5 a.m. summer, 5 30 a.m.; retreat at sunset. Men on sentry cloak from 1st November to 1st May, retreat to reveille. Coffee is given to guards before mounting in summer. Parades, drills, fatigues, any time in winter; before 8 a.m. and after 4 30 p.m. summer. Helmets worn 8 a.m. to 4 30 p.m. Working hours, supply corps, 8 a.m. to 1 p.m., and 2 p.m. to 4 p.m. winter; 6 a.m. to 1 p.m. summer. Two blankets are allowed in summer, three in winter. Breakfast, 7 30 a.m.; dinner, 12 30 p.m.; tea, 4 30 p.m.

MEANS OF RECREATION.

Cricket, football, quoits, concerts, theatricals, boating.

CONSERVANCY.

Dry earth system in barracks; hospital, water urinals or urine tubs, dry earth latrines.

WATER SUPPLY.

Distributed by pipes; Nile water from Mahmoodeeah Canal, boiled and filtered, barracks and hospital.

VENTILATION, WARMING, LIGHTING.

Standard system, stoves in hospital, kerosene lamps.

Army of Occupation in Egypt—Summary of Medical Statistics.

Years	Strength	Admissions	Deaths	Invalided	Constantly sick
1882	13,466	14,392	405	3,229	301·97
1883	7,897	8,995	275	669	600·74
1884	6,468	8,190	75	320	497·08
1885	9,593	14,601	278	1,462	769·71
1886	11,062	14,070	408	928	820·64
1887	5,272	5,821	81	141	365·19
1888	3,346	3,428	47	75	216·09
1889	3,431	3,278	40	123	207·43
Total,	60,534	72,775	1,609	6,947	3,778·55

Years	Ratio per 1,000				
	Admissions	Deaths	Invalids	Constantly non-effective from sickness	Average duration of each case of illness
1882	2,322·0	88·90	520·97	—	—
1883	1,139·0	34·82	84·71	76·07	24·38
1884	1,266·2	11·59	49·47	76·85	22·15
1885	1,522·0	28·98	152·40	80·23	19·24
1886	1,271·9	36·88	83·89	74·17	21·28
1887	1,104·1	15·36	26·74	69·26	22·90
1888	1,102·4	14·05	22·42	64·58	23·07
1889	955·4	11·66	35·85	60·46	23·10

Enteric Fever.

	Admissions	Deaths	Percentage deaths to admissions	Ratio per 1,000 Admissions	Ratio per 1,000 Deaths
1882	575	223	38·78	92·8	35·98
1883	258	50	19·4	32·7	6·33
1884	161	32	19·9	24·9	4·95
1885	361	87	24·1	44·5	10·71
1886	733	241	33·	66·3	21·79
1887	157	37	23·5	29·8	7·01
1888	96	20	20·8	28·7	5·98
1889	139	14	10·07	40·5	4·08

Army of Occupation, Average Yearly, 1882-'89.

Strength	Admissions	Deaths	Invalided	Constantly sick	Average duration each case of illness
7,561	9,097	201	868	472·32	21·99

Comparative Statistics.

	Years	Admissions	Deaths	Invaliding	Constantly non-effective from sickness	Average duration of each case
Troops at home and abroad	'77-86	1,082·4	11·75	37·80	53·72	18·04
Egypt	'82-87	1,298·6	28·07	122·88	74·91	21·99
India	'77-86	1,521·9	17·02	34·31	66·90	16·04
Alexandria	'89	883·8	5·54	28·65	60·83	24·41

HEALTH DISTURBING CAUSES.

Recent arrival, non-acclimatisations, predisposed age, vicissitudes of climate, intense heat, hot winds, chilly nights, campaigns, insanitary condition of towns and inhabitants, inpure drinks, unregulated prostitution, accidents, malaria in certain situations when Nile falls, defective drainage.

Improvement in Health of the Army of Occupation.

	Ratio per 1,000 1882-84	1886-88	1889
Admissions -	1,298·7	1,184·9	955·5
Deaths -	22·10	27·31	11·66
Invalided -	96·28	58·13	35·85
Constantly sick	78·18	71·23	60·46

Absolute Gain from 1882–85.

Ratio per 1,000 Admissions	Deaths	Invalided	Constantly sick
343·2	10·44	60·43	17·72

The mortality to cases treated, and the prevalence of certain diseases, are largely influenced by temperature alone more than any other factor, except age and recent arrival. The experience of the 1st Yorkshire Regiment shows this very conclusively—

1886.	Deaths per 1,000,	Assouan -	- 70
1887.	,, ,,	Alexandria -	- 21
1888.	,, ,,	Cyprus -	- 3

DEATHS FROM ENTERIC FEVER.

Frontier Field Force,	1866 - -	1 in 2·74
Citadel	,, - -	1 in 3·64
Abbasseyeh	,, - -	1 in 3·18
Alexandria	,, - -	1 in 4·62

During the greatest heat at Assouan—from 12th to 19th June, average maximal temperature in the shade 120° F.—23 deaths occurred, of which 18 were patients suffering from enteric fever. In the Egyptian command the ratio per 1,000 admissions have been highest in August—viz, 127·8 per 1,000—also the deaths (3·70) with an absolute maximal temperature of 100·7°, mean maximal, 91·7°; mean temperature, 81·8°; relative humidity, 53°. The Nile at about half its normal rise at Cairo, a month of steady moist heat, lassitude, and disturbed rest. On the frontier June, with its intense dry heat and excessive temperature before the rising of the Nile. The troops are healthiest in the months of December, January, February, and March. When sufficiently far away in camp from the noisome slums of the garrison towns they are much healthier, and have a more robust appearance.

ARMY OF OCCUPATION IN EGYPT, 1882-89.

ARMY OF OCCUPATION IN EGYPT,

1882-89.

On July 17th, 1882, the British troops arrived in Egypt, 13,466 officers and men, average strength; maximum strength, 9th September, 20,885. Admissions, 7,590; deaths, 232; invalided, 2,321. Rates per 1,000 for period, 583·3, 17·83, and 178·36 respectively. The military operations were confined to Lower Egypt.

1883 was a period of settled occupation after a campaign. The troops new to the country, or only just becoming acclimatised; barracks in a state of transition from the normal, unsanitary condition of Egyptian buildings to a state more suitable and healthy. The hospitals at Cairo, Abbassiyeh, and Ramleh, Alexandria, suitable to the wants of the sick, no overcrowding; the water filtered before distribution, and the dry-earth system of conservancy in use throughout the command. Regular bathing parades and clothing of grey serge for the summer months; rations and cooking satisfactory; average annual strength, 7,897; admissions, 8,995; deaths, 275; constantly sick, 600·74; an annual ratio per 1,000 of 1,139·0, 34·82, and 76·07 respectively. Epidemic cholera broke out at Damietta on 22nd of June. The first case occurred amongst the troops on 21st of July, causing 183 admissions and 139 deaths; percentage of deaths to attacks, 75·95. The prevailing diseases in the command were enteric and other continued fevers, cholera, dysentery, diarrhœa, venereal.

1884.—Average strength, 6,468; admissions, 8,190; deaths, 75; constantly sick, 497·68; ratios per 1,000 of 1,266·2, 11·59, and 76·85. These ratios were influenced somewhat by the Eastern Soudan Expeditionary Force in the early part of the year, and the commencement of the Nile Expedition later. The same classes of disease prevailed.

1882 to 1889—Egyptian Command	Admissions	Deaths	Invalids
Principal Diseases.			
I.—General Diseases.—Febrile Group.			
Eruptive fevers — Small-pox	221	24	—
Eruptive fevers — Other	92	1	—
Continued „ — Enteric	2,480	704	619
Continued „ — Other	9,830	9	212
Yellow fever	—	—	—
Paroxysmal	1,270	18	34
Cholera	183	139	—
Dysentery	3,348	131	271
Constitutional Group.			
Rheumatism	1,428	5	92
Primary Venereal Ulcers	8,058	—	13
Secondary Syphilis	1,351	—	86
Phthisis Pulmonalis	256	29	154
Scurvy and Purpura	12	—	1
II.—Local Diseases.			
Nervous System	573	18	203
Eye	4,149	—	51
Other Organs of Special Sense	604	—	40
Circulatory System	704	12	257
Absorbent	1,264	2	46
Ductless Glands	13	—	—
Respiratory System	1,931	56	83
Digestive	12,044	74	211
Urinary System, Gonorrhœa	4,758	—	—
Generative System	1,251	1	39
Organs of Locomotion	354	—	41
Cellular Tissue	1,379	—	24
Cutaneous System	2,084	—	22
III.—Debility	3,017	6	788
IV.—Poisons (Alcohol chiefly)	243	12	1
V.—Injuries			
General	415	85	30
Local	4,360	53	65
In action	399	19	77
No appreciable disease	125	—	—

Air Temperatures, 1888.

Month	Maximum	Minimum	Mean
January	75·0	36·3	48·5
February	75·0	43·1	59·7
March	106·1	40·6	67·7
April	97·0	48·7	70·5
May	101·4	54·5	73·8
June	103·4	58·1	81·2
July	111·7	65·8	88·0
August	104·5	64·5	84·1
September	97·8	60·6	78·8
October	107·7	56·3	77·0
November	84·9	42·4	62·7
December	76·4	41·9	55·5
Mean	95·1	51·1	70·6

1885.—The average annual strength rose to 9,593, the admissions to hospital to 14,601. There were 278 deaths, and 769·71 were constantly sick. Ratios per 1,000 of admissions, 1,522·0; deaths, 28·98; and constantly inefficient through sickness, 80·23. There were in Lower Egypt 8,013, on the frontier 1,115, at Suakim 465. The ratios of sickness and mortality were all very high, particularly those of the troops at Suakim, where sunstroke and heat exhaustion and enteric fever were the chief diseases. On the frontier the principal diseases were fevers, including many of enteric, dysentery, and diarrhœa. In Lower Egypt the same, with venereal affections. Most of the men had gone through a most arduous campaign, and those who returned from Suakim took a long time to get over the effects of climate experienced there. On the frontier the highest ratios of admissions and mortality were in the 1st Yorkshire Regiment—1,684·5 and 57·14 per 1,000; the lowest in the 1st Royal West Kent—945·3 admissions. At Suakim the 1st Shropshire Regiment had a ratio of admissions 2,461·8, and mortality of 96·15!

Annual Ratios per 1,000 at the three Stations.

	Admissions	Deaths	Constantly sick
Lower Egypt -	1,499·6	20·72	81·35
Frontier Field Force -	1,339·0	28·70	69·85
Suakim - -	2,346·2	88·17	86·82
Average - -	1,522·0	24·91	80·23

1886.—Active operations closed on the 22nd January. The average annual strength was 11,062; admissions, 14,070; deaths, 408; invalided, 928. The following table shows the composition, stations, and admissions per 1,000. Average constantly sick, Lower Egypt, 601·38; on the frontier, 205·30; at Suakim, 13·86; total, 820·54:—

Ratios per 1,000.

	Admissions	Deaths	Invalids sent Home	Constantly sick
Lower Egypt -	1,335·7	19·73	83·08	81·84
Frontier -	1,161·2	70·51		58·60
Suakim -	886·2	23·70	128·00	65·69
Average -	1,271·9	36·88	83·89	74·17

Of the invalids sent home only 24·40 were finally discharged the service. The principal feature was, that while the admission ratio had declined 250·1 per 1,000, and constant inefficiency through sickness 6·06, the mortality ratio had increased by 7·90, and of 10·67 as compared with the three previous years. The average sick time to each soldier was 27·07 days, and the average duration of each case of sickness 21·28 days. The rate of constant inefficiency was highest in the artillery, next in the infantry, then in the cavalry, engineers, and departmental corps. In the infantry the regiment showing the highest ratio of admissions per 1,000 was the 1st Dorsetshire—1,758·5, and of deaths 157·17. With regard to the influence of age and service in the command, the ratio per 1,000 of admissions among men under 20 was 996·8; 20 and 25, 1,489·1; between 25 and 30 years, 1,142·6; declined to 733·7 in the next five years, and to 709·3 over that age. Among the men under one year's service in the command the admission rate was 1,554·7 per 1,000; in second year, 1,464·1; in third, 699·6; in fourth year, 683·0. The death-rate in the first year in the command 37·27 per 1,000; in the second, 48·78; in the third, 30·71; and in the fourth, 12·79.

1887.—The average strength had now fallen to 5,272. The stations occupied were Cairo, Abbassiyeh, Alexandria, and, for a short time, Assiout; in Upper Egypt Assouan, where, at the commencement of the year, the garrison was 1,994, reduced in March to 842, and in June to 91. By December the troops in Egypt were further reduced to 4,440. At the beginning of the year the garrison consisted of the 20th Hussars, 1 battery R.H.A., 5 batteries of garrison artillery, Royal Engineers, 8 battalions of infantry, some mounted infantry, detachments, departmental corps,

and garrison staff; 1 horse and 4 garrison batteries were withdrawn, and five battalions of infantry. There were 5,821 admissions to hospital, 81 deaths, 141 invalids, and 91 finally discharged the service; average daily sick, 365·19.

Ratios per 1,000.

	Admissions	Deaths	Invalided	Average Constantly sick
Lower Egypt -	1,129·3	14·09	26·74	71·56
Assouan - -	831·5	26·96		44·45

In Lower Egypt the admission rate had decreased by 206·4 per 1,000, the mortality by 5·64, and the rate of constant inefficiency through sickness by 10·28, and on the frontier by 329·7, 43·55, and 14·15 respectively, attributed to "the more careful selection of the men, none being allowed to serve there in the hot weather who were under 22 years of age, and to their being relieved every six weeks during that season."

Among the corps which served the whole year in the command the highest rate of admissions—1,674·0 per 1,000—occurred in the 1st Battalion Welsh Regiment, and the greatest amount of inefficiency through sickness, which reached 92·25 per 1,000. The lowest ratio was 57·61 in the 20th Hussars, which had no mortality.

Comparative Statistics, Principal Stations, 1883–84.

	Admissions		Deaths		Constantly Sick	
	1883	1884	1883	1884	1883	1884
Cairo -	1068·3	1259·7	19·25	8·38	65·17	68·88
Abbassiyeh -	1046·9	1271·8	19·72	6·90	63·08	73·98
Alexandria -	1401·4	1219·6	26·44	18·71	97·83	93·59

In 1883, some patients were transferred from Cairo and Abbassiyeh to Ramleh, Alexandria, for change of air; but, although possessing a milder but damper climate, the change did not prove of any material advantage.

The first of our later campaigns in Egypt, under General Viscount Wolseley, commenced on July 17th, 1882, and terminated on October 12th. In less than two months Arabi's rebellion was suppressed, his troops defeated or captured, and order restored.

Average Strength of Troops	Admissions	Deaths	Invalids	Annual Ratio per 1,000		
				Admissions	Deaths	Invaliding
13,013	7,590	232	2,321	2,504·9	76·57	766·01

Of the 172 deaths, 74 were from disease, 5 from accident, and 93 killed in action or died of their wounds. Continued fevers accounted for 956 admissions, conjunctivitis and tarsal ophthalmia, 1,139, and diseases of the digestive system 2,725. These were the main causes of inefficiency. There were only 77 cases of ague, 1 of erysipelas and pyæmia, 127 of rheumatism (103 of the acute form), 313 admissions for syphilis, 71 for phthisis, 171 for sunstroke, with but 3 deaths; 1·4 and 1·8 per 1,000 admissions for circulatory and respiratory diseases. Among the diseases of the digestive system dysentery accounted for 698, and 21 deaths (2·2 per cent. of deaths to cases treated), diarrhœa 1,791, and 8 deaths due to the continued effects of great heat, change of temperature, bad and polluted water, indifferent rations, and the great amount of fatigue and exposure undergone. There were 446 admissions for debility, the great majority being invalided. Injuries received in action caused 378 admissions, a ratio of 29 per 1,000; 7·15 per 1,000 died, 256 were invalided, and 111 returned to duty. The wounds were treated antiseptically, and there was a total absence of infective wound disease.

Five hundred and forty-one officers served in the campaign; 253 were admitted to hospital, 467·6 per 1,000, and 4 died; 192 were invalided. This small battalion thus gave the following ratios per 1,000:—

	Admissions	Deaths	Invalided
Officers . .	467·6	7·39	354·89
N. C. Officers and Men	583·3	13·21	178·36

Their principal diseases were fevers and sunstroke, 30 of the latter, or 55·4 per 1,000, as compared with 13·1 per 1,000 among the non-commissioned officers and men. They, on the other hand, had only 4 admissions for eye affections, probably owing to greater care and attention to cleanliness. 52, or 96·1 per 1,000 of the officers were invalided, as against 29·0 per 1,000 non-commissioned officers and men.

Of 378 wounds received in action, 113 were of the lower extremities, 99 of the upper, and 22 of the head; 11 primary and 36 secondary amputations were performed—total 47; 9 of these died.

In the expeditionary force then in the field enteric fever gave 118 admissions and 27 deaths, attributed to the very impure water at Ramleh, Alexandria, where it at first commenced, and at Cairo chiefly to insanitary conditions, indifferent water and rations, and

the recent exposure and fatigue. There was an entire absence of small-pox.

Between the 26th of September, 1882, and 1st of January, 1883, 2 officers and 85 non-commissioned officers and men were admitted to the Royal Victoria Hospital at Netley with enteric fever contracted in Egypt. In 58 dysentery or diarrhœa had preceded the symptoms of the disease, often by several weeks. In 10 chest affections, pneumonia, bronchitis, pleurisy occurred in the course of the fever. In no case did the malarial type of the fever present itself. The disease was in all its essential features the same as observed in Europe. Maximal temperature 106°; in 31 cases 104°; in 37, from 103° to 103·4°; 59 were between 20 and 25; 22 between 25 and 30 years of age. There were only 5 deaths. The treatment consisted briefly in rest, quiet, fluid nourishment in regulated quantity at proper intervals, the occasional administration of quinine when the temperature was high and persistent, opium and bismuth when the diarrhœa was excessive, and turpentine to combat excessive tympanites, and a rather more free administration of stimulants for obvious reasons.

At Cairo the troops suffered most from continued fever, prevalent at all times, caused by exposure to the sun, bad water, unwholesome food, and bad liquor. Towards the end of October enteric prevailed in an epidemic form, was of a severe type, in many cases proving fatal in five or six days, becoming less severe, with a large proportion of recoveries in November and December. The diarrhœa was invariably attended with bilious derangement and dyspeptic symptoms. In all the enteric cases the convalescence was slow, owing to impaired vitality, resulting from hard service in the field. In November and December, when the weather became cold, there were many admissions for jaundice, due to hepatic congestion, and few of the ophthalmic cases passed beyond the stage of conjunctivitis. They were treated in marquees under the shade of trees, and did admirably. Venereal became prevalent soon after the troops settled down. The troops generally wore European summer clothing.

The usual field ration—viz., meat, 1 lb.; bread, $1\frac{1}{4}$ lb.; fresh vegetables, $\frac{1}{2}$ lb.; tea, $\frac{1}{6}$ oz.; coffee, $\frac{1}{3}$ oz.; sugar, 2 oz.; salt, $\frac{1}{2}$ oz.; pepper, $\frac{1}{36}$ oz.—was at first issued; next a modified ration—meat, 1 lb.; bread, 12 oz.; Erbswurst, 1 tin; rice, 4 oz,; potatoes, 8 oz.; vegetables, 4 oz.; tea, $\frac{1}{2}$ oz.; coffee, $\frac{1}{3}$ oz.; sugar, $2\frac{1}{4}$ oz.; lime juice, $\frac{1}{2}$ oz.; salt, $\frac{1}{2}$ oz.; pepper, $\frac{1}{36}$ oz.; $1\frac{1}{4}$ lb. meat, when

Erbswurst was not issued. Finally, after active operations ceased, the occupation ration—less complicated :—Fresh meat, 1 lb.; bread, 1 lb.; rice, 2 oz.; potatoes, 12 oz.; vegetables, 4 oz.; pepper, $\frac{1}{36}$ oz.; salt, $\frac{1}{2}$ oz.; tea, $\frac{1}{8}$ oz.; coffee, $\frac{1}{3}$ oz.; sugar, $2\frac{1}{4}$ oz.

The following were the sanitary precautions recommended :—

1. Before marching in morning, hot tea, with bread or biscuit, to be served.

2. When unusual exertion demanded, a tin of Kopf's Erbswurst between two men.

3. Tea in water bottles for use during the march.

4. On line of march, open order. Coat and shirt to be opened to give free play to chest.

5. Head to be protected always by helmet; abdomen by kummerbund; spine by cotton pad. Clothes not to be thrown off after a march.

6. When practicable to sleep under cover.

7. Eyes to be frequently bathed in clean water.

8. Each man to use his own towel only, and wash it daily.

9. Goggles to be worn in the bright sun.

10. Stagnant, tainted water, unripe fruit, underdone vegetables, underdone meat, and internal organs of animals to be avoided.

11. Before marching, feet to be wiped dry, rubbed with soap, and boots then put on. Stockings to be frequently washed; also feet at end of march; blisters to be opened only at end of march by passing a needle through the skin at the edge.

12. Spirits to be issued on recommendation of principal medical officer.

13. Driest ground available to be selected for encamping upon.

14. If preserved vegetables alone procurable, lime-juice to be given invariably with them.

15. Every hospital to have a tent or building for reception of clothes, dirty flannel; filthy clothes to be picked out and properly treated.

16. In transports, kits and clothes to be stowed away after being thoroughly fumigated; directly sick land, to be thoroughly washed, scraped, walls and roofs lime-washed, and between decks constantly fumigated.

17. Principle of separation to be adopted; wounded on one deck, fever on another, &c. If weather permit, sick and wounded to be treated under awnings upon upper deck.

18. Men discharged convalescent from the hospital to be sent on a short sea trip.

Between February 15th and April 6th, 1884, a force under Sir Gerald Graham, largely augmented from Egypt, was operating in the Eastern Soudan for the relief of Tokar, with its base at Suakim. Average strength, 4,018; admitted to hospital, 512: killed in action, 126; rate per 1,000 admissions, 127·42; deaths, 31·36. The prevailing admissions were—Continued fevers, 39; primary syphilis, 35; diseases of the digestive system, 67; rheumatism, 11; nervous system, 11; respiratory, 12; cellular tissue, 14; cutaneous, 23; debility, 10; local injuries, 43. Severe actions were fought at Bir-el-Teb and Tamaai. A second expedition was despatched in 1885, operating there from March 1st to May 14th. Average strength, 7,235; admissions, 2,146; deaths, 104 (including 47 killed in action); rates per 1,000, 296·6 and 14·37. There were 99 wounded in action, 13·7 per 1,000, with 6·50 per 1,000 deaths. The principal diseases were enteric, 88, and 11 deaths; other continued fevers, 129; paroxysmal fever, 38; rheumatism, 78; primary syphilis, 181; secondary, 41; diseases of nervous system, 226; eye, 49; absorbent, 31; respiratory, 31; digestive, 622; gonorrhœa, 59; cellular tissue, 58; cutaneous, 83.

During the months of March and April the health of the troops was exceptionally good, with only 4·3 per cent. of sick. In the early part of the campaign the most prevalent diseases were diarrhœa, sun fever, and nervous exhaustion. A large number of venereal cases were developed on the voyage out. On March 4th, the sick in hospital numbered 1 officer and 107 men, rising gradually to 27 and 604 on May 11th. 39 officers and 418 men were invalided to England; 1 officer and 169 to Suez, where, during both expeditions, a base hospital was organised for 200 sick. Total killed, 5 officers and 49 men; wounded, 5 officers and 116 men; missing, 1 officer and 40 men. An Australian and Indian contingent assisted—6,500 followers accompanied the latter. In the Indian hospital, 82 Europeans, 669 natives of India, and 133 Arabs were treated; and, as "out-patients," 1,042 natives of India, 72 Europeans, and 116 Arabs. Prevailing diseases—Ague, primary syphilis, dysentery, ulcers, abscess, bronchitis, rheumatism, pneumonia, diarrhœa, conjunctivitis.

The large amount of ague and dysentery amongst the natives of India, as compared with other diseases, was attributed to the porous soil rendered dry and moist by the flow and ebb of the tide, the same impregnated with human fæces and camel urine, an occasional rain moistening the air or filthy dust, or a breeze bringing the poisonous germs of decomposition from dead animals to the camp. The percentage of deaths was—For Arabs, 1·39; Europeans treated, 6·8; natives of India, 1·7. 6 Europeans, 33 Arabs, and 212 natives of India were invalided.

Average Days in Hospital and Admissions per 1,000 *of Strength—Indian Contingent.*

	Europeans	Arabs	Natives of India
Average days in Hospital -	10·06	13·35	13·21
Average admissions to Hospital -	286·20	160·31	106·36

While these military operations were being carried on in the Eastern Soudan, the Nile Expeditionary Force for the relief of General Gordon was being organised and pushed forwards towards Khartoum from March 18, 1884, to July 31, 1885, when the last detachment not forming the permanent garrison of the Soudan reached Wady-Halfa. In September, 1884, Lord Wolseley and Staff proceeded up the river, at which date Assiout, Assouan, and Wady-Halfa was already in occupation of an advance party. The medical arrangements were under the supervision of Surgeon-General John O'Nial, C.B., Principal Medical Officer. Along this historic Valley of the Nile many ancient armies had proceeded in the vain attempt to penetrate into Ethiopia and the Lybian desert. B.C. 594, Battus III., of Cyrenaica, supported by some auxiliary Greeks, extended his conquests in this direction, but failed to drive the inhabitants from their native country. The Persians under Cambyses were buried in great numbers under the whirlwinds of sand—the terror of travellers—and suffered such unspeakable hardships from hunger and thirst that they were obliged to return. B.C. 336, Alexander entering Egypt from Palestine *viâ* Gaza and Pelusium, finally marched to Memphis, but did not himself attempt to penetrate these inhospitable deserts. It remained to his lieutenant, Appollonidas, to march from Memphis to Elephantine, and master the whole valley below the Cataracts. A.D. 68, the Roman General, Ælius Gallus, marched into Ethiopia with an army of 10,000 men from Pselcis across the desert to Premis, 250 miles on the northerly bend of the river, made himself master of the capital, Napata, but did not attempt to hold the country, contenting himself with leaving a

garrison at Syene or Assouan to stop the Ethiopians entering Egypt, the Roman territory ending at Hiera, 12 schoeni, or 70 miles beyond where, later in the reign of Domitian, the poet Juvenal commanded 3 cohorts at Syene, Philæ, and Elephantine. Of the then normal garrison of 2 legions in Egypt, 4 in Syria, under Muciamus, and 3 under Vespasian carrying on the memorable war against the Jews, the power of Rome was felt 100 miles beyond Assouan only. The last serious expedition of the Romans to the frontier (A.D. 300), under Diocletian, found the revenues of Ethiopia less than the cost of the troops required to collect them. No serious attempt was made to penetrate these regions by Europeans until Dessaix, ordered by Napoleon to follow the army of Murad Bey into Upper Egypt, set out on 26th of August, 1800, with his division of 3,500 men on his toilsome march to Assouan, arriving at Elephantine after numerous delays on February 4th, beyond which he did not attempt to extend his journey—his troops exhausted by fatigue, almost without provisions or ammunition, their clothes worn, and themselves almost blinded by ophthalmia, without medicines or instruments, and harassed by a hostile population. Just three-quarters of a century later, an estimated strength of British soldiers, 10,771—composed of 3 camel corps, 19th and 20th Hussars, R. A., R. E., 9 battalions of infantry and detachments of Transport, Mounted Infantry, C. and T. Corps, O. S. Corps, M. S. Corps—accomplished a journey which no European troops have hitherto performed.

Of the foregoing, the 1st Yorks at Assouan; the Cameronian Highlanders, at Korosko; and detachment 2nd Essex, at Assiout, formed the permanent garrison of these places. The expedition ultimately extended from Merawi to Cairo, a distance of 1,700 miles by river. 8,953 men were admitted to hospital, 557 died, and 630 were invalided, giving the following ratio per 1,000 of strength:—

Admissions	Deaths	Invalids
831·21	51·71	58·49

Of the deaths, 389 were due to disease, 38 to accident, 84 were killed in action, and 42 died of their wounds. The principal diseases were as below:—

	Admissions	Deaths	Invalids
Febrile Group -	2,514	288	108
Constitutional -	783	4	28
Digestive - -	2,402	72	165

Average Strength, Admissions, Deaths, and Invaliding—Nile Expeditionary Force—March 18*th*, 1884, *to July* 31*st*, 1885.

NON-COMMISSIONED OFFICERS AND PRIVATES.

—	Admitted	Died	Invalided
Class I.—General Diseases.—Febrile Group.			
Small-pox	41	5	—
Other Eruptive Fevers	6	0	—
Enteric	760	277	63
Simple Continued	1,635	6	40
Paroxysmal	40	—	5
Other Diseases	11	—	—
Constitutional Group.			
Rheumatism	160	—	10
Primary Syphilis	429	—	—
Secondary "	164	—	8
Tubercular Diseases	21	4	7
Scurvy and Purpura	8	—	2
Other Diseases	1	—	1
Class II.—Local Diseases—			
Nervous System	143	15	22
Eye	511	—	7
Ear	41	—	3
Nose	—	—	—
Circulatory	50	1	19
Absorbent	45	—	1
Ductless Glands	—	—	—
Respiratory System	196	9	8
Digestive	2,420	72	165
Urinary { Gonorrhœa	197	—	—
Urinary { Sequelæ of	57	—	—
Urinary { Other Diseases	39	—	—
Generative System	60	—	—
Organs of Locomotion	43	—	3
Cellular Tissue	387	—	8
Cutaneous System	367	—	6
Class III.—Debility	464	—	170
Class IV.—Poisons	10	1	—
Class V.—General Injuries	—	37	—
Local	384	2	8
In action	241	126	74
No Appreciable Disease	19	—	—
General total	8,953	557	630

Average strength, 10,771; admitted, 8,953; died, 557; invalided, 630. Ratio per 1,000, 831·2, 51·71, 58·49. Officers—

average strength, 600; admitted, 514; died, 41; invalided, 105. Ratio per 1,000, 836·6, 68·33 and 175·0—all in excess of the non-commissioned officers and men.

The boats built for the expedition were of an average weight of 1,000 lbs. They each contained a crew of 12 men, and 150 days' supplies. The "stern wheelers" had a towing power of 20 tons; speed, 8 or 9 knots; carrying tonnage, 25 to 40 tons. The ordinary nugger, the great cargo boat chiefly used above the second cataract, carried about 20 tons. In the management of these the Dongolese were especially expert. The following liberal ration was issued to each man on the Nile boats:—

Preserved Corned Meat	- 1 lb., 4 days out of 6
Fresh - -	- 1 lb., 1 day out of 6
Boiled Tinned Mutton	- 1 lb., 1 day out of 6
Bacon - -	- 1 lb., 1 day out of 6
Cheese - -	- $\frac{3}{4}$ oz.
Biscuit, Navy -	- 1 lb., 5 days out of 6
Flour - -	- 1 lb., 1 day out of 6
Pickles - -	- $\frac{1}{2}$ oz., 4 days out of 6
Jam or Marmalade -	- $1\frac{1}{3}$ oz., 1 day out of 6
Tea - -	- 1 oz.
Sugar - -	- 3 oz.
Salt - -	- $\frac{1}{4}$ oz.
Preserved Vegetables	- 1 oz.
Lime-juice - -	- $\frac{1}{320}$ gallon
Erbswurst - -	- 1 ration every third day
Cocoa and Milk -	- Extra for occasional use
Vinegar - -	- $\frac{1}{1280}$ gallon
Rice - -	- $\frac{1}{2}$ oz.
Oatmeal - -	- $\frac{1}{2}$ oz.
Pepper - -	- $\frac{1}{36}$ oz.

Tobacco on payment at 1s. 4d. lb.; common soap, on payment $\frac{1}{2}$d. a piece.

The field hospital supply case contained—3 bottles of brandy, 2 bottles port wine, 12 4-oz. tins Liebig's extractum carnis, 2 lbs. mustard in tins, 1 lb. yellow soap in tins, 1 lb. candles in tins, 1 tin alum, 2 lb. arrowroot, $\frac{1}{4}$ lb. salt in tin box, 4 tins condensed milk, 2 boxes safety matches, $\frac{1}{2}$ lb. compressed tea, 1 corkscrew, 1 opening knife, 1 bottle of permanganate.

In the stationary camps the following scale of rations was issued to the troops:—

Fresh beef with bone, 6 days a week - -	20 oz.
Tinned beef, 1 day a week - - -	16 oz.
Bread, daily - - - - -	20 oz.
Potatoes, daily - - - - -	16 oz.
Salt, daily - - - - -	$\frac{1}{2}$ oz.
Coffee - - - - - -	$\frac{1}{3}$ oz.
Lime-juice, daily - - - -	$\frac{1}{2}$ oz. to 1 oz.
Pepper, daily - - - - -	$\frac{1}{36}$ oz.
Wood, daily - - - - -	3 lbs.
Rum, when recommended - - -	$2\frac{1}{2}$ oz.
Sugar, daily - - - - -	$2\frac{1}{2}$ oz.
Tea, daily - - - - -	$\frac{1}{3}$ oz.

Notwithstanding this liberal scale of diet, the men bought large quantities of biscuit in the canteens. The sale of liquors was prohibited, and beer was too expensive to buy. The troops lived in double mountain Indian service tents, six men in each. The latrines were the usual field trenches to leeward. Water was obtained from the Nile; but, owing to the scarcity of fuel, could not be boiled. From June to September, during the rise of the river, it was turbid, and when filtered of its coarse impurities still contained a considerable amount of chlorides, and both lime and magnesia carbonates. The water was pumped from mid-stream by means of a tube suspended from an anchored buoy, and afterwards passed through native zeers, through which the water oozed, and on the large surface was thoroughly exposed to the action of the air. In this way the muddiest water became perfectly clarified, but was exposed to dust containing or not morbific germs.

All non-commissioned officers and men were specially examined as to their fitness for service in Upper Egypt 48 hours before departure, and all under 20 years of age were excluded. Each was supplied with 1 pair of goggles, 1 helmet curtain, 1 gauze veil, 1 back pad, 1 clasp knife and lanyard, 1 skin hand-guard for rifle, 2 blankets, 1 pair of putties, 1 woollen night-cap, a seaman's thick blue knitted jersey, 2 cholera belts, a waterproof sheet. The following articles of clothing and equipment being taken on the person—viz., 1 khakee, or serge frock; 1 khakee, or serge trousers; 1 flannel shirt, 1 pair of boots, 1 flannel belt, 1 pair of socks, 1 pair of braces, 1 helmet, 20 rounds of ball ammunition, haversack,

water bottle, mess tin. In valise—1 flannel shirt, 1 flannel belt, 2 pair boot-laces, 1 hold-all, complete; 2 pair of socks, 1 towel, 1 pocket ledger, 1 pair boots, 1 piece of soap, 1 brush, 1 box grease, 1 housewife, 1 new first field dressing, 1 oil bottle, 1 Glengarry cap, 1 great coat. A reserve of these articles were carried regimentally. Some of the regiments slept in the open in the desert with their clothes and accoutrements on, and were exceptionally healthy. The duties, when not on the march, were those of fatigue and building forts and barracks of large blocks of dried mud taken from native huts.

The prevailing wind was almost due north, and blew with great force almost unremittingly during the year. It was extremely dry and, as a rule, cold, with a high degree of electric tension. The desert was almost entirely devoid of vegetation, except a few prickly acacias and tamarisk bushes at the bottom of the wadys, or old dry water-courses. On the elevated strip on the river bank the vegetable products consisted of dates, dhurra wheat, peas, beans, lubin, a few pumpkins, fringed here and there with date palms. This strip of cultivation, when present, averaged about 200 yards in width, the land consisting of recent Nile deposit. The hills were composed of alluvial deposit, mixed with the *debris* of basalt, quartz, Nubian sandstone, fresh water shells, plants, &c. Some fossilised remains of the elephant and hippopotamus were found. The temperature was extremely variable. During the summer, 120° Fahr. in the shade was not uncommon; but the nights were almost invariably cool. Besides the diurnal changes, the temperature varied greatly during each month. Intermittent fever was unknown. Conjunctivitis was the most common complaint amongst the natives.

1. Cairo to Assiout, 254 miles by rail.
2. Assiout to Assouan, 344 miles by river steamer or steamer towing barges.
3. Assouan to Philæ, 9 miles round cataract by train.
4. Philæ to Wady Halfa, 240 miles by river, by small steamers towing boats.
5. Wady Halfa to Dongola, 202 miles by boats, sailing or rowing, by river and by canals. Between Wady Halfa and Dongola stretches of river, broken by cataracts and rapids, impassable except at "High Nile."
6. Dongola to Ambugol, 100 miles.
7. Ambugol to Shendy, 100 miles across desert.

During the long line of 1,700 miles the stations at which medical and surgical aid was provided were Dal, Abri, Kaiban, Shaban, Abu-Fatmeh, Dongola, Handuck, Abu-gus, Debbeh, Kurot, Tani, El Gubet, or Metemneh, Gakdool, Abu-Klea, El Howyieat (desert post), Korti, Merawi, Akasheh, Ambigole, Semneh, Sarras, Wady Halfa, Korosko, Shelal, Assouan, Assiout, Cairo, with disembarking bases at Suez and Alexandria, where was the Nile reserve depot for equipping all drafts and receiving weakly men unfit to proceed. All invalids were sent to the citadel hospital, Cairo, in the first instance. All convoys of sick, numbering 20 or more men, never had less than 2 non-commissioned officers with them, the medical officer classing the invalids into "helpless" and "helpful," the former being placed in special charge of hospital orderlies.

In water transport of invalids, two classes of boats were employed—the large flat-bottomed nuggers and "whalers." Each of the former carried 25 sick, provided with bedsteads (charpoys), filters, cooking places, awnings, and other necessaries. They continued to run while the wind was favourable. The "whalers" or Nile boats carried six or seven "sitting-up cases," or two stretcher and two "sitting-up cases." Six Egyptians or Dongolese formed the crew, and there was a private M. S. C. in each boat to attend to serious cases. Before being placed in the boats in the early morning the party had tea, bread, cocoa, and milk; their kits, arms, accoutrements, and provisions went with them, all medical requisites and medical comforts. About one p.m. the convoy hauled up by the river bank, selecting a shady place; fires were lighted, and a warm meal prepared and issued, and patients and wounds attended to. They afterwards proceeded, and towards evening put up at a suitable rest camp, in which they passed the night. The serious cases were provided with lying-down accommodation, on stretchers made comfortable with air pillows, folded blankets, mattresses, bolsters, &c. Each boat was provided with an awning. On the return journey, when the regiments were marching, they did so along the river bank, beginning at sundown, halting about midnight, when hot cocoa and milk was served out. On reaching their new ground, early next morning, they rested there during the day. None but healthy men were allowed to march, and few fell out. Each party was accompanied by a medical officer, with field panniers or field companions. The hospitals ranged in accommodation, as a rule, from 20 to 200 beds, according to the requirements of each station, in E. P. tents,

accommodating 8 patients each, or huts of matting of dhurra straw, each 22 ft. × 16 ft. × 9 ft.; a door at either end, with a movable mat in front; roofs of double matting, in hot weather supplemented inside by blankets. Each hut held 10 to 12 sick; they were cool, clean well ventilated, and antiseptic. In all cases of small-pox there were some marks of vaccination. The percentage of deaths to cases treated in enteric cases was 36·44, as compared with 15 to 25 in civil life, but many cases of a mild type escaped under other denominations. The ages of the men attacked in 528 cases were as below:—

Under 20	20 to 24	25 to 29	30 to 34	35 to 39	40 and upwards
15	378	115	12	7	1

At Wady Halfa, where there were 178 admissions and 47 deaths, the medical officer reported—"The camps themselves are clean, but the ground is very foul in consequence of the Egyptians defecating all over the place." At Assouan, in December, the S. M. Officer wrote—"Water supply not good, as we are about 300 yards below the fort occupied by 200 Bashi-Bazouks, and numerous women and children. Foreshore in front of fort in a very unsanitary condition. The goats could not be milked at camp or hospital, and the milk had to be taken from the natives on their own terms; the liability to contamination was therefore great. The following was a typical *post-mortem* appearance in a bad case of the disease, as seen "Up Nile":—"Ulceration of Peyer's patches; lower part of small intestine inflamed and softened; mesenteric glands greatly enlarged; large intestine semi-gangrenous in parts; congestion of lungs; friable spleen." The high rate of mortality was attributed to many avoiding reporting sick in the early stage, in the keen desire to go forward when treatment was most likely to prove beneficial, frequent movement for military and unavoidable reasons, and the nervous exhaustion due to the heat conditions surrounding the patients, the temperature in the huts in which some were treated reaching to 112° Fahr. "It was not the enteric which killed them, it was the heat." The simple continued fevers were due mostly to solar exposure on days when there was an absence of wind, and consequently stagnation of air, especially in June; debility often followed. The comparative freedom from syphilis was partly due to absence of facilities for intercourse and drunkenness, and partly to careful inspection of the troops prior to proceeding "Up Nile."

From the beginning to the end of the campaign there were only

5 cases of scurvy—·46 per 1,000. A slight scorbutic taint was observed among the men at Kurot and Abu-Fatmeh, but promptly met by an increase in the lime-juice ration and additional vegetables. The blacks in Egypt are stated to be naturally predisposed to scurvy, and when some regiments had been stationed "Up Nile" for two years, where fresh vegetables were very scarce, it was not uncommon, the men first complaining of weakness and pain behind the knees and in the upper part of the calf. In the more severe cases in this class the disease manifested itself by great sponginess of the gums, which in some cases almost covered the teeth; swellings of the legs, ulcerations, &c. It invariably succumbed to treatment by lime-juice.

Sunstroke caused 64 admissions, 13 deaths, and 9 invalids—a small number considering the intense heat to which the men were exposed, with physical exhaustion and fatigue, and at times deficiency of water, often powerful predisposing causes, but counterbalanced by the healthy, out-door life, extreme dryness and purity of the air, and absence of intoxicating liquors.

Of 511 admissions for diseases of the eye, 486 were from conjunctivitis, and only 1 from purulent ophthalmia; 7 only were invalided. In the respiratory class the chief admissions were bronchitis, bronchial catarrh, pneumonia, and pleurisy. Dysentery and diarrhœa accounted for 923 admissions, and 911 among diseases of the digestive system. Of the former 60 died, as did also 5 from liver abscess. Much of the diarrhœa was attributed to chills, errors in diet, and impure water, and towards the end of the campaign to the too free use of fruits and tinned provisions when returning down river. Many cases of abscess of cellular tissue were caused by the severe manual labour employed in towing and rowing the boats in the river. General debility caused only 464 admissions. There were only 6 cases of *delirium tremens*, 4 of alcoholic poisoning, and 1 death. Thirty-seven deaths were due to drowning.

The admission rate for wounds equalled 22·4 per 1,000 in eight engagements. Of 241 wounded non-commissioned officers and men, 88 were wounds of the lower extremity, 66 of the upper, 22 of the head, 10 of the face, 10 of the neck, 12 of the chest, 19 of the back, and 4 of the abdomen. All the latter died. At Abu-Klea, January 17th, 1885, spear wounds accounted for half the total injuries. In all the other actions gunshot wounds prevailed. In the case of the spear wounds, the soft parts were usually

"horribly lacerated and deeply incised." As a rule the bony structure escaped and the main vessels. Some had to be covered with lint and bandages from head to foot, and took two hours to dress. When bones were extensively smashed, amputation was resorted to. All were dressed antiseptically, and where they fell. The spear wounds were dressed with carbolic, alternating with boracic acid. They required frequent dressing, but kept very sweet. In simple gunshot wounds the antiseptic dressings were not changed for days. In a case of amputation of the upper arm, dressed antiseptically, at the end of 14 days the patient was assisting in the wards of the hospital.

As a result of observation in the desert, it was thought that antiseptic dry dressings, wood-wool, &c., owing to their being absorbent, their warmth and the protection they afforded would be very serviceable in the field. In some of the amputation cases the flaps sloughed, due not to one but several causes—viz., severe collapse from the injury, great temperature variations—49° Fahr. at 5 a.m. to 91° Fahr. at noon—delay in operating owing to frequent movement, want of rest, arduous work, and use of tinned meats acting on the constitution, and when skin and skin flaps were much made use of. The flap method was employed in all operations, and hæmorrhage controlled by Esmarch's bandage, to the use of which some cases of sloughing of the flaps was attributed by one medical officer. The bleeding veins were secured by catgut ligatures, and chloroform given in all cases. Forty-three operations were performed, two secondary excisions, both of which terminated fatally. The pureness of the desert air aided greatly in the healing of wounds rapidly, and the patients' health improved quickly on removal from the camping grounds in the desert, which rapidly fouled from accumulation of large parties of men. The transport of the sick and wounded across the desert was effected by means of litters and cacolets fastened on camels and by stretchers carried by hand. The cacolets answered admirably. On reaching the Nile the patients were in some cases transported by water entirely to Cairo, or to Assiout, and thence in railway ambulance by land. The chief drawback to comfort was the intense heat.

Assouan was the first military station occupied by British troops on the Nile, situated on the right bank of the river, at the north end of the first cataract, 547 miles from Cairo. It had a population of about 4,000 inhabitants. The country is sandy and barren. On arrival at Assiout, the sick sent down by river steamer or barges were transferred to invalid railway carriages, which came alongside the wharf. The hospital accommodation in Lower Egypt was—at the Citadel, Cairo, 500 beds; Abbasiyeh, 300; Ramleh, Alexandria, 500; Suez, 200.

Between November 27th, 1885, and January 27th, 1886, the frontier was again the scene of a military expedition under the command of Lieutenant-General Stephenson, terminating in the action at Ginnis, on December 30th. The average strength was 254 officers, 5,875 non-commissioned officers and men. Admitted to hospital, officers, 33; died, 3; non-commissioned officers and men, 1,152, and 56; killed in action, 2; wounded, 43. The admissions were—enteric fever, 3; simple continued fever, 10; dysentery, 6; eye, 1; respiratory, 6; circulatory, 3; local injuries, 1; in action, 3. Non-commissioned officers and men—enteric fever, 95, and 17 deaths; simple continued fevers, 155; dysentery, 127, and 4 deaths; other general diseases, 5; venereal, 85; parasitic disease, 3; scurvy, 1; debility, 12; rheumatism, 21; tubercular disease, 1; other diseases, 2; nervous system, 11; eye, 52; other organs of special sense, 11; circulatory, 8; respiratory, 35; digestion, 184; lymphatic and glandular, 4; urinary, 1; generation, 10; organs of locomotion, 2; connective tissue, 33; skin, 64; general injuries, 2; local, 53; in action, 43. Total, 1,052 in two months.

Rates per 1,000.

	Admissions	Deaths
Officers - - - -	804·9	73·17
Non-commissioned officers and men	1,147·2	30·26

This force was formed into two infantry and 1 cavalry brigades, with the following hospitals from front to base at Assouan :—

With fighting line—		
Movable field hospital	- 50 beds	- Surgeon-Major.
Kosheh Fort	- 25 „	- Surgeon.
Akasheh -	- 25 „	- Surgeon.
Ambigole -	- 9 „	- Surgeon.
Sarras -	- 10 „	- Surgeon.
Station Hospital—		
Halfa - -	- 150 „	- Brigade Surgeon.
Korosko - -	- 100 „	- Surgeon Major.
Base Hospital—		
Assouan -	- 200 „	- Brigade Surgeon.

The movable field hospital was divisible into 2 sections of 25 beds each, and a medical officer with a pair of field panniers, field

companion, &c., were attached to each regiment. Between 30 and 40 patients could be evacuated from Akasheh on alternate days. The half bearer company which accompanied the cavalry and first brigade in pursuit of the enemy was constituted of 25 camels for sick—viz., 9 pairs of litters and 16 pairs of cacolets, and 21 camels for riding purposes for officers and men. 50 sick could be transported at one time. The sick were evacuated to Wady Halfa by bearer company from Abri to Kosheh, Kosheh to Sarkamatto by whale boats, Sarkamatto to Dal by cacolets, litters, stretchers, &c. They remained one night at Sarkamatto and one at Akasheh, and were transferred to Cairo. No sick requiring hospital diet or treatment for more than a few days were retained above Halfa.

Total Admissions and Deaths in the Five Egyptian Campaigns, 1882–87. *Aggregate Strength,* 41,174.

——	Admissions	Deaths
Eruptive Fevers	52	5
Continued	3,855	339
Paroxysmal	352	6
Other General Diseases . . .	21	0
Rheumatism	397	0
Primary Syphilis . . .	977	0
Secondary „	269	0
Tubercular Diseases . . .	41	4
Scurvy and Purpura . . .	11	0
Other Constitutional . . .	6	0
Nervous System	587	16
Eye	1,760	0
Ear	75	0
Circulatory	85	1
Absorbent	117	0
Respiratory	357	12
Digestive	6,203	108
Gonorrhœa	442	0
Sequelæ of do.	92	0
Other Urinary	67	0
Generative System . . .	115	0
Organs of Locomotion . . .	70	0
Cellular Tissue	612	0
Cutaneous System . . .	797	0
Debility	1,000	5
Poisons	15	1
General Injuries	42	42
Local	904	6
Wounded in Action . . .	959	401
No appreciable Disease . . .	22	0
Missing	0	42
General Total . .	20,099	983

NILE EXPEDITION, 1884-85.

Hospitals established on the line of communication and with fighting column:—

P. in O. Surgeon General

Total Field Inspectors, 4.

Sec. 1. Field Inspector	Assiout	12	beds.	
	Assouan	200	,,	dieted.
	Korosko	40	,,	
	Wady Halfa	500	,,	dieted.
Sec. 2. Field Inspector.	Gemai	50	,,	
	Sarras	25	,,	
	Semneh	25	,,	
	Ambuko	25	,,	
	Tanjar	25	,,	
	Akasheh	200	,,	
	Sarkamatto	75	,,	
	Abri	25	,,	
Sec. 3. Field Inspector	Absarat	25	,,	
	Kajbar	25	,,	
	Koyeh	25	,,	
	Abu Fatmeh	180	,,	dieted.
Sec. 4. Deputy-Surgeon-General.	Dongola	100	,,	
	Shabutuk	25	,,	
	Abu Gussi	50	,,	
	Kurot	200	,,	
	Debbeh	25	,,	
	Tani	200	,,	
	Korti	200	,,	dieted.

1,250 miles from Mediterranean.

River Column.		*Desert Column.*	
Abu Dom	25 beds, dieted.	El Howyieat	50 beds.
River Column	200 ,,	Gakdul Wells	75 ,,
		Abu Klea	50 ,,
		Gubat	75 ,,

Total Beds.—Flying column, 475; line of communications, 2,257. Total, 2,732.

Base Hospitals.—Citadal, Cairo, 500; Abbasseyeh, 300; Alexandria, 400.

Personnel of Field Hospital.—Medical officers, 4; staff sergeant, 1; sergeants, 4; corporals, 2; cooks, 2; privates, 31; batmen, 4; interpreter, 1. Total, 49.

Medical Staff, Egypt, Jan. 1885.—Surgeon-General; deputy surgeon-generals, 2; bridgade surgeons, 2; surgeon-majors, 36; surgeons, 77; quartermasters, 8; apothecary to the forces, 1. Total, 127; Up Nile, 103; Lower Egypt, 24.

Medical Staff Corps.—2 warrant officers; 576 N. C. officers and men.

Army Medical Staff Serving in Egypt, 1890:—Deputy-Surgeon-General, J. Jameson, M.D.; Brigade-Surgeon, A. A. Gore, M.D.; Surgeon-Majors, O. G. Wood, M.D., J. J. Greene, M.B.; Surgeons, H. J. Michael, H. O. Stuart, F. J. Morgan, A. O. C. Watson, M.B., E. W. Gray, M.B., D. Stiell, M.B., L. E. A. Salmon, J. Minniece, M.D., R. H. Penton; Quartermasters, T. O'Connor, Hon. Capt., T. Phillips, Hon. Lieut.; Nursing Sisters, S. Ireland, M. Russell, L. W. Tullok, M. J. Burke, C. H. Keer.

Medical Staff Corps:—Sergeant-Major, 1; Sergeants, 11; Corporals, 11; Privates, 56.

GENERAL SUMMARY.

DISEASES	Admissions: 10th Oct. to 31st Dec., '82	Admissions: 1882–85	Admissions: 1886–88	Admissions: 1889	Deaths: 10th Oct. to 31st Dec., '82	Deaths: 1882–85	Deaths: 1886–88	Deaths: 1889	Invalided: 1882–85	Invalided: 1886–88	Invalided: 1889	Constantly Sick: 10th Oct. to 31st Dec., '82	Constantly Sick: 1882–85	Constantly Sick: 1886–88	Constantly Sick: 1889
	Ratio per 1,000														
Eruptive Fever, Smallpox	·86	3·9	4·6	12·3	—	·31	·56	1·75	—	—	—	·03	·37	·41	1·52
Eruptive Fever, Other		·5	2·1	·3	—	·04	—	—	—	—	—	—	·03	·17	—
Continued, Enteric	638·82	34·3	50·1	40·5	43·64	7·47	15·44	4·08	12·85	15·70	6·12	29·80	4·84	7·53	7·01
Continued, Other		157·9	170·4	106·4		·09	—	—	7·07	2·95	1·17		7·34	6·55	4·30
Paroxysmal	62·02	23·4	14·9	1·2	3·16	·09	—	—	·76	·51	—	4·07	1·16	·74	·04
Cholera	—	8·1	—	—	—	6·18	—	—	—	—	—	—	·17	—	—
Rheumatism	32·73	34·9	23·6	19·5	—	—	·26	—	2·35	1·93	—	2·03	2·24	1·64	·95
Primary Syphilis	142·12	204·5	69·0	47·2	—	—	—	—	·67	·15	·29	6·84	14·93	5·48	3·91
Secondary "	12·34	31·3	25·9	23·9	—	—	—	—	2·89	·97	·58	·29	2·42	2·18	2·23
Tubercular Diseases	3·12	8·2	3·5	4·4	·58	·62	·71	·58	4·14	2·44	3·21	·15	1·08	·71	·88
Scurvy and Purpura	·29	·2	·2	—	—	—	—	—	·05	—	—	·05	·01	·01	—
Nervous	9·47	22·4	9·8	6·7	·29	1·16	·61	—	6·97	3·20	3·21	·59	1·72	·82	·55
Eye	178·29	50·1	57·2	39·6	—	—	—	—	1·73	1·02	·88	4·73	2·17	2·14	1·84
Ear	4·88	14·7	13·2	15·2	—	—	—	—	1·61	·66	·58	·14	·80	·64	·71
Nose	·29	·6	—	—	—	—	—	—	—	—	—	—	·02	—	—
Circulatory	9·76	18·1	14·8	15·7	·58	·27	·36	—	6·14	4·93	6·41	·34	1·61	1·50	1·32
Absorbent	13·21	18·4	23·9	23·0	—	—	—	—	1·21	·51	·29	·68	1·76	2·74	3·18
Respiratory	47·95	44·0	34·5	18·6	2·29	1·21	1·27	—	2·41	1·78	·87	2·22	2·91	2·52	1·27
Digestive	535·46	229·9	229·6	174·0	12·63	2·09	4·27	3·79	13·48	9·25	5·34	22·98	10·58	10·40	8·39
Gonorrhœa	37·32	98·1	96·9	104·7	—	—	—	—	—	·10	—	1·49	5·75	5·93	5·92
Generative	7·75	10·0	85·0	100·5	—	·05	—	—	·44	·30	—	·35	·63	5·51	6·34
Organs of Locomotion	6·02	7·1	6·2	5·8	—	—	—	—	1·29	·61	—	·34	·49	·44	·29
Cellular Tissue	17·23	26·8	26·2	22·1	—	—	—	—	·75	·25	·87	·77	1·26	1·26	1·01
Cutaneous	45·65	71·9	56·7	42·3	—	—	—	—	·72	·36	—	1·97	3·59	2·60	2·15
Debility	83·83	61·1	41·9	14·3	·58	·05	—	—	22·59	8·08	2·92	4·36	3·86	24·7	·97
Poisons	2·29	3·2	7·0	7·9	·29	·31	·25	·29	—	·05	—	·06	·11	·25	·27
General Injuries	·29	·1	4·2	1·5	1·15	·53	2·34	·88	—	·30	—	·02	—	·25	·08
Local "	46·81	87·2	91·7	88·6	1·72	1·21	1·17	·29	1·87	1·22	1·75	1·83	3·97	4·12	4·25
In Action	—	·4	—	—	—	·22	·10	—	3·06	·36	—	—	·89	·09	—
No Appreciable Disease	·86	2·4	3·5	—	—	—	—	—	—	—	·29	·01	·04	·12	·20
Other Diseases	13·25	25·0	18·3	19·3	—	·20	—	—	1·23	·50	1·07	·56	1·43	2·01	·88
Total,	1,952·91	1,298·7	1,184·9	955·5	66·91	22·10	27·34	11·66	96·28	58·13	35·85	86·70	78·18	71·23	60·46

HOW THEY WENT UP NILE,

AND RETURNED.

FROM GEMAI TO KORTI, 1884.

HOW THEY WENT UP NILE,

AND RETURNED.

FROM GEMAI TO KORTI, 1884.

On November 22nd there left Halfa for Gemai by train, at 7 a.m., 1 officer of the Medical Staff and 2 non-commissioned officers and 18 men of the M. S. Corps, who took over on arrival three whale-boats with their equipment. Shipped 13 cases of medical stores at Sarras, arriving about sunset. They had a Canadian voyageur in each boat, and two interpreters accompanied them.

23rd.—Shipped two complete sets of Nile boat stores and 15 days' ordinary rations, and started at 4 p.m.

26th.—After a very laborious journey, a great part up rapids, reached Semneh, unloaded, and, with the help of Dongola natives, portaged their stores.

27th.—The three boats having been hauled up Semneh Cataract, they started onward at 7 a.m.

29th.—Reached Ambigole Rapids.

December 4th.—Having got through two portages, started at 3 p.m.

9th.—Reached Tangier Cataract at 3 p.m. Hauled up, and again started at 1 40 p.m.

10th.—Reached Akasheh. The boats were hauled up the rapids, and they started for Dal about noon, reaching there at 6 p.m., after dark.

12th, 13th, and morning of 14th.—Occupied in portaging and getting the boats up the rapids. Their voyageurs were taken away here. Fewer rocks, but more sandy shoals. Left to their own resources.

22nd.—Reached Kaibar Cataract.

23rd.—Started again. The wind rather failed, and they had to resort to "tracking" and rowing.

27th.—Reached foot of Hannek Cataract. Sailed and rowed up unaided. At sunset got to Abu-Fatmeh.

28th.—Started for Dongola.

29th.—Arrived at 6 p.m. Two of the boats had dropped behind.

January 4th, 1885.—Reached Debbeh at 4 p.m. Made only half an hour's halt, and had to track incessantly, as the stream was strong and there was no wind. The heat was great, and they were much pestered by myriads of sand flies.

8th.—Arrived at Korti between 2 and 3 p.m., 1 month 17 days from Halfa. All the boats in good order, and all the stores landed in good condition after incessant labour, which lasted every day from daylight to dark. Six men in each boat. The other boats had an average crew of 12 men. Owing to a block of boats ahead, nearly nine days were consumed in passing Ambigole and Dal Cataracts. Were it not for this they would have reached Korti in 39 days.

With the River Column—Field Hospital.

They arrived at Abu Dom on January 10th, 1885. Materials of No. 2 Field Hospital were in a marquee. Leaving the marquees behind, and taking only the most necessary articles of the Field Hospital and a sufficient supply of medical comforts, left on 20th in 8 boats, with 5 officers and 42 non-commissioned officers and men of the Medical Staff Corps; the crews completed from 1st Gordon Highlanders to 8 oars, a coxswain, and a bowman; a section (one-eighth) of the reduced Field Hospital equipment in each boat, the P.M.O. following in a ninth with a reserve of medicine, surgical equipment, and some special comforts.

21st.—Arrived at Handab, and joined Major-General Earl's column, consisting of the following regiments:—1st South Staffords, 2nd D. C. Light Infantry, 1st Royal Highlanders, 1st Gordon Highlanders, a squadron of the 19th Hussars, one Egyptian Camel Battery, one Egyptian Camel Corps, detachment Commissariat and Transport Corps, &c.

24th.—Advanced up river, and tracked up cataracts and rapids day by day, sleeping in zerebas at night, always accoutred, using tents only for the sick, and that but seldom, the enemy falling back as they advanced, now and then exchanging a few shots with the advanced parties. Berti was evacuated, and the people deserted their villages and fled.

February 10th.—At last the enemy made a stand at Kirbekan, near Dulka Island. Prepared five camel loads of the most necessary equipment for a dressing station; obtained camels to carry water; the men stood by their stretchers, and pressed up as closely as possible to the attacking columns, prepared restoratives, and collected the wounded as rapidly as circumstances would permit into three groups, and afterwards removed them by stretcher parties to the bivouac opposite Dulka Island, where food was provided, dressings readjusted, and their wants generally attended to, accommodating them for the night on stretchers in boat tents. Carried them on from day to day in boats, sometimes landing them and placing them in tents, all having to work incessantly early in the morning and late at night in providing for their wants, both tedious and laborious when carried out in boats. Fresh meat rations were issued whenever obtainable.

24th.—Reached to within 22 miles of Abu Ahmed on the right bank, having crossed the river at Kebeh on the 21st. Here had orders for the column to return to Korti. The river had fallen some feet, and cataracts and rapids were more difficult to descend. On but one or two occasions had the sick to be removed from the boats and portaged. In the stern of each boat was stowed the heavy divisional boxes, medicines, field panniers, field companions, haversacks, &c.; amidships, boxes of provisions and medical comforts—foremost of these the Nile boat stores. The supplies proved ample while the column was in the field. The health of the troops was excellent.

Evacuation of the Dongola District.

Orders were received on May 12th, 1885, and the withdrawal commenced fifteen days afterwards, commencing at Merawi.

At Halfa.—Remained, one troop of 19th Hussars, half battery of Egyptian Artillery, the West Kent Regiment, one battalion of Egyptian Infantry, and the Black Egyptian troops from Abu Gus.

At Korosko.—One troop of 19th Hussars, the Egyptian Camel Corps, half battery of Egyptian Artillery, the Sussex Regiment, one battery of Egyptian Infantry, and Commander Baker's black troops.

At Assouan.—Remainder of 19th Hussars, one battery of Royal Artillery, the Essex Regiment, the Duke of Cornwall's Light Infantry, and two battalions of Egyptian Infantry.

At Cairo.—All other troops.

Arrangements were made on the line of communications for the establishment of rest camps with sun shelters, at intervals of about 10 to 12 miles along the river from Fatmeh to Railhead; also for 10 small hospitals, each with a *personnel* of 1 non-commissioned officer and 3 privates of the Medical Staff Corps; a pair of field panniers, a pair of divisional boxes, a field companion, and medical comforts sufficient for 8 to 10 weeks. There was thus a small hospital for every two marches for men who might get sunstroke, sun fever, or other serious ailments, preventing them being carried.

The troops proceeded from Fatmeh by march route, in parties about 300 strong, leaving Fatmeh at about the rate of 1,500 a week, nine half battalions included, each having a medical officer, pair of field panniers, field companion, two boxes of medical comforts, water, one camel with cacolets, and 12 donkeys for sick. Each medical officer had a camel for riding and one for panniers. The march commenced at 5 p.m.; there was a halt midway for tea, coffee, &c., and it terminated at 7 a.m. The first four regiments to go down were the Royal Highlanders, South Staffordshire, Gordon Highlanders, and Royal Irish.

Three hundred sick at Fatmeh were at once removed in anticipation, at the rate of about 30 a day—the largest number which could be sent across the desert from Akasheh to Railend.

Provision was made at Akasheh for 200 sick, and 100 at Dal. The medical stores at Tani were sent down in the "Lotus" to Fatmeh in the first instance. There was at this time 16 hospitals from Assiout to Merawi—those at Assouan, Wady-Halfa, Abu-Fatmeh, Kurot, and Tani, of very large size; and others of medium dimensions at Akasheh, Sarkamatto, Dongola, Shabadood, Abu-Dom, Abu-Gusi, and Kaibur. Absarat, Sarkamatto, and Akasheh, were the hospitals in the line of march where sick might be left.

Halfa, Korosko, and Assouan were to be the future frontier posts.

At Halfa were left 1 brigade-surgeon, 1 surgeon-major, 3 surgeons, and 19 men of the Medical Staff Corps, and 100 beds.

At Korosko, 1 surgeon-major, 3 surgeons, and 19 men of the Medical Staff Corps, and 100 beds.

At Assouan, 1 deputy surgeon-general, P.M.O., 1 brigade-surgeon, 1 surgeon-major, 4 surgeons, 1 quarter-master, and 37 men of the Medical Staff Corps, and 200 beds.

Deputy Surgeon-General Lithgow, C.B., D.S.O., was P.M.O.; Brigade-Surgeon Archer at Halfa, and Brigade-Surgeon Ramsbotham at Assouan, senior medical officers.

Later an hospital was opened at Sarkahmatto and Abri, each of 25 beds, for the returning troops. Few men fell out, and those from blistered feet and chafes. No case of sunstroke occurred.

E

Boat Service for Conveying 30 Sick from Abu-Fatmeh to Sarras, 1 medical officer, 1 non-commissioned officer, and 3 privates of the Medical Staff Corps with each. One-third of Sick to be carried, two-thirds to ride or walk over short portages; 4 bearers to each stretcher.

Name of Stopping Place	Distance in miles below place by water	Length of Portage	Description of Route	No. of Boats	Porters	Donkeys or Mules
Abu-Fatmeh -	—	3 miles	Flat, easy	3, 20 tons each	80	20
Kalbar - -	30	600 yards	Good and flat	3, 20 tons each	40	10
Amara - -	60	"	"	3, 20 tons each	40	10
Dal - -	20	4 miles	Fairly good	6, 5 tons each	80	20
Tanjour - (Left bank)	22	3 miles	Heavy and sandy	6, 5 tons each	80	20
Ambigole -	13	1 mile	Rough	6, 5 tons each	80	20
Semneh -	19	300 yards	Fair	—	20	5
Sarras - -	9	20 yards	Easy	6, 5 tons each	20	5
	173	12 miles	—	—	440	110

It was the duty of the field inspectors to see that the field panniers of regiments were complete; to see that the medical comforts were packed in two boxes for camel transport, and to supply regiments arriving at Fatmeh without them; to see that the equipment for each small hospital was put together and ready for despatch—this equipment was obtained from surplus hospital stores at Fatmeh—and see that each medical officer to be in charge looked after the packing and stores of their respective hospitals; that proper precautions were taken to keep the rest-camps in proper sanitary condition, with especial reference to conservancy, filtration of water, and protection from sun; and that all hospitals in their district were prepared to meet all increased demands that might be made upon them for medical comforts and medicines; that a sufficient amount of lime-juice was stored at

the several places, so that each man passing could have an ounce per diem.

Fifty-nine bales, containing blankets, flannel shirts, belts, and palliasses, were sent to Fatmeh, where the stores of Nos. 1 and 2 field hospitals were arriving daily. The Surgeon-General, Dr. O'Nial, was then at Dongola, where a field hospital was still established. Hospital nuggurs, with some 15 to 22 sick, 3 men of the Medical Staff Corps, and a medical officer, were constantly passing—a pinnace, when available, expediting their journeys, aided by the "Lotus," which was also utilised. When there was no nuggur available to take on the sick to Fatmeh, they were received at Dongola, the empty nuggur returning to Kurot.

As each station was finally evacuated the hospital was broken up, all the sick without exception were removed, and the equipment was transferred to Fatmeh. Surgeon-Major Will, under Brigadier-General Grenfell (who was responsible for the movements of the troops downwards), was responsible as field inspector over the whole line of communications.

A steamer of the National Aid Society was sent to Assouan to aid in the conveyance of sick from that station to Assiout. She could accommodate 48 patients at a pressure, but with comfort not more than 24. She had the advantage of drawing very little water and making quick passages. Ordinary large barges were also in use, in which the sick were conveyed most comfortably.

May 29th.—Deputy-Surgeon General Lithgow arrived for duty at Dongola.

On the 30th Surgeon-General O'Nial, accompained by his staff, left Dongola at noon, and, completing a tour of inspection *en route*, arrived at Cairo, June 15th, and took over the duties, P.M.O., Egypt.

From Dongola to Cairo before the move.

The Surgeon-General left Dongola on May 30 in a whaler towed by a steam pinnace, which threw the party off after 14 miles, when they proceeded by rowing, going 7 miles further, when they anchored for the night.

At 6 30 a.m., May 31st, left their bivouac, and arrived at Hafir at 10 a.m. A regiment was quartered there in camp on the west bank and close to the river. The site was good, and there was considerable shade afforded by palm trees. All the troops were in huts, in the construction of which much care hai been expended.

The huts were constructed of dourra stalks, and some of them had verandahs; they had double roofs; and there was a canteen, kitchen, and recreation room for the use of the men; a detached ward set apart for slight cases; all requiring admission to hospital being sent in a whaler to Fatmeh, 8 miles away. The camp was healthy, and the medical officer thought no cases of enteric fever had been contracted there. There were two Nile boat filters for use, supplemented by native zeers, with an ample supply of medicines, and a tolerably abundant supply of eggs, fowl, milk, butter, &c. Fresh rations were issued daily. Plenty of onions and pumpkins could be bought, and the men had gardens, where were grown radishes, lettuce, &c.

Left Hafir, and arrived at Fatmeh at 1 30 p.m. Most of the patients had been evacuated. There was hut accommodation for 70 patients, a reserve of hospital marquees, and straw huts for 165 patients.

Proceeded by land to Kaboddie, the north end of the Third Cataract, 5 miles. A sick convoy which arrived—9 officers and 32 non-commissioned officers and men—were accommodated in huts for the night.

June 1st.—Left at 8 a.m. with convoy, all proceeding in whalers, 4 to 6 in each, according to the gravity of the cases—patients requiring lying-down accommodation lying fore and aft on stretchers, two in each travelling very comfortably. Each of the whalers had a crew of 9 Egyptian soldiers. The medical officer of the convoy had one to himself, with an ample supply of medicines, medical comforts, cooking utensils in it, and 4 men of the Medical Staff Corps. There were awnings for each boat. As the wind was strong they had to be taken down, but as the day was cool this caused little inconvenience. There were large umbrellas to hold over cases that required them. The Cataract of Shaban, 12 miles lower down, was reached in two hours, and the stretcher cases carried by land, a distance of one-fourth of a mile, the other sick remaining in the boats. Stopped for an hour at 1 p.m. to have dinner, and at 6 30 p.m. for the night, about 5 miles from Kaibar. Here the stretcher cases remained on their stretchers in the boats, the other patients disembarking and sleeping on the bank on their waterproof sheets. Each had his own blanket, an hospital blanket, and his great coat.

2nd.—Left the bivouac at 7 a.m. after the sick had breakfast, and arrived at Kaibar at 9 a.m., where the sick of the convoy were detained in hospital to await the arrival of whalers to carry them on. There was accommodation for 50 patients in huts constructed of wheaten straw mats. The hospital was at the south end of the cataract. Left Kaibar at noon and arrived at Absarat at 6 p.m., where there was accommodation for 25 patients in straw huts, and plenty of tents available if required.

3rd.—Left Absarat at 7 30 a.m., and passed the rest-camp Said Effendi in the whaler at 9 a.m., 14 miles from Absarat, one of the several halting places erected for troops that were to march northwards. There was shelter for 500 men, composed of huts built of poles covered with wheaten straw mats, open at one side; a small commissariat depôt, and some donkeys and camels to assist weakly men when marching. Arrived at the next station, Koyehmatto, at noon, where was an hospital for 25 patients, field ovens, and trenches for latrines completed, medical comfort, medicines, 1 non-commissioned officer and 3 privates of the Medical Staff Corps. Left at 2 p.m., and arrived at Auchamath at 6 p.m., the next rest-camp, 11 miles from Koyehmatto. It was already prepared for 500 men.

4th.—Left Auchamath at 6 a.m , and arrived at Kosheh at noon, the next rest-camp, 12 miles, and fitted up as the first. Left at 2 p.m., and reached Abri at 5 p.m., the next halting place, cool, and shaded by palms. General Grenfell, general officer commanding line of communications, and the Field Inspector, were quartered here. A 25-bedded hospital was located in a very good mud hut with ample room and a separate room for sick officers. Field kitchens, latrines, sun-shelters of straw and palm branches were ready for 500 men, but local supplies were scarce.

5th.—Left Abri in whalers at 10 a.m., and arrived 4 miles from Sarkamatto at 6 30 p.m., having passed Mograkeh, the intermediate rest-camp. on the way.

6th.—Arrived at Sarkamatto, left bivouac at 5 30 a.m., arriving at 6 a.m. There were only 7 Europeans and 6 Kroomen under treatment in the hospital hut. Excellent huts for 48 sick, and tents for 52, besides a hut for 2 sick officers. The sick convoys passed a night here on their way down. The hospital was well supplied with all necessaries. There were in addition some shelters for 500 men. Left at 8 a.m. on camels and proceeded to Dal, the north end of the cataract, a distance of 7 miles, where embarked on other whalers at noon, and arrived at Akasheh at 2 30 p.m. There was here most substantial hut accommodation for 160 patients—the huts built of mud and sun-dried bricks and roofed with straw and palm branches. Half the camel bearer company was here for the use of sick convoys crossing the desert. The camp was in a good sanitary condition—latrines, filters, &c., all ready and well looked after. There were only 7 patients in hospital. Left Akasheh at 5 30 p.m. on camels, and marched across the desert for 9 miles, and arrived at Tanjour Road at 11 p.m. The halting place was 5 miles from the Nile, from which water was carried by camels, and stored there for the use of convoys and troops passing through. There was tentage for 50 sick, and the sick convoys halted here for a day to rest the patients. Filters were provided and good latrines and sun-shelters for marching troops.

7th.—Left Tanjour Road on camels at 1 30 a.m., and marched by moonlight 9 miles to Ambigole Wells, the next resting-place. Here there was tentage for 50 sick, and a large straw hut to accommodate 60 patients. Water for animals (slightly brackish) was obtained from wells sunk 20 feet in the sand, and the water was pumped up as desired. The supply was abundant. Water for the men was conveyed on camels from the Nile, 4 miles away, and stored in wooden tanks for use. Filters were available, field trenches for latrines, and sun-shelters for marching troops. A reserve of camels was kept here for sick convoys and troops passing. The station was in telegraphic communication with Tanjour, Akasheh, and the Railhead. A convoy of sick arrived while they were in camp. Those unable to sit up were conveyed on stretchers carried by Egyptian soldiers (8 bearers to each), and those able to sit up were in cacolets carried by camels. Water, medicines, and medical comforts were carried by the convoy on camels. All seemed cheerful and comfortable. Left Ambigole Wells at 5 30 p.m., and arrived at Railhead (12 miles) at 11 30 p.m. The Railhead, or Ambigole Road Station, was 51 miles from Wady Halfa, but the railway embankment and cutting extended to Akasheh, and the rails were laid for 7 miles beyond Railhead. Drinking water was carried for the men from Sarras by the trains in iron tanks, and the animals obtained water from the Mohrat Wells, 3 miles distant, and to which place they were taken as required. There were tents at the Railhead for sick passing through, but, as a rule, the convoys did not delay there, but went into the train ready for them on arrival and on to Halfa at once. The carriages were arranged on Zavdofski's plan. Sick from the few men employed here were treated in Wady Halfa Hospital.

8th.—Left the Railhead by train at 10 20 a.m., and arrived at Wady Halfa at 2 p.m. The British troops lived in barracks constructed of sun-dried bricks, roofed with wheaten straw. The rooms were cool and comfortable, and arranged round the hospital in the form of a square, for military reasons. The outer walls of the huts that did not adjoin the river were loopholed. The men slept on country palm-branch cots, and kitchens, recreation rooms, canteens, &c., had been provided. The usual native filters were provided, and the dry earth system was in use. There was accommodation for 130 patients. There were only the sick of the corps in hospital, those arriving by convoys being despatched to Cairo. There were four nursing sisters on duty. The sick convoys from Halfa to Assouan proceeded in two different classes of boats—the "chaloupa," flush-decked boat, accommodating 50 or 60 sick, and the "dahabieh," which was decked forward, and had cabins aft. When on board the dahabieh sick officers travelled in the cabins; if on board a chaloupa a place was screened off for them. Serious cases slept on palm-leaf country cots; ordinary cases on mattrasses on deck. Dry earth was used for deodorising purposes. Fowl, sheep, and all other necessary supplies were carried, so that fresh rations were always at hand. Filters were also provided. These vessels were towed by steamers from Halfa to Assouan—the journey divided into three reaches, owing to the shallowness of the water at the present season. On arrival at a shallow the boat was cast adrift by the steamer and floated down to the station of the next. The shallows were not over a mile in length, some less.

9th.—Left Halfa in postal steamer at 4 a.m., passing a sick convoy in two chaloupas towed by a steamer, and arrived at Korosko at 3 30 p.m. A European regiment was quartered here in barracks built of sun-dried bricks and roofed with straw. The sick were treated in a similar building. The regiment had been so far healthy, although the temperature was high, owing to the radiation from the high hills which surrounded it on three sides. Left Korosko at 3 30 p.m., and anchored for the night.

10th.—Left at 4 30 a.m., and arrived at Shellal at 1 p.m., proceeding to Assouan by train, and arriving there at 2 p.m. Found a regiment of British infantry and some Egyptian troops quartered there. The barracks of the regiment were quartered on a hill about 100 feet high, and about 2 miles south of the town. The hill commanded a pleasant outlook over the river, and was probably the coolest place near Assouan. The huts were of mud or sun-dried bricks, roofed with straw, well ventilated, and the men slept on country palm-branch cots; water was carried from the Nile by camels. The troops had fresh meat and vegetables, including potatoes, daily. The hospital was on the same hill as the barracks and constructed on the same type, with accommodation in buildings for 100 patients; was dieted and well supplied. There had been a great prevalence of enteric fever when the troops occupied the old camp at Assouan. There were then 2 officers and 62 men in hospital, including 7 of enteric fever, some of the latter dropped by sick convoys. The sick convoys proceeded from Assouan to Cairo on barges; four specially fitted up for the purpose. Each would accommodate 60 to 80 patients. They were very comfortable. Ventilation was secured by large port-holes cut in opposite sides and by the hatchways. Each had a double roof of thatch, and a separate part was cut off by a partition for officers; latrines were erected over the side; and all patients slept on palm-branch country cots. Live stock and abundant supplies were carried. The barges were towed, and the Nile was then, from Assouan to Assiout, divided into reaches on account of the river being so low. A barge took 7 or 8 days to get to Assiout.

11th.—Left in postal steamer at 4 a.m.; arrived at Assiout at 2 a.m. The garrison usually consisted of 100 men. The barrack was in form of a square, the outside walls loopholed. Water was laid on from the general town supply. Rations and vegetables were good and abundant. The soldiers slept on palm-branch bedsteads. The hospital of 12 beds was established in a private house—4 rooms, 4 beds in each, with a kitchen, surgery, orderlies' room. It was surrounded by a large garden. There were then 10 patients under treatment. They lived on field rations, supplemented by chickens, eggs, milk, &c., as extras. They were on the regulation hospital bedsteads. Left Assiout at 8 30 a.m., and arrived at Cairo at 7 p.m., 13 days from Dongola.

Medical Staff, Egypt, Soudan, and Suakin.—May 1st, 1885.

Surgeons-General - - - -	1
Deputy Surgeons-General - - -	4
Brigade-Surgeons - - - -	6
Surgeons-Major, ranking as Lieutenant-Colonels -	26
Surgeons-Major - - - - -	28
Surgeons - - - - -	135
Quartermasters - - - - -	14
Apothecary to the Forces - - -	1
Total - -	215

Troops up Nile, 10,771; Suakin, 7,235; Lower Egypt, 6,730. Total 24,736.

BEARER COMPANIES UNDER FIRE.

Action at Kassassin, August 28th, 1882.

All day the enemy maintained a distant cannonade, which kept not only our troops on the alert, but also those at Mahsameh and Mahuta. Late in the afternoon the Egyptians made a determined attack with a force estimated at 8,000 infantry, 1,000 cavalry, and 12 guns. General Graham's force defended itself vigorously. Our guns opened fire, and the cavalry after a short interval charged the Egyptian guns, scattering the gunners and flying infantry. Our casualties were 15 killed and 90 wounded. Among the former was Surgeon-Major G. Shaw. Thirty-two stretchers and a full complement of bearers were available during the engagement. The hospital was freely shelled for two hours by the Egyptian artillery. Major Foster, D.C.L.I., was wounded at the hospital, and Private Holledge, Army Hospital Corps, when assisting to dress a case, was hit by a bullet on the head.

Tel-el-Kebir.

All tents were struck at 6 30 p.m. on 12th; the baggage piled. Each soldier carried 100 rounds, two days' rations, water-botties filled with tea. When darkness set in the whole force—11,000 infantry, 2,000 cavalry, and 60 guns—marched silently into the desert, where it bivouacked on a ridge over the camp till 1 30 a.m., when it advanced across the desert on the strongly fortified position, in the darkness of the night, guided by the stars, and carried, at daybreak the whole line of the enemy's entrenchments with a simultaneous assault at the point of the bayonet, the cavalry division sweeping down on his line of retreat. The wounded were collected and removed from the field with quick promptitude to the field hospitals at the entrenchments on the canal, where everything was ready for their reception, treatment, and transport to the field hospitals at Kassassin, where two were established, and thence to the hospital ships in the harbour. To each division half a bearer company was attached, and a special cacolet corps, consisting of 25 cacolets carried on horses, was organised for the rapid movements of cavalry. There were, in addition, 80 dhoolies and dandies, with a full complement of bearers. After a short interval the sounds of firing were heard, and some shells passed over the field hospital depôt. Behind one of the enemy's earthworks were several Egyptian wounded. The advanced field hospital was established here; on its right-front was the enemy's forsaken camp. By the afternoon the Medical Staff and Army Hospital Corps were very much exhausted; the heat was great, and they had all been up the night before; all but 17 to 20 European wounded were dressed, and evacuated by midnight. The principal medical officer wrote—"I was myself a personal witness of the admirable manner in which the bearer companies and Indian kahars performed their duties on the field." The two field hospitals were afterwards established at Ghezireh.

Eastern Soudan, 1884–85.

On February 25th, 1884, the 1st battalion Gordon Highlanders and 2nd battalion Royal Irish Fusiliers left camp at Trinkatat at 10 a.m. to occupy Fort Baker, three miles off in the direction of El-Teb. Immediately after the men's dinners on the 28th the total force—1st and 2nd infantry, and Naval Brigade and corps troops, under the command of Sir Gerald Graham—followed; the equipment, medical and surgical stores, and medical comforts to form a dressing station, with water for the sick only, carried on 12 camels and 12 mules, with Quartermaster Enright and 38 non-commissioned officers and men, Army Hospital Corps, under the command of Surgeon J. Prendergast, followed immediately in rere, cacolets and litters being carried by each regiment and corps; in addition were 100 mules and drivers. When passing through the salt marsh of thick mud the men sank up to their knees, and the horses sometimes to their girths. Towards daylight of the 29th a heavy downpour of rain occurred, soaking everyone in camp. The dressing station—1 officer and 11 non-commissioned officers and men—was left at Fort Baker under Surgeon Prendergast; 27 non-commissioned officers and men, under the command of Surgeon H. O. Stuart, with cacolets and litters, accompanied the force. At 8 a.m. on February 29th the troops advanced in square formation, carrying their ammunition, one day's ration, great coats, and blankets. At 11 20 a.m. the enemy was found strongly posted

on the left flank, and at once opened on them with case, shell, and rifle fire. The case pattered inside the square chiefly, like hail; the shell, for the most part, passing over their heads, and bursting some distance beyond them. Within a few minutes they had a great number of wounded, and some killed. The wounded were immediately attended to, medical officers of corps accompanying the men to the ever-shifting dressing point, in charge of Surgeon-Major Wilson. The troops were continually changing ground, and the wounded had to be carried with the square to avoid being cut off; not a single wounded man was left outside. This state of affairs lasted until the end of the engagement—between 2 and 3 p.m., when the wounded were grouped by regiments and corps near the wells of El-Teb. Their casualties were 4 officers and 14 men killed; 146 non-commissioned officers and men wounded; two naval medical officers were also wounded. On March 4th Tokar was evacuated, and the rescued inhabitants sent to Suakin. On March 10th following, at 6 30 a.m., a second advance was made in the direction of Tamasi. The day was sultry, and upwards of 40 men fell out on the way to the first zereba. At 1 15 p.m. on the 12th the force advanced from the first zereba, a distance of 7 miles, to their encamping ground, at 5 p.m., and were greeted by the enemy on arrival with a rifle fire at long range. Next morning after daybreak there was an almost constant Remington fire into and over the camp; some men, horses, and mules were wounded and killed. Two companies of the Gordon Highlanders being detailed to guard the zereba, the troops advanced at 8 a.m.—two squares in échelon, flanked by cavalry, and were soon hotly engaged with the enemy, particularly the square of the 2nd brigade, and numerous casualties occurred. While bending over a wounded man on a stretcher, Surgeon J. Prendergast was speared through the lungs. When the stress of the attack was over, and the enemy in sullen retreat, the wounded—about 100—were sent back on stretchers, under infantry escort. One year afterwards, in the fight at Hasheen, Surgeon J. R. Lane, Medical Staff, with No. 1 field hospital, was shot through the lungs, and died the next day; one of three officers wounded. In this action the right-half of No. 2 field hospital lost 2 men killed, and had 4 wounded.

Across the Bayuda Desert with the Bearer Company.

On the 8th of January, 1885, left Korti, Brigadier-General Sir Herbert Stewart in command of the whole of the camel corps, with the exception of the light camel regiment; No. 2 and 3 sections of the bearer company, commanded respectively by Surgeons A. Harding and J. R. Lucas; 40 non-commissioned officers and men. 12th.—Reached Gakdul Wells; left for Metemneh on 14th. On 16th.—Enemy seen in force among hills near Abu-Klea by 19th Hussars, halted for breakfast, and soon after 1 o'clock advanced towards them—the main body of troops in column, with a broad front, then the transport, followed by the field hospital, bearer company, regimental baggage, and rear guard behind. At 3 p.m. halted; camels of escort and convoy massed in close order, those of field hospital and bearer company being in the centre, with an open space in front reserved for packing, equipment, and preparing stretchers, &c.; got ready the bearer company equipment, prepared the stretchers, opened one set of field panniers, unloaded water tanks. Four stretcher parties paraded under the command of Surgeon Lucas, Surgeon Harding, with remainder of non-commissioned officers and men of company, and some Aden drivers, and formed a low stone zereba on right flank of baggage, working until dark, when the enemy having commenced a brisk and accurate fire, beginning to take effect on the troops, he marched the party back to the centre of the square. Two stretchers were despatched to each medical officer doing duty with troops to bring in wounded during the night. At daybreak the firing was more brisk, and was directed principally on the front face, where most of the troops were massed. Four stretcher parties, under Surgeons Harding and Lucas, now took up a position on the left flank to bring in any cases of wounded to the field hospital, which was practically the dressing station. During the night and morning 4 officers and 16 non-commissioned officers and men were brought in wounded, and 3 dead. At 9 30 a.m. on 17th, with exception of Royal Sussex and details left to guard the zereba, the whole force in hollow square, with Royal Artillery and bearer company in centre, advanced towards the enemy's position. The firing being continuous and accurate, men began to fall immediately they moved off. The first four or five cases were sent back to hospital; but after that they were picked up and placed on stretchers, and then on litters and cacolets, according to the nature of wounds, when occasional halts gave an opportunity. Surgeon Magill, Guards camel regiment, was seriously wounded while attending a man. Advanced in this formation for about a mile and a half. Number of wounded at that time was 12.

Enemy now seen in large numbers on the left front, both cavalry and spearmen, with a large number of flags. They rushed on with great determination and courage, striking the left corner of the square, which was pushed back. In the *mélée* camels got loose, were thrown down and killed, and a number of wounded in cacolets and litters speared, only a few escaping. After half an hour's desperate fighting the enemy were forced to retire, leaving about 70 of our men and 700 of themselves dead on the field. In the battle of Abu-Klea lost 9 officers and 59 men killed, and had 9 officers and 70 men wounded. The Bearer Company lost heavily in animals and equipment, and two of the camel drivers were killed and a private of the Medical Staff Corps severely wounded. The square having by this time re-formed, the wounded were collected and dressed, and the missing equipment recovered as far as possible. Many camels having been killed, the cacolets which they had carried had to be abandoned. At 3 p.m., the wounded (15 officers and 56 men) having been arranged into three classes—viz., those able to sit in cacolets, as many lying down on litters as there was accommodation for, and the most serious cases on stretchers carried by the Bearer Company and 70 regimental fatigue men, the column started for the wells, reaching them at 4 p.m., greatly exhausted by fatigue and want of water. The wounded were then made as comfortable as possible for the night, but they suffered a good deal from the cold. Beef-tea and brandy were supplied to all, and they were accommodated as far as possible on stretchers, the worst cases having the preference. At 7 p.m. the mounted infantry returned to the zereba, escorting sufficient cacolets and litters to be placed at the disposal of the medical officer who was remaining with those previously wounded at the zereba. These returned on the morning of the 18th, at 7 30 a.m., bringing 4 officers and 16 men, together with the wounded in yesterday's attack on the square, and were placed in an hospital established for the purpose. At 4 p.m. the whole force, with the exception of two companies of the Royal Sussex, left as a garrison, started for the river bank south of Metamneh, marching throughout the night. In the darkness it was impossible to keep in proper order; the animals, tired and hungry, tried to feed on everything within their reach; the men sleepy, and frequently falling off the camels. Several cases had to be carried on cacolets. At daylight of 19th order was restored, and an advance made to the river. About

8 a.m., when distant about two miles, the enemy were seen in large numbers. The camels were again massed, and a dressing station opened in the centre, a shelter being made with cases, pack saddles, &c., as far as time allowed, the fighting portion of the force being formed round the animals. The enemy shortly opened a galling and accurate fire, and wounded began rapidly to be brought in to the dressing station, Sir Herbert Stewart being one of the earliest hit. The dressing station was, owing to the rapidity of movements, considerably exposed, many of the casualties occurring in its immediate vicinity. One officer, 1 warrant officer, and 21 men killed, and 8 officers and 85 men wounded. About 2 p.m. the whole force (with the exception of about 200) formed square, with 18 non-commissioned officers and men of the Bearer Company, 20 pairs of cacolets and litters, one pair of field panniers, and four water tanks, under the command of Surgeon Harding, with two surgeons acting regimentally, and advanced to drive the enemy from their position, and seize upon a site upon the banks of the river. As the fire of the enemy continued heavy, several casualties immediately occurred, those hit during the first 200 yards being sent back to the zereba; after that, carried on stretchers or camels, as opportunities offered. After advancing about a mile the enemy's spearmen appeared in large numbers, with the evident intention of charging the square, but were driven off by the rifle fire with considerable loss. The opposition then practically ceased, and the square advanced slowly to the river bank, arriving there about dark, with 3 officers and 31 non-commissioned officers and men wounded, 10 men having been killed.

A site having been chosen for a temporary hospital, the wounded were all re-dressed, and medical comforts, &c., administered; they felt the cold a good deal, but were covered as far as practicable, nets of baggage camels being used as beds for those not having litters or stretchers. Next morning a village, distant about half a mile, having been occupied, the wounded were removed to it on stretchers, &c., an hospital established, with a medical officer, a corporal, and 5 men detached from a section of Bearer Company. The remainder of the Bearer Company then returned with the troops to the zereba, and preparations were immediately made for the removal of the wounded to the village. They were arranged in three classes—viz., those able to sit up in cacolets, those for whom there was accommodation in litters, and the remainder (those most severely wounded) on stretchers, carried by fatigue

parties furnished by various corps, all the men of the Bearer Company, with the exception of four of the stretcher detachment, being necessarily employed in looking after the wounded in litters, &c., supplying them with water and comforts when necessary. Started at 2 30 and reached the village at about 4 30, when the severer cases were put in beds that had been collected during the day, the remainder being placed on stretchers outside the huts, every wounded man having a bed of some kind to lie upon. On morning of 21st all available troops at 5 a.m. formed up to advance on the village of Matemneh, the Bearer Company with all available men and camels accompanying the force. Nearing the village they were met by a severe fire, including round shot, from the guns mounted on the walls. About 9 a.m. were joined by 4 steamers belonging to General Gordon, who landed some of these guns. Our troops then retired from their position between the town and river, and, in conjunction with guns from the steamers, shelled the town till 11 a.m.; then retired, having lost 1 officer, and 1 non-commissioned officer wounded. On return to the village, preparations were immediately made to move the whole of the sick and stores down to the river bank, and to build a fort there. This was done in the afternoon, the wounded, numbering 10 officers and 93 non-commissioned officers and men, being carried down by stretchers and camels, and an hospital established as well as circumstances would permit. On the morning of 22nd shelters were made for all with what tents there were, and the tentes d'abri of the Bearer Company and blankets.

On January 31st a large convoy of 1,000 camels, carrying provisions, and escorted by 400 men of the Heavy Camel Corps, under the command of Lt.-Col. Talbot, 1st Life Guards, reached Matemneh, having exchanged a few shots with the enemy. With it was No. 1 section of the Bearer Company from Gakdul. On February 1st it was reported that Khartoum had fallen. Fifty sick and wounded at 8 p.m. on that day were sent back to Gakdul in cacolets and litters. The night was intensely cold, and many halts had to be made to attend to the several wants of the sick and wounded. Abu-Klea was reached at noon the following day without any casualty having taken place. At Abu-Klea 66 additional wounded were placed in cacolets and litters, and on pack animals, and at 4 p.m. the sick convoy, numbering now 109 sick and wounded, started for Gakdul, where it arrived on February 5th. Having captured a large flock of sheep en route, fresh meat was available for two days. They were on the 8th, evacuated to Korti. Throughout the entire journey the wounded were carefully attended, and the food they received was excellent and abundant. No. 1 section and some details returned to Matemneh, which was reached on 11th. On the 13th the Headquarter Bearer Company left for Abu-Klea, en route to Gakdul, with 69 sick and wounded, including Major-General Sir Herbert Stewart, who had been dangerously wounded in the abdomen on January 19th. He and five other bad cases were conveyed on stretchers by Egyptian soldiers—ten men being told off to each stretcher. The convoy halted at 10 a.m. to allow of nourishment being given to the patients, and at 11 a.m. were ready to move on, when they were suddenly attacked by the enemy, who for a considerable time kept up a well-sustained fire on our men, wounding 6 European and 29 Gordon's Egyptian soldiers, several of whom had accompanied them from Matemneh. Two died in a couple of hours; the wounds of the others were dressed, and they were placed in cacolets and litters. At 2 p.m. the convoy again started, reaching Abu-Klea at noon the following day, again starting with 20 additional sick and wounded. On the 16th Sir Herbert Stewart died, and was buried the following day at Gakdul. The bullet had entered over the left anterior superior spine of the ilium, and had impinged against and fractured the back part of the bone near its junction with the sacrum. The fracture was extensive and starred. The bullet had lodged in the upper part of the sacro-iliac synchrondrosis, death resulting from exhaustion. On February 20th Surgeon Lucas returned to Abu-Klea with 9 non-commissioned officers and men Medical Staff Corps, 24 pairs of cacolets and litters, chloroform, and medical and surgical stores—a report having been received that General Buller had been attacked by the enemy, and had suffered a loss of 28 wounded. The convoy of 33 sick and wounded for Korti, left in charge of three medical officers, 87 convalescents being evacuated with them, followed on 25th by 64 sick. On 26th those who were severely wounded at Abu-Klea, and a few cases of fever, arrived at Gakdul.

On the 27th the whole of the sick and wounded were evacuated to Korti from Gakdul. Korti was reached on March 4th. On the 6th the Bearer Company was again ordered across the desert to render aid to the force retiring from Gakdul under the command of Major-General Sir E. Wood, V.C., but only proceeded to El Howyieat, returning with all sickly men, and again reaching Korti on March 11th. Before starting every morning each patient had his breakfast; a halt was always made at 10 a.m. to give the more serious cases beef-tea, milk, and brandy, while the convalescent had an opportunity of eating some of the ordinary rations. At 4 p.m. the convoy halted for the night, when the patients were given tea, soup, &c., and those requiring it had their wounds dressed. Although every drop of water had to be carried over a distance of nearly 200 miles, on no occasion did any one want any. The duties were of the most trying and arduous nature, with a large sick convoy, and were incessant day and night. In addition to the special duties of a Bearer Company all those usually devolving upon a field hospital had to be performed. The behaviour of the men left nothing to be desired, stretcher parties going out under a heavy fire as quietly and unconcernedly as though at a parade at Aldershot. The camel was found to be well suited for the carriage of sick and wounded, being quiet, docile, long-suffering, and unconcerned even under the heaviest fire; worked hard when well and regularly fed, and specially selected for his work—the largest and the heaviest being the best for carrying sick and wounded. Eleven hundred and sixty-one wounded, sick or footsore, soldiers were carried by the Camel Bearer Company during the operations across the Bayuda desert.

After the action near Matemneh, Sir Charles Wilson wrote:—"Before lying down I went to see the wounded who were having their wounds dressed. The medical officers behaved splendidly—nothing could have been better. They had been up three nights and through two fights, and here they were working again the fourth night. One of them fainted from exhaustion, but they went on until every wounded man had been attended. The Bearer Company also behaved admirably, not a wounded man was left on the ground; everyone was at once picked up and put on a cacolet, or a camel, or on to a stretcher. The hospital after a fight is a horrible sight, but the men bore their wounds bravely, and were much quieted then."

The force remained entrenched at El Gubat till February 14th, when, being reinforced by the Royal Irish Regiment, and half battery of the Royal Artillery, it commenced its return journey on the 14th of February, 170 miles to Korti.

Kirbekan, February 10th.

8th.—Left Castle Camp, Colonel Butler taking command of the whole of the advanced guard. 9th.—Came in sight of the enemy at Kirbekan. Bivouacked a short mile from their position. 10th.—Colonel Butler leading the attacking column, the Staffords in red and the Black Watch in kilts, marching in line of half battalions, the company stretcher bearers with stretchers following their own companies, quickly advanced; a detachment of the field hospital, with 3 camels carrying surgical and hospital equipment, paraded with the infantry, 2 camels carrying water for the wounded, and the reserve ammunition camels marching between the Staffords and Black Watch. During the action, in which the enemy were defeated, leaving 200 dead on the ridge, the wounded were collected in groups by the stretcher detachments and a dressing station was established at successive points as the troops advanced. Restoratives administered. Owing to the nature of the ground the medical officers and wounded had been frequently exposed to a heavy cross fire. As soon as the action was over additional men were told off as stretcher bearers, and the wounded were brought into camp, and were afterwards carried in the boats with the column as it proceeded up river, generally doing well. Three officers and 9 men were killed and 44 wounded. General Brackenbury wrote of this column:—"A month out of Hamdab of unprecedented exertion in the open air, rowing against the swiftest water, unprecedented among any troops in a campaign, the physical condition of the men was magnificent; a life of incessant toil, in ragged clothing, never changed, scarred and blistered by the sun, and rough work performed with constant cheerfulness and unceasing energy and admirable discipline. There was no more gallant or trustworthy body of men." Starting from Korti December 28th, 1884, the column arrived at Huella, 25 miles from Abu Hamed, February 23rd, 1885, and again reached its base 3rd March. At Huella had had only 18 sick, or 6·4 per 1,000.

The diseases which caused the largest number of admissions amongst the non-commissioned officers and men were:—Simple continued fever, 18; dysentery, 7; enteritis, 3; febricula, 2; enteric fever, 2. Of the 3 deaths 2 occurred from dysentery and 1 from enteritis. Admissions from disease, 69; wounds received in action, 45; total, 114. Officers:—Disease, 12; wounds, 4; total, 16. Deaths:—From disease, 3; drowning, 5; wounds, 3; killed in action, 7; total, 18. Officers:—Died from disease, 1; killed in action, 3; total, 4.

SOME PRACTICAL LESSONS OF THE CAMPAIGNS.

(*Different Officers.*)

An army in the field should always be accompanied by a large and well-organised sanitary or conservancy corps.

With the Principal Medical Officer should be an experienced officer upon whom should rest the responsibility of furnishing all the land transport, the supply and equipment of hospitals, and he should be empowered to purchase locally whatever the Principal Medical Officer considered necessary for the well-being of the sick and wounded.

The general impression among medical officers that men who get to the front will obtain all the rewards, and that those that remain in the useful but less brilliant positions along the line of communications will be neglected, is injurious to the public service, and the interests of good officers should not suffer because they have been selected for useful and responsible rather than showy positions.

The drip-stone filter, of native manufacture, was largely employed, and answered admirably when properly attended to and washed out daily.

Litters are useless unless carried by specially trained mules. For cavalry, cacolets on mules are a mistake, as the mules cannot keep pace with the cavalry. Cacolets for cavalry should be on horses, those used for the band being trained in time of peace to carry them.

The grey serge clothing supplied to the troops in the earlier campaigns appeared to be more suitable for the bivouac than khahee.

The worst cases were best carried across the Bayuda desert on stretchers, with Soudanese soldiers as bearers. Cacolets on camels answered admirably, but litters did not come up to what was expected from them. The chief drawback to the sick was the intense heat. The purity of the desert air aided greatly in procuring the rapid healing of wounds. Patients' health improved quickly on removal from the camping ground in the desert, which soon became fouled.

The amount of invaliding was large during the Nile campaign—58·49 per cent. of strength. Chief causes—fevers, bowel affections, general debility, and wounds in action.

The regulation field dressing was more effective where a little iodoform was added, and a layer of boracic wool placed over all.

To attend to men in dhoolies, and see them supplied with water, milk, and beef-tea, as required during a dusty march in a tropical country, is one of the most important duties of the Medical Staff Corps, the actual carrying of the sick being done by natives.

Maltese carts are lighter and equally useful as "tip carts," but require more careful packing.

A bearer company before taking the field should be exercised with its equipments at home, and embark in its entirety fit for work. A great advantage would result if all the non-commissioned officers and men were chosen from one district. Various articles of spare equipment should be carried. More than 8 surgical haversacks for a company are required. The transport staff should embark with the company completely equipped, with all its equipment in the same vessel, and not be detached from it. Divisional boxes should be light. Half a load for a mule, or one box, should contain all that is required for a detachment.

Tents, single circular, are unfitted for the climate, and had to be changed for European privates' tents, Indian pattern, when the heat increased.

Lascar pals are too hot for a mid-day sun as the heat increases; double flies are necessary. The best form of tent and most suitable for field service in any climate is the ridge pole, double fly, of a shape similar to those known as the "Cabul pattern," made to hold 2, 4, or 6 wounded, or double that number of men in health, opening at either end to insure thorough ventilation. They are always the coolest. The Indian double fly pal, mountain battery, weighs $1\frac{1}{4}$ maunds, superficies 96 feet; accommodates 2 sick on stretchers comfortably. Double Lascar pal weighs $3\frac{1}{2}$ maunds, superficies 252 feet; accommodates 8 sick comfortably. E. P. tents—weight 10 maunds, 320 superficial feet; most suitable for standing camps; accommodates 8 sick comfortably, on wicker bedsteads, or bedsteads and trestles; 8 hospital beds crowd it too much when there are bedside tables in addition; the bedsteads are too wide. The Lascar pal is useful, portable, and readily pitched. Joining the walls of Indian pattern tents, so as to form a flat roof, and then raising this on poles, 8 or 9 feet from the ground, afforded the best protection from the sun.

Fairly comfortable beds—4 at a side, 8 in a tent—can be made from large forage-bags, partly filled with tibbin, suleetahs underneath, separating them from the earth or sand.

In the desert at night blankets and great coats are necessary,

and a shelter to windward from the keen north wind. The sick and wounded feel the cold much.

Packing cases should be of the size of medical panniers, of wicker with a good tin lining, means for easily strapping on to mules or camels, have strong rope handles, locks and hinges.

Each surgeon on field service should have readily available several artery forceps, Sir Spencer Wells' pattern, for controlling hæmorrhage.

The absence of spirituous liquors largely contributed to the efficiency of the troops during the arduous duties performed by them.

In warfare with barbarian or semi-barbarian tribes, the medical staff corps ought to carry a large-bore revolver—the short sword is an inadequate protection.

Condensed water, from 2 to 3 gallons daily, was not disagreeable when filtered through charcoal; no kind of disease could be traced to it. When men have little to do and are exposed to a fierce sun, a large meat ration is unnecessary. Lime-juice should always be issued to natives serving in the field.

Two camels are required to carry an E. P. tent complete; a mule can carry easily a double fly pal, mountain battery—average weight, 130 lbs.

A camel bearer company for desert work is best arranged as follows—viz., into 2 half companies, each sub-divisible into 2 sections—1 medical officer to each section, 1 quartermaster, combining the duties of paymaster, for the whole; 1 staff sergeant to each half company. To each section 1 sergeant, 2 corporals, 17 privates, including cook, batman, and 3 spare privates. Interpreter, 1 to each half company, and a saddler; camel-drivers, 1 to every 3 pack animals; equipment litters, 6 per section; cacolets, 19 do.; divisional boxes, 1 set do.; field-panniers, 1 pair do.; surgical reserve panniers, 1 pair do.; cooking-pots, 1 nest do.; water-tanks, 8 do.; bearers, 12; tents, operating, 1 to each half company; dressing haversacks and water-bottles, 1 to every other man. Riding camels—officers, 5; staff sergeants, 2; sergeants, 4; interpreters, 2; privates, if operating with mounted troops or on convoy, 1 each. Special camels—100 for sick; 10 spare. Packs for equipment, baggage, men's kits, water, &c., 50; spare, 5 per cent. Rations, water, fire-wood, patients' kits, and forage to be carried by transport department.

In the event of an action on a large scale, and in a situation not accessible for camels, stretchers and men require to be supplemented—the former from the field hospitals, the latter from regiments. Camels for carriage of sick and wounded should be specially selected for their strength, and be trained for that purpose, and should not be used for any other work. Total camel-bearer company—5 officers, 2 staff sergeants, 4 sergeants, 8 corporals, 82 privates, 4 batmen, 2 interpreters, 2 saddlers, 60 drivers. Equipment—litters, 6 pairs; cacolets, 19 pairs per section; 4 sets of divisional boxes, 8 pairs of panniers, 4 sets of cooking utensils, 32 water-tanks, 32 stretchers, 48 bearers, 2 tents, operating. 12 dressing haversacks, 12 water-bottles.

In boat expeditions which have to proceed a long distance, and the sick cannot be regularly evacuated, the field hospital equipment must be reduced to a minimum and re-arranged, if whale-boats are employed, into 8 sections, each so far complete in itself so that it might be detached as required, and contain all essentials for a small field hospital stowed in its own whaler—the excess carried with head-quarters—a proportion of medical comforts being divided amongst the sections. Brandy, as giving greater value for the space occupied, should be substituted for port wine. Four or five of the Medical Staff Corps in each boat, supplemented by a coxswain, bowman, and rowers from regiments. A medical officer in each boat, with a pair of field-panniers, surgical bag, field companion, haversacks, antiseptic dressings, &c. A diet-sheet, accurately filled in, the only voucher to be required for admission and supplies from a mobile, river-column field hospital. Boat-tents answered for the sick, and being lighter were easily carried.

When the Nile was clear and in the upper reaches filters were unnecessary in boats, as the water from midstream was sufficiently pure and clear, cool and palatable. A lump of alum in a boat would be more useful than a filter.

The bacon did not keep well, much became bad. Some of the cheese was very good; navy biscuits were very good. Cabin biscuits became bad in large quantities; jam was much relished. The tea was of excellent quality; preserved vegetables were not considered of much value. The oatmeal was very good; rice, sugar, and tea, packed in bags, was much injured by water. The supply of medical comforts was well selected, but the boxes were not sufficiently secured.

On river encampments native troops should not be encamped above European infantry; water should not be drawn for drinking or cooking from the bend of a river where fouled by natives. Troops

should be encamped above a town to insure a purer water supply. Filled-in latrines should always be marked by a mound of earth; should be at least 100 yards from tents. Water should be taken from midstream, or as near to as practicable.

Well-built huts were found much cooler than the tents, and more comfortable. In the summer, camps of straw huts—dimensions, $40' \times 15' \times 8'$, with native bedsteads, each to accommodate 4 men—were very comfortable.

The rations for the Troops south of Assouan, viz.—$1\frac{1}{4}$ lb. fresh meat, or 1 lb. preserved; $1\frac{1}{4}$ lb. bread, or 1 lb. biscuit; $\frac{1}{3}$ oz. tea, $\frac{1}{2}$ oz. salt, $\frac{1}{3}$ oz. coffee, $\frac{1}{3}$ oz. pepper, $2\frac{1}{2}$ oz. sugar; 1 lb. of fresh vegetables, or 1 oz. of compressed, or 1 tin of Erbswurst; $\frac{1}{320}$ gallon of lime-juice, with $\frac{1}{4}$ oz. sugar, preserved health, with occasional increase of lime-juice when required to $\frac{3}{4}$ or 1 oz.; but there was a deficiency of fat for culinary purposes. Mincers should be supplied where tough meat only can be obtained.

There were no fresh potatoes obtainable above Sarras; the vegetables consisted chiefly of pumpkins and onions. The mutton obtainable was of fairly good quality, but the beef was poor, hard, and tough, destitute of fat, and deficient in nourishment. At some camps the hand-ground flour, obtainable from the natives, was of inferior description, and from the mode of grinding contained a large admixture of sand and grit. The bread baked from it was heavy and sodden.

There should be always a large reserve of lime-juice, and it should form a portion of the daily ration of the troops, and the taking of it should not be optional with the men, and they should be seen to consume it. The lime-juice issued was of good quality, and on analysis yielded the most satisfactory results.

There was a wide difference in the relative value of the preserved meats issued. The Australian and New Zealand were highly appreciated by the men, and looked upon as far superior to any fresh obtainable, but they soon tired of the others on account of their containing such an amount of salt, which excited an undue thirst. They were consequently not used on desert marches while the water supply was limited. The cases should be covered over and protected from the sun. A spirit ration was so rarely given that it was practically unknown.

The Nile boat and field service filters were very valuable, rapid in their action, efficacious, simple in construction, and easily cleaned; where they were fresh filtered water could always be obtained.

As there was a great sameness in the food, the occasional issue of cocoa and milk, jams, marmalade, pickles, vinegar, oatmeal, and rice proved advantageous up Nile.

The hot weather commenced on April 1st, and terminated at the end of September. During December, January, and February up Nile the climate was very cool and pleasant, but a considerable increase of temperature took place in March and April. The highest temperature in the shade during the whole period was 120° at Tani camp on the 27th of March, and the lowest in the shade was 41° on the 22nd and 23rd of December at Akasheh and Sarkamatto respectively. The lowest monthly mean minimum was 48·9° in February, and the highest monthly mean maximum was 106° in May, and the lowest monthly mean range 24° in January. February was the coldest month, and May the hottest. The mornings, evenings, and nights were always cool and pleasant, and refreshing sleep could be obtained. The greatest heat during the day was shortly after noon, and the greatest cold immediately before dawn. The N. and N.E. wind which prevailed during the greater part of the year cooled the atmosphere, and modified the climate, and rendered it agreeable. The hot S. Khamsin was during 1885 very slight; it first appeared at the end of March—26th, 27th, 31st; 12th, 13th, 18th, 19th, 20th, 21st, 25th, 26th of April; 17th, 18th, 19th, 22nd, 23rd of May. It lasted from one to four days at a time. Whilst it continued there was a marked rise in the temperature, and the wind was felt hot and scorching. Rain fell only on May 22nd, a slight shower lasting about five minutes, and accompanied by thunder and lightning. The climate was generally healthy, its principal characteristics being its extreme dryness and the high daily range of temperature. On account of its dryness it was less enervating than that of most countries with corresponding high temperature, and the daily changes were less felt. The variations which took place during the twenty-four hours were liable to produce in delicate constitutions diarrhœa, dysentery, and visceral congestions, but with ordinary care and prudence these affections could be easily guarded against. The only disease peculiar to the country was ophthalmia, which was caused mainly by impalpable dust with which the atmosphere was generally loaded.

The first two regiments sent up Nile from Cairo took with them hospital equipment for 80 beds. Shelter huts and hospital huts were constructed at Assiout and Keneh. A stretcher per company was carried by each regiment. Field hospitals should admit of

suffici ent sub-divison to meet the exigency and ever-varying demands of war, should be organised in as many sections as there are medical officers, and each of these further divisible into sub-sections, so that each would be in a position to move at a moment's notice with a light or intermediate equipment. The weight of each separate article should be recorded. The camels for the movable field hospital should be in charge of the medical officers, always available and strong, to avoid delay in moving. To be fed and attended by a section of Army Service Corps attached.

The camel bearer company for 200 sick, divisible into four sections, for the first time regularly organised in connection with the military operations of war with a British army, acquitted itself admirably.

As compared with the mule, the camel has some disadvantages for such transport. His mode of progression is not as easy or comfortable for sick or wounded men, and the fore and aft movement communicated to a pair of litters is not desirable for serious cases. In patients able to sit on a cacolet, the camel was all that could be desired.

The camels of the bearer company were placed completely under the orders of the medical officers of the company, who attended to their food, and saw that the native drivers were paid and properly treated, and naturally took much interest in the well-being and condition of the animals of their company. The result was that they lasted longer, and when others were knocked up, were able to carry on the sick and weakly men unable to march.

Five hundred boxes made at Cairo, of the following dimensions:—length, 28 inches; breadth, 12 inches; height, 14 inches; a red line of paint 2 inches wide surrounding the box on each side, so that no matter what its position was, its nature could be seen at a glance, weighing about 80 lbs. when full, with rope handles to facilitate transport over portages and cataracts, answered admirably, and served for the medical and surgical supplies of the Nile expedition, and packing of most of the stores of the movable field hospital. A supply of medicines sufficient for an hospital of 50 patients for two months packed in five of these boxes, numbered 1 to 5, was found most useful. They were sent up to Fatmeh, 1,300 miles, without difficulty. The loss of a particular box could be easily and promptly replaced by a similarly numbered box from another set. Should be made of thoroughly seasoned and light wood, with other fastenings for the lids besides screws, which quickly became useless.

The "Field Companion" was found most useful for small detachments separated from regiments for short periods.

Back pads to keep off the sun were of considerable advantage, but goggles were rarely used, and not liked by the men. Helmet curtains were found to be a great additional protection when issued. The ordinary helmet did not shade the head and temples sufficiently.

Mincers should form part of the equipment of every hospital, and each company should be furnished with one.

The packing of hospital stores per units of 25 beds answered well, supplemented by other articles where necessary when the transport arrangements allowed. With the necessary tents each unit weighed 1½ tons.

Screw-drivers, piercers, and hones were found most useful articles of equipment.

In consequence of the great ranges of temperature in some parts of the Soudan, and the cold particularly at night, a second blanket was carried for each man, fitted with tapes and loops, so that it might cover the *tentes d'abri*, and mitigate the power of the sun when necessary.

Stretchers on Zavdofski's plan for railway transport of sick gave much satisfaction, as they almost entirely prevented the effect of vibration from the carriages being communicated to the patients.

Medical officers had power to draw imprests of money from the Pay Department when necessary, to enable them to purchase in the local markets for the sick. The privilege was largely availed of, and with good results. The employment of native labour for the more commonplace work of the hospital on the lines of communications allowed the Medical Staff Corps to attend more largely to their nursing duties.

It was found that the whalers could be used for the transport of sick at low Nile, and that they were most appropriate and handy for the work, besides being independent of wind and current.

The system of field inspectors on the long line of communications worked well.

Separate tents or huts for the treatment of native or other followers were found to be necessary at each station.

There were no mosquitoes in the hospitals in the Soudan.

At Abu-Klea the great utility of having a large number of stretchers to carry the men when wounded on with the square as it advanced was very marked.

After the severe fighting and desert march terminating at El

Gubat, the hospital established there was singularly free from pyæmia, hospital gangrene, or wound diseases.

From Abu-Fatmeh to Akasheh the sick were carried on whalers, the only boats which could be relied upon, as independent of wind and current in a part of the river where steamers could not ply.

Ice machines proved quite useless in practice, the system not having been effective owing to the intense heat.

Field hospital blankets should be of a different colour to that of the general service, to prevent loss. Four mosquito nets per section were sufficient. Sheets should be omitted where soap and washing materials are difficult to procure. Each section should have an operating lamp.

The 2nd Royal Sussex Regiment was the first to proceed up Nile, leaving Cairo, March 18th, 1884, for Assiout, near to which place it was encamped for the most part of the summer. It was then transferred to Assouan—afterwards ordered to Wady Halfa. In the middle of September it was at Dongola, proceeding there in nuggurs, and arriving in three weeks after a tedious journey. In 1885 the following were its health statistics:—

Average annual strength, 740; admitted, 1,363; died, 13; invalided, 98; average number of constantly sick, 68·06. Rate per 1,000—admitted, 1841·8; died, 17·24; invalided, 132·43; constantly sick, 91·42. Average sick time to each soldier, 33·36.

Instructions for the Medical Officers in charge of Sick Convoys in Boats from Abu-Fatmeh to Sarras (Wady-Halfa).

1. The medical officer is responsible for the management and discipline of the sick and attendants, subject when at the posts to the officer commanding the troops, if the officer has a commission in the British army.

2. The medical officer should occupy the fastest boat in the convoy, so as to be able to be present at any point when required; distribute his men of the Medical Staff Corps so as to have one if possible in each boat, and issue to them definite instructions, orders as to the formation in which the boats are to proceed, &c.

3. At different posts to apply to the officer commanding troops for any assistance required, and not disembark his sick until he has ascertained that everything necessary for their reception and transport has been arranged by the officer commanding the post at the different portages.

4. He can obtain urgent supplies from the hospital at Dal, also at Sarras.

5. He should be in the leading boat before stopping for the evening, in order to indicate where the convoy was to halt, and stop in time to allow of the sick being examined and prescribed for. All the sick should be carefully inspected at this time.

6. At the end of the voyage, "Weekly States," ending each Friday, should be completed, and other documents prepared in accordance with instructions.

7. The medical officer will make all haste to return to Abu-Fatmeh, and bring with him all his men, stores, and drugs (not consumed), replenishing the stock at Halfa Hospital.

8. At the portages all helpless cases are to be carried on stretchers by hand, all others to ride or walk.

9. The medical comforts to be so placed that waste or pilfering of them cannot be effected during the journey.

10. The medical officer will be furnished at Abu-Fatmeh with a list of stores in the boat, and will be responsible for them until he has returned them into store at Abu-Fatmeh.

11. The superintending medical officer at Abu-Fatmeh will furnish books, stationery, and forms for use in the boats.

12. All men of the Medical Staff Corps who have to be admitted into hospital at Dal, Wady-Halfa, or during the journey, are to return to Abu-Fatmeh as soon as they are discharged from hospital.

13. On arrival at Sarras the medical officer in charge of the convoy will ask the officer commanding the post to telegraph to the hospital at Halfa the departure of the convoy, or will do it himself.

14. When returning to Abu-Fatmeh he will take charge of any stores or supplies for posts up river.

15. Non-commissioned officers with the convoy, if not too ill, will assist in maintaining discipline and order in the boats; should be directed to do so, and be distributed accordingly.

16. The soldiers in the boats are to be warned before starting that they are not to interfere with the crew in their management.

17. The interpreter is to explain to the captain of the boat everything necessary.

AN ADDRESS

ON

The Preservation of Health

DURING

SCHOOL BOY LIFE.

Presented by
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4.5.91

BY

WM. JOHNSTONE FYFFE, M.D.
(Dep. Surgeon-General),
PHYSICIAN TO CLIFTON COLLEGE.

Bristol:
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ON THE PRESERVATION OF HEALTH DURING SCHOOL BOY LIFE.

It is now a recognised fact among School Authorities that Education does not consist merely in the cultivation of the mental powers, or in the acquisition of stores of knowledge alone, but that, in order to be effective, to enable the subject of it to become a successful worker in the future, the Physical Education, the cultivation and care of the bodily powers, should proceed *pari passu* with the intellectual development.

It would be impossible in a single address to enter into an exhaustive discussion on all the questions of hygiene affecting a great School like this. I will, therefore, pass by the consideration of most of those questions which are under the special control of the Masters and Governing Body, merely premising that the cardinal points to be observed in every house where a number of young persons reside are: efficient drainage, a pure and uncontaminated water-supply, plenty of cubic space in dormitories, studies, and class-rooms, free and ample ventilation without draughts, good lighting, both natural and artificial, and a sufficient and well-ordered dietary. Certainly, the standard of health in a public school should be a high one. School hygiene is a question which now engages a large share of public attention. It embraces a wide field of subjects: questions which were never thought of thirty or forty years ago have come prominently to the front, and parents now look as narrowly into the sanitary reputation of a public school as they do into its traditions, or into the eminence of its teaching staff.

I will address myself principally, though not exclusively, to the consideration of those questions affecting the health of the members of the School, which to a great extent, they hold in their own hands. How can boys best preserve their health during school life? This is the main subject I have to consider, and I ask your attention while I discuss it as rapidly and concisely as I can in the time at my disposal.

I wish to make two preliminary observations. First, I would say that, as regards your health, life at school is probably the most important part of your existence. The processes of development are then in their fullest vigour, the structures of the body are growing with great rapidity, and will continue to grow until the full stature of manhood is reached, at about twenty-two years of age. It is also during school life that the great transition period which bridges over the passage from boyhood to early manhood is being traversed. Hence the importance of care, lest the steps through which this development is accomplished should be injured or impeded.

While I desire to impress this fact upon you, I wish, on the other hand, to avoid the dangerous alternative of exciting in your minds any morbid sentimentality about

your health, for I do not know a greater misfortune that could happen to a boy than to become sensitive about his health without due cause, to magnify every little ailment, and to be afraid of every wind that blows. My wish is to give you a few practical hints, from a doctor's point of view, which may help you to maintain in your own persons a sound, vigorous, manly standard of health, free from carelessness on the one hand, and nervous fancies on the other.

For the sake of order, I have divided my subjects as follows:

I shall first speak of school diet and food.

2ndly. On brain-work at school.

3rdly. On school games, exercises, and recreations, and their bearing on health.

Lastly. On the personal care of the body.

A copious and well-arranged dietary is matter of great importance in every schoolmaster's house; and, above all, the cooking should be thoroughly good. Without going into particulars, or wishing to criticise the dietary, I would again point out the importance of including fish as an article of diet. I have often spoken in private on the importance of vegetable food, because there is a distinct object in doing so. Too much meat without sufficient vegetables induces certain skin diseases, boils, eczema, and bilious attacks, and also mild forms of scurvy, evidenced by pale and flabby complexions. Therefore, stewed fruits, cabbage, spinach, salads, and other vegetables should be freely partaken of. I am aware of the difficulty of getting young people to eat vegetable food, and I think it is possible the fault sometimes lies in the cooking.

I come to another point about diet. I believe the first school lesson, or, at any rate, the first piece of brain-work, begins about 7.30. It should be a law unalterable that no work should be done on an empty stomach. A biscuit and a little milk in summer, or a small cup of coffee or cocoa in the winter, or even a biscuit alone, might be taken with great advantage before the morning work begins.

I believe thoroughly in a good breakfast. I regard it as the most important meal of the day; it should be a substantial one. Oatmeal porridge is, I hope, a popular food.

Some boys eat their breakfasts in a great hurry, and bolt their food half-masticated, and then rush off as fast as they can to school, especially town boys. This is an injurious proceeding; it produces indigestion and headaches. There should be a little quiet time after breakfast. By attention to these minor matters, derangements of digestion are avoided, and regular habits in obedience to the calls of nature are formed, and the risks of constipation are prevented.

The practice of eating between meals is open to some objections. I am quite ready to admit the advantages of the authorised grub-shop, and there are many boys who are all the better for a little wholesome food about eleven o'clock. All that I desire to suggest on this point is that there should be a very moderate consumption of pastry. Sweet things will do little harm, as sugar is a necessity

for growing boys. Fruits in their season and milk are always wholesome; but the principal point to be borne in mind is, that the luxuries of the grub-shop should never be allowed to take the place of regular meals.

Heavy suppers, with meat and beer, are highly objectionable. I am quite aware that a little light supper, with a few fellows together, is among the social joys of school life. But, I beg of you, do not let it be an hour for overloading your stomachs with food, often of the most unwholesome description, which you cannot possibly digest during the hours of sleep. The consumption of an indigestible meal at a late hour is not infrequently followed by unpleasant consequences, by restless nights, bad dreams, bilious and asthmatic attacks, and, as a matter of course, visits from myself.

Then, what am I to say about hampers? Well, I can only say this, that I am always glad when the first week of the Term passes by without receiving a call to visit some one who has consumed the contents of the home hamper with more rapidity than wisdom; and sometimes hampers have been sent to boys ill in the sanatorium, with very incongruous contents, which would have made the patients very ill indeed if they had partaken of them—which, I need not say, they did not.

As I am speaking on the subject of food, I had better say a few words on drinks.

The temptation to drink large quantities of cold or acid drinks in hot weather, when the body is much heated by violent exercise, is very great. It is best not to drink large quantities, a moderate amount will do no harm: water is best, but lemonade, lemon squash, and good ginger beer are safe beverages. But beware, in your runs or walks in this neighbourhood, of drinking water from any wayside stream or well.

And now, what am I to say about beer? for that is the only form of alcoholic beverage used openly and by permission at the regular meals of the boarders. I am not going to treat you to a temperance lecture; this is not the place, nor am I the person to do so, but speaking from the platform of a school Doctor, I have a word or two to say on the subject.

There is a general consensus of opinion among medical men that stimulants are not necessary for maintaining the health of young people. I do not deny the use of alcohol in its right and legitimate place, and I am not one of those who think there is any sin in drinking a glass of wine or beer. There may be some who from peculiarity of constitution require it; but what I mean is, that to the healthy schoolboy it is not a necessity, but a luxury, possibly a dangerous one. It is my conviction that, as regards his school work, his brain-work, especially if it take the form of preparation for a competitive struggle, he will do well to avoid even the conventional small beer; and in reference to school games and athletics, I have not a doubt the abstainer will have the advantage.

I now come to speak of Brain-work at school and its bearing upon health.

Intellectual development, what does it mean when

viewed from the standpoint of the physiologist? It means brain education: the storing up in the great organ of the mind, the brain, the facts and impressions brought into it from without. By the organs of special sense, by sight, hearing, touch, and taste, we are constantly receiving knowledge in some form or other. This brain development goes on until the middle of the decennial period, between thirty and forty years of age, and when that cultivation and development are guarded and preserved, and the bodily powers kept in health, the result is generally a brilliant old age, such as may be observed in some of our most distinguished judges and statesmen.

I believe that the secret of success in brain-work during school life is the judicious, regular daily admixture with it of recreation and rest, and where these are watched over and insisted on as far as possible, there is little or no danger from that which is called over-pressure or brain-exhaustion from overwork.

I am quite aware that earnest, hard-working boys, towards the close of a long preparation for a competitive struggle, or even at the end of a Term, may, and do, feel the effect of this close brain-work; but, I am happy to say, after nearly nine years' experience of Clifton College, I have hardly ever seen any bad consequences which could not be removed by a short rest and medical treatment.

When brain-work produces headache and sleeplessness there is something wrong, and medical advice should be sought without delay.

Sleep is the great brain restorer. What amount of sleep is necessary for healthy boys? You have heard the saying, "Six hours sleep for a man, seven for a woman, and eight for a fool." If this be true, then, assuredly, every working schoolboy should have the latter portion, and something more. Boys under fourteen should have ten hours in bed; after that age, nine hours. Briefly, the preventives against brain-exhaustion from work are, plenty of good food, regular hours of work, interspersed with exercise and recreation, and an abundance of sleep.

There are two points I wish to mention before leaving this subject: one is, that blows or falls on the head should not be disregarded. The brain lies inside the skull somewhat loosely. The shaking of the organ, caused by any violence, may give rise to unpleasant consequences. Such accidents should always be mentioned to the house matron or, in the case of town boys, to parents, with a view to medical treatment.

The other point I wish to refer to is, the care of the eyes and eyesight. This is a subject which has of late years occupied the attention of ophthalmic surgeons and school medical officers. There can be no doubt that shortsight, headaches, and other troubles may be caused in schools by working with improper and insufficient light. This, of course, is a question for the consideration of the Governing Body: but I may mention that a distinguished oculist in this city, Mr. Richardson Cross, has recently drawn attention to this question, pointing out the fact that the primary strain in school work falls upon the eye,

and that every possible means should be adopted to make its work easy; and these means are three in number. Perfect lighting in form rooms and studies, good printing with no illegible papers, and properly arranged desks.

But, to the members of the School, I may say that when pain in the eyeballs results from work, especially if it is followed by headache, or when there is difficulty in reading ordinary print, advice should be sought on the subject.

I will now make a few remarks on School games and their bearing on health.

It was a wise inspiration, from whomsoever it proceeded, to make games compulsory in Public Schools for all healthy boys. I say healthy boys, for there is always a small percentage of boys who, from physical infirmity or delicacy of constitution, must be exempted from certain games and exercises.

The institution of compulsory games has one advantage. It deters to a great extent that mischievous thing, Loafing. Public School life should practically extinguish the loafer. It should teach him that he will be stronger, healthier, happier by joining in games, than by spending his time out of school in any lazy propensity.

It also shows the hard student, the boy who cultivates his brain at the expense of his body (and I have great sympathy for such) that he will do his work better, and win the goal to which he aspires more easily by participation in games and physical exercise.

*In October of last year that most popular person and truthful critic, *Mr. Punch*, who invariably talks sound common-sense, gave a perfectly accurate description of the harm that is done by parents and doctors in attempting to prevent boys, who are sound and well, from joining the school games. It is called "An Eton Loafer's Diary." I will give you a short extract from it. This young gentleman notes down his thoughts as follows:

"The governor's last words were: 'I'm not going to have Richard's time for reading and his own amusement usurped by athletics. They want to make him play football. Football, forsooth! Look at me! if I had wasted my youth in any of these nonsensical games, I shouldn't be half the man I am!' Probably not, says my Cousin Jack, for he scales nearly twenty stone as it is. My Cousin Jack, a new boy like me, is awfully keen to play football. It's my private opinion that Jack's an ass! I never cared for football, so mamma has got her doctor to say I am not fit to play, and I'm not to get up at seven in the cold mornings, but to keep in bed until the room gets properly warmed, and the maid brings my hot water; and I'm not to sit in a draughty form room, and I'm not to do any fagging, because I might scald myself, or catch a chill after toasting before a fire."

To make a long story short, this boy is sent to school as a Loafer, and spends a good deal of his time in the tuck-shop and makes himself ill. After doing this, he continues his diary thus:

* From an address by Dr. Dukes, Medical Officer of Rugby.

"The school doctor came and vowed I had over-eaten myself. What rot! Why, mamma is always complaining of my poor appetite. The doctor said I was as strong as a horse, and only wanted regular meals and plenty of exercise. I call it a howling shame. My tutor has been influenced by that Idiot of a doctor."

In the end he is made to join in the school games, becomes healthy and happy, develops into a keen player, and, from being wretched and bored, discovers that "Eton is the jolliest place in the world; but I didn't think so when I was a loaf."

There is no part of our school exercises here which receives so much opposition from outside as our Runs, and at the beginning of each Run Term I am beseiged with letters and certificates from medical men on the subject. Some of these certificates are obviously just and right, and when this is the case I give them every consideration; but not a few are evidently given without care, in* ignorance of the claims of physical exercise in schools, and in oblivion of the fact that every reasonable precaution is taken here that no one shall join in these exercises unless he is sound in wind and limb. As a matter of fact, I may say that I have only known two instances where any unpleasant consequences occurred from runs or races, and in these the results were not permanent.

The Long and Short Penpoles, and the Athletic Races, are, I am aware, a considerable test of running powers,

* From this charge I entirely exempt my Medical brethren in Bristol and Clifton.

and require that heart and lungs should be in a healthy state; but, as you know, no one is allowed to run in these races who has not undergone a fixed amount of training during the Term. And in this lies the secret of safety.

Every schoolboy is more or less in training. A great deal of nonsense has been written about training. The professional trainer who proposes to give you a diet of raw beef, who makes you run till you are ready to drop before breakfast, and hardly allows you to drink a drop of water for fear it should turn by some inconceivable process to internal fat, is generally ignorant of what he is doing. Training, to be successful, must be carried out consistently with the laws of health. Regular, systematic exercise not pressed up to the point of fatigue, coupled with sound, wholesome diet, are the cardinal principles on which all good training should rest.

*A writer on this subject has truly said that the secret of success is to do every detail thoroughly, and not to waste energy in slovenly practice.

With reference to football, I suppose I may say that one of its great attractions is that it is rough, and that it calls forth the latent powers and forces which in every English schoolboy must find an expression. Of course, there are accidents sometimes, but they are not very serious. An occasional broken collar-bone is, probably, the worst we have had, and these are very rare. You will find, I think, that the serious accidents occur mainly, if not exclusively, when the game is played by *men*, not

* Dr. Fletcher.

by boys. Dr. Dukes, the medical officer of Rugby, who has had twenty years' experience, in the very birthplace of football, states that he has seen no accident more severe than that which he has had from cricket, house runs, swimming, gymnasium, and, above all, skylarking. But there are moral gains from football, in addition to the healthy exercise and enjoyment of the game. It cultivates pluck and promptitude, moulds the character in the direction of fearlessness and confidence both in self and others, qualities which, I do not doubt, in after-life, will be productive of good results. Occasionally we have a little trouble in the Football Term from a skin disease which attacks the face and hands, especially if we happen to have a wet season. I believe if more care was taken by the members of the School in carefully washing immediately after a match, we should see less of this malady.

From a doctor's point of view, I have little to say of the other games, such as fives, bat fives, racquets, and cricket: they all afford health-giving exercise and amusement. As for cricket, the risks are so few, and the advantages, both physical and moral, so great, that there is nothing to be said but praise of the great English game. Occasionally there are accidents when our ground has been very crowded; but as our space is to receive a very considerable addition, these will be reduced to a minimum.

In very hot weather cases of exhaustion occur from exposure to the sun, and certainly the ordinary school cap is rather an insufficient protection against the sun's rays.

But these risks are as nothing in comparison to the health, physical and moral, which is gained by participating in this noble game. The spirit of honour, unselfishness, and good temper it evokes, and that consideration for the feelings of others which is the characteristic of the true gentleman, are so helpful, that looking at the game purely as a hygeist, it may be regarded as one of the chief factors in the sanitary equipment of every school.

One word about walking. I hope my friends in Clifton College take all the advantage they can in their leisure hours of our proximity to the Downs, and other parts of our beautiful neighbourhood. A pleasant walk with a friend, or a game of golf, on a fine day is surely better than sitting in a study over a story-book.

I should like also to say a word about bathing and swimming. There are just a few precautions necessary. In this School, where the time of immersion is regulated, there is no danger; but during the holidays, at the seaside, there is the temptation to remain too long in the water, or to bathe in the sea more than once in the day. This is a risky proceeding, and all the good that otherwise would be done is frustrated. It produces lassitude, loss of flesh, and other ailments, and may lay the seeds of disease; while a short plunge, a good swim, or even the cold tub, which is as necessary to every clean English gentleman as his daily bread, are healthful and invigorating.

The health of a school depends often very much on the season of the year and the mildness or severity of the weather.

In the winter months colds are caught in various ways; sometimes through circumstances over which the members of the School have no control, by deficient or over-ventilation in form-rooms, or they may be epidemic or infections.

They are caught by town boys by coming in wet weather from their homes and sitting in damp clothes. But they are caught principally from hanging about after matches and not changing quickly into dry clothes, or from lying on the ground when it is damp.

There are two important subjects connected with physical training to which I will briefly advert. I mean drill and gymnastics. As a matter of fact, about 17 per cent. of the School is drilled in the Rifle Corps; but I am very glad to know that our new Head Master has introduced drill for boys who are not strong enough to join in the Runs. I believe every one ought to be drilled. It is remarkable to observe its effect on growing lads: the stooping shoulders are erected, the chest expanded, and the personal aspect improved in every way, and the whole muscular system of the body invigorated and developed.

In the same way the Gymnasium, under such careful supervision as we have, becomes a most valuable, indeed an indispensable aid in the physical training of our boys. The effect of carefully regulated gymnastics on the chest measurement, on the increase in size of the muscles of the arm and leg, and on the power of expansion of the lungs, is very remarkable; even the most delicate boys, to all appearances, improve immensely under a course of these exercises. At a recent visit which I paid to Marlborough School, I was interested to observe that records of the effect of gymnastic exercise on body-weight, girth of chest, and other results of training were kept by a scientific young master who is an enthusiast in such matters.

I think I have said enough about physical training, and it may seem to some that I have exaggerated its importance in school life. I do not wish to be misunderstood.

It is *not* the main purpose of your life here, of course. The mere athlete, who cultivates his muscles and neglects his intellectual training, becomes an animal only, with a contempt for the noblest part of human nature. All that I contend for is, that it is possible and desirable to combine earnest brain work with a thorough enjoyment in, and enthusiasm for, games and exercise; and that it is in every way beneficial to a boy that physical training should form a part of his school education, contributing, as it certainly does, to the harmonious development of all his faculties.

I now pass, lastly, to a brief consideration of the Personal care of the body.

The late Professor Parkes, the greatest teacher of hygiene of this or, probably, any other century, remarks that, "Health is a blessing so great, so priceless, that all

the luxuries of wealth, and all the trappings of pomp, are as nothing in comparison, and in his health a man possesses a gift of Heaven which, if he were wise, he would not barter for the wealth of Crœsus. And yet this health is squandered with a strange and marvellous carelessness."

Esau sold his birthright for a mess of pottage, and many, with equal indifference, surrender, for a moment's sensual pleasure, this great gift of God.

The laws of personal health teach us that habits of cleanliness conduce to its preservation; that we should take daily care of those parts of the body of which so much is required, of the skin, of the hands and feet, of the teeth, of the special organs of sight and hearing, and of the functions of digestion. Even a slight knowledge of physiology teaches us something of the mechanism of this earthly tabernacle in which we dwell; showing how that with care it can be preserved, invigorated, ennobled, and how, on the other hand, it can be weakened and debased.

The body is a delicate, intricate organisation. Every organ in it has its natural uses: treat them with care, and you will be repaid by sound and good health; neglect or mis-use them, and they are soon put out of order, and the process of repair is slow and difficult.

Do you wish to be fit for all your school games here, and to leave this place healthy and vigorous young men? Then take care of your bodies, treat them with reverence and respect.

There *are* dangers in school life, into which some fall through absolute ignorance of the consequences to health and morals. I do not intend to say much on this subject, but I cannot pass it by when I know, that more or less into every school Evils I will not name are liable to creep, which sap the health, and mar the happiness of many a promising young life.

I am not here as a teacher of morals, but I should fail lamentably in my duty as your physician and friend if I did not warn you, that Nature's laws cannot be broken with impunity, and that for every breach of them she will demand sooner or later an inexorable punishment.

Let me advise you to cultivate habits of daily life in conformity with the laws of health. Rise early; take plenty of exercise in the open air, especially in the holidays; use the cold bath frequently.

Observe moderation in eating, drinking, and sleeping. Avoid as a pestilence every form of unwholesome literature. Employ leisure time in games or in the pursuit of some object of interest, which will keep head and hands busy.

But there is something higher. Cultivate and cherish, under all the circumstances of life, that trust and confidence which should ever exist between parent and son. Let that relationship be such as a great master* of the English tongue describes it: "To be to the father his strength, to the mother his sanctification, and to both his chosen refuge through all the weakness and danger and amazement of his young life."

* Ruskin.

Then, be careful of your Friendships. There is, to me, something tremendous in the responsibility of a school friendship. What a power there may be in it for good or evil! When formed upon that healthy, manly basis, which has in it no taint of spurious sentimentalism, it will endure, and often *does* endure, with all its influence for good while life lasts. All these are helpful; but, best of all, is the resolve, in dependence on God's help, to live a pure and innocent life.

Upon you who are the seniors and leaders of the School rests a grave responsibility. The example of your lives, if they are true and loyal, will have an influence over your schoolfellows which will be of incalculable benefit to them in mind and body. I have known Cliftonians before whom, to use Dr. Arnold's expression, I could "stand bare-headed," for the brightness of their example.

Let it be your aim to use the power and responsibility committed to your trust in such a manner as to make impurity in every form an impossibility wherever the range of your influence extends. Let your own lives be spotless in this respect; and living as you do constantly in the sight of your younger, less experienced brethren, become to them a refuge and help in their struggle to do right. Happy indeed will be your retrospect in after-life, if your example here has been such as to lead others to follow you in the path of virtue and true manliness. What stronger language could I quote to you all, than that which has fallen from the lips of our late honoured Head Master? In one of his most powerful addresses to the

School, he says: "You who are yet innocent, who scarcely know what I am speaking of, let me implore you, for God's sake, to keep that innocence as your dearest, most sacred treasure. Forbid in yourself, and forbid in your presence, forbid, yes, even the youngest of you, with instant, indignant, savage earnestness, the introduction of a foul word or thought into conversation. I would rather," he continues, "hear it said of Clifton boys that their presence was a guarantee for purity in whatever society they found themselves, than that you won every other honour this world has to bestow on you."

Assuredly, there ought to be a clear moral atmosphere in Clifton College. Is it so? What is the object of all the good influences constantly at work in this place? the hope and strength imparted to you by true friend, master, or schoolfellow; the helpful words you hear from the pulpit of the Chapel, all the sacred hours passed there, the memory of which will cling to you through life. What are these but the factors by which to cultivate all the higher and better parts of your character, and to expel and subdue all that is sensual and debasing.

The honour, the prestige of your School rests in your hands. Clifton College is distinguished for scholarship and learning. She has won her honours in sports and games, and occupies to-day a splendid position among the great Public Schools of England.

It is for you to see that her higher life is preserved pure and without reproach.

One word more and I have done.

This preservation of health of which I have been speaking, what is its great object? Surely it is the preparation for that manhood on which you will enter when you leave these walls, a preparation which will enable you to take with you, not only the well-ordered store of knowledge which your intellectual training here gives you, but also sound health, fitness for the struggle of life, and some portion of those qualities of which the Poet Laureate speaks: "Self-knowledge, self-reverence, self-control—these three alone lead life to sovereign power."

Armed with these you will become worthy members and citizens of that great Commonwealth which is your birth-right as English boys.

"We talk of our greatness," says a living historian;* "but do we clearly know in what a nation's greatness consists? Whether it be great or little, depends on the sort of men and women it is producing. A sound nation is a nation composed of sound human beings, healthy in body, strong of limb, true in word and deed, brave, sober, temperate, chaste, to whom morals are of more importance than wealth or knowledge; where duty is first, and the rights of man second; where, in short, men grow up, and live and work, having in them "'the fear of God.'"

* I. A. Froude.

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EIGHTH INTERNATIONAL CONGRESS OF HYGIENE & DEMOGRAPHY,

BUDA PEST, SEPTEMBER 1-9, 1894.

DIVISION A.—HYGIENE.

SECTION II.

THE PROPHYLAXIS OF EPIDEMICS.

"THE RELATIONSHIP BETWEEN THE OCCURRENCE OF DIPHTHERIA AND THE MOVEMENT OF THE SUBSOIL WATER".

BY

MATTHEW A. ADAMS, F.R.C.S.,

OF MAIDSTONE.

Maidstone:

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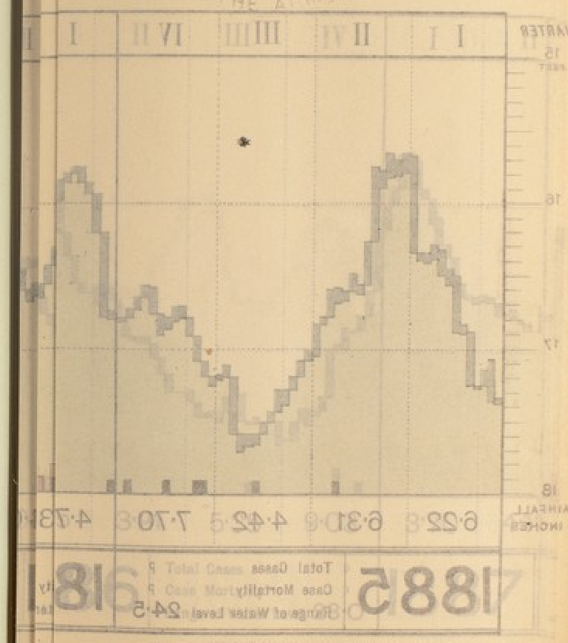
DIPHTHERIA IN

The Cases of

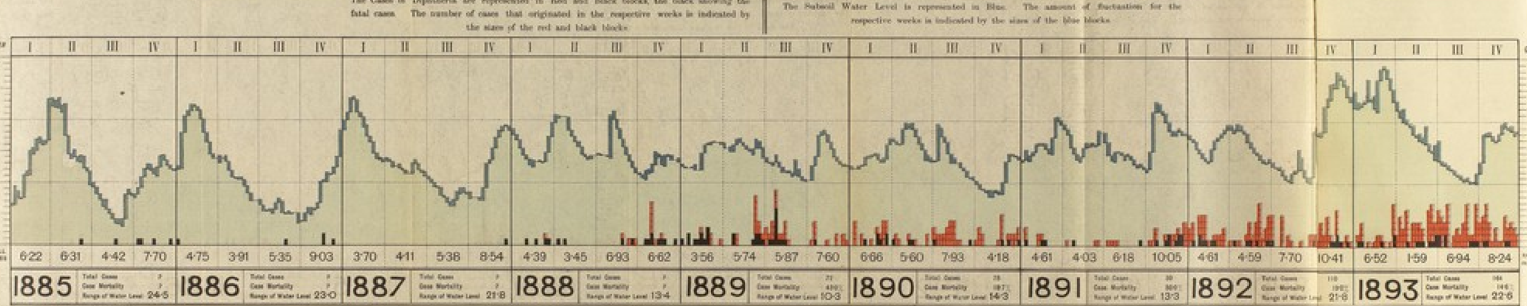
fatal cases



DIPHTHERIA IN RELATION TO HEIGHT AND FLUCTUATION OF SUBSOIL WATER AT MAIDSTONE.

The Cases of Diphtheria are represented in Red and Black blocks, the black showing the fatal cases. The number of cases that originated in the respective weeks is indicated by the sizes of the red and black blocks.

The Subsoil Water Level is represented in Blue. The amount of fluctuation for the respective weeks is indicated by the sizes of the blue blocks.



Time not allowing of a statement of the grounds upon which these conclusions are based, I will proceed to demonstrate the result of my further observations by means of the diagram placed before you, which exhibits the rise and fall of the Subsoil Water, along with the corresponding prevalence of Diphtheria, week by week, for the years 1885-93; the actual extent of the movement of the Subsoil Water for each week being indicated by the position and length of the corresponding blue block, and of the Diphtheria prevalence by the red and black blocks, the black indicating the fatal cases; each of course plotted in a position corresponding with the date of its origin.

My remarks shall be arranged under three heads:—

I.—As to the facts relating to the movements of the Subsoil Water.

II.—As to the facts relating to the prevalence of Diphtheria.

III.—As to the relationship between the two sets of facts.

I.—In the first place, looking at the diagram as a whole for the entire nine years, we observe a striking similitude between the three first years' records; each of these three years has its well marked high tide during the cold season, and equally well marked low tide during its hot season, the transitions being gradual.

In contrast with this, during the four succeeding years, 1888-90, the tides are almost completely lost, being replaced by irregular and often abrupt oscillations of an indefinite and limited character, often misplaced or transposed in respect of time, so that high tides came when low tides were expected, and *vice versâ*; examples of this may be seen in the third

quarters of 1888 and 1890 and first quarters of each of the years 1888-92.

Next I will ask you to observe that the range of movement was greatest in 1885, year by year becoming less, till in 1889 when it had become reduced to 42°/₀ of what it had previously been; since then the yearly range has graually expanded to within 7°/₀ of what it was in 1885.

It follows as a consequence of this variation in the yearly range of movement of the Subsoil Water, that the condition of the Subsoil as respects its moisture and aëration varied proportionately. The extent of this variation may be roughly appreciated by allowing the eye to follow the 17ft. line by which it is demonstrated that on four occasions only has the water fallen low enough to embrace a dry space beneath the 17ft. level, that is to say 1885-86-87 and to a small extent, though in a different position as respects time, in 1890; for mark you in 1890 the occurrence was postponed from the third to the fourth quarter, moreover during the third there had been interposed a very steep high tide.

In consequence of the repeated absence of the summer low tide, the soil became more and more waterlogged; this is made manifest by the chart for 1893, which exhibits a curve distinctly of a type similar to those for 1885-87, and having abundant range, with, however, this great difference: the water level never descended below the 17ft. line but on the contrary it stood on a much higher level throughout the whole of the year than it had done in any previous year.

Another feature that must not be overlooked is the occasional sudden and violent change of level, examples of this are seen to have occurred in the third quarters of 1888 and 1890, and fourth quarter of 1891-92.

II.—As to the facts relating to the Diphtheria prevalence, the record is complete as respects the fatal, but not for the non-fatal cases; during the first three or four years, before the notification act came into operation I had no reliable source of information concerning those that were non-fatal.

Taken as a whole it is, however, abundantly manifest that during 1885-86-87 Diphtheria was scarce, and year by year becoming more so, until the fifth week of 1888, which may be regarded as the date of the commencement of a severe and prolonged epidemic. During the middle of 1888, for a period of 17 weeks, there was a pause, followed by a more serious outbreak in the middle of the third quarter, which increased and became more fatal during the fourth quarter; thence forward throughout 1889-90 the epidemic waxed in violence and volume, continuing through the five succeeding years, though with obvious abatement during the first three quarters of 1891, but suddenly breaking out afresh with intensified virulence during the fourth quarter of that year, growing more and more plentiful right on through the next two years to the end of 1893, becoming less fatal as time went on.

As a matter of special remark I would have you observe that near about the junction of the third and fourth quarters there has usually been a very notable mitigation of the disease; for instance, in 1889 six consecutive weeks passed without a case, in 1890 four weeks, in 1891 six weeks, in 1892 there were twelve, interspersed with non-fatal cases, and in 1893, although there was no positive exemption, for seven weeks there was no fatal case.

I will conclude my remarks under this head, by pointing out that the case mortality, commencing at 43·0% in 1889, dropped to 18·7% in 1890, rose again to 36% in 1891, and fell to 19·0%, and finally 14·6% in 1892-93 respectively.

III.—All that now remains is to show how these facts are connected.

In setting before you what I consider to be the evidence of the relationship between the movements of the Subsoil Water and the prevalence of Diphtheria, I must again ask you to allow me to assume, as a working hypothesis, that the germ of the disorder resides in or upon the soil, and by one cause or another is liable to be displaced and dispersed along with the Subsoil Air, into the air we breathe, and in this manner invade our bodies. This admission being made, the foregoing facts readily fall into their places, and much that concerns this otherwise mysterious disorder becomes as light as day.

By general acceptance, analogy and observation both justify the belief that damp close stagnant states of the atmosphere promote, whilst the opposite conditions oppose prevalence of Diphtheria. In these records we have, as regards the Subsoil, evidence of these opposite conditions having at various times prevailed, and, broadly speaking, right through the nine years, from beginning to end, a strict concordance may be traced between soil dampness and Diphtheria on the one hand, and absence of Diphtheria and soil dryness on the other hand. But the dampness and dryness have their appropriate seasons, and so long as the order of this occurence is preserved, health is maintained. As long as the soil is well washed by the winter's high tide and afterwards dried and aërated during the summer's low tide all goes well, Diphtheria is kept in abeyance; but so soon as these salutary movements are arrested, or their order disturbed, Diphtheria gets the mastery, reaching its acme of violence when stagnation is most complete; and I wish to lay particular stress upon the fact that the virulence of the disorder increases with the stagnation of the soil air. This fresh developement of my observations, besides affording valuable support to the general argument, also shows that the QUALITY as well as the QUANTITY of this disorder varies in obedience to the circumstances concerning the Subsoil Water, there being an agreement, in the inverse ratio, between the case mortality from Diphtheria and the range of the movements of the Subsoil Water.

For the first four years the records as respects non-fatal cases is too imperfect to allow of a calculation being made of the case mortality; 1889 is the first year when I can do this with anything like confidence. The range of the movement of the Subsoil Water that year was only 10·32 inches, and the associated case mortality from Diphtheria was 43·0°/°; in 1890 with the range increased to 14·28, the mortality fell to 18·7°/°; in 1891, with the range reduced to 13·32, the mortality rose to 36°/o; and during the last two years, as the range increased to 21·84 and 22·56, so the mortality sank to 19·0°/o and 14·6°/o, in accordance therewith.

Thus far we have dealt broadly with the facts, let us now study them more in detail. We have said, a drying of the soil in the summer quarter is propitious; observe, there is generally some indication of this drying process even in unfavorable years, and invariably in association with it either a cessation, abatement,

or attenuation of the disease. In 1889, our very worst year, there are six weeks made free; in 1890, four weeks; in 1891, six, and if we except one solitary case, nine weeks; in 1892, for twelve weeks there are no fatal cases, and for seven of these none at all; and in 1893, the disease was so attenuated, that for seven weeks though there were many sore throats, not a single fatal case.

On the other hand I would have you remark how that a rise of the Subsoil Water taking place at this time of the year is invariably accompanied or immediately followed by a fresh outbreak of the disease, or an increase of its volume or violence, and the more sudden and considerable the rise, the more pronounced the effect; for example, it was to a rise of this sort in the midst of the summer of 1888 that we may attribute the starting point of our epidemic; the less sudden rise in 1889 being spread over three or four weeks, and not completed till the beginning of November when the colder season had set in, produced an effect which, though obvious, was of shorter duration and smaller dimensions. The following year, 1890, furnishes a most interesting and instructive chart, in which the summer fall commences in the middle of the second quarter, but is suddenly interrupted and reversed by a rapid rise in the second week of the third quarter, after which the fall re-asserts itself and ultimately the water level reaches a lower point in the middle of the fourth quarter than it had done any previous time since 1887; corresponding with these movements, what do we find? The beginning of the summer fall is, as usual, attended by a mitigation of the disease, four out of five of the last weeks of the second quarter are free of Diphtheria, but the moment that the tide turns, and the misplaced rise of the second week of the third quarter takes place, a whole cluster of cases occur; and again when the fall re-establishes itself, away goes the Diphtheria, and four more consecutive weeks are absolutely free, but no sooner does the autumn rise set in, than back again it comes. In a similar way the order of occurrences may be traced through the remaining years, but it is not necessary that I should consume your time by mere reiteration of similar facts. I may however point out that the sinking of the tide below the 17ft. line in 1890 appears to have had a mitigating effect right into 1891, for it was not until after the sudden and impetuous rise in the autumn of that year that the disease again became seriously prevalent.

In conclusion, with two sets of phenomena extending over so long a period as nine years presenting points in order of occurrence in such circumstantial and frequent agreement, I would ask, is it possible to escape from the conclusion that these two things, otherwise so distinct, are as respects this particular matter related as cause and effect? Such is my belief, but I feel it as much a duty as a pleasure to submit the question to the judgment of the Congress.

NOTE:

The two chief agents concerned in the discharge of the soil air into the atmosphere we breathe, are:—

I.—Reduction of atmospheric pressure, which acts by aspiration.

II.—Rainfall, which operates by compression.

Probably the latter is by far the most effectual, though no doubt, both often act in concert. The way rainfall operates, especially when sudden and copious, is as follows:—The outside uncovered soil receiving the rain becomes temporarily sealed by moisture, and the underlying imprisoned ground air is driven downwards and laterally beneath protected parts such as are sheltered by buildings, and so finds an easy way of escape upwards through the unwetted surfaces that underlie buildings. Therefore the tendency for ground air to be forced into dwellings, depends upon the relative proportion that the uncovered bears to the covered area, consequently, in country situations, with relatively far more uncovered area than in towns, rainfall may be expected to be more effective. This appears to be one reason for the rural proclivity of Diphtheria; more especially, as what with piggeries, middens, cesspools, and farm yards, the area immediately surrounding country houses, is in many instances, far more befouled than that around town houses.

With the Author's compliments

AN ADDRESS

UPON

HYDROPHOBIA, DOG-BITES,

And other Poisoned Wounds.

DELIVERED BEFORE THE BALLOON SOCIETY,

AT

9, CONDUIT STREET, REGENT STREET, LONDON

(F. H. ALDERSON, ESQ., M.D.,

President of the Incorporated Medical Practitioners' Association,

IN THE CHAIR),

ON

TUESDAY, SEPTEMBER 18th, 1894.

BY

C. R. ILLINGWORTH, M.D.,

OF FOREST HILL, S.E.

LONDON:

BAILLIÈRE, TINDALL AND COX

KING WILLIAM STREET, STRAND.

1895.

PRICE ONE SHILLING.

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1895.

Dedicated

TO

THE BRITISH PUBLIC.

HYDROPHOBIA.

MR. CHAIRMAN, LADIES AND GENTLEMEN,

I am here this evening, in response to an invitation from the President of this society, to read a paper on Hydrophobia. I accepted that invitation gladly; firstly, because a keen and appreciative interest is taken by the public in preventive and curative medicine, and I see no reason why the members of this society should not be informed of what advances, or otherwise, have been made in the treatment of hydrophobia: for, unfortunately, this disease stands almost alone in the fact that no remedy of a curative nature has as yet been admitted to be of the slightest value when it has really set in, whilst preventive treatment, such as that instituted by M. Pasteur, is believed by many medical men to be worse than useless. Secondly, because I have to place before you a statement of facts regarding the treatment of dog-bites and other poisoned wounds which you ought to know, but which for the moment you will find some difficulty in believing.

In order to do this clearly, I shall have to enter upon the enunciation of certain elementary facts in physiology and pathology, which will appear to many of you absurdly simple, but which form so sound and complete a basis for the rational treatment of all disease and injury that a description of them cannot be omitted.

I trust that amongst my audience there may be both believers and unbelievers in Pasteur, and his, to my mind, fallacious and mischievous doctrines regarding rabies; so that, by full and free discussion, the truth may be elicited, or, at least, such additional light thrown upon it as to hasten its recognition and the consequent amelioration of the lot of mankind.

There are the old and the new methods of treatment to discuss. I am for trusting in the old and well-proved method by recognised drugs and the adoption of other rational means. In the new method, by means of extracts prepared from defunct or living diseased animals, I have no confidence whatever. But both shall have fair treatment at my hands, and all I ask is, that you will give me a patient hearing.

Blood is composed of red and white corpuscles, or cells, floating in a fluid named *liquor sanguinis*. Blood is coagulable by reason of the existence in its cells and blood liquor of two elements which, under favourable conditions, unite to form a substance called fibrin. This coagulability is diminished by the addition of certain medicaments, such as soda, potash, and ammonia, whilst it is increased by others, such as iron, acids, etc.; it is also greatly increased, and in fact made absolute, by perfect rest. When from any cause fibrination has taken place in blood, a yellowish liquid is seen to ooze from the clot, which does not solidify, and is named serum—comparable to the whey of milk, and containing all the salts of the blood, such as chlorides, phosphates, carbonates of potash, soda, etc.

When from any cause arterial or red blood is brought to a standstill, as in inflammation of any part or by being shed, it begins to clot; that is to say, its fibrin elements unite to form a solid or semi-solid body. Venous or dark blood clots much less slowly and firmly, because it contains less fibrin. It is important to note that in all inflammatory diseases the fibrin of the blood is increased, whilst in all those associated with deprivation of oxygen, as in suffocation, etc., it is diminished to the vanishing-point.

?

I called especial attention to the above physiological facts about fibrin, as of the utmost importance in treatment, in a paper published in the *Medical Press and Circular*, on a 'New System of Treatment through the Blood,' on January 20, 1886, and following numbers.

I now turn to some points in pathology regarding fibrin.

In surgery fibrin plays an important part, and an essential one, in protecting the blood from the influence of possible external infection. Thus, when a wound is made, blood-clots seal the divided ends of the bloodvessels.

Professor Erichsen, in his book on surgery, says:

'By what channels the poison enters the system in septicæmia is still uncertain; it may be either by the veins or the lymphatics. Of one thing, however, there seems no doubt, that healthy granulations, under circumstances of ordinary pressure, offer a decided barrier to the passage of any of these infective materials into the blood; and it is also just as certain that recent wounds, before their surfaces are covered with organizing lymph or granulations, offer them a ready entrance.'

In my opinion it is extremely probable that the lymphatics, as in their well-known action in cases of poisoned wounds, are the first to convey the infective material into the circulating fluid, the veins only becoming channels for the absorption, after the softening of their contained clots under the influence of putrefaction products.

And now for the bearing of the above-mentioned principles regarding fibrin upon pathological conditions generally.

Fibrin is increased in quantity in all inflammatory conditions, whilst in all conditions accompanied by deficient blood-aëration it is sooner or later diminished.

Speaking generally, we may divide diseases into two classes —those which prevent or lessen the formation of fibrin in the blood, and those which increase its fibrin-forming power.

Under the former come pneumonia, pleurisy, bronchitis, meningitis, articular rheumatism, etc., in all of which there is an increase of the fibrinous elements, and a consequent indication for the giving of what may be termed 'liquefying' remedies, such as ammonia, the salicylates, iodide, and nitrate of potash, etc. Under the latter class may be arranged such diseases as pyæmia or septicæmia. puerperal and typhoid fevers, in all of which, I argue, not only from the symptoms, but also from the nature of the poison absorbed, there is a decrease in the fibrin-forming power of the blood, and an indication therefore for the administration of fibrin-formers, or hæmatinics and astringents, such as the strong preparations of iron and dilute mineral acids. Taking septicæmia as a type of the class of diseases in which the formation of fibrin is lessened; it is only necessary to refer to the morbid anatomy in a case, to find it an established fact that 'the blood is of a dark colour, and imperfectly coagulated' (Jones and Sieveking). The explanation of this is to be found, I think, in the absorption of putrefaction products from the source of infection, such as typhoid ulcers, putrescent wounds in surgical fever, etc., resulting in the diminution or destruction by these poisonous products of the fibrin-forming power of the vital fluid.

The bacterial origin of the disease is, of course, an indication that, if accessible, antiseptics should be applied; while if they cannot be reached in this manner they should be destroyed by the administration of internal remedies, which I assert can be as safely and as simply administered as local ones. In 1887 Dr. Clement Dukes, of Rugby, and Dr. Hoadley Gabb, of Hastings, testified in the *British Medical Journal* to the high value of the combination of the biniodide of mercury with the iodide of potassium in the treatment of scarlet fever and diphtheria. And I may say that I can confidently predict that treatment having for its object the destruction of the disease germs will become universal, and that the present helpless attitude of allowing the ravages of hosts of bacilli to go on in all cases of dog-bite, insect-sting, erysipelatous, and all poisoned wounds, will cease.

I should point out, however, that a disease may at first be accompanied by increased, and subsequently by diminished, fibrination. Bronchitis, for instance, in a fatal form, exemplifies this fact, the deficient aëration of the blood towards the end of the patient's life setting up a defibrinated state of the blood, such as is found in cases of death by drowning or suffocation. Again, in diphtheria and other germ disorders there is acute local inflammation and excessive fibrination in mild cases; whilst in malignant cases of these disorders the blood is so devoid of fibrin-elements that it oozes through the vessels to form effused dark patches in

the substance of the skin (as in typhus); into the pocks in small-pox and chicken-pox, etc.

In the same way, in snake-bite, wasp-sting, mussel-poisoning, etc., there is an excessive diminution of coagulability or fibrination of blood, and consequently intense swelling, beginning at the part affected, and spreading along to the centre of the body. In snake-bite more especially, these symptoms are most marked, the fluidizing effect extending to the nose and bronchial tract, and leading to an appearance of impending suffocation (Woodhead).

For these reasons, in 1888, I suggested a treatment by iron internally, and the application of a suitable antidote locally, or at any rate an experiment upon a small animal thus poisoned.

When snake-poison is injected into the veins or tissues, it causes swelling of the bloodvessels, small hæmorrhages, and soft patchy tissue-swelling, showing great reduction of the coagulability of the blood. A snake and a wasp, of course, here stand as direct analogues of bacteria, and are thus valuable indicators, through their products, that all bacterial products are essentially defibrinant in their action upon the blood, and consequently chemically comparable to that of the alkaline salts—in all probability by reason of the compounds they form with the constituents of blood immediately they are introduced; for into the composition of some *formic acid* largely enters.

In hydrophobia the ultimate defibrinant action of the germ-products is seen in the passive congestion of the membranes of the brain, effusion into the ventricles, and bleeding into the substance of and around the upper part of the spinal cord; whilst the dependent parts of the body are very livid, and the lungs loaded with frothy mucus.

The inoculation-period is usually from one to two months; but may only last eight days, or may extend to twelve years.

The symptoms I need not describe, except to state that the most positive evidence of a germ-origin is furnished by the occasional wound-symptoms near the close of the period of incubation. These are heat, tingling, pain, and occasionally reopening of the cicatrix. We shall now see the important bearing of fibrin on medical practice in general, and the treatment of dog-bites and other poisoned wounds in particular.

About the year 1886 certain Continental surgeons, and especially M. Tarnier of Paris, advocated the use in surgery of the bichloride of mercury, a drug familiar to you all by the name of corrosive sublimate, as an antiseptic of great power. Brilliant results were described as the effect of treatment by it, although there were occasional deaths from mercurial poisoning, on account of the formation of an albuminate of mercury with the albumin of the blood, and the consequent deposition of that compound in the tissue. One by one, from that time to this, the various authorities on the Continent, in surgery, medicine, bacteriology, and obstetrics, abandoned the use of it, owing to this great objection; and in this country Dr. Woodhead, the director of the London laboratories in 1888, and Dr. Luff, lecturer on toxicology and physician to St. Mary's Hospital in 1889, pointed out in no uncertain manner the extreme dangers attendant upon its use in all departments of medical practice.

In 1886 I reported in the columns of the *British Medical Journal* that I had accidentally found the biniodide of mercury dissolved in a defibrinant salt—iodide of potassium—to be a valuable curative agent in scarlet fever and diphtheria, and explained this on the ground of the solvent iodide enabling the antiseptic to permeate every particle of the infected tissue, and destroy the disease-germs, thus aborting the disease in its first stage of invasion.

For a period of eight years, passed for the most part in general practice, I have frequently published in every medical journal open to me, cases of treatment of germ disorders and poisoned wounds, and others of rapid healing in ordinary surgery treated by this solution, and have urged its use in every possible way, and especially that it should have a fair trial in all cases of bites from dogs, insect-stings, erysipelatous and all poisoned wounds, etc.

In 1887 several Russian surgeons pronounced the solutions of the biniodide to be more powerful and less poisonous than the bichloride.

In 1888 Woodhead pronounced the same opinion and gave six reasons for it.

In obstetrics, Professor Von Hoffman, in his Vienna lectures' said: 'I fear the dangers attending the use of corrosive sublimate (*i.e.*, the bichloride) are not duly recognised by the profession.' A great many Continental surgeons uttered the same sentiments, whilst the fatalities, it is no exaggeration to say, which have been recorded in the journals, would fill a fair-sized volume.

In 1893, M. Tarnier, the originator of its use, denounced it in unmeasured terms, for the reason that, after adopting every possible precaution to prevent fatalities from its use, he had lost eighteen patients by mercurial poisoning. To this important fact I drew the attention of the profession in the columns of the *British Medical Journal* immediately after the Newcastle meeting, at which this very drug had been referred to as the best to use in the prevention and cure of puerperal fever (*vide Brit. Med. Journ.*, October 21, 1893).

Clinically, Dr. Luff, of St. Mary's Hospital (in a paper read by him before the Harveian Society in 1889), reported *cent. per cent.* cures of that disorder of children known as infantile diarrhœa in eighty cases treated by him with the soluble biniodide, by the method I advocated in the *British Medical Journal* in 1866.

Dr. Luff also declared and published cases showing that the combination of these germicide and defibrinant remedies readily destroyed bacterial products, such as the milk-ptomaine—*tyro-toxicon* (*Brit. Med. Journ.*, April, 1890).

The effect of these pronounced opinions upon the efficacy of this solution of the biniodide of mercury has been the adoption of it as a germicidal agent by many general practitioners and a few specialists. But the vast majority of medical men, and especially is this the case in the most dangerous department of gynecology, causing most frequent and terrible deaths, seem to be of the opinion that one mercurial is as good as another, shutting their eyes to the fact that it is not so much the relative value of the two mercurials as the power conferred on the biniodide by the vehicle potassium iodide that constitutes its indisputable and vast superiority. Only the most puerile reasons have been advanced in support of the continued use of corrosive sublimate. It has even been said that 'notwithstanding the superiority of the biniodide, the iodide of potassium as a solvent for it is so expensive that no hospital would tolerate the necessary expenditure.' Now, I argue—nay, I have no hesitation in vehemently declaring—that expense should be no bar to the use of a valuable remedy where human life is at stake. As a matter of fact, the cost is but sixpence a gallon, and the expense is more than counterbalanced by the greater rapidity of the healing process, and the absolute safety of the patient from any ill effects.

Messrs. Miguel and Rueff, of Paris, are, as chemists, conceded a high place in the medical world, and out of a hundred so-called antiseptics they place the two mercurials first, the biniodide showing twice or thrice the bactericidal power of the bichloride. Down at the bottom of the list almost stands caustic, or nitrate of silver. It is important to note the question asked a patient by his friends when he is suffering from a dog-bite. It is not, 'Have you had the wound thoroughly washed with a powerful and penetrating antiseptic?' but 'Have you had caustic applied?' When every chemist and every medical man has the most powerful and the least powerful antiseptic at command, the one chosen is the most worthless of the weakest ones in the list. And this is done with the object of preventing one of the most horrible and deadly diseases which afflict humanity. Truth is indeed stranger than fiction!

The Nature and Treatment of Hydrophobia.

The ubiquitous germ has a great deal to answer for. In some cases it works benignly, as in the formation of some foods and drinks, the ripening of cheese, etc.; but in the realm of disease it has a wide sphere of operation, and its action is wholly mischievous. In scarlet fever, measles, diphtheria, etc., by inhalation and deglutition, germs are lodged on mucous membranes, where they grow and multiply. In other cases they can only be planted in the body by actual contact, with or without

an open wound. To this latter class hydrophobia belongs. In cholera, again, germs and their products, taken with them in the shape of poisonous *ptomaines*, work havoc in the intestinal tract.

Ordinary wounds into which simple germs have fallen are quite amenable to treatment by cleanliness and the use of simple antiseptics, like borax, Friar's balsam, etc.; but where malignant ones have by any means been introduced, it has been found by a large majority of the profession of medicine that the utmost care and attention have been wholly unavailing. Hence, in the present day, one reads of blowing up wounds with gunpowder, of cutting the part out, of amputating the limb, and so on. Dr. Schimmelbush, for instance, in reference to this subject, reporting to the Surgical Congress at Berlin in 1893, said:

> On casting a critical glance at the development of disinfection, the impression was received that it had not been based on exact proofs. There had been, indeed, an abundance of experiment as to the activity of antiseptic substances, but these were always made on dead objects, and were never applied to an infected wound. It had been assumed as a matter of course that substances that killed bacilli in watery solutions would do the same in wounds; and yet such investigations were readily made. Nothing more was required than to make a wound, to bring the wound in contact with infective material, then to disinfect and see whether the animal lived or died. The experiments he had made were limited to the infection of mice with anthrax, and rabbits with a species of streptococcus that was very destructive to them. Care was taken that the animals should not lick nor gnaw the wound nor soil it. Mice were kept singly in cages; their tails were drawn through a small hole in the side and kept fixed there. The wound was made about 2 ctm. from the root of the tail; it could then be watched and disinfected without the animal being able to get at it. Serum from animals that had died of anthrax was now placed on the wound, and immediately after the inoculation irrigation with a 2 per 1,000 solution of sublimate was commenced. The

first series of mice all died. A second series of experiments was made, and the irrigation was repeated, with the same unfavourable result. A large number of disinfectants were now tried: 5 per cent. carbolic solution, alum acetate, zinc chloride, creoline, etc.; later on 10 per cent. potash solution, nitric acid, boiling water, concentrated carbolic acid, and caustic potash. The effect was constantly the same, notwithstanding that the fluid was allowed to run over and cover the wound. In the case of the rabbits inoculated with the streptococcus the result was exactly similar. A very small wound was made on the ear, a drop of streptococcus culture was applied and immediately followed by sublimate irrigation, but in spite of it all the animals died. The result was unchanged even when the mode of disinfection was altered—for instance, when the wound was rubbed out with the disinfectant.

'From these experiments, the speaker went on to say, substances that in the reagent glass had an extraordinary germicide power, had no effect when applied to infected wounds. This surprising result might depend on various causes: it might be that the disinfecting material was rendered inert by the albumin of the blood and wound products, or that it was practically impossible to bring all the parts of the wound into contact with the disinfectants; or it might be that the germs penetrated the tissue so rapidly that they escaped the action of the germicide. This was a very probable cause in the case of septic infection. The rapidity of entrance of germs was generally under-estimated. In 1849, horses were inoculated with glanders, and sheep with variola, and in ten minutes the inoculation spot was burnt out with the actual cautery, but all the animals died. In 1873 Collin inoculated the ears of rabbits with anthrax, and then amputated the ears at the root, and if the amputation was delayed a few minutes it was not capable of preventing the lethal action of the inoculation. He had amputated the tails of mice inoculated with anthrax, and if the amputation was delayed more than ten minutes, the animals died. If infective germs, then, could traverse a space of 3 ctm. in so short a time, it was probable that they penetrated the tissue too rapidly for the disinfectant to reach them.'

In *The Medical Times and Hospital Gazette* of June 10, 1893, I wrote:

'Permit me to point to the important experiments of Dr. Schimmelbush, detailed at the Surgical Congress, as indicating the necessity for further work upon the same lines. I am persuaded that in this way the validity of antiseptic surgery would be clearly proved. The experiments showed that strong germicidal agents had no effect in arresting sepsis in infected wounds. I submit that the reason why they failed lay in the fact that they were not employed in such a form as to place them on what may be termed an "equal footing" with the inoculating material. The invariable action of bacteria is one of a defibrinating or liquefying nature; whilst that of all the bactericides of any power in Dr. Schimmelbush's experiments is productive of fibrinous effusion in the blood and tissues. The consequence is, as was found—failure of disinfection, and death of the subject. What is needed in further experiments is a potent antiseptic applied to a living infected wound in such a form as will not excite the formation of albumin compounds and fibrinous effusions, to the detriment of its pursuing and bactericidal powers. The only strong antiseptic at present known in such a form and with such powers is the iodide of potassium, or sodium solution of the biniodide of mercury. During the past seven years I have treated all kinds of poisoned wounds with it, and I have never known it fail in preventing and curing erysipelas and blood-poisoning of every description.'

In the same journal, of December 23, 1893, appeared the following:

'Sir,—On June 10 last, I submitted in your columns that the reason for the failure of Dr. Schimmelbush to save life in animals infected with anthrax by direct inoculation was the use of antiseptics which precipitated albumin (like corrosive sublimate); and that if a potent antiseptic, such as the biniodide of mercury, held in solution by a vehicle which does not precipitate albumin were used, the bacilli would be followed and killed by the penetrant power of the bactericide.

As no one has acted upon the suggestion, I have obtained a license myself, and with the facilities kindly offered me by Professor Crookshank and Dr. Hewlett, in the laboratory at King's College, I am experimenting with mice and other small rodents, by directly inoculating them with virulent anthrax cultures, and observing the effect of the above-named solution. Two initial experiments, carefully made, with intermittent irrigation for the short space of one hour and one and a half hours, have resulted in the saving of two mice out of four.'

The application of the knowledge gained by the study of the effects of these two compounds of mercury upon blood, tissues, and germs, is of course of the most vital importance. In the case of the solution of the bichloride in water, there is first the formation of an envelope of fibrin round each deposited germ; this is not dissolved by the lotion, but is at once surrounded by a second one of albuminate of mercury, effectually preventing the germ-destroying mercury touching the enveloped germ and spore; whilst the solution of the biniodide in potassic iodide at once clears away all deposited fibrin from the wound and germs, thus fully exposing the latter to the full force of the mercurial germ-killer, and then, passing through the tissues to the excretory channels, leaves the system and wound free from both germ and germicide.

A very frequent practice amongst advertisers of antiseptics is to prominently put down how long it takes to kill cholera and other germs in a test-tube. The lines laid down by Schimmelbush and alone proved valid in this matter of potency, will, I think, have fully demonstrated to you the great fallacy of such a procedure. The question to ask the proprietors of antiseptics thus loudly vaunted is this: 'Will your preparation follow and kill germs in a living wound as shown by direct experiment?'

Hitherto only one antiseptic has been used with success in this direction—that one which is placed first by Messrs. Miguel and Rueff in their list, and used by me as I have directed and described for seven years. British surgeons and obstetricians, in fact, are alone in their adoption and

continued use of so dangerous a remedy as corrosive sublimate, in direct opposition to the full and final denunciation of its use by the originator and other European authorities. Just therefore, as the general public and also many medical men seem blindly determined to use 'caustic' for dog-bites, so do the bulk of the profession seem intent on using corrosive sublimate in preference to the biniodide, although, as I have shown, there is physiological, pathological, chemical, bacteriological and clinical evidence in abundance from our highest authorities of the great danger ever present from its use, and of the great safety and absolute efficiency of the biniodide, by reason of its being dissolved in a solution of a drug which prevents fibrination.

Now, whether this is British obstinacy or the principle of conservatism in medicine and surgery it is not for me to say. But it is assuredly detrimental to the public health, and consequently concerns you most materially.

I am convinced that large numbers of the profession are now seeking with energetic honesty of purpose amongst bacterial products for a better means of treatment of some deadly disorders, such as hydrophobia, than they have concluded is to be found in any of the therapeutic measures we at present possess.

Some are afraid to use mercurials at all. There are some, of course, who cannot believe that the simple addition of potassium iodide to a solution of corrosive sublimate can provide so safe and effective a means for the preventive and curative treatment of these fell diseases; but now the fact has been demonstrated that whilst corrosive sublimate *alone* is powerless to save life, the addition of a salt to change it into the biniodide makes all the difference between death and life to the patient, such objections will not 'hold water.'

You will now have no difficulty in seeing why I strongly advocate the immediate treatment of dog-bites by this method.

Such a method of treatment is reasonable:

Firstly, because it consists in employing the strongest known antiseptic, according to the authority of Messrs. Miguel and Rueff, of Paris, and S. Woodhead, of London.

Secondly, because there is physiological evidence that this combination prevents blood-clotting, and thus allows the drug applied locally to enter the opened bloodvessels in the open wound, and to follow and kill the germs which have been lodged in the tissues by the dog's teeth.

Thirdly, because it is absolutely safe; for no one has ever complained of the slightest mischief or deadly effects from its use.

Fourthly, because it is the only remedy which ever saved life in the most deadly of all poisoned wounds in animals—*anthrax*, or wool-sorter's disease.

After working at this subject for a month, I reported these experiments to the Local Government Board, and suggested a trial of the remedy in glanders, with the object of preventing the wholesale slaughter of animals, advocated as a preventive measure by the veterinary faculty. But the Board absolutely refused to have anything to do with any suggestion of the kind, or to advise the faculty to take the matter up.

I failed, moreover, to secure the powerful aid of the medical journals in this matter.

Phagocytosis.

I must now refer to Dr. Elias Metchnikoff's theory of 'Eating Cells' or 'Phagocytes,' as it has an important bearing in the opinion of some medical men, and especially in that of the originator himself, upon the curative process in all germ diseases, and, no doubt, upon that in hydrophobia itself.

Under high powers of the microscope in inflammation may be seen numbers of cell-like bodies, some merely in contact with, others partly enclosing, and others again entirely enclosing, bacilli or germs. These are Dr. Metchnikoff's 'germ-eating cells.' He avers that they come in 'armies,' wherever germs have found an entrance, and devour the said germs. Sometimes there is a 'hard fight,' and some time is taken before the germs are overcome and consumed by 'the army.'

Frequently the germs successfully resist the phagocytes, in severe cases of infection, finally 'routing' the protecting army of 'eating cells,' and causing the death of the patient, leaving

no trace of the phagocytes visible on 'the field of blood' as seen on a microscope slide.

The disciples of Metchnikoff, as I have said, believe that these cells go out and seize the germs to devour them. But they have never been seen going, for all life ceases when the drop of blood for the microscope slide is drawn from the body. All that can be said is that they are there. It is *infinitely more likely* that the germs are attacking the circulating blood for food, and thus bringing minute portions of it, or its elements, to a condition of *stasis*, with the effect of causing union of the two elements of fibrin, in the form of a minute cell-like body, corresponding microscopically to the appearance of inflammation and fibrin-formation in every disease caused by germs as seen by the naked eye, and notably in diphtheria! If this should prove to be the case, Metchnikoff must have 'placed the cart before the horse' in this astounding theory.

If such a theory as phagocytosis be true, there is every reason to trust that, by searching for the original home of the 'army,' and training the young 'recruit cells,' great success may be achieved in the routing of *rabies bacilli!*

If you ask me how it is that with these widely published and well-known facts concerning chemistry, etc., the use of the worst possible remedy is still practised, I cannot tell you, for the simple reason that I do not know. I have protested against the practice for seven years in the profession, and my chief reason for coming here to-night is that I may do the same out here.

I submit to every one of you, in or out of the profession, that the only rational course to pursue with a dog-bite is to use the strongest antiseptic which can be procured, provided that it be perfectly safe and have the property of overcoming that great block to its passage—clotted blood in a wound.

Biniodide of mercury as a solid is of little more use than corrosive sublimate; but, dissolved in that agent known as iodide of potassium, which possesses the penetrant power required, it forms the desired remedy and is carried in by its solvent through every corner of the wound, to the destruction of hidden germs or spores, and I trust to the salvation of the patient from a most horrible death. I have not unduly vaunted this remedy. I have simply proclaimed its efficacy and published the results of treatment of germ diseases and poisoned wounds for seven or eight years; and though there are a few believers in biniodide treatment, I am looked upon by the majority of the profession as a faddist on the subject. If I alone suffered it would be a small matter; but it is not too much to say that millions of human beings are suffering from unnecessarily prolonged sickness with frightful sequelæ, and thousands dying owing to the listlessness and indifference of those whose duty it is to protect them.

Three reasons occur to me why biniodide treatment is not in general vogue: ignorance of chemistry, ignorance of physiology, and inertia. It is not sufficient that contributions to medical science should be of an unblamable character; the difficulty in medicine, as in other matters, is to overcome the inertia, and induce men to test that which for the moment they do not understand.

M. Pasteur's Method of Preventing Hydrophobia.

This depends upon the belief that the tissues of the body can be acclimatized, as it were, to weak solutions of the rabic poison, which M. Pasteur avers is deposited by the germs of the disease in the upper part of the spinal cord.

A somewhat similar theory is now 'the rage' in the medical profession, a theory that the serum of the blood of animals which have been made immune or are naturally immune to such diseases of germ-origin as diphtheria, cholera, etc., when passed into the body of a person exposed to the infection of, or actually suffering from, those diseases, will both prevent and cure them more effectually, or rather to a greater percentage, than is possible by means of drugs. The serum of horses is now generally employed. The percentage of cures, however, of diphtheria, has not yet risen to fifty.

The properties conferred on the serum of horses, etc., by the toxins of diphtheria bacilli are said to be 'anti-diphtheritic,' and they form the basis of this empirical method of treatment called 'sero-therapy.' The substance which is believed to confer the curative and immense benefits is called

'anti-toxin,' but its nature is quite as much a mystery as the 'toxin' it 'overcame.'

One naturally asks, however, if any serum would answer as a curative agent. Containing as it does all the alkaline and earthy salts of blood, the effect of a teaspoonful of such a concentrated solution of defibrinating agents would, as injected into children's bodies, tend to prevent fibrination in a disease such as diphtheria, and thus begin a cure of any case. 'Control' experiments of this nature are not forthcoming yet. The method is still in its first stages of trial, and is entirely empirical. But it is certainly better than no treatment at all. I have it on the best authority that at one of the infectious hospitals in 1893 no medicinal treatment was given, the patients recovering or otherwise as nature determined. On inquiring the reason I was informed that the last 'craze' cure used was a certain form of crystal, which gave such disappointing results that it was resolved by the physicians that further 'remedies' in the shape of physic should not be given, and consequently we may assume that the genus bacillus had, in the slang of the present day, a 'high old time'; and, indeed, the mortality of four per thousand would seem to bear this out. Contrast their happy freedom under such circumstances with the difference which would have prevailed had the germicidal biniodide been properly brought to bear upon them, and you will be ready to admit that amidst the general depression and disquietude that prevail one race at least has had no cause to complain.

In diphtheria there are germs which have burrowed into the superficial layers of the mucous membrane, but no further; for although on microscopical examination there are found cast epithelial scales, there are no bacilli found in the blood. There is a white membrane of fibrin, just as there is a red clot of the same material in a dog-bite.

Now, as proved by myself in 1886 and reported as a proved fact to the *British Medical Journal* by the following members of the medical profession, what is required in the treatment of germ disorders is the internal, and where possible external, application of a strong antiseptic, dissolved in an agent which by its defibrinant effect on blood can penetrate that fluid, and thus destroy efficiently and entirely any invading germ. In this way I cure every case of scarlet fever, almost without exception, in five to seven days, and diphtheria in five, without sequelæ. The other day I was called to a case of diphtheritic paralysis affecting the nerves of the heart and the whole body, and effected a cure in seven days with the combination alone.

Dr. Clement Dukes, of Rugby, in 1887, wrote of the same effects in scarlet fever, as to prevention of *sequelæ* and rapidity of cure, and several others since that date. In diphtheria, also, Dr. Hoadley Gabb, of Hastings, wrote concerning rapid cures in 1887 and 1888; also Drs. Watson, Main, Ackley, and Ringwood in 1887. Again, Dr. Luff, of London, as already stated, cured *cent. per cent.* of cases of infantile diarrhœa—a disease which carries off about 20,000 children annually in this country alone—a cure being effected in every case within seven days and in 70 out of 80 in three to four days (*Brit. Med. Jour.*, November 16, 1889).

Is it not strange that with this ample evidence of the superiority in various germ diseases of such a remedy as the biniodide of mercury thus dissolved, the profession absolutely refuse, as a body, to use it in diphtheria, diarrhœa, cholera *nostras* and *Asiatica*, in dog-bites, erysipelas, and other poisoned wounds?

On inquiring in one of the medical journals of a gentleman who acted in some official capacity in Hamburg during the recent epidemic, as to whether this remedy had been used during that fearful time in the treatment of this particular specific malady, he replied that it had not, and that it was 'too poisonous' to use. On pointing out the experience in the treatment of infants of Dr. Luff with the drug, he did not reply.

Further, all confidence in drug treatment having been largely lost, the profession is eagerly and expectantly watching Dr. Haffkein on his 'inoculation-march' through India, 'immunising' his hundreds of thousands against cholera, whilst drugs are at a discount.

During the height of the epidemic of scarlet fever and diphtheria in London in 1893, I wrote to the medical superintendents of all the fever hospitals (some fourteen in

number), offering to explain the practical application of the method of treatment to them. Two only replied, but refused the offer.

To return to M. Pasteur and his method of preventing hydrophobia. He injects every day what he considers germ-products from spinal cords of dead rabid rabbits. Those cords which have been longest dried contain the least virulent virus; and to render human beings, dogs, and other animals immune, Pasteur by injection gives doses of each, passing daily from the least virulent to the most virulent cords. They are then considered proof against the disease. The following points seem to me to show sources of fallacy in this method of treatment:

(1) Of all persons bitten by mad animals, only from 5 to 50 *per cent.* suffer from hydrophobia: and proof is not forthcoming in many cases going to Paris of such rabidity of the biting animals.

(2) The disease produced by rabid dogs' saliva has distinctly different symptoms to those induced by the injection of spinal cord emulsion. The symptoms of the latter are paralytic, whilst the hydrophobic — invariably the same — are not paralytic, but convulsive.

(3) Pasteur's injection confers immunity for nine months only; so that even if it be really antirabic, it could not have the slightest influence upon a case which took a year or more to incubate.

(4) Of the twenty dogs inoculated to the full with dried spinal cord, the test adopted by M. Pasteur to prove their immunity was the injection of freshly-cut spinal cord of an infected dead rabbit, and not, as it should have been, the saliva of a rabid animal. Otherwise no perfect control could be effected in so important an experiment.

(5) Of all Pasteur's cases, some 280 have died since his treatment, either from pure hydrophobia, or from a peculiar paralytic disease similar to that of the rabbits killed with virulent doses of dried spinal cords. It thus appears possible that those who submit themselves to Pasteur's treatment, either in Paris or in London, are in danger either of being 'wrecked on the Scylla' of hydrophobia or of 'falling into the Charybdis' of 'laboratory paralysis.'

(6) It has not yet been proved that the bacillus of rabies is unlike that of diphtheria, in never leaving the place where it is deposited, to enter either the blood or any of the organs of the body. In fact, although it is certain that there is a bacillus of rabies, it has not yet been positively identified. Herein, therefore, Pasteur's method is very possibly not in accord with sero-therapy, dependent as that theory is upon cultures of germs themselves, for their germ-products, or 'toxines,' in order that by the injection of these the so-called, yet mythical, 'antitoxines' may be secured for the treatment of the disease by 'sero-therapy,' from the serum of the thus-immunised horse or guinea-pig, as the case may be.

Newspaper Report of the Lecture.

At the conclusion of the lecture, the chairman gave it as his opinion that there was still some good in caustic. Were he bitten that night, he was confident he should use it; but at the same time he should use the biniodide of mercury, which would of course not be altogether scientific. Nothing, however, would induce him to send a child to Pasteur to be inoculated.

A resolution was proposed and seconded, in support of the lecturer's opinion, 'That mercurial germicides, such as described by Dr. Woodhead, the Director of the London Research Laboratories, in his Edinburgh Laboratory Reports, 1888, should be employed in the treatment of dog-bites; and that it is desirable to test the preventive effect of these drugs—more especially the biniodide solutions in potassic iodide—upon small animals inoculated with virulent rabic poison, and thus arrive, if possible, at a more rational method of preventing hydrophobia than that of M. Pasteur.'

Dr. Goodsell had, he said, nothing but praise for the lecturer in addressing the society upon the subject of hydrophobia, and in promulgating views which he practically stood almost alone in holding. He (Dr. Goodsell) held that he had not proved his case. From the very nature of the disease he believed that no cure for hydrophobia would ever be found. He did not believe that by merely placing a lotion on a wound, when the mischief was done, such a disease could be cured.

As regarded the chairman, he considered it was fully justifiable on his part, in a matter of this kind, to appeal to the sentiments of the outside public as he had done so thoroughly and impartially. He begged to move as an amendment that 'The treatment of hydrophobia, as suggested by the lecturer, is unscientific and devoid of any element of success.'

Captain Leman seconded the amendment. He said he was not a medical man, but a representative of the suffering public which was being continually experimented upon by medical men, who attempted to cure them by pouring poisons into their bodies. Dr. Illingworth had proposed to pour into their systems two virulent poisons—mercury and iodine—and he protested with all his energies against such poisonous proposals. Natural methods were not tried, and nature had thus to throw off both the poisons used as well as the disease before the patient could get well. He himself would tie a band tightly round the bite, and let the poison of the rabid animal thus flow out, assisted by steam applied to the part.

Mr. Bryan (the Secretary to the Society for the Prevention of Cruelty to Animals by Vivisection) supported the amendment. He stated that the germ of rabies had never yet been discovered; but Pasteur used the spinal cord because he believed it contained the *virus* of rabies. In his opinion Pasteur's theory was not worth believing, and he was glad to see the medical gentlemen on the platform did not believe in him. The fact was that the biniodide treatment was not fashionable, and therefore was not used. The Pasteur method was fashionable, and therefore was used.

The amendment having been put, there were four voted for it. Those against it were twelve in number. The amendment having been lost, the Chairman was about to put the resolution, when

Mr. Bryan proposed that 'The resolution be referred to the Council of the Balloon Society for consideration before being put to the meeting.'

It was at once objected that such a proceeding was entirely out of order.

Mr. Bryan protested that he was entirely in order.

The President (Mr. Lefevre) suggested that Mr. Bryan could secure all he wished for by moving a subsequent direct negative.

Dr. Alderson ruled that Mr. Bryan was out of order, and put the resolution to the meeting, when sixteen voted for it and only four against.

And now, gentlemen, I have laid before you, according to my poor abilities, some of the questions connected with the treatment of germ diseases, including scarlet fever, diphtheria and hydrophobia. To many of you much of what I have said may be new. But I claim to have given you such scientific evidence—bear in mind Dr. Woodhead, Professor Von Hoffmann, M. Tarnier, Messrs. Miguel and Rueff, Dr. Luff, and others—and such reasonable ground for attaching the highest value to the treatment of germ diseases by the biniodide of mercury in a potassic iodide solution, that the result should be that it will be no longer a matter of indifference to you on what principle you or yours may be treated should you unhappily suffer from any germ disorder, but that you will impress on your medical attendant that he is not to stand by merely as an onlooker or bottle-holder, whilst you and the germs fight out your deadly battle; but that he is to bring to your help a germ-destroyer—the one I have described—and so deliver you from their evil power.

And in the matter of that deadly, perhaps increasing scourge, hydrophobia, what would you do? Would you inoculate with hydrophobic preparations, and perhaps succumb to a disease you otherwise ought not to have taken, or to 'laboratory paralysis'; or will you use what, in the light of the reason with which God has endowed us, we know to be the safest and the most powerful germ-destroyer that His providence has given?

If only public opinion would bring pressure to bear upon those who have the authority, we should soon have experiments properly made and verified, so that the present ignorance could not endure, and many diseases would lose half their terrors.

Let an epidemic of cholera come, and what would be done? It also is a germ disease. Surely the best germ destroyer would be used. Not one bit of it! The same applies to scarlet fever, diphtheria and small-pox. They are all germ diseases, and a hospital ward should be set apart for treatment now under proper supervision, so that a careful record of results could be made.

To do this, a great deal of 'red-tapeism' would require undoing, and a good deal of national and professional jealousy wiped out. This is fully shown by my nine years of useless disputation; by the conduct of the Local Government Board; by the profession in general, and that of the superintendents of the fever hospitals in particular.

Let your war-cry be, 'Down with all prejudice!' for

'Salus populi suprema lex.'

FOREST HILL, LONDON, S.E.,
April, 1895.

APPENDIX.

In 1891 I noticed that Professor Wright, of Netley, was adopting and advancing similar views in the *British Medical Journal*. On July 14, last year, he continued to write concerning this matter in the same journal, concluding with these words:

'I have only to emphasize that the methods which have been under discussion are not put forward as adequately tested therapeutic measures. They may, however, chance to be, if I may so express them unblamed, contributions to the building up of a newer and better system of therapeutics.'

I wrote to Professor (then Dr.) Wright, pointing out to him my original paper on the same method, and, by reference to numerous cases in the journals, that I had been pursuing such a course of treatment as he advocated with great and pronounced success for five or six years. Dr. Wright thanked me for my letter, expressed much pleasure with the list of cases he had examined, and promised to send me some of his astringent fluid for the treatment of bleeding in persons of hæmorrhagic diathesis; but he has neither communicated with me, nor referred to my five years of work previous to his own in this direction, nor sent me the promised fluid for trial, from that day to this, although, as I have shown, he is intensely earnest in his desire, in 1894, to direct the attention of the profession to what he believes will prove 'contributions to the building up of a newer and better system of therapeutics.'

For this I am sorry, because I firmly believe that the hearty co-operation of a professor of pathology would ere this have gone a long way towards the establishment of a 'newer and better system of therapeutics.' Those of my professional brethren who are present, however, I should like to refer to Professor Wright's paper on 'Methods of Increasing and Diminishing the Coagulability of the Blood, with Especial Reference to their Therapeutic Employment,' a pleasure naturally not diminished by the fact that I have been proclaiming and practising since 1886 the principles he advocated in 1891.

One journal closed its columns to, and made no observations upon, my communication; whilst, at the time, the other was actually engaged in the suppression of correspondence upon the relative merits of the two compounds of mercury —the bichloride and the biniodide—and of deliberately supporting in this way the advocates of the former, although almost every country in Europe by its foremost medical representatives had at the time condemned its use in every branch of medicine on account of its deadly and poisonous effects.

For this I am extremely sorry, because without the valuable aid of the press (both medical and lay) no wide influence, either for good or evil, can possibly be attained; and editorial partisanship, unaccompanied by reasonable discussion, is, I submit, very far removed from 'righteous judgment' in its effects.

Having doubts, however, as to the soundness of these new views, I wrote, in 1892, to the *British Medical Journal*, expressing my opinion regarding this theory, and questioning Dr. Bokenham upon a case of erysipelas that gentleman recorded, as bearing out the theory in every detail.

Dr. Bokenham replied; but on my venturing to differ from his explanation and giving my reasons to the editor, I met with prompt editorial condemnation. The news that 'phagocytosis had devoured another cell' was assured, no doubt to Dr. Bokenham's satisfaction.

As the following letters show, I was not successful in my efforts to induce that gentleman to continue the correspondence in another journal. He replied privately that, as the editor had not thought it advisable, he himself could not continue it in another journal.

Thus have I frequently been, figuratively speaking, many times phagocytically devoured, from a Metchnikoffian point of view, by medical editors. But I fancy I have clearly shown that the 'Bacillus Illingworthii' is a little more tough, and consequently more difficult of digestion, than they at first

sight supposed, in so important a pathological matter—important because, as anatomy is the basis of physiology, so pathology is the basis and only sound guide in the right course of treatment from a practical medicinal standpoint.

My opinion is strongly this: that no editor has any right thus to 'give away' arguments on any subject whatever advanced in his columns.

PHAGOCYTOSIS.

To the Editor of the 'Medical Times.'

'ACCRINGTON,
'*December* 17, 1892.

'SIR,

'May I ask you to allow a short discussion to take place in your columns on the above subject? I enclose my original letter and Dr. Bokenham's reply as they appeared in the *British Medical Journal*. On answering Dr. Bokenham's objections to my view I did not secure insertion in due course, and although I urged that the matter was, I thought, worthy of discussion, I have waited for six weeks without receiving any intimation from editorial sources that there is any chance of the matter being again mentioned.

'In Professor Metchnikoff's most recent article to the *Medical Week*, he says: "It may therefore be regarded as proved that the animal organism is provided with a means of defence against pathogenic bacteria. This means consists in an army of phagocytes of various kinds, which fight the invaders, take them up into their substance, and kill them."

'In my criticism of this view it will be seen that I repudiate as unscientific any such intelligent action of the cellular elements, and advocate an explanation of the appearances presented, upon purely physical grounds, by the formation of microscopic accretions of elementary fibrin round each microbe, initiated by their attraction. In other words, I maintain that the microbes are the active, and the so-called "cells" the passive, agents.

'My reply to Dr. Bokenham's objections, written on Oct. 8, was to the following effect:

'1. The use of the word "tissue" is perfectly legitimate when speaking of any organized body, such as a microbe, and it does not imply either comparison with or resemblance to the ordinary animal tissues. Being an organism, a microbe must have elementary constituents, and these are capable of absorption.

'2. Although "fibrin is an excellent nutrient medium for the S. erysipelatis," the culture process is in the presence of oxygen; whilst in the so-called "phagocytic" process the *pabulum* attracted to itself by each microbe from the blood leads to *stasis*, with the inevitable formation of both microscopic and macroscopic fibrin, and this, except in malignant cases, eventually forms a prison-cell for each microbe, effectually preventing the entrance of the necessary oxygen, or other nutritive principle.

'I am, yours, etc.,
'C. R. Illingworth, M.D.'

The following are the letters referred to by me, and which were published in the *British Medical Journal* of October 8 last.

I wrote:

'As the new theory called phagocytosis is hardly yet proved "up to the hilt," permit me, as an unbeliever in every part of it, to ask Mr. T. J. Bokenham a question regarding the three observations upon erysipelas which appear in the *British Medical Journal* of September 10. How can anyone prove that the so-called phagocytic action upon micrococci is not the well-known process of fibrination around each organism, set up by stasis around each, and consequent union of fibrinogen and fibrino-plastic material? The more virulent the culture, the greater the diminution of the fibrin elements of the blood, and the less, in consequence, the formation of so-called "cellular elements" for "phagocytic action." The fibrin once formed, shuts off further supplies of nutrient material to the attracting micrococci, which therefore die and break up into their elementary constituents, as all other tissues do in the processes of nutrition and excretion. In other words, they are absorbed.'

In reply to this note, Mr. T. J. Bokenham wrote:

'Dr. Illingworth is, of course, not alone in his scepticism with regard to the doctrine of phagocytosis. I do not see, however, that the explanation he proposes of the phenomena described by me is better than my own. Indeed, the evidence of the microscope in this particular case was so clear, and the masses surrounding the group of streptococci were so evidently nucleated cells, that I have practically no doubt that the explanation advanced by me at Nottingham was correct. If Dr. Illingworth had seen the specimens which I was able to throw on the screen, I think he

would agree with me that it was really a question of cells, and not of unorganized "fibrinated" proteid. In conclusion, may I point out that a micrococcus is not a "tissue," nor can it be compared, as Dr. Illingworth suggests, with "all other tissues," and, further, that fibrin is an excellent nutrient medium for the S. erysipelatis?'

Convinced of Pasteur's error, I wrote the following letter:

'Forest Hill, S.E.,
'*August* 13, 1894.

'Sir,

'The terrible death of Lieut. Stevenson from the bite of a mad dog, after Pasteurian treatment, leads me to take up my pen to point out once more that the only treatment which can be of any avail in such cases is the suitable germicidal treatment of the wound.

'I have written in most medical and some lay papers that a remedy is to be found in the solution of the biniodide of mercury in iodide of potassium. I have proved this to my own satisfaction in private practice for seven or eight years past, in all kinds of poisoned wounds.

'I have done more: I have demonstrated the fact by direct experiment upon living animals with the poison of *anthrax*.

'As this has not been sufficient for the profession, I now challenge the British Institute of Preventive Medicine to investigate this matter, and thus either to prove or disprove my contention. If after inoculation with rabic poison and treatment of the wound by my method, under my supervision, this remedy should be found to fail in preventing hydrophobia in the animals inoculated, I will give ten pounds to the institute.

'If my contention, however, be found valid, I shall have shown, what I have argued from the first, *that the British Institute of Preventive Medicine is a totally unnecessary establishment*. In any case the institute can have no reasonable objection to accept my challenge, in the interests of the public health *and canine comfort;* especially when it is remembered that the only remedy which, on the lines laid down by Dr. Schimmelbush in his experiments upon living wounds, reported at the Berlin Surgical Congress last year, and adopted by me with the usual precautions, had the effect of saving life when all others had failed, was the solution I now challenge the British Institute of Preventive Medicine to use as I have directed upon dumb animals.

'I am, sir, yours, etc.,
'C. R. Illingworth,
'M.D., M.R.C.S., D.P.H.'

A copy of the *Medical Times and Hospital Gazette*—in which this appeared, was sent to Dr. Armand Ruffer, the director; but as no reply was forthcoming, I wrote on September 5, enclosing a copy, and requesting his kind attention to it. On the 10th I received the following reply:

'The Brit. Inst. of Prevent. Medicine,
'*September* 10, 1894.

'Dear Sir,

'I beg to acknowledge your letter and enclosure, dated September 5, 1894, and to inform you that we have no accommodation in which experiments such as you propose can be carried out.

'I am, sir,
'Yours faithfully,
'M. Armand Ruffer.'

THE END.

Baillière, Tindall & Cox, 20 and 21, King William Street, Strand.

ANNUAL REPORT

ON THE

PUBLIC HEALTH

OF

GIBRALTAR,

FOR THE YEAR

1894,

BY

W. G. Macpherson, M.A., M.B. (Edin.), D.P.H. (Camb.)

Surgeon-Major, Army Medical Staff,

MEDICAL OFFICER OF HEALTH.

GIBRALTAR:
GARRISON LIBRARY PRINTING ESTABLISHMENT,
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FOR THE YEAR 1894.

VITAL STATISTICS.

Population. This report deals with the civil population only, which at the last census numbered 19,100, a number comprising 16,906 "fixed civil" population and 2,194 "resident aliens."

These numbers form the basis of calculation in estimating the birth and mortality rates of the year. It should, however, be mentioned that the civil population would have increased, according to the Registrar General's method of estimating population at intercensal periods,* to 19,340 by the middle of the year. The difficulty of applying this test to Gibraltar has been explained in previous reports and depends upon the fact that restrictions upon residence and house accommodation interfere here with natural increase of population. It may be mentioned, however, that the effect of taking this estimated increase, instead of the actual census population, as a basis of calculation would be to produce birth and mortality rates slightly lower than those shewn below.

Travellers passing through Gibraltar or residing for short periods in Hotels, &c., and persons landed from the Bay or brought from Spain for medical and surgical treatment are regarded as non-residents and have been excluded from the vital statistics of the locality.

A certain number of residents, probably a very small number, was shewn in the Census return as belonging to the "military population," although they are not included in Army statistics as on the "strength" of the Garrison. These individuals, having been excluded in the Census returns from the civil population, must also be excluded from the vital statistics of that population.

Births. No births are registered amongst the alien population, in consequence of restrictions as to marriage, &c. The birth statistics deal, consequently, with the fixed civil population only.

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* *i.e.* According to the formula $P = P^{d}(1+r)^{n}$. Last year, in consequence of a copyist's error, the estimated increase was published as 19,227 instead of 19,266.

The number of births in 1894 was 477, 261 being males and 216 females. This is equal to a birth rate of 28·21 per 1,000 of fixed civil population.

The birth rates of the previous three years were 29·8 in 1893, 32·23 in 1892, 28·1 in 1891.

The average for the decennial period 1881-90 was 29·35 per 1,000.

The distribution of births according to months is shewn in Table III., Appendix, and calls for no special remark.

The excess of births over deaths amongst the fixed civil population is 75.

In 1893, 1892 and 1891 it was 169, 134 and 136 respectively.

Amongst the "military population" 126 births were registered during the year, as compared with 146 in the previous year.

General mortality.

The number of deaths registered during the year was 418 for the total civil population (comprising 402 of "fixed civil" and 16 of resident alien population), 54 amongst the "military population" and 23 amongst "non-residents;" (*i.e.*, persons landed sick from the Bay, &c).

The general death rates of the civil population are shewn in the following table, which is given for the purpose of comparing the mortality of the year with the previous three years and with the decennial period 1881-90:—

General Death-rates.

Population.	Estimated Death-rates per 1000 living.				
	1894.	1893.	1892.	1891.	Average 1881-90
Total Civil	21·88	17·74	21·72	18·95	23·03
Fixed Civil	24·37	19·81	24·31	20·70	25·83
Resident Alien... .	7·29	1·82	1·82	5·4	2·2

It will be noticed that the general death rates of "total" and "fixed civil" population in 1894 closely resemble the corresponding death rates in 1892; and that, although they are considerably in excess of the exceptionally low death rates of the year 1893, they continue to keep below the mortality rates of the previous decennial period.

The fluctuations in the general death rates of the "resident alien" population indicate practically nothing, the figures being too small for the purpose of comparing one year with another. The number of deaths is, besides, largely influenced by the age-groups to which re-

sident aliens belong, and by the fact that individuals in this class are liable to return to their homes in Spain in case of serious illness.

The corrected general death rate for comparison with English towns is 24·02 per 1,000 for the total civil population (factor for correction = 1·09809).

Quarterly mortality.

The quarterly mortality is shewn in Table III., Appendix I.

The first and last quarters are practically alike and the second and third quarters are also practically alike, so far as the death rates of the total civil population are concerned. In the quarterly death rates of the fixed civil population, the second quarter is somewhat lower than the others, while there is little difference between the other three.

These results are completely at variance with what has obtained in previous years, the second quarter having almost invariably shewn the highest mortality and the last quarter the lowest. Judging too by the normal rates of mortality for previous years, the cause of the discrepancy must be sought amongst the factors producing greater mortality in the 3rd and 4th quarters rather than amongst those producing a less mortality in the 1st and 2nd quarters.

The results may be, of course, accidental; a contingency one must expect to arise in dealing with the statistics of small numbers, but it will be seen below that a very high proportion of the deaths in August was caused by zymotic and tubercular diseases, and that the deaths of old people were exceptionally numerous during the two last quarters of the year.

Monthly mortality.

The monthly mortality is also shewn in Table III., Appendix I.

The highest mortality amongst the total civil population occurred in January and the lowest in May.

Amongst the fixed civil population the lowest was also in May and the highest in December. July and March were also months of high mortality.

The mortality in August is remarkable for the fact that 21 out of the 37 deaths were due to tubercular and zymotic diseases. In 1893 there were only 5 deaths from these diseases in August, in 1892 there were 15.

During the last six months of the year the mortality amongst persons of advanced years was practically double the mortality at the same ages in 1893.

These points indicate, in a way, the general causes of excess in the mortality of 1894 as compared with the previous year.

Infantile mortality.

There were 86 deaths amongst children under 1 year of age; equal to an infantile mortality of 180·0 per 1,000 births.

The infantile mortality of the previous three years has been 170·3 per 1,000 births in 1893, 183·4 in 1892 and 152·3 in 1891.

The average infantile mortality for the decennial period 1881-90 was 167·4.

Infantile mortality does not, therefore, compare favourably with previous years, although it will be seen later on that diarrhœal diseases, the usual cause of a high mortality amongst infants, are considerably less. Zymotic diseases such as small-pox, measles and whooping cough are causes of increase in the year under review.

Age group "under 5 years."

Amongst children under 5 years of age there were 149 deaths; equivalent to a death rate of 80·5 per 1,000 living in this age-group.* In the previous three years, 1893, 1892 and 1891, the corresponding death-rates were 71·3, 78·9 and 68·1 respectively. The average for the decennial period was 85·5.

The mortality of this age-group compares unfavourably with immediately preceding years, but is somewhat less than the average mortality of the decennial period 1881-90.

As has already been pointed out, the fluctuations, in dealing with small numbers, are too great to be depended upon for drawing definite conclusions. At the end of the present year, 1895, a better opportunity of discussing the mortality of this important age-group will be afforded, as one will then be in a position to deal with the aggregate statistics of a quinquennial period and to compare them with those of previous quinquennial periods.

Other age-groups.

The mortality of other age-groups is shewn in Table II., Appendix I.

The figures call for little remark. As a rule, they follow the normal rules of mortality for the several age-groups.

Compared with the previous year, the greatest discrepancy is found in the age-groups "65 to 75" and "75 and upwards," 100 individuals dying at these ages in 1894 as compared with 70 in 1893. In noting the quarterly and monthly mortalities, attention has already been drawn to the influence of this fact on the higher mortality of the year.

Ages of school life.

Compared with the decennial period, there is a slight excess in the mortality of the age-groups of school life ("5 to 20"), due more especially to the increase in the mortality of the

* Population of age-group = 1849 at last Census.

age-group 15-20, consequent upon the prevalence of small-pox and tubercular diseases.

Sex mortality.

The mortality of the sexes, distributed according to months and age-groups, is tabulated in Table II., Appendix I.

The number of deaths amongst males was 227, amongst females 191.

The following table compares the recorded male and female death-rates of the year with those of previous years:—

"Recorded" Death-rates (Sex mortality).

	Death-rates per 1000 living of each sex.				
	1894.	1893.	1892.	1891.	Average 1881-90.
Males	26·15	18·54	24·1	22·00	25·5
Females	18·33	17·09	19·6	16·41	20·8

The difference between male and female death-rates is more accurately shewn by the "corrected" death-rates of sex mortality as given in the following table:—

"Corrected" Death-rates. (Sex mortality).

Factors for correction.	Per 1000 living.				
Males = 1·1339. Females = 1·0598.	1894.	1893.	1892.	1891.	Average 1881-90.
Males	29·65	20·97	27·3	24·94	28·80
Females	19·42	18·01	20·7	17·39	21·96

One expects, in Gibraltar, to find, as a normal condition, a very marked difference between the male and female death-rates. A glance at the above tables will shew that this difference has received greater accentuation than ever in the year under review; and, when one comes to regard it more closely, it will be found that, while the female death-rate has remained practically as low as in previous years, the male death-rate shews a remarkable and noteworthy increase, being in fact higher than the average for the decennial period.

Apart from the general fact that certain diseases, notably the zymotic and respiratory diseases, were higher than they ought to have been, this phenomenal difference appears to be due to one of those fluctuations consequent upon dealing with small numbers. It will be noticed that in the previous year the male death-rate was phenomenally low, very nearly approaching the female death-rate, which remained comparatively stationary. In 1894 the male death-rate fluctuates back to the opposite extreme, the female death-rate still remaining comparatively stationary; so that, when one strikes an average between the two years, a normal difference between the male and female mortality is obtained.

This explanation is further confirmed by the fact that the exceptional mortality amongst old people has occurred more amongst males than amongst females, the number of males, who died at ages over 65 years, being 46 in 1894 as compared with 27 in 1893, while the number of deaths amongst females at these ages is 54 in the former, as compared with 43 in the latter year.

This explanation of the increased mortality is not, however, intended to disguise the fact that there has also been an increase in deaths from preventible diseases during 1894. It explains only the phenomenal differences between the male and female death-rates of that and the previous year.

DISEASES CAUSING MORTALITY.

General diseases.

An analysis of the registered causes of death will be found in Table I. (Appendix), which is similar to the tables published in previous years. The zymotic, tubercular and respiratory diseases are still further tabulated in Tables III. and IV. (Appendix), in the former of which the chief meteorological features of the year are also shewn.

Zymotic mortality.

The principal zymotic diseases caused 69 deaths during the year. This is equal to a "zymotic mortality" of 3·61 per 1000 of the total Civil population. The zymotic mortality of previous years was 2·46 per 1000 in 1893, (the lowest on record), 3·14 per 1000 in 1892, 3·03 in 1891 and 4·88 for the decennial period 1881-90.

Although the "zymotic mortality" of 1894 is, therefore, considerably below the decennial average, a fact of some importance when one considers the prevalence of epidemic disease during the year, it would be manifestly unwise to remain blind to the further necessities of Gibraltar in combating this mortality.

The chief points requiring attention in this connection are noted later on in reviewing the sanitary conditions of the locality.

Small-pox epidemic.

Small-pox was epidemic in Gibraltar during 1894.

Its origin.

The origin of the epidemic was stated in last year's Annual Report, where a brief note will be found tracing the introduction of the disease from Tangier into the village of "La Tunara" and thence to the surrounding districts. Although isolated cases occurred in Gibraltar during 1893, the disease did not acquire an epidemic form

until the beginning of 1894, when it was found that cases were being concealed in the town.

Its extent.

No trustworthy information has been obtained regarding the extent of the disease in neighbouring towns, but that it has prevailed there in a virulent form during the whole period of its epidemic activity in Gibraltar has been gathered from the following sources of information:—

(1). Direct statements of persons residing in Linea, &c., regarding the presence of small-pox in their own or their neighbours' houses.

(2). Frequent detection in the streets of persons from Linea bearing the marks of recent severe attacks of the disease.

(3). Admission into the Colonial Hospital of a patient from Linea, who a day or two afterwards developed small-pox.

(4). Official memoranda, regarding the precautions to be taken to prevent the spread of the disease, issued from San Roque to the hamlets around in December.

(5). Various newspaper notices, giving accounts of the severity and extent of the epidemic in neighbouring Spanish territory.

With a daily influx of between 4000 and 5000 persons from the infected districts, there is little wonder that Gibraltar partook to a certain extent in the epidemic.

Influence of Bay cases.

Statements have been made, and are generally current here, that small-pox epidemics in Gibraltar have arisen in the past from the admission of patients from ships into the Segregation Block of the Colonial Hospital. There is no proof of this, and a careful investigation into the small-pox records since 1869 onwards, the year in which Death Registration became compulsory, fails to establish any relationship between Bay cases and town cases.

On the other hand there are records shewing that at the time small-pox prevailed in Gibraltar the disease was also prevalent and virulent in the neighbouring territory.

General features of the epidemic.

I have endeavoured to place most of the facts regarding the epidemic of 1894 before the Commissioners in the detailed statement and charts, which form part of the Appendices to this Report, but the following remarks give an account of the general features of the disease.

Number of cases.

From the 1st January to the 31st December, 85 cases were noted and eight died.

Duration.

Since the 31st December and up to the 20th May 1895, the date on which this report passed through the press 23 more cases have occurred, and it is not yet time to say that the epidemic is at an end.

Monthly distribution.

The distribution of the cases by months is best shewn in the graphic chart (Chart I. Appendix II.), and in Table IV., Appendix I. The former very clearly shews two distinct periods of activity, the first lasting from January to July with its maximum in April, and the second from November 1894 to February 1895 with its maximum in November.

It would appear that the hot dry months had an influence in checking the activity of the disease, and when one notes the monthly distribution of previously recorded epidemics here the fact of its lessened activity in these months appears to be something more than a coincidence.

Comparison with previous epidemics.

In 1878-79-80 and in 1883-84 epidemics occurred which shewed an exactly similar seasonal distribution, with periods of lessened activity in the hot months and recrudescence in the cold.

A severe epidemic in 1871-72-73 is also similar in many respects, although its monthly distribution does not follow so regularly the rule of subsidence in the hotter and recrudescence in the colder months. The only other epidemic recorded since 1871 is in 1879-80, which in duration is also similar to the others without, however, shewing the same peculiar characters of recrudescence. All these epidemics are graphically shewn in the Chart appended, (Chart I.,) for comparison with the epidemic of the year under review.

This chart will also be found to give an instructive idea of the probable duration of the present epidemic; Epidemics with two periods of activity (*e.g.*, that of 1883) lasting twelve to fifteen months and those with three periods (*e.g.*, 1871-72-73 and 1878-79-80) lasting somewhat more than two years, with intervals of two or three months between each period of recrudescence.

It may be useful to mention here, as factors possibly influencing the extent and duration of these epidemics, that compulsory vaccination came into force on 27th January, 1869, and that no Bye-Laws were issued authorizing compulsory removal to Hospital and disinfection of premises until April, 1883. When these Bye-Laws were made compulsory removal to Hospital could only be enforced in the case of patients occupying tenements for which they paid a rent not exceeding *ten pesetas weekly*. Afterwards an Order in Council was promulgated defining the rent of these so-called "Common Lodging Houses" as "not exceeding *25 pesetas monthly*." An amendment order was passed in 1889 making it *50 pesetas monthly*.

Local distribution.

The majority of the cases in 1894 came from the upper portion of the Town, *i.e.*, from the districts lying above Town Range and Engineer Lane, which are the most densely populated districts.

Only eleven cases were from districts in the lower part of the town, and 3 from districts in the South. Two cases were residents in Linea, one a patient in the Colonial Hospital, to which he had been admitted two days before the disease declared itself, and the other a man who was found walking about the streets in the second stage of the disease.

Distribution in tenements.

The class of tenement occupied by the 83 cases from Gibraltar is shewn in the following table :—

Distribution of Small-pox cases in Tenements.

Classification of Cases.	Nature of Tenement occupied.			
	1-room.	2-room.	3-room.	+ 3-room.
Isolated in Hospital	32	10	2	3
Not isolated in Hospital	1	1	8	16
*Concealed cases	8	1	—	1
Totals	41	12	10	20

The table shews no marked distinction between the wealthier and poorer class of dwellings. As a matter of fact, in proportion to population, the tenants of the former were attacked, if anything, in a higher ratio than the latter, chiefly because of their not having been isolated in Hospital.

Effects of non-isolation and concealment.

The effect of concealment and non-removal to Hospital in maintaining the prevalence of the disease is shown in the statement in Appendix II., detailing the connection of one case with another, and in the following table which gives the facts with regard to the actual number subsequently attacked in the immediate families of persons suffering from the disease.

*Most of these concealed cases were afterwards removed to Hospital for the purpose of disinfection or for further treatment.

Table shewing the spread of Small-pox in families.

Classification of Cases.		Nature of Tenement.				
		1-room.	2-room.	3-room.	+ 3 room	Total.
Isolated in Hospital.	Aggregate number of individuals in the families of persons attacked	90	47	11	15	166
	Subsequently attacked in same family	—	2	—	—	2
Not isolated in Hospital.	Aggregate number of individuals in the families of persons attacked	—	5	22	60	87
	Subsequently attacked in same family	—	—	1	5	6
Concealed.	Aggregate number of individuals in the families of persons attacked	20	6	6	12	44
	Subsequently attacked in same family	8	1	2	2	13
Totals.	Aggregate number of individuals in the families of persons attacked	110	58	39	90	297
	Subsequently attacked in same family	8	3	3	7	21

It will be noticed that two cases are shewn as having occurred in families of persons removed to Hospital, but it should be mentioned that these two cases were the result of non-compliance with the order to remove the original case to Hospital, at the time the order was given, the patient eventually being taken to Hospital only after the prosecution of the father and after much delay and adjournment from day to day in the hearing of the case in Court. Although the patient was thus subsequently removed, the disease was so advanced then as to make it hopeless to expect that others of the family would not become infected, especially as they were found never to have been vaccinated.

Amongst the three-room tenement families a family has been entered under the heading of concealed cases. The original case left the tenement for Linea and so escaped notification or detection, although two others in the tenement, duly notified, were subsequently attacked. The existence of the case was verified by reference to the medical attendant in Linea, but it has not been shewn in the return of the cases in Gibraltar.

The Graphic Charts (Chart III. A. B. C. Appendix) shew at a glance the part played in the epidemic by isolation, non-isolation and concealment. The two cases, referred to above as having subsequently occurred in a two-room tenement dwelling after the first case had been removed, have been placed, in preparing the Charts, under the results of "non-isolation at the time of notification," in order to give a more accurate impression of the beneficial effect of isolation in the early stage of the disease.

Concealed cases.

The effect of concealment not only upon the families of persons attacked but also upon their relatives and the rest of the community deserves earnest attention. The *data* are unfortunately scarcely suitable for giving a complete record in the form of a graphic chart, (as has been done with the *data* from the families of persons attacked,) and the detailed statement of the groups of cases in Appendix II. must supply, although in a less interesting manner, those facts which may be of importance in enabling the Commissioners to estimate the way in which the disease has been spread by concealed cases.

Connection of cases with one another.

This statement shews eight groups of four or more cases, each definitely dependent upon one or other of the cases in the group to which they belong. The original source of the infection in five of the eight groups was concealment of the disease. Insufficient isolation and disinfection were the starting points of the other three groups. These eight groups account for as many as 51 out of the 83 cases, (or 61·4 per cent. of the total number of cases), in addition to 8 others which were registered in 1895 or escaped registration altogether.

A ninth group, accounting for 11 more of the registered cases in 1894, consists of cases distinctly traceable to previous cases or to sources not included in the eight principal groups. Of these 11 cases, four were contracted from known cases in Linea, one from a concealed case and the remaining six from cases insufficiently isolated.

Of the 21 cases unaccounted for in the detailed statement of these nine groups (Appendix II.), 5 were doubtful cases, leaving 16 definite cases of small-pox which could not be attributed to any known contact with a previous case, and which in themselves gave rise to no other known cases. Nine of these cases were following the employment of coal heavers, quarry men, or Linea house agents or were in contact with servants, who frequented Linea regularly. Of the other seven cases one was a gas fitter by trade, one the unvaccinated child of a charwoman, one a child occupying a house where a case occurred four months previously, one a school boy living in a locality where several cases had occurred during the previous month, and the three others women living under poor circumstances, but with no definite employment.

Influence of vaccination. The influence of vaccination on the ages of the reported cases and in modifying the virulence of the disease is shewn in the following table :—

State as to Vaccination.	Ages of those attacked. Under 3 months.	3 months to 1 year	1 to 5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	Other ages.	Not noted.	Total cases.	Total deaths.
Vaccinated in infancy or doubtful	—	1	1	6	11	23	15	8	4	3	—	1	73	*1
Unvaccinated	3	1	1	2	3	1	—	1	—	—	—	—	12	7
Re-vaccinated	—	—	—	—	—	—	—	—	—	—	—	—	0	0

The two vaccinated cases under five years of age were two of the five doubtful cases of small-pox noted above. Two of the twelve unvaccinated cases, one 6 years old and the other 11, were subsequently vaccinated but only eight days before the close of the incubation period of the disease, so that they must be included amongst the unvaccinated in estimating the protective influence of vaccination. Both of the cases, however, recovered.

The influence of vaccination in modifying the virulence of the disease is well marked and is more strikingly shewn in the graphic Chart (Chart IV., Appendix), the percentage of deaths in vaccinated cases being 1·39 and in unvaccinated cases 58·3.

The conditions with regard to re-vaccination are considered elsewhere. As none of the cases had ever been re-vaccinated, there are no statistics to bring forward, but it is a significant fact that in two families where cases were being treated at home and where some of the members of the families submitted to re-vaccination and others refused, those, who refused, were subsequently attacked.

Notification. Twenty-four of the 85 cases were without medical attendance and came to the notice of the Health Officer and Sanitary Inspectors on information received from parents or neighbours or during visits to the houses where they occurred.

* Occurred in a person, aged 16, whose vaccination marks were not clearly defined, and whose vaccination in infancy was considered doubtful.

The diseases, with which, on one or two occasions, small-pox was confounded in the notification schedules, were "Influenza" "Fever," "Measles" and "Chicken-pox ;" the only wonder is that the difficulty of diagnosis was not greater considering the fact that a measles and an influenza epidemic prevailed during the first period of the small-pox epidemic, and that the eruption of the one and the initial symptoms of the other closely resemble the symptoms of the earlier stage of small-pox.

Other zymotic diseases. Of the other zymotic diseases measles, diphtheria and enteric fever are the most important. With the exception of influenza, which was epidemic in January and February and was returned as the cause of one death, none of the other zymotic diseases attained any prevalence or importance.

Scarlet fever. The six isolated cases, returned as scarlet fever, had no known source, and, as has been noted in previous years, the disease does not appear to acquire any epidemic virulence in Gibraltar.

Measles. Measles, on the other hand, appears to return at regular periods in epidemic form. In the Annual Report for 1893 mention was made of a fear lest it should become epidemic in that year, as several cases, connected in all probability with an epidemic of the disease in Algeciras, were reported then. The epidemic, however, was held in check till the beginning of the year under review, when measles began to spread somewhat rapidly in certain districts and attained a *maximum* prevalence in March, gradually declining in April, May and June, till it finally disappeared in July. Energetic measures were taken to prevent the disease becoming extensive and fatal, as had been the case in a previous epidemic in 1887. Each case was visited and all members of the family kept from school. The Sanitary Inspectors made daily visits to the tenement dwellings, where the cases occurred, and the result of their labours in endeavouring to instruct the families as to the value of isolation and fresh air is shewn by the small mortality and comparatively small number of children attacked.

The character of the epidemic as compared with the other epidemics, that have occurred since the notification of Measles became compulsory, is graphically shewn in Chart II., Appendix II.

It will be seen that, although the period of epidemic prevalence and the character of the rise and fall of the curves on the Chart are exactly similar in all three epidemics, the epidemic of 1894, in point of numbers attacked, was very much smaller.

This may be due to the fact of there having possibly been a less number of children susceptible to the disease. From the close of the epidemic in 1882 to the commencement of an epidemic in 1887, 2,157 children were born in Gibraltar, as against 1,568 born between the close of the 1887 epidemic and the commencement of the epidemic of 1890-91, and 1,304 between the close of the latter epidemic till the beginning of 1894; so that, if these numbers are taken as indicating the probable proportion of susceptible cases, the last epidemic should certainly have been the least extensive.

How far this has influenced the character of the present epidemic is shewn in the following table, the proportion of cases to these births being taken as the more accurate method of indicating the possible effects of the special sanitary action taken in 1894. The table shews a very striking difference between the epidemic of 1894 and the two previous epidemics, the percentage of attacks to previous births being only 13 in the former, as compared with 35 and 39 in the two latter.

Measles Epidemics.

Epidemic Periods.	1887	1890-91	1894
Number of births since previous epidemic	2157	1568	1304
Reported cases of measles... ...	861	560	173
Proportion of cases to 100 births	39	35	13

The total number of cases reported in 1894, it will be seen, was 173. The number of deaths, 5, is equal to a mortality from measles of ·2 per 1,000 of population, a low mortality as compared with the standard of England and Wales.

No children were attacked in the South districts until the decline of the epidemic, when eight cases were reported. The remaining cases were entirely confined to the town districts, one densely populated tenement dwelling accounting for twenty of them alone. The others were scattered through several districts chiefly as isolated cases, except where two or three of a family living in the same tenement were attacked.

The density of population and the proportion of 1-room tenement dwellings here are so great that the fact of the epidemic having proved so inconsiderable is evidence of the thoroughness of the supervision maintained over the tenements by the Sanitary Inspectors. The infectivity of measles declines so rapidly in fresh air and after the active stage is past that there was every reason to hope that the maintenance of a thorough supervision according to the instructions issued to the Inspectors would have this result.

Diphtheria. Including "membranous croup," the cases of diphtheria

during the year numbered 21; the deaths 9. This is equal to a mortality of ·47 per 1000 of population.

In the three previous years (1893, 1892, 1891) the "diphtheria mortality" was ·41, ·47 and ·36 respectively, and ·95 per 1000 in the decennial period 1881-90. Although there has been a marked diminution in the mortality from the disease during the last four years, the mortality of ·47 per 1,000 is still very much higher than the standard for England and Wales. The disease is practically endemic in Gibraltar and has only occasionally assumed an epidemic form. The cases reported during 1894, all of which were sporadic, throw no further light on the causation of the disease, beyond what can be stated generally regarding want of sanitation in the construction of dwellings and regarding defects of drainage. Thus four children of one family alone were attacked and three died at the beginning of the year in a house which had been constructed some years ago on a plan different from that submitted to the Commissioners for approval, and one which gave every facility for the escape of sewer gas into the tenement. Another case occurred in a house, built against the retaining wall of a private road, in which a large drain was laid. The owner refused to permit the drain to be opened for examination until he was brought before the Police Magistrate. The drain was found in a most defective state and permitted the leakage of sewage into the soil, which practically formed part of the wall of the house in question. These were the most notable examples of the co-existence of Diphtheria and grave Sanitary defects.

The distribution of the cases was irregular. Two only occurred in the South Districts, namely, in December. They were supposed to have been connected with a serious outbreak of the disease in Military quarters at Windmill Hill, but no definite connection could be traced.

Enteric fever. Nineteen cases of Enteric Fever were reported during the year and eight died. This is equal to a mortality of ·41 per 1,000 of population. The enteric mortality of 1893, 1892 and 1891 was respectively ·10, ·31 and ·20. It was ·45 for the decennial period.

Enteric fever in 1894 has consequently shewn considerably greater prevalence than in the three previous years, although its mortality is slightly below the average for the decennial period.

In proportion to population the South Districts give the highest percentage of cases, and this has generally been the case in previous years also. Amongst the military population, too, the highest percentage of cases in proportion to strength comes from the South, and, although there is no positive proof of the truth of the surmise, there is a strong suspicion that proximity to the lower portions of the main sewerage system is a considerable factor in the production of the disease in these districts.

None of the cases, reported during the year, seemed to be connected with one another.

They were all sporadic and no two occurred in the same family or in the same house.

The water supply was analyzed in each case, but no evidence of contamination was detected. Some of the cases occurred in rooms close to water closets, ventilating on to closed corridors, and the co-existent sanitary defects, if any, were similar to those noted in connection with Enteric fever cases in previous years.

It should however be mentioned that two of the cases were evidently contracted during a shooting expedition in Spain, and three, if not more, were exceedingly doubtful cases.

Continued fever. Continued fevers accounted for six reported cases and one death.

Septic diseases. No cases of puerperal fever or other septic diseases, if one excepts two cases of erysipelas, were notified, but one death from pyaemia, in an infant, was registered.

Chicken pox. Chicken pox was prevalent throughout the year, concurrently with small pox. Each case was carefully observed in order to prevent any error of diagnosis which might lead to the spread of the more dangerous disease, and the results were in every respect satisfactory.

Whooping cough. Whooping Cough prevailed at the close of the year, and, although this disease is not notified, it accounted for three deaths in December and one in November.

The full statistics of these zymotic diseases is shewn in Tables III. and IV., Appendix I.

Other diseases. The other diseases requiring special mention are the diarrhœal, tubercular and respiratory diseases.

Diarrhœa. Diarrhœal diseases, in which have been included cases of infantile diarrhœa, usually returned as enteritis and gastro-enteritis, accounted for 34 deaths, of which 8 were in the first, 5 in the second, 13 in the third and 8 in the fourth quarter of the year. This seasonal distribution is similar to what usually obtains not only in Gibraltar but elsewhere. The mortality from diarrhœal diseases in 1894 is equivalent to 1·78 per 1000 of population.

In the previous three years 1893, 1892 and 1891 it was 1·83, 1·83 and 2·25 respectively.

The mortality for the decennial period was also 2·25 per 1000, so

that the year under review compares favourably with other years in this important respect.

Tubercular and respiratory diseases. With regard to tubercular and respiratory diseases the results are far from satisfactory.

Sixty-nine deaths from the former and 121 from the latter give a mortality per 1000 of population of 3·61 and 6·33 respectively, both rates of mortality being much in excess of the corresponding rates during the previous three years, viz., 2·56 and 4·24 in 1893, 3·29 and 6·12 in 1892, and 2·77 and 5·18 in 1891. They are also in excess of the rates during the decennial period 1881-90, viz., 3·39 for tubercular and 6·15 for respiratory diseases.

Forty-one of the sixty-nine deaths from tubercular diseases in 1894, or approximately sixty per cent., occurred in poor class tenements and in overcrowded damp patios. The greatest mortality was in the last quarter and the lowest in the first quarter of the year. In fact the high mortality from tubercular diseases in the last quarter has helped much to raise the mortality of the year generally above the average.

Overcrowding and dampness are the usual conditions, under which excessive mortality from tubercular diseases occurs, and it was in the latter half of the year that these conditions prevailed most.

Amongst the respiratory diseases pneumonia accounted for nearly half the deaths.

The prevalence of influenza and measles has probably largely influenced this mortality; and, as a matter of fact, it will be found that nearly 64 % of the deaths from respiratory diseases occurred in the first two quarters of the year, when these epidemics were present. Respiratory diseases, therefore, contrast as a whole with tubercular diseases in that the highest mortality of the former occurred in the first half of the year and of the latter in the second half.

The statistics of these diseases are given in Table III. Appendix I.

SANITARY CONDITIONS.

Prevention of infectious diseases. During the year some practical points have come into prominence in connection with the measures available for preventing infectious diseases, although, it must be stated, most of them have been touched upon in previous annual reports. The following are the more important facts:—

(1.) *Isolation.*—It happened that on one or two occasions a tenement nominally rented at more than 50 pesetas monthly, the maximum rent of a tenement from which cases of dangerous infectious disease may be compulsorily removed to Hospital, had been sublet and divided up for the use of several families, and apparently there was no power to remove cases of small-pox, occurring in the family of the nominal tenants, to Hospital. Groups V. and VIII. of Appendix II. are instances of such cases; and it is scarcely necessary to comment upon the fact that it is as difficult to properly isolate dangerous infectious diseases in these sublet tenements as in the tenements which come under the Bye-Laws.

Difficulties also arose in connection with the isolation of doubtful cases, in consequence of there being no observation ward in connection with the isolation Hospital.

(2.) *Disinfection.*—Instances occurred of persons objecting to having articles of bedding, &c., disinfected in the steam-disinfecting apparatus, which is at present the only adequate method of disinfection available here. Objections of the kind not only obstruct any efforts that may be made to render known *foci* of infection innocuous but may, if persisted in, nullify the results of other measures taken to prevent the spread of dangerous infectious diseases.

On several occasions during the year articles of bedding and clothing, &c., were detained at the disinfecting apparatus for many days, and poor families were subjected to great distress by the delay.

The Commissioners are not, however, responsible for such delay. They labour, indeed, under many disadvantages in having no steam disinfecting apparatus of their own, and the acquisition of such an apparatus is a matter for serious consideration.

Any one, who considers for a moment the hardship to which a poor family is put by the temporary removal of even a single article of bedding or clothing, needs no further argument to convince him of the absolute necessity of avoiding delay in the disinfection and return of such articles. The Commissioners will, no doubt, feel that it is only by having the disinfection processes under their own control and management that promptness and, indeed, economy can be ensured.

(3.) *Notification.*—The number of concealed cases of dangerous infectious disease during the year has been considerable, and, if report be true, there were many undetected cases, known to persons who might have, but would not, bring them to notice. No argument can be too strongly in favour of imposing the duties of notification upon all those who happen to become cognizant of any such cases.

There can be little doubt that, had all cases of Small-pox been promptly notified, the disease would scarcely have become epidemic in the community. The results graphically shewn in Chart III., Appendix II., exemplify this in the strongest possible light.

The Commissioners further labour under the disadvantage of having no official knowledge of the existence of epidemic diseases in neighbouring territory. Early information regarding their extent and severity must always be of value in enabling the Commissioners

to make special preparations for any outbreak of dangerous infectious disease in Gibraltar.

(4). *Vaccination.*—There are several unvaccinated children in Gibraltar, discovered, as a rule, only on their becoming subjects of an attack of small pox. This arises from the fact that children born outside Gibraltar have no vaccination notices served upon them and are not registered, unless they happen to be children of aliens. With the exception of one child of five months old, whose vaccination was postponed, all the unvaccinated persons, who were attacked with small pox during the year 1894, were born outside Gibraltar, i.e., in South America, the Channel Islands or Spain, or, if born in Gibraltar, were under 3 months of age.

Except by registration and serving vaccination notices on the parents or guardians of all children born elsewhere, there seems no possibility of preventing the occasional appearance of severe and fatal attacks of small pox here.

Re-vaccination has been almost entirely neglected. Had it been otherwise, had medical practitioners, that is to say, insisted upon re-vaccinating all members of families attacked, or had the Commissioners power to compel the re-vaccination of all persons occupying crowded tenement dwellings, where small pox cases occurred, it is safe to say that the number of cases during the year would have been diminished by about one third. As an instance of the value of re-vaccination, it may not be out of place to mention that the only case of small pox amongst the troops was a soldier, whose re-vaccination had failed, and yet the troops are practically as much exposed as the civil community to the risk of infection from outside.

Primary vaccination is, on the other hand, fully carried out amongst children born in Gibraltar, and its influence in protecting children and in rendering the majority of the attacks mild in character is undeniable.

Without it, the experiences of the year under review would have been very serious indeed.

Sewerage and Water Supply.

With regard to other sanitary conditions in the locality, considerable progress has been made in dealing with the general questions of sewerage and water supply.

The scheme for increasing the latter includes filtration, which is in itself one of the most important requirements of the public water supply here. The analysis of the water from the present collecting areas shewed so high a degree of organic impurity at the commencement of the rainy season that a considerable quantity of the water collected had to be wasted.

The Moorish Castle Tank was emptied and cleansed in September and supplied temporarily with condensed water, but the unfiltered rain water from the present collecting areas, with which it has since been filled, is far from satisfactory so far as its chemical analysis is concerned.

The Engineer has devised a cheap and efficient method of filtering water in private tanks, which would be of much benefit to the public, and which will, it is hoped, be brought to their notice in time. Filtration has always been one of the *desiderata* here in connection with water supply, and there is certainly some prospect now of having the difficulties in its way overcome.

Private tanks and wells have been dealt with as in previous years, 164 of the former having been cleansed. Some of them were very heavily polluted owing to pollution of collecting areas and to impurities entering the tank from other sources. The well waters, of which 15 were analyzed, shewed the brackish characters possessed by all well waters here.

Milk Supply. Under the new Milk Bye-Laws energetic action was taken during the year and the following are the results of the various analyses :—

Milk Analyses.

Month.	Number of samples analyzed.	Number up to standard.	Number adulterated.
January	8	8	0
February	8	7	1
March	4	4	0
April	12	10	2
May	11	7	4
June	10	6	4
July	13	12	1
August	16	9	7
September	0	0	0
October	31	20	11
November	26	23	3
December	22	21	1
Total	161	127	34

The amount of added water in the adulterated samples varied from 12 per cent. to 55 per cent.

In the previous year 17 samples, of which 12 were found adulterated, were analyzed, the Bye-Laws coming into operation only towards the end of the year.

Twenty milk vendors were prosecuted and fined sums varying from

15 to 125 pesetas. There is reason to believe that most of the adulteration takes place in the shops just before the milk is being sent out for sale by street vendors.

The registration of milk shops and the improvement of their general character are matters which have scarcely been dealt with yet, but they ought certainly to be considered in any scheme for sanitary control over the milk supply of the locality.

Sodawater manufactories and bakeries. The supervision of Sodawater manufactories and bakeries was carried out systematically. Certain improvements have been effected in the latter and the employment of mules in the kneading trough rooms is gradually being abandoned.

Market supplies. The market supplies were satisfactory in quality, especially during the last quarter of the year, when, for the first time, butchers were able to buy their live-stock by public auction in Gibraltar, instead of through a middleman in Tangier.

The diseases noted were, as in previous years, chiefly cysticerci and other parasitic diseases of the internal organs.

Defects in dwellings. The sanitary defects dealt with in habitations are noted in Table V., Appendix I.

With regard to these dwellings, there is little to report, beyond what has been stated in one Annual Report after another for many years back. The chief defects in the construction of old buildings are, generally speaking, those which deprive the living rooms of sunshine and pure air, and favour instead dampness and other impurities of atmosphere. Add to these density of population and overcrowding, and it is hopeless to expect zymotic and especially tubercular diseases to be banished from the locality.

One point, which has not been touched upon previously, is the absence of fire places in many of the living rooms. It has not been considered necessary in this climate to provide means of warming the rooms. Nevertheless the want of fire places is undoubtedly felt and their absence aggravates the evils of dampness and inadequate ventilation, and tends to maintain a high mortality from respiratory diseases in exceptionally wet and cold seasons.

New buildings. With regard to new buildings, there is a marked improvement in the sanitary aspect of many of the plans submitted during the year, but exception must still be taken to the construction of huge artisan blocks on the *patio* system.

Nearly all such houses possess the evils of the back to back system of dwellings, evils which are aggravated by the fact that the *patio* arrangement deprives the lower rooms of direct light and sunshine, prevents free circulation and favours stagnation of air.

Overcrowding. Overcrowding is still no better than in previous years. Though no statistics are available to shew how far it has increased during the year, there is a strong presumption that the population of the tenement blocks has become excessive.

W. G. MACPHERSON,
Surgeon-Major, A.M.S.

Gibraltar, March 20th, 1895.

APPENDIX I.

OF THE

ANNUAL REPORT ON THE PUBLIC HEALTH

OF

GIBRALTAR,

FOR THE YEAR

1894.

STATISTICAL TABLES.

TABLE I.

Deaths registered in Gibraltar during 1894, amongst the Civil Population, shewing diseases causing death and ages at death.

CAUSE OF DEATH.	At all ages.	Under 1 yr. of age.	1 year.	2 years.	3 years.	4 years.	Total under 5 years.	OTHER AGE-GROUPS. 5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
General Diseases	172	52	21	7	7	1	88	5	4	5	5	5	14	11	7	9	19
Local Diseases	238	33	17	5	2	3	60	4	2	5	3	19	16	25	32	44	28
Poisons (none)	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Injuries	8	1	...	...	...	...	1	...	...	...	...	...	3	2	2	..	...
Total...	418	86	38	12	9	4	149	9	6	10	8	24	33	38	41	53	47
CLASS I.																	
GENERAL DISEASES.																	
GROUP A.																	
Small Pox	8	3	...	...	1	...	4	...	1	3	...	...	...	...	...	...	...
Measles	5	2	1	...	2	...	5	...	...	...	...	...	...	...	...	...	...
Influenza	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...
Whooping Cough	4	2	2	...	...	...	4	...	...	...	...	...	...	...	...	...	..
Diphtheria	7	...	...	2	3	...	5	2	...	...	...	...	...	...	...	...	...
Croup (membranous)...	2	1	1	...	...	...	2	...	...	...	...	...	...	...	...	...	...
Continued Fever	1	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...
Enteric Fever	8	...	...	...	...	...	...	...	1	...	3	1	2	...	1	...	...
Diarrhœa	34	16	7	1	...	...	24	...	...	...	...	1	...	...	...	3	6
Pyæmia	1	1	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...
Syphilis	2	2	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...
GROUP B.																	
Starvation	10	8	2	...	...	...	10	...	...	...	...	...	...	...	...	...	...
Alcoholism	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...
GROUP C.																	
Immaturity at Birth ...	5	5	...	...	...	...	5	...	...	...	...	...	...	...	...	...	...
Debility	2	1	...	...	...	...	1	...	...	...	...	...	...	...	...	1	...
Old Age	12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	12
GROUP D.																	
Rheumatic Fever	2	...	...	...	...	...	...	...	1	...	...	...	1	...	...	...	...
New-growths	19	...	...	...	...	...	...	...	...	...	...	...	4	6	4	5	...
Tubercle (unclassified)	8	1	2	1	...	...	4	1	1	...	...	1	1	...	...	...	...
" of Lungs ...	13	...	...	...	...	...	...	...	...	1	2	2	5	1	1	.	1
" of Glands ...	5	2	1	2	...	...	5	...	...	...	...	...	...	...	...	...	...
" of Brain	17	5	5	1	1	1	13	2	...	...	...	...	1	1	...	...	...
Scrofula	2	2	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...
Ricketts	1	1	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...
Diabetes	2	...	...	...	...	...	...	...	...	...	...	...	...	1	1	...	...
Total of General Diseases..	172	52	21	7	7	1	88	5	4	5	5	5	14	11	7	9	19

TABLE I.—*Continued.*

CAUSE OF DEATH.	At all ages.	Under 1 yr. of age.	1 year.	2 years.	3 years.	4 years.	Total under 5 years.	OTHER AGE-GROUPS. 5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
CLASS II.																	
LOCAL DISEASES.																	
NERVOUS SYSTEM.																	
Congestion of Brain ...	3	...	...	...	...	...	...	1	...	...	...	...	1	...	...	...	1
Sclerosis of Cord	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...
Inflammation of Brain.	1	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...
Apoplexy	12	...	...	...	...	...	...	...	...	...	...	...	...	1	4	3	4
Paralysis	4	...	...	...	...	...	...	...	...	...	...	...	1	...	...	3	...
Hemiplegia	9	...	...	...	...	...	...	...	...	...	...	...	...	...	4	2	3
Cerebral Embolism......	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...
Infantile Convulsions...	8	5	3	...	...	...	8	...	...	...	...	...	...	...	...	...	..
Melancholia	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1	.	...
Dementia	1	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...
CIRCULATORY SYSTEM.																	
Heart Disease (unclassified)	23	...	...	...	...	...	...	...	...	...	...	2	...	2	4	10	5
Endocarditis	4	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	3
Pericarditis	3	...	...	...	...	...	...	...	...	...	...	2	1	...	...	...	...
Valvular Disease......	6	...	...	...	...	...	...	...	...	2	...	1	...	1	...	2	...
Dilatation of Heart ...	2	..	...	...	...	...	...	...	...	...	...	...	...	1	...	1	..
Angina Pectoris......	1	...	...	...	...	...	..	...	...	...	...	...	...	...	...	1	...
Aneurism of Aorta ...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
RESPIRATORY SYSTEM.																	
Bronchitis	22	9	3	...	...	...	12	1	...	...	...	...	...	3	1	4	1
Asthma	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...
Haemoptysis	1	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...
Congestion of Lungs...	5	...	...	...	...	...	...	...	...	...	...	1	...	...	...	3	1
Pneumonia	55	10	8	4	2	1	25	2	...	1	1	3	2	6	6	5	4
Gangrene of Lungs ...	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...
Phthisis	26	1	2	...	...	...	3	...	1	2	2	5	7	3	3	...	...
Atelectasis	1	1	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...
Pleurisy	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...
DIGESTIVE SYSTEM.																	
Teething	3	3	...	...	...	...	3	...	...	...	...	...	...	...	...	...	...
Inflammation of Stomach	7	4	1	1	...	...	6	...	...	...	...	...	...	...	...	1	...
Ulceration of Stomach...	3	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...
Haemorrhage of Intestine	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...

TABLE I.—*Continued.*

CAUSE OF DEATH.	At all ages.	Under 1 yr. of age.	1 year.	2 years.	3 years.	4 years.	Total under 5 years.	5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
								OTHER AGE-GROUPS.									
CLASS II.																	
LOCAL DISEASES—*Cont.*																	
DIGESTIVE SYSTEM—*Cont.*																	
Obstruction of Intestine	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1
Ulceration "	1	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...
Hepatitis "	6	...	...	...	...	1	1	...	...	...	...	...	...	1	1	1	2
Cirrhosis of Liver ...	2	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	1
Lardaceous Liver	1	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...
Peritonitis	1	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...
LYMPHATIC SYSTEM.																	
Graves' Disease	1	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...
URINARY SYSTEM.																	
Granular Kidney	2	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...
Chronic Nephritis	1	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...
Cystitis	3	...	...	...	...	...	...	...	...	...	...	...	...	...	1	2	...
Retention of Urine.....	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
Uraemia	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...
Dropsy (renal)	2	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1
GENERATIVE SYSTEM.																	
Metritis	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...
ORGANS OF LOCOMOTION.																	
Gangrene	5	...	...	...	...	...	...	...	...	...	...	...	...	...	2	2	1
Total of Local Diseases	238	33	17	5	2	3	60	4	2	5	3	19	16	25	32	44	28
CLASS IV.																	
INJURIES.																	
Multiple Injury	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...
Injury to Cord	1	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...
Injury to Skull	2	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...
Suicides—Cut throat ...	2	...	...	...	...	...	...	...	...	...	...	...	1	1	...	...	...
Gun shot ..	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...
Murder—Injury to skull	1	1	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...
Total of Injuries...	8	1	...	...	...	...	1	...	...	...	...	...	3	2	2	...	...

TABLE II.

Sex Mortality amongst Civil Population in 1894, distributed according to Months and Age-groups.

Months.	Deaths at all ages. Males.	Females.	Deaths amongst Males according to Age-groups. Under 5	5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.	Deaths amongst Females according to Age-groups. Under 5	5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
January	23	17	10	1	...	...	...	...	2	3	2	2	3	4	1	...	...	...	1	1	1	3	3	3
February	22	14	7	...	...	1	...	2	1	2	3	2	4	3	...	...	...	...	...	1	2	3	2	3
March	22	14	7	...	2	...	...	5	...	2	...	4	2	2	1	...	2	...	3	...	...	2	4	...
April	22	14	9	..	1	...	...	1	3	1	5	1	1	4	...	...	1	1	...	2	...	1	3	2
May	14	15	3	...	...	2	...	...	2	3	...	1	3	9	...	...	...	1	1	1	1	...	1	1
June	18	13	7	...	1	...	...	...	1	5	2	1	1	6	1	...	...	...	1	...	...	2	...	3
July	15	17	2	1	...	1	1	..	3	2	2	1	2	5	...	...	...	...	1	1	1	2	5	2
August	19	18	7	...	...	...	2	1	2	4	...	3	...	10	1	...	1	...	1	...	...	2	3	...
September	19	12	10	...	...	...	1	1	2	2	1	2	...	7	...	...	1	...	1	...	...	3	...	...
October	20	16	6	1	...	...	2	2	1	2	1	3	2	6	1	1	...	...	...	3	1	1	1	2
November	15	19	5	...	...	...	...	1	1	3	...	2	3	5	1	1	1	...	...	1	1	3	1	5
December	18	22	7	...	...	...	...	1	4	2	1	2	1	8	...	...	...	...	1	1	...	2	6	4
Total deaths	227	191	80	3	4	4	6	14	22	31	17	24	22	69	6	2	6	2	10	11	7	24	29	25
Annual death-rate per 1000 at each age ...	26·15	18·33	90·49	3·59	4·51	4·35	6·82	9·60	18·42	37·30	34·48	107·14	275·00	71·30	6·88	4·17	4·87	1·76	5·79	8·68	7·00	32·74	72·30	142·04

TABLE III.

Monthly distribution of Births, Deaths & principal diseases causing death amongst the Civil Population of Gibraltar during 1894.

Months.	Meteorology.			Total Births (Fixed Civil Population).	Deaths from all causes.		Monthly Death-rates per 1000 living (1)		Quarterly Death-rate sper 1000 living (1)		Principal zymotic diseases (1)		Deaths from principal zymotic diseases.								Tubercular Diseases. (3)		Respiratory Diseases. (4)	
	Rainfall in inches.	Mean relative humidity.	Mean temperature in shade (Fahrenheit).		Total Civil Population.	Fixed Civil Population.	Total Civil Population.	Fixed Civil Population.	Total Civil Population.	Fixed Civil Population.	Total deaths.	Death-rates per 1000 living by quarters.	Small Pox.	Measles.	Scarlet fever.	Diphtheria (2)	Whooping cough	Enteric fever.	Contin'd fever.	Diarrhoea.	Total deaths.	Death-rates per 1000 living by quarters. (1)	Total deaths.	Death-rates per 1000 living by quarters. (1)
January	2·58	72	54·1	53	40	35	25·13	24·84	23·45	24·84	7	3·14	...	...	...	3	...	...	...	4	3	2·74	11	8·79
February	2·50	73	55·9	33	36	34	22·61	24·13			2		...	1	...	...	...	...	...	1	4		15	
March	6·92	74	57·6	41	36	36	22·61	25·55			6		1	1	...	1	...	...	...	3	6		16	
April	1·69	68	60·3	40	36	34	22·61	24·13	20·10	22·24	5	3·76	2	2	...	...	...	...	...	1	4	2·93	18	7·32
May	1·53	69	63·7	43	29	29	18·21	20·58			5		1	1	...	1	...	1	...	1	5		11	
June	·02	78	69·7	36	31	31	19·47	22·00			8		2	...	...	...	...	3	...	3	5		6	
July	·00	80	74·8	45	32	32	20·10	22·71	20·63	23·42	5	4·18	...	...	...	...	...	1	1	3	4	3·97	3	4·18
August	·02	79	76·1	41	37	36	23·24	25·55			11		1		...	2	...	2	...	6	10		6	
September	2·42	80	72·6	44	31	31	19·47	22·00			4		...	...	...	...	...	...	...	4	5		11	
October	2·50	76	68·1	31	36	32	22·61	22·71	23·03	24·60	4	3·35	...	...	...	1	...	1	...	2	6	4·81	7	5·21
November	7·05	82	61·7	29	34	32	21·36	22·71			6		...	...	...	...	1	...	...	5	7		8	
December	3·16	79	58·0	41	40	40	25·13	28·38			6		1	...	...	1	3	...	...	1	10		9	
Totals, means or annual rates per 1000 living	30·39 (mean)	75·8 mean	64·3 (mean)	477	418	402	21·87	23·77	21·85	23·77	69	3·69	8	5	...	9	4	8	1	34	69	3·61	121	6·33

(1) Calculated on a Total Civil Population of 19100, and a Fixed Civil Population of 16906. (2) Includes 2 cases of membranous croup.
(3) Includes Phthisis and diseases returned as Tubercular.
(4) Includes diseases returned as Bronchitis, Pneumonia, Phthisis, Tubercle of Lungs, Congestion and Oedema of Lungs.

TABLE IV.

Infectious and Contagious Diseases notified during 1894, under provisions of Section 10, "Medical Ordinance, Gibraltar, 1885."

Months.	Cases occurring amongst the Civil Population.																						Cases landed from the Bay.					
	Small Pox.		Chicken Pox.		Scarlet Fever.		Measles.		Whooping Cough.		Diphtheria.		Membranous Croup.		Enteric Fever.		Continued Fever.		Influenza.		Erysipelas.		Small Pox.		Enteric Fever.		Continued Fever.	
	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died
January	6	...	5	...	3	...	13	2	...	...	5	2	1	1	...	...	2	...	23	...	...	...	...	...	...	...	...	...
February	3	...	3	...	...	...	41	...	...	...	...	...	...	...	...	...	...	...	35	1	...	...	3	...	...	...	...	...
March	11	1	4	...	1	...	48	1	...	...	1	...	2	1	...	...	...	...	1	...	...	...	1	...	...	...	...	...
April	14	2	4	...	1	...	36	1	...	...	...	...	...	...	1	...	...	...	...	...	...	...	2	...	...	...	...	...
May	9	1	1	...	...	...	15	1	...	...	1	1	...	...	1	1	...	...	...	...	...	...	1	...	...	...	...	...
June	7	2	...	...	1	...	18	...	...	...	1	...	...	...	4	3	1	...	...	...	...	...	...	...	...	...	...	...
July	7	...	...	...	...	...	1	...	...	...	...	...	...	...	3	1	2	1	...	...	1	...	...	...	1	1	...	...
August	1	1	1	...	...	...	...	...	...	...	2	2	...	...	1	2	...	...	...	...	1	...	...	...	1	1	...	...
September	2	...	4	...	...	...	...	...	...	...	...	...	...	...	4	...	1	...	...	...	...	...	...	...	...	...	...	...
October	2	...	1	...	...	...	1	...	...	...	2	1	...	...	2	1	...	...	...	...	...	...	...	...	...	...	...	...
November	13	...	2	...	...	...	...	...	3	1	1	...	1	...	3	...	...	...	6	...	...	...	...	...	2	...	...	...
December	10	1	8	...	...	...	...	...	...	3	4	1	...	...	...	...	...	...	4	...	...	...	2	...	2	1	1	...
Totals	88	8	33	...	6	...	173	5	3	4	17	7	4	2	19	8	6	1	69	1	2	...	9	...	6	3	1	...

TABLE V.

Statement of the chief sanitary defects dealt with amongst the civil habitations of Gibraltar during 1894.

Description of Defect.	Number of Houses in which the defect was noted.
A.—WATER SUPPLY.	
1. Collecting area polluted	23
2. Mouth or inlet of tank exposed to pollution	24
3. Water in tank impure	13
4. Overflow of tank directly connected with drain	2
5. Insufficient supply of water for flushing, &c.	31
B.—SEWERAGE.	
1. Insufficient W.C. accommodation	4
2. Insufficient means of flushing	6
3. Situation of W.C. insanitary	16
4. Soil pipes leaking	9
5. Soil pipes embedded in the walls	22
6. Soil pipes unventilated	3
7. Fittings, &c., insanitary	39
8. House drains defective	13
9. House drains connected with adjoining houses	5
10. House drains untrapped	1
11. Rain gutter pipes connected with drain	2
12. Ventilation of W.Cs. insufficient	48
C.—KITCHENS.	
1. Sinks untrapped	12
2. Sinks directly connected with drains	14
3. Without flues	7
4. Accommodation deficient	10
D.—LIVING ROOMS.	
1. Dirty	4
2. Damp	10
3. Overcrowded	6
4. Badly lighted and ventilated	41
5. Generally unfit for habitation	10
6. Roofs leaking	13
7. Drains under floor	6
E.—YARDS.	
1. Badly paved	26
2. Badly ventilated	3
3. Blocked with stores and refuse	8
4. Surface drain traps defective	30
5. Fouled by keeping of animals	3
F.—PREMISES GENERALLY.	
1. Unfit for habitation	2
2. In bad repair	4
3. Deficient of refuse receptacles	55
Total	525

APPENDIX II.

TABLES AND CHARTS

ILLUSTRATIVE OF

SMALL-POX & MEASLES EPIDEMICS

IN GIBRALTAR,

1894.

…OUP V.	…n crowded tenen…	[illegible]	25· 5·94	28· 5·94	Step-brother of case 46 and in communication with him, though living in different district	10	1-room.	Infancy.	By father.
		47	4· 6·94	11· 6·94	Sister of case 40, and occupying same room. Sister-in-law of case 46. Gave birth to child on 7·6·94, which died 21·6·94 without symptoms of small-pox	18	do.	do.	By husband.
GROUP IX. (Isolated cases from a definite source of infection).	Concealed case.	25	8· 4·94	12· 4·94	Slept in room where there was a concealed case, discovered convalescent on 20·4·94. Case 25 was a patient in Hospital from 2·4·94 with fractured skull	19	1-room.	Infancy.	From Col. Hospital, in-patient.
	Insufficient isolation.	26	11· 4·94	19· 4·94	Father, servant in house of, and in contact with attendant on case ill at home from 21·3·94	19	do.	do.	By Med. Pract.
	Insufficient isolation and disinfection (?)	*31	21· 4·94	24· 4·94	Lives next door to and is brother-in-law of case ill from 28·2·94	16	do.	Unvaccinated.	"
	Ditto	*45	28· 5·94	31· 5·94	Intimate with and related to case which left Hospital 21·4·94	$\frac{3}{12}$	do.	do.	"
	Ditto	54	9· 7·94	13· 7·94	Occupied afterwards room of a case, removed 20·5·94	27	2-room.	do.	"
	A case in Linea.	60	26· 8·94	not removed.	Frequents Linea and stayed 14 days previously in house where there was small-pox	21	+ 3-room.	Infancy.	"
	Insufficient isolation	61	6?· 9·94	12· 9·94	Father has been frequenting house of case 60 daily	13	1-room.	Doubtful.	"
	Insufficient isolation	62	14· 9·94	not removed.	Nurse of case 60. Refused re-vaccination	30	+ 3-room.	Infancy.	"
	A case in Linea.	74	23·11·94	Do.	In contact with woman on 12·11·94, who had just buried her child in Linea from small-pox	27	do.	do.	First as chicken pox
	Ditto	80	10·12·94	13·12·94	Two weeks previously lived in Linea, in house where there was small-pox, and where some people had died from the disease	$\frac{3}{12}$	1-room.	Unvaccinated.	First as chicken-pox Cl. Hos. out-patient.
	Ditto	81	11·12·94	13·12·94	In adjoining room and intimate with family of case 80	13	do.	Infancy.	Discovered by H.O. on visiting case 80.

APPENDIX II.

Groups of cases of Small-pox in 1894 (Civil Population, Gibraltar).

(Those cases marked * died).

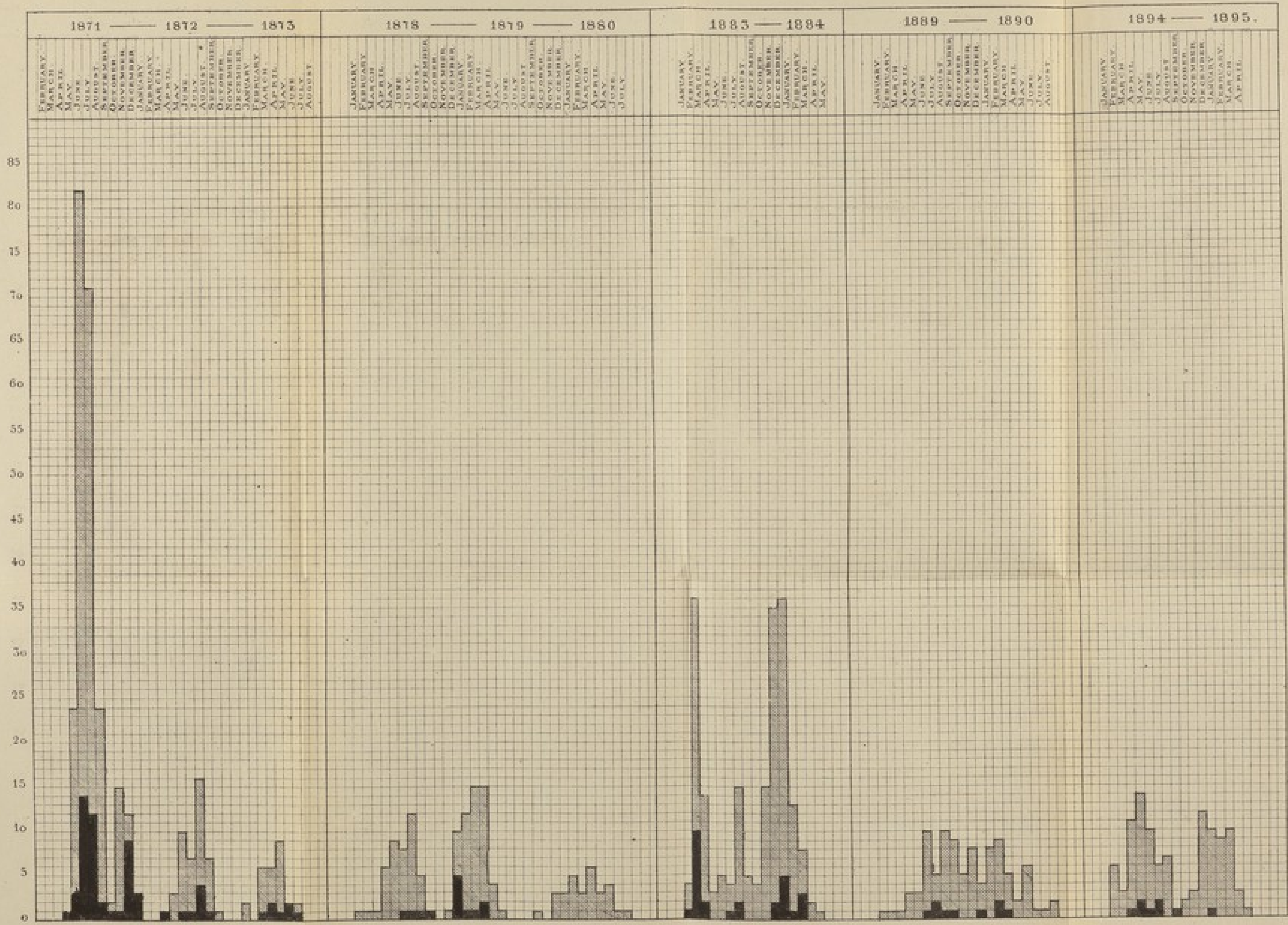
Index No. of Groups.	Source of initial infection.	Registered No. of case.	Date of attack.	Date of removal to Hospital.	Circumstances of exposure to infection.	Age.	Nature of Tenement.	Condition as to Vaccination.	How notified.
GROUP I.	Unrecognised case of small-pox and subsequent concealed cases in a crowded tenement.	1	10·12·93	not removed.	Was seamstress in house of a case, notified 20·11·93 as chicken-pox, but which was really a case of small-pox	18	1-room.	Infancy.	Concealed case discovered 6·1·94.
		2	2·1·94	6·1·94	Sister of case 1 and occupying same room	11	do.	do.	Discovered 6·1·94
		3	3·1·94	6·1·94	Brother of case 1 & occupying same room	14	do.	do.	" "
		4	4·1·94	8·1·94	Do. do.	9	do.	do.	" 7·1·94
		5	7·1·94	11·1·94	Schoolfellow of case 3, and in same class	10	do.	do.	By father.
		6	7·1·94	11·1·94	Brother of case 5, & sleeping in same bed	6	do.	do.	"
		7	7·1·94	11·1·94	Sister do. do.	8	do.	do.	"
GROUP II.	Concealed cases.	8	18·2·94	19·2·94	Source unknown; lives near cases 5, 6, 7. Removed from original tenement at time of attack	16	2-room.	Infancy.	Concealed case reported 19·2·94
		*17	1·3·94	9·3·94	Sister of case 8; lived in same room 14 days previously	15	1 room.	Unvaccinated.	Concealed case discovered 9·3·94
		19	12·3·94	not removed.	Cousin of cases 8 and 17 and in communication with family	3	2-room.	Infancy.	First as measles.
		*22	26·3·94	Do.	Do. do. do.	$3\frac{1}{2}$	2-room.	Unvaccinated.	By Med. Pract.
GROUP III.	Insufficient isolation in crowded tenements.	11	27·2·94	not removed.	Source unknown: a telegraph messenger living in a patio crowded with tobacco workers from Spain	19	2-room.	Infancy.	By Med. Pract.
		18	12·3·94	Do.	Sister of case 11, living in same tenement; was the only member of family who would not be re-vaccinated ...	21	do.	do.	"
		23	1·4·94	Do.	Intimate friend and in communication with cases 11 and 18	19	+ 2-rm. sublet	do.	"
		27	13·4·94	19·4·94	Do. do. case 23	22	2-room.	do.	"
		30	17·4·94	22·4·94	Friend of case 23 & working in same office	19	do.	Doubtful.	"
		36	27·4·94	not removed.	Lives in next house to cases 11 & 18; window of bedroom adjoins window of their bedroom. Is also in a house full of tobacco workers from Spain	16	+ 2-room.	Infancy.	First as measles by Med. Pract.
		39	17·5·94	Do.	Acquainted with and in contact with case 36 on 29·4·94 or later	16	do.	do.	By Med. Pract.
		43	23·5·94	26·5·94	Tobacco worker in same house as case 36	24	1-room.	do.	"
		37	4·5·94	9·5·94	Lived in room of case 27 after case occurred, and father works in house of cases 11 and 18	18	2-room.	Doubtful.	"
		not registered	21·5·94	In Linea.	Removed case 37 to Hospital. Lives in Linea; refused re-vaccination before removing case	?	In Linea.	Infancy.	Not notified; a Linea resident.
		48	11·6·94	13·6·94	Brother of above case. Visited him while ill at Linea	26	1-room.	do.	By Med. Pract.
GROUP IV.	Concealed cases in crowded tenements.	41	? Feb. 94	not removed	Works amongst tobacco workers from Spain	?	1-room.	Doubtful.	Concealed case, not detected till 23·5·94
		10	? Feb. 94	28·2·94	Lives next house to case 41. Found walking about streets in third stage of the disease	31	do.	do.	Concealed case discovered 28·2·94
		13	28·2·94	3·3·94	Works in same manufactory as case 41...	19	do.	Infancy.	By Med. Pract.
		20	13·3·94	not removed.	Lives in same house as case 41. Intimate with and frequents same places as case 10...	27	2-room.	do.	"
		15	2·3·94	8·3·94	Lives in same house with case 13	22	1-room.	do.	First notified as fever.
GROUP V.	Concealed cases in crowded tenements.	46	1·5·94	not removed.	Unknown. Storeman in a grocer's shop. Found after convalescence	25	1-room.	Infancy.	Concealed case, discovered 2·6·94.
		40	19·5·94	23·5·94	Sister-in-law of case 46. Living in next house	20	do.	do.	By husband.
		*44	24·5·94	not removed.	Lives in room above case 46	$\frac{7}{12}$	+ 2-rm. sublet	Unvaccinated.	Concealed case, discovered 29·5·94.
		45	25·4·94	28·6·94	Step-brother of case 46 and in communication with him, though living in different district	10	1-room.	Infancy.	By father.
		47	4·6·94	11·6·94	Sister of case 45, and occupying same room. Sister-in-law of case 46. Gave birth to child on 7·6·94, which died 21·6·94 without symptoms of small-pox	18	do.	do.	By husband.
		49	12·6·94	not removed.	Aunt of case 44; living in same tenement. Refused re-vaccination...	37	+ 2-rm. sublet	do.	By Med. Pract.
		50	12·6·94	Do.	Uncle of do. do. ...	26	do.	do.	"
		51	16·6·94	18·6·94	Got some old clothes from family of cases 44, 49, 50, after outbreak of small-pox	20	Military Qrs. Flat Bastion R.	do.	"
		53	17·6·94	20·6·94	Sister of cases 40 & 47, and sister-in-law of 46, but living in different district ...	24	1-room.	do.	"
		59	29·7·94	31·7·94	Brother-in-law of cases 40, 47, 53, living in Linea, but parents live in house of cases 40 & 47. Found walking about streets	28	Linea.	do.	Concealed case found in streets.
GROUP VI.	Insufficient care in isolation.	66	30·11·94	not removed.	Unknown. Mixes with Spaniards from Linea in his employment. Servant came to house from Linea 12·10·94 ...	23	+ 2-room.	Infancy.	By Med. Pract.
		78	26·11·94	2·12·94	Servant in house of case 66; sent out of the house when first symptoms appeared	18	do.	do.	By friend to whose house she went on being attacked.
		75	28·11·94	not removed.	Sister of case 66, and in same house; not re-vaccinated	27	do.	do.	By Med. Pract.
		76	28·11·94	Do.	Do. do. do.	21	do.	do.	"
		77	28·11·94	Do.	Do. do. do.	17	do.	do.	"
		Register'd in 1895	6·1·95	9·1·95	Living in room to which case 78 went on 26·11·94; not revaccinated...	21	2-room.	do.	"
		Do.	6·1·95	9·1·95	Sister of previous case living in same room	15	do.	do.	"
GROUP VII.	A woman entering daily from Linea, while nursing child suffering from small-pox.	71	18·11·94	24·11·94	In contact with cigar-maker who was at the same time nursing a child with small-pox in Linea, and living in a house where there were other cases of small-pox	24	2-room.	Infancy.	First notified as influenza.
		72	25·11·94	not removed.	Intimate friend & companion of case 71	19	+ 2-room.	do.	By Med. Pract.
		73	22·11·94	28·11·94	Do. do. of cases 71 & 72	15	1-room.	do.	By neighbour.
		Unregistered.	10·12·94	not removed.	Sister of case 73 living in same room. Had initial symptoms only. Gave birth to case 82 on 16·12·94. Never had eruption	17	do.	do.	Not notified.
		*82	16·12·94	Do.	Born 16·12·94 with small-pox eruption characteristic of 6th day of the disease. Died 17·12·94	1 day	do.	Unvaccinated.	From Col. Hospital out-patient Dept.
		85	26·12·94	29·12·94	Brother of case 73, uncle of case 82, and living in same room	20	do.	Infancy.	By neighbour.
GROUP VIII.	Concealed case.	Unregistered.	10·11·94	To Linea 18·11·94	A concealed case. Left tenement to stay in Linea to conceal appearance of the disease	?	2-rm. sublet	Infancy.	Not notified.
		69	20·11·94	not removed.	Tenant of same tenement as previous case	19	do.	do.	By Med. Pract.
		70	22·11·94	Do.	Sister of case 69, and in same tenement...	16	do.	do.	Detected by H.O. on visiting case 69.
		79	6·12·94	12·12·94	Was at dinner in house of cases 69 & 70 on or about 22·11·94. Intimate with family	9	2-room.	Unvaccinated.	By Med. Pract.
		83	22·12·94	25·12·94	Brother of case 79 and in same room ...	11	do.	Unvaccinated until 14·12·94	"
		84	22·12·94	25·12·94	Do. do. ...	6	do.	do.	"
		Register'd in 1895	2·1·95	not removed.	Lives next room to cases 79, 83, 84, and in contact with them	21	+ 2-room.	Infancy.	"
		Do.	6·1·95	9·1·95	Confined on 23·12·94, by mid-wife, who had that day or previous day been in house of cases 79, 83, 84	?	Military Qrs.	do.	"
		Do.	18·1·95	9·1·95	Infant of previous case removed to Hospital with her	2 wks.	do.	After admission to Hospital.	From Small-pox Hospital.
GROUP IX. (Isolated cases from a definite source of infection).	Concealed case.	25	9·4·94	12·4·94	Slept in room where there was a concealed case, discovered convalescent on 20·4·94. Case 25 was a patient in Hospital from 2·4·94 with fractured skull	19	1-room.	Infancy.	From Col. Hospital, in-patient.
	Insufficient isolation.	26	11·4·94	19·4·94	Father, servant in house of, and in contact with attendant on case 25 at home from 27·3·94	19	do.	do.	By Med. Pract.
	Insufficient isolation and disinfection (?)	*31	22·4·94	24·4·94	Lives next door to and is brother-in-law of case 25 from 28·3·94	16	do.	Unvaccinated.	"
	Ditto	*45	28·5·94	31·5·94	Intimate with and related to case which left Hospital 21·4·94	$\frac{7}{12}$	do.	do.	"
	Ditto	54	9·7·94	13·7·94	Occupied afterwards room of a case, removed 20·5·94	27	2-room.	do.	"
	A case in Linea.	60	26·8·94	not removed.	Frequents Linea and stayed 14 days previously in house where there was small-pox	22	+ 2-room.	Infancy.	"
	Insufficient isolation	61	6·9·94	12·9·94	Father has been frequenting house of case 60 daily	18	1-room.	Doubtful.	"
	Insufficient isolation	63	14·9·94	not removed.	Nurse of case 60. Refused re-vaccination	30	+ 2-room.	Infancy.	"
	A case in Linea.	74	23·11·94	Do.	In contact with woman on 12·11·94, who had just buried her child in Linea from small-pox	27	do.	do.	First as chicken-pox
	Ditto	80	10·12·94	13·12·94	Two weeks previously lived in Linea, in house where there was small-pox, and where some people had died from the disease	$\frac{7}{12}$	1-room.	Unvaccinated.	First as chicken-pox Cl. Hos. out-patient.
	Ditto	81	11·12·94	13·12·94	In adjoining room and intimate with family of case 80	13	do.	Infancy.	Discovered by H.O. on visiting case 80.

d cases;

the deeply shaded the number of deaths. Each square equals ten cases.

Chart I

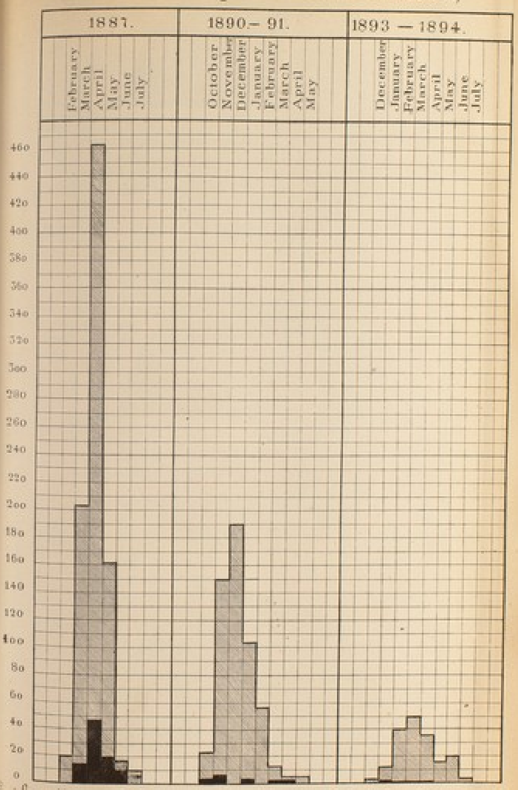
Smallpox Epidemics since 1870 in Gibraltar



Explanation. The lightly shaded squares represent the number of reported cases; the deeply shaded the number of deaths. Each square equals one case.

Chart II

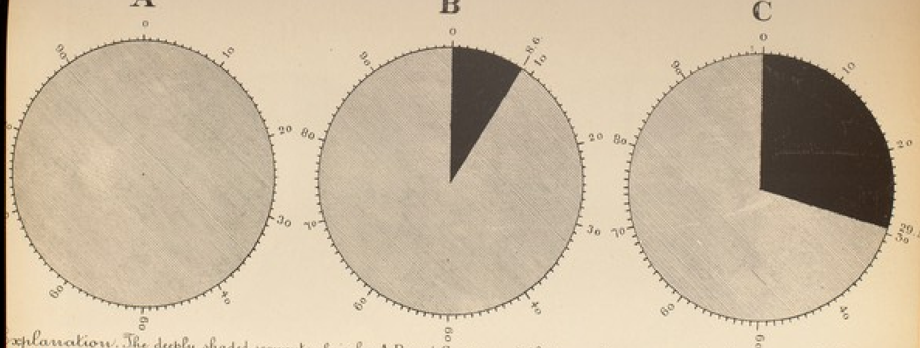
Measles epidemics (1887 to 1894.)



Explanation. The lightly shaded squares represent the number of reported cases; the deeply shaded the number of deaths. Each square equals ten cases.

Chart III

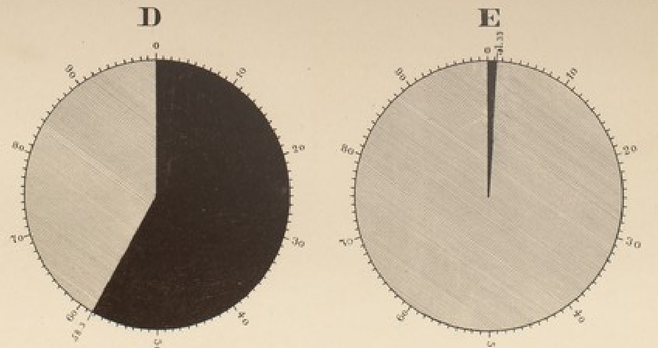
Shewing the influence of isolation, non-isolation and concealment in the Smallpox Epidemic of 1894.



[E]xplanation. The deeply shaded segments of circles A.B and C represent the proportion per cent. of individuals belonging to families, where Smallpox occurred, who were subsequently attacked with the disease; circle A representing [t]he families of cases removed at once to Hospital, circle B of cases treated at home and circle C of concealed cases; i.e. the percentage of subsequent attacks in circle A = nil, circle B = 8·6, circle C = 29·5.

Chart IV

[S]hewing the mortality amongst vaccinated and unvaccinated cases in the Smallpox Epidemic of 1894



Explanation. The deeply shaded segments of circles **D** and **E** represent the proportion per cent of fatal cases, circle **D** representing unvaccinated and circle **E** vaccinated cases. i.e. the percentage of fatal cases in circle **D** (unvaccinated) = 58·3 and in circle **E** (vaccinated) = 1. 35.

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FOR THE YEAR

1895,

BY

W. G. MACPHERSON, M.A., M.B., (Edin.) D.P.H. (Camb.)
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ANNUAL REPORT

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PUBLIC HEALTH OF GIBRALTAR

FOR THE YEAR 1895.

VITAL STATISTICS.

The year 1895 completes a quinquennial period. It is, accordingly, advisable to include in this report a review of the period as a whole. It will be remembered that the statistics recorded in previous annual reports,* when taken by themselves, were regarded as unsafe tests of the sanitary condition of the locality year by year, in consequence of the fluctuations which are apt to occur in dealing with the small numbers provided by the Gibraltar population in any one year; and more reliable proofs of the state of the public health were expected to be forthcoming when a review could be made of the quinquennial period, that has now come to a close, as a whole. The statistics of the whole period are, therefore, of much interest and importance; and are valuable not only for future reference but also for purposes of comparison.

Population. The "total civil population" at the last census, in April 1891, amounted to 19,100, including 2,194 aliens living here on temporary permit. That is to say, the "fixed civil population" amounted to 16,906 and the "resident alien" population to 2,194. These numbers have been taken as the basis for calculating the various statistical rates in each year of the subsequent quinquennial period.

In Gibraltar, where house accommodation does not increase *pari passu* with natural expansion of population, it is extremely difficult to say whether the civil population has increased or not since 1891. The increase, in any case, would occur in the "fixed civil population," as the number of aliens residing here on temporary permit remains practically the same.

The following table indicates the probable increase that would have occurred under normal conditions, according to the Registrar-General's method of estimating population at intercensal periods:—

---

* These statistics deal with the civil population only. The statistics of the military population are compiled and recorded in the Army Medical Department's Annual Reports.

Year.	Estimated "fixed civil population" at middle of year.	Estimated "total civil population" at middle of year.
1891	16,924	19,118
1892	16,997	19,191
1893	17,072	19,266
1894	17,146	19,340
1895	17,226	19,414

On the other hand the official statistics of estimated population compiled by the local police authorities and published in the Gibraltar Blue-book, indicate a decreasing rather than an increasing population; although the numbers given do not correspond very clearly with the number of houses and occupied rooms. There are indeed reasons for believing that the population has increased rather than diminished during the quinquennial period, notably the fact that the tendency of the population to overflow into neighbouring Spanish territory has received a considerable check recently and the general demand for labour in Gibraltar has had the effect of bringing back to the locality many of this migrating population. The fact that the birth rate, which is considered a useful population test, has slightly increased during the quinquennial period is also in favour of the supposition that the population has not at any rate decreased, and certainly justifies the retention of the census figures as the basis for calculating the birth and death rates and the disease mortality rates.

Births. The birth statistics deal only with the "fixed civil population," as no births are recorded amongst the "resident aliens."

During the year 1895, there were 521 births, 278 males and 243 females. This is equal to a birth rate of 30·81 per 1000 of fixed civil population.

The distribution of births according to months will be found in Table III. Appendix, and calls for no special remark, the births being somewhat evenly distributed throughout the year.

The excess of births over deaths amongst the "fixed civil population" during 1895 is 259.

The following table shows the corresponding facts for the quinquennial period 1891-95 and for the two previous quinquennial periods. It will be noted that the increase in the birth rate is only fractional:—

Year.	Total Births.	Birth-rate per 1000 (fixed civil population).	Excess of births over deaths (fixed civil population).
1891	486	28·10	136
1892	545	32·23	134
1893	504	29·80	169
1894	477	28·21	75
1895	521	30·81	158
1881-85	2407	29·50	239
1886-90	2446	29·39	351
1891-95	2533	29·83	672

In addition to the births, noted above, in 1895, there were 89 births recorded amongst the military population, a number very much less than that recorded in the three previous years, when the numbers were 126, 146 and 112 for 1894, 1893, and 1892 respectively.

Deaths. The number of deaths registered in 1895 was 374 amongst the total civil population, (comprising 363 of the "fixed civil" and 11 of the resident alien population,) 53 amongst the military population and 37 amongst the non-resident population (*i.e.*, amongst persons landed sick from the Bay or brought into the town from other localities for the purpose of medical or surgical treatment.)*

The deaths registered amongst the total civil population give the following general death rates for the year under review,—19·58 per 1000 of total civil, 21·47 per 1000 of fixed civil, and 5·01 per 1000 of resident alien population.

These death rates can be more readily compared with the death rates of previous years in the following table, which also shows the death rates, as far as possible, for all the quinquennial periods since compulsory death registration was introduced here:—

Year.	Estimated death rates per 1000 living.		
	Total Civil Population.	Fixed Civil Population.	Resident Alien population.
1891	18·95	20·70	5·40
1892	21·72	24·31	1·82
1893	17·74	19·81	1·82
1894	21·88	24·37	7·29
1895	19·58	21·47	5·01
1867-70	24·61	not recorded.	not recorded.
1871-75	23·88	"	"
1876-80	23·98	"	"
1881-85	23·68	26·54	2·37
1886-90	22·44	25·10	2·19
1891-95	19·97	22·13	4·39

These figures, as a general index of the sanitary condition of the locality in recent years, are highly satisfactory, although they require, of course, further analysis in connection with age, sex and disease mortality. While much caution must be exercised in attributing the result entirely to sanitary action, it is interesting and significant to note that the death rate has been reduced from an average of 24·61 per 1000 for the years 1867-70, the first years of continuous sanitary

* The non-resident population would also comprise the large daily influx of people from Spain, amounting to between 7,000 and 9,000 persons, and including the majority of the laborers on the Admiralty and New Sewerage Works. Some deaths occurred amongst these laborers from accidents on the works during the year, and these are included in the 37 deaths among non-residents.

work in Gibraltar, to 19·97 per 1000 during the quinquennial period that has just ended. Still further, more than half this reduction has occurred during the latter period, a period in which, as has been generally recognized, the application of sanitary principles has been more rigidly enforced. The reduction in the death rate, it is scarcely necessary to state, represents a great saving of life and, probably, a still greater saving in general sickness. It has been concomitant with a notable reduction in the zymotic death rate, as will be shown later on and as is graphically represented in Chart I. in the Appendix.

"Corrected" general death rate.

For comparison with English towns, the "corrected" general death rate for 1895 is 21·51 per 1000 and, for the quinquennial period 1891-95, 21·93 per 1000, of total civil population.*

Quarterly mortality.

The quarterly mortality for the year 1895 is shown in Table III., Appendix. The first quarter shows an extremely high mortality, due to the excessive mortality in the month of January. The second and third quarters, on the other hand, have a low mortality, while the mortality of the last quarter is practically the same as the average for the whole year.

These results, like the results of the quarterly mortality in the previous year, 1894, are at variance with what has obtained in the decennial period 1881-90, when the second quarter almost invariably showed the highest mortality and the last quarter the lowest, as is shown in the following table of quarterly mortalities per 1,000 of total civil population :—

Quarterly Mortality of Total Civil Population.

Period.	1st quarter.	2nd quarter.	3rd quarter.	4th quarter.
1881-90	23·20	24·20	23·50	21·10
1891-95	24·16	19·46	17·48	18·66

The first quarter in 1895 was unusually wet and cold, one of the wettest winters known here, and the deaths amongst old people and from diseases of the respiratory system were unusually numerous and account almost entirely for the exceptionally high mortality of the quarter. The column of respiratory disease statistics, along with the meteorological records, in Table III. Appendix, shows this at a glance.

The comparative figures in the table given above have some further significance and may be taken as exemplifying a fact that has been

* Factor for correction = 1·09809, (see Appendix to the Annual Report on the Public Health of Gibraltar for 1891, Table III.). The corrected death rate is the death rate corrected to a standard of age and sex distribution equal to that of England and Wales. The census returns give no data for working out the factor for correction of the death rate of the fixed civil population.

noted in the vital statistics of other localities subsequent to the application of sanitary measures; namely, a lowering of the general death rate so far as the diseases of the earlier periods of life are concerned and a raising of the death rate amongst diseases incident upon old people. This is indicated by the shifting of highest quarterly mortality from the second quarter of the year to the first quarter, when the mortality from respiratory diseases and amongst old people is invariably greatest.

In fact the quarterly mortality rates of the quinquennial period 1891-95 have assumed the character presented by the quarterly mortality rates in England and Wales, with which the quarterly mortality rates of previous quinquennial periods were at variance; at variance, too, in consequence of their high zymotic mortality, as can be readily observed by examination of the statistics of these periods, where measles comes prominently forward as the main factor in causing the second quarter to show the highest mortality during the decennial period 1881-90.

Monthly mortality.

The monthly mortality for the year 1895 is shown in Tables II. and III. Appendix.

The greatest number of deaths occurred in January, as has been already stated, the mortality of the month being as high as 35·81 per 1,000. The lowest mortalities were in June, July and August. Each of these months gave a death rate of only 12·82 per 1,000 of total civil population.

Twenty-five out of the 57 deaths in January occurred amongst persons over 55 years of age. The mortality of the age-group "under 5 years of age" was also exceptionally high in January; and the unusual severity of the weather, along with the prevalence of whooping cough, which predisposes to respiratory disease of a fatal type, readily accounts for the high general mortality of the month.

As compared with the decennial period 1881-90, the monthly mortality of the quinquennial period 1891-95 is as follows :—

Monthly mortality per 1000 of Total Civil Population.

Period.	January	February	March	April	May	June	July	August	September	October	November	December
1881-90	22·00	23·5	24·3	29·3	22·5	20·7	24·5	25·0	21·1	20·6	19·7	22·9
1891-95	26·49	24·11	21·84	20·95	18·32	19·08	18·32	17·62	16·23	16·94	18·95	19·98

Here again is a clear illustration of the shifting of the months of maximum mortality from the 2nd and 3rd quarters, (the quarters of maximum zymotic mortality), to the 1st quarter, (the quarter of maximum mortality from respiratory diseases.)

Infantile mortality. The number of children dying under 1 year of age during 1895 was 76, equal to an "infantile mortality" of 145·8 per 1000 births.

Although this mortality is considerably less than the corresponding mortality of the previous years, the quinquennial period itself shews no improvement as compared with the previous quinquennial period; and it is scarcely possible to hope that in a population like that of Gibraltar, where nearly half of the families live in 1-room tenement dwellings,* any definite or continuous improvement in the infantile mortality will occur.

The marked decrease in this mortality during 1895 has been under the head of general diseases.

The following table enables a comparison to be made of the infantile mortality and the mortality of the age-group "under 5 years" for successive years and periods :—

Year.	Infantile mortality.	Mortality of age group under five years per 1000 of total civil population.
1891	152·3	68·1
1892	183·4	78·9
1893	170·3	71·3
1894	180·0	80·5
1895	145·8	69·2
1881-85	170·3	84·8
1886-90	165·4	86·8
1891-95	166·3	73·6

Age-group "under five years." The figures in the table given above show a decrease in the mortality of this age-group, not only during the year under review, but also for the quinquennial period.

The mortality of this age-group is considered a more important sanitary test than the mortality of any of the other age-groups. The decrease, therefore, from 84·8 and 86·8 per 1,000 in previous quinquennial periods to 73·6 per 1,000 in the quinquennial period 1891-95 must be regarded as further corroboration of the general improvement in the public health, that has been indicated during the latter period by the general death rates.

The chief diseases influencing the mortality of this age-group are diarrhœal diseases, measles and diphtheria, in all of which a decrease has taken place.

Other age-groups. The mortality of the several age-groups is shown in Table II. Appendix, and calls for no special remark. The figures follow the normal rules of mortality at the different ages. The

* See Annual Report on the Public Health of Gibraltar for 1892, Table IV., Appendix

following table of these mortalities may be found useful for further reference. Unfortunately there are no means of comparing these death-rates with the death-rates of previous quinquennial periods, as the population in the census returns of 1881 was not grouped in the same way as in the census of 1891.

Mortality per 1000 of Total Civil Population at the several Age-groups.

Year.		Under 5 years	5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
1891	Males ...	71·26	4·79	5·65	1·08	5·68	11·67	18·35	20·45	40·56	102·68	?
	Females...	67·35	6·88	1·08	9·81	6·12	2·89	11·04	13·00	19·10	57·50	?
1892	Males ...	88·30	7·19	1·13	8·26	7·96	8·92	19·26	25·27	42·59	93·75	200·00
	Females ..	70·67	6·86	0·00	3·24	3·53	8·11	11·05	15·00	28·64	70·00	176·13
1893	Males ...	81·40	1·20	3·30	1·00	4·50	4·10	10·00	22·80	32·40	62·50	162·50
	Females ..	62·10	3·40	2·10	2·40	6·10	6·90	8·60	14·00	31·30	70·00	85·20
1894	Males ...	90·49	3·59	4·51	4·35	6·82	9·60	18·42	37·30	34·48	107·14	275·00
	Females ..	71·50	6·88	2·17	4·87	1·76	5·79	8·68	7·00	32·74	72·50	142·04
1895	Males ...	81·44	0·00	2·25	2·17	3·41	4·80	14·23	25·27	42·59	93·75	200·00
	Females ..	59·05	2·29	3·26	1·62	4·41	9·27	9·47	11·00	21·82	67·50	238·63
1891-95	Males .	82·58	3·35	3·37	2·37	5·67	7·82	16·05	26·22	38·52	91·96	?
	Females	66·13	5·26	1·72	2·59	4·38	6·59	9·77	12·00	26·70	67·50	?

Sex mortality. The mortality of the sexes in 1895, distributed according to months and age-groups, is also tabulated in Table II. Appendix.

The total number of deaths amongst males was 182 and amongst females 192, equal to a death-rate of 20·96 and 18·42 per 1000 of total male and total female civil population respectively.

The chief feature of sex mortality in Gibraltar is the difference between the male and female death-rate, which in England and Wales remains almost constant with a female death-rate about 2 per 1,000 less than the male death-rate. In Gibraltar the difference is much greater. The comparison should be made from the "corrected" male and female death-rates, *i.e.*, the recorded death-rates corrected to a standard of age distribution, the standard taken being the age distribution of each sex in England and Wales.*

The following table gives the comparative results for the years of the quinquennial period 1891-95, for the quinquennial period as a whole, and for the two previous quinquennial periods :—

* See Annual Report on the Public Health of Gibraltar for 1891, Table III. The factor for correction of male death rate is 1·1339 and of female death rate 1·0598.

Table of Sex-mortality, Total Civil Population, Gibraltar.

Year.	"Recorded" death rates per 1000.			"Corrected" death rates per 1000.		
	Males.	Females.	Difference	Males.	Females.	Difference
1891	22·00	16·41	5·59	24·94	17·39	6·55
1892	24·10	19·60	4·50	27·30	20·70	6·60
1893	18·54	17·09	1·45	20·97	18·01	2·96
1894	26·15	18·33	7·82	29·65	19·42	10·23
1895	20·96	18·42	2·54	23·76	19·52	4·24
1881-85	25·80	21·70	4·10	29·32	23·00	6·32
1886-90	25·10	19·90	5·20	28·43	20·93	7·50
1891-95	22·35	17·97	4·38	25·32	19·01	6·31

The explanation of the marked difference between the male and female death-rates in Gibraltar presents considerable difficulties, and there is practically none to offer beyond what has already been noted in the Report on the Public Health for the year 1891, where the large number of females in Gibraltar, shown in the census returns as following no occupation, was pointed out as a possible factor in the production of these results. One should note, however, in this connection, that the majority of aliens resident here on permit are females, and this fact tends to lower the female death-rate, as compared with the male, because the alien residents, in the case of serious illness or unfitness for work, are apt to leave Gibraltar and return to their homes in Spain The majority of female aliens is not however so great as to explain entirely the remarkable difference in the sex mortality of Gibraltar.

It will be observed, from the above table, that, while the reduction in the general mortality during the past five years has been caused by a reduction in the mortality of both sexes, the greater reduction has taken place in the male mortality.

DISEASES CAUSING MORTALITY.

A table of the diseases causing death during the year 1895, similar to the tables published in previous annual reports, will be found in the Appendix. The majority of these diseases do not call for any detailed examination, but a note should be made of the fact that some misapprehension seems to exist with regard to "natural causes" being registered as a cause of death. Three such cases are shown in the return, and it seems in a way unaccountable that a child of 4 years of age should be so shown.

Cases of puerperal fever have been returned under the heading of septicaemia, in accordance with the official nomenclature of diseases; and all cases of gastro-enteritis have, as in previous years, been grouped as diarrhœal diseases. Similarly, cases of acute meningitis in children are classified as tubercle of brain.

The diseases calling for detailed examination are the zymotic, tubercular and respiratory diseases.

Zymotic diseases. The principal zymotic diseases, namely, small-pox, measles, scarlet fever, diphtheria, whooping cough, enteric and continued fevers, and diarrhœal diseases, accounted for 43 deaths during 1895.

This is equivalent to a "zymotic mortality" of 2·25 per 1000 of the total civil population, and is the lowest "zymotic mortality" yet recorded in Gibraltar, as will be observed in the following table, and also in Chart I., Appendix:—

"Zymotic mortality" per 1000 of Total Civil Population.

Years.	"Zymotic" mortality.
1891	3·03
1892	3·14
1893	2·46
1894	3·61
1895	2·25
1881-85	4·50
1886-90	5·36
1891-95	2·89

The reduction in the zymotic mortality is sufficiently great to account, of itself, for a large proportion of the very considerable reduction, already shown to have taken place in the general death-rate of the locality during the last quinquennial period; and no more satisfactory indication could be forthcoming of an improvement in the public health. That is to say, the improvement has occurred in those very diseases, which sanitary measures are intended and expected to control and mitigate. The following table shows at a glance the class of zymotic diseases, which have thus experienced a reduction :—

Principal Zymotic Diseases.	Number of deaths recorded.		
	1881-85	1886-90	1891-95
Diarrhœa	200	222	179
Diphtheria	55	114	35
Whooping Cough	7	24	21
Enteric Fever	53	33	20
Small Pox	28	9	10
Measles	24	91	8
Continued Fever	14	12	4
Scarlet Fever	8	2	0
Total	389	407	277

As each of the quinquennial periods suffered from epidemics of measles and small-pox, and as such diseases as enteric fever, continued fever and diphtheria are more or less endemic in the locality, the statement that a marked improvement has occurred is justifiable. At the same time one must endeavour to avoid falling into the error of supposing that our means of controlling these diseases are practically perfect. The geographical position of the Rock and the specific density of its population render it necessary to keep up a persistent and progressive policy of sanitary supervision, which it is extremely difficult to exercise under certain circumstances.

A detailed statement of the zymotic diseases and of the notified infectious and contagious diseases for the year 1895 is shown in Tables III. and IV., Appendix.

Small-pox. The epidemic of small-pox, which was fully recorded in the Annual Report for the year 1894, gradually disappeared from May 1895 onwards, one case only being notified during each of the four subsequent months, and none being recorded since September. The total number of cases reported during the year was twenty-nine, and there were no deaths. The features of the epidemic up till May, when the epidemic practically ceased, are noted in the last Annual Report, which did not pass through the press till the 20th of that month. It is, therefore, unnecessary to consider the epidemic again as a whole, more especially as the chief sanitary lessons taught by it have already led to definite legislation with a view to giving the Sanitary Commissioners increased powers in controlling the spread of such infectious diseases in the future.

The practice of re-vaccination has not, however, been advanced, and the extent, to which small-pox epidemics may be expected to develop, will depend, to a considerable degree, on the thoroughness with which this important preventive measure is carried out, either at the voluntary request of the individual or by medical pressure and advice.

Chicken-pox. Chicken-pox was prevalent during the first six months of the year, but is of little importance beyond the fact of its co-existence with small-pox. Thus two mild but very distinct cases of small-pox in adults were notified as chicken-pox in March, and there is always this danger of confounding the two diseases when they are both prevalent at the same time.

Scarlet Fever. Four isolated cases were reported. There were no known sources of infection ; and two of the cases, at any rate, the two notified in October, were extremely doubtful cases. During the quinquennial period this disease has shown no tendency to assume an epidemic form.

Measles. Measles was practically absent from the locality during the year, three very doubtful cases only being notified.

Diptheria. During 1895 eight isolated cases were reported with two deaths. This is equal to a mortality of ·10 per 1,000 of total civil population from diphtheria, the lowest diphtheria mortality on record here. During the quinquennial period there has been a very marked and noteworthy decline in this mortality. The following table shows the endemic incidence of the disease, since compulsory notification came into force in 1885 :—

Diphtheria.

Years.	Reported cases.	Deaths.	Mortality per 1000 of Total Civil Population.
1885	20	18	·96
1886	31	18	·96
1887	31	16	·85
1888	22	23	1·21
1889	155	37	1·95
1890	46	20	1·05
1891	12	7	·36
1892	18	9	·47
1893	12	8	·41
1894	21	9	·47
1895	8	2	·10
Quinquennial period 1886-90	285	114	1·20
Quinquennial period 1891-95	71	35	·36

How far this satisfactory state of affairs will continue, it is impossible to predict, but the Sanitary Commissioners and the public may rest assured that it is only by steadily and persistently raising the standard of sanitation amongst the civil habitations and by maintaining a supervision over the food, water and milk supply that these results are obtained. Anything that tends to arrest the progress of sanitation, or, still worse, anything that tends to permit its retrogression will distinctly affect this improvement in "diphtheria mortality" and in the "zymotic mortality" generally.

Enteric Fever. Six cases were reported during the year with no deaths. Two other cases were reported as suffering from enteric fever in the town, one a phthisical patient, who came here for treatment from Madrid and who died with the symptoms of tubercular disease of the intestine, a disease frequently confounded with enteric fever. The other proved to be a case of peritonitis following miscarriage and was so shown in the death register. These two cases have, accordingly, been eliminated from the returns of deaths caused by enteric fever amongst the civil population during the year 1895.

The incidence of enteric fever during previous years is shown in the following table :—

Enteric Fever.

Year.	Reported cases.	Deaths.	Mortality per 1000 Total Civil Population.
1885	25	16	·85
1886	13	8	·42
1887	10	7	·37
1888	23	8	·42
1889	10	7	·37
1890	7	3	·15
1891	13	4	·20
1892	14	6	·31
1893	11	2	·10
1894	19	8	·41
1895	6	0	·00
Quinquennial period 1881-85	not notified.	53	·57
Quinquennial period 1886-90	63	33	·34
Quinquennial period 1891-95	63	20	·20

Here again the mortality of the quinquennial period shows a decided decrease compared with the mortality of the previous quinquennial periods.

These facts are shown graphically in the Charts in the Appendix, where the enteric and continued fever mortalities are grouped together, as, by so grouping the two diseases, for purposes of comparison, the effect of errors in diagnosis is more or less counteracted.

Continued fever.

The deaths from simple-continued fever, it may be stated, amounted to 12 during the period 1886-90 and to 4 only during 1891-95. During the year under review there were no deaths registered from this disease.

Other infectious diseases.

Other infectious diseases notified during 1895 are whooping cough, (with eight deaths), influenza (1 death), mumps (no deaths), erysipelas (no deaths) and puerperal fever (3 deaths).

Puerperal fever.

With the exception of puerperal fever, these diseases are not capable of sanitary control to any great extent at present. Puerperal fever can be mitigated by sanitary supervision over the midwives and the possibility of introducing special measures to aid sanitary authority in this respect ought not to be lost sight of. It is satisfactory, however, to note that disinfection and all other necessary measures of prevention have been, so far, willingly acquiesced in by the midwives themselves.

Diarrhœal diseases.

The number of deaths from diarrhœal diseases, including deaths from gastro-enteritis during 1895, amounted

to 33. The quarterly distribution of these deaths is 7 in the first, 4 in the second, 9 in the third, and 13 in the fourth quarter. The mortality per 1000 of total civil population is 1·72.

The mortality from these diseases during the five years of the quinquennial period and for previous quinquennial periods is as follows:—

Diarrhœal Diseases.

Year.	Number of deaths.	Death rate per 1000 of Total Civil Population.
1891	42	2·25
1892	35	1·83
1893	35	1·83
1894	34	1·78
1895	33	1·72
Quinquennial period 1881-85	200	2·15
Quinquennial period 1886-90	222	2·35
Quinquennial period 1891-95	179	1·88

The figures show a certain improvement in the public health so far as diarrhœal diseases are concerned, but not so great an improvement as in the case of diphtheria and enteric fever.

Cholera.

The fact should be noted that a formidable epidemic of cholera existed in Morocco from September 1895 onwards. The disease has never approached so near to Gibraltar since the year 1885. It was introduced into Tangier by pilgrims from Mecca; a pilgrim ship, with cases of cholera on board, being allowed to disembark its passengers there. This fact is notorious in Tangier, although, it should be mentioned, a report* by a French Medical Officer directly contradicts this statement. During the progress of the epidemic, Tangier and other coast towns in Morocco were placed under quarantine restrictions.

Tubercular diseases.

The mortality from tubercular diseases presents, during the past quinquennial period, a record very different from that of the zymotic diseases. In 1895 the number of deaths from tubercular diseases, including phthisis, acute meningitis in children and other manifestations of tubercle, amounted to 68.

The following is the record of the deaths from these diseases during the fifteen years from 1881 onwards:—

* Report by Dr. Soulié to the French Minister in Tangier.

Tubercular Diseases.

Year.	Number of deaths.	Death rate per 1000 of Total Civil Population
1881	63	3·42
1882	78	4·22
1883	66	3·56
1884	71	3·82
1885	87	4·66
1886	73	3·89
1887	62	3·29
1888	35	1·85
1889	50	2·63
1890	49	2·57
1891	53	2·77
1892	63	3·29
1893	49	2·56
1894	69	3·61
1895	68	3·56
Quinquennial period 1881-85	365	3·93
Quinquennial period 1886-90	269	2·85
Quinquennial period 1891-95	302	3·16

Tubercular mortality, therefore, judging by the above figures, shows no definite sign of improvement; and it is a significant fact that the conditions, which most favour the prevalence of tubercular disease, are undoubtedly those which the Sanitary Commissioners have as yet been least capable of combating. Briefly, these conditions are overcrowding, dampness, absence of sunshine, more especially in the lower rooms of houses built on the *patio* system, and the want of means, by notification, isolation and disinfection, of dealing with tubercular diseases as diseases of a distinctly infectious and contagious nature. These latter measures are considered impracticable at present and little can be done, except by complete reconstruction, to increase the hygienic condition of the rooms in old overcrowded dark *patio* houses. The tubercular mortality, nevertheless is extremely high here and deserves serious consideration.

Respiratory diseases. The deaths from the chief respiratory diseases, including tubercle of the lungs and phthisis,* amounted to 97 during the year 1895. The fatality of these diseases during the first quarter of the year is well shown in Table III. Appendix; 53 of the 97 deaths occurring in it alone, as compared with 20 in the 2nd, 12 in

* In previous reports these diseases have been included in the statistics of chief respiratory diseases for the purposes of comparison. A more accurate comparison might, however, be made by including the statistics of bronchitis, pneumonia and congestion of the lungs only in this group.

the 3rd and 12 in the 4th quarter. Tubercular diseases on the other hand show an incidence of 19, 11, 15 and 23 deaths in each quarter respectively; so that it is evident from these figures that such diseases as bronchitis and pneumonia have been influenced by the cold and wet of the first quarter, and that, on the other hand, these climatic conditions have affected the comparative results of tubercular mortality in a very much smaller degree.

The death rate per 1,000 of total civil population in 1895 from the chief respiratory diseases is 5·07. The following table gives the statistics of respiratory diseases during the five years of the quinquennial period and the average mortality during the two previous quinquennial periods for comparison:—

Mortality from the Chief Respiratory Diseases.

Years.	Number of deaths.	Death rate per 1000 of Total Civil Population.
1891	99	5·18
1892	117	6·12
1893	81	4·24
1894	121	6·33
1895	97	5·07
Quinquennial period 1881-85	620	6·69
Quinquennial period 1886-91	530	5·71
Quinquennial period 1891-95	535	5·38

These figures are somewhat spoiled as comparative tests, by the fact that in 1882, for example, when measles was prevalent and notification had not come into force, many deaths were probably registered as deaths from bronchitis and pneumonia instead of from measles, of which the respiratory diseases were only secondary complications. In fact it is the unprecedented mortality from respiratory diseases in 1882* that gives such a comparatively high respiratory mortality to the quinquennial period 1881-85. If one could eliminate, therefore, this complication in the statistics, it would probably be found that the three quinquennial periods from 1881 to 1895 had very much the same respiratory mortality. An absence of decrease in this mortality, a tendency even to increase, has been observed in connection with the disease statistics of other localities which are subject to the same sanitary measures as have been in force in Gibraltar, and is regarded as evidence of prolongation of life from improvement in the public health, in consequence of the fact that these diseases are specially incident to ad-

* 160 deaths — 8·67 per 1000 of total civil population were recorded from respiratory diseases in 1882.

vanced life and ought, therefore, to increase as the mean duration of life increases.

The charts in the Appendix show graphically the mortality from tubercular and respiratory diseases since 1881, as compared with the decrease in the mortality from the zymotic diseases.

SANITARY CONDITIONS.

The year 1895 has been marked by very considerable progress in the sanitation of the locality, both by the introduction of legislative measures and by the commencement and partial completion of works calculated to vastly improve the quantity and quality of the public water supply. The new sewerage system with outfall at Europa Point was also commenced during the year.

Prevention of infectious disease.

Notification of infectious diseases has been made compulsory on parents and others, who may have become cognisant of the existence of a case of infectious disease in any house or tenement, as well as on the medical attendant. This system of dual notification is in force in England and tends to prevent concealment of dangerous infectious disease.

The notification of tubercular diseases is a question that is acquiring prominence in England. It will probably be found impracticable to enforce it at present in Gibraltar, but the extensive ravages made by these diseases here should be an inducement to consider the possibility of dealing with them in much the same way as other infectious diseases are dealt with.

Vaccination is in the same state as in former years. That is to say, primary vaccination is carried on efficiently amongst the children born in the colony, but some children, born outside it, may, and do, remain in the town unprotected by vaccination in consequence of there being no notification to the Sanitary Commissioners of their entrance into the locality.

Revaccination, as already stated, is practised entirely as a voluntary measure and its protective value has, as yet, failed to find universal favour amongst the people. In time, no doubt, its value will become more generally recognised. There is every reason to believe that a much higher standard of sanitation is demanded by the people themselves than was formerly demanded, and this gradual enlightenment and appreciation of sanitary measures, as a whole, will extend, it is hoped, to the practice of revaccination.

The facilities for *isolation* are also much the same as in former years, and have proved fairly adequate. But more clearly defined powers seem necessary to enable the Sanitary Commissioners to remove to Hospital cases of dangerous infectious disease occurring in tene-

ments that have been sublet, even though a rent of over fifty pesetas monthly is paid for the tenement by the nominal tenant.*

For prompt and economical *disinfection* a reliable disinfecting apparatus under the Sanitary Commissioners' own control seems needed, although with the existing apparatus, at present made available for the Commissioners' use at the Colonial Hospital, the provision of such cannot be considered a matter of great urgency. What is really wanted is some arrangement by which the bedding and clothing of the poorer classes can be disinfected cheaply and returned to them without delay, and this, of course, can be best effected by an apparatus under the Commissioners' own control.

In connection with disinfection another point, which it is well not to overlook, is the necessity of systematically *cremating* the excreta of cases of such diseases as enteric fever, instead of relying upon disinfection by chemicals. In private houses the latter process would necessarily be relied upon, but in Hospitals, which discharge their sewage into the Sanitary Commissioners' drains, there seems no reason why cremation of such excreta and indeed of most hospital refuse should not be carried out as a regular routine. The matter is one, which, in the interest of the public health, should receive serious consideration.

Disinfection of sewers has been carried out as in previous years but the process cannot be considered capable of completely counteracting the evils of a defective system.

School attendance has received recognition in the Sanitary Order Amendment Ordinance which came into force on the 9th October, 1895, and which makes school authorities, parents and guardians responsible that no child belonging to a family, where infectious disease exists, shall attend school until the Health Officer certifies that the risk of infection has disappeared.

Sewerage.

The new sewerage works were commenced towards the end of the year. The completion of the scheme will be of immense value to the public health and should have the effect of removing the cause of the disproportionate amount of enteric fever cases that has been noticed to occur in the southern districts, which are in close proximity to the present outfall and to the very defective line of sewer leading to it.

Water supply.

The public water supply has experienced a noteworthy improvement during the year, as regards both its quantity and its quality.

Fresh *collecting areas* have been obtained in the upper part of the rock, and a system of filters and interceptors have been introduced, which, so far as present experiment goes, promise well.

* Existing Bye-Laws give power to compulsorily remove to Hospital only when the case occurs in a tenement paying a rent not exceeding fifty pesetas monthly.

The *filter* constructed in connection with the Moorish Castle Tank consists of layers of polarite and sand and was laid down after careful experiment and consideration of every detail.

Condensed sea water was distributed to the public for a short time in October during repairs to the Moorish Castle Tank but was discontinued on account of the objectionable colour acquired during its passage through the pipes to the upper tanks for distribution. The water itself was pure and lost its objectionable colour after being allowed to stand for a few weeks. It is extremely important that there should be facilities for supplying the town with condensed water during the prevalence of certain epidemic diseases.

Measures have also been undertaken for improving the condition of the *Watering Jetty Wells*. That the present wells require very careful reconstruction is undoubted but, with an increased supply of rain water from the new collecting areas, the well water may possibly in time be dispensed with altogether as a source of water supply for domestic purposes.

With regard to *private tanks*, every practicable measure has been taken to insist upon owners of houses keeping their collecting areas, inlets to tanks and tanks themselves free from pollution; but it is impossible, without some means of filtration, to ensure a permanently good water supply from rain collected on the roofs of houses and stored in masonry tanks under rooms and yards, surrounded by habitations and drains of every description. In the Appendix, drawings are given of an excellent arrangement of filter for these private tanks. By the arrangement shown in the drawings, the water is pumped from the tank direct into the filter, and passes from the filter into a storage tank, from which it can be distributed to any part of the house.* The adoption of some such filtering arrangement generally throughout the town is very desirable and the publication of the plans in the Appendix may enable the public to judge of it for themselves. The construction of such filters in private houses should be under the supervision of the Sanitary Commissioners' experts, until, at any rate, the principles are sufficiently well grasped by the general public.

Water analyses.

The analyses of both public and private water supplies undertaken during the year by Mr. Abrines, the Sanitary Commissioners' analyst, show the same general characters, both in the tank and well waters, as have previously been noted here, the impurities of the former varying considerably according to the condition of the

* The filter has been devised by the Commissioners' Engineer, Mr. W. W. Copland, A.M. I.C.E. The filtering medium used is polarite and sand, but, of course, filters on the Pasteur system could be used in the same way. The special point to note is the arrangement by which water pumped out of the tank *must* be filtered before it can be obtained for use.

collecting area and position of the tank, while the latter invariably showed an excessive amount of mineral constituents, and, in one or two cases, direct communication with drains, such as is always liable to occur in wells sunk in the midst of habitations.

Bacteriological laboratory.

The Commissioners have sanctioned the construction of a bacteriological laboratory in connection with the chemical laboratory. This is an important step in advance and it is hoped that, not only in connection with the water supply but also in connection with the outbreak of infectious diseases, valuable information may be obtained, which may enable the Commissioners to deal more thoroughly, more scientifically and, as a result, more economically with many conditions affecting the public health.

Milk supply.

A systematic supervision of the milk supply has been maintained. During the year the following analyses were made of samples taken at random from dairies and street vendors :—

Milk analyses, 1895.

Months.	Number of samples analyzed	Number of samples up to standard.	Number of samples adulterated.
January	11	11	—
February	7	4	3
March	49	41	8
April	4	4	—
May	10	10	—
June	4	3	1
July	18	14	4
August	7	7	—
September	16	13	3
October	20	19	1
November	18	13	5
December	6	6	—
Totals	170	145	25

The amount of added water in the adulterated samples varied from 12 to 51 per cent.

Ninety-three of the samples were taken from street vendors and thirteen of these or nearly 14 per cent., were adulterated. Of the remaining 77 samples, taken from dairies, 12 or over 15½ per cent., were adulterated.

During the previous year the number of adulterated samples from street vendors amounted to 28 per cent. of an almost similar number analyzed, while the samples from dairies had only 7 per cent. adulterated.

During the year under review all the milk shops in the town were brought under the licensing clauses of the milk Bye-Laws. Licenses were refused in the case of three, which existed in premises quite unsuited for the purpose of a dairy.

Amongst the proposals, still under consideration, are additions to the milk Bye-Laws with a view of imposing penalties upon any one, suffering from an infectious or contagious disease, being concerned in the milking of cows or goats, handling of vessels or, in other ways, taking part in the production, distribution or storage of milk, and also upon anyone who interferes with the quality of the milk by removing any of its constituent parts for the purpose of defrauding the purchaser.

Other food supplies.

Supervision has been maintained, as in previous years, over the bakeries, ærated water manufactories and market supplies. The supplies from Morocco were cut off during the period of quarantine restrictions upon Tangier and Tetuan.* These restrictions had no apparent effect upon the public health. Although the prices of the market produce increased, the meat supply obtained from Spain and Portugal was certainly of better quality than that usually sent here from Morocco.

Habitations.

The sanitary defects, noted during the year in connection with habitations, are enumerated in Table V., Appendix. With regard to these defects, there is nothing to be added beyond what has already been brought before the Sanitary Commissioners and the public.

The task of improving the condition of old insanitary buildings goes on gradually and steadily, although somewhat slowly; but, without complete reconstruction the measure of reform capable of being affected in some of them is extremely slight. Owners naturally oppose measures entailing any great expense and in many cases such expense means for the time being loss of income. In such cases power seems needed, as in England, to compel the sale of insanitary premises, unless owners are in a position themselves to put them into good sanitary condition. Without some such measure much hardship is at times entailed and the progress of sanitary reform is distinctly and almost unavoidably retarded.

A similar difficulty appears to exist in connection with the erection of new buildings, persons occasionally undertaking their erection at a cost that cannot be remunerative unless an excessive number of tenements is crammed into confined spaces.

Plan after plan has been submitted, as the Commissioners are aware, regardless of the requirements of sanitation, and it is entirely the fault of owners and their architects that they are unfavourably reported upon. Perhaps much of this might be avoided by establishing a rule

* Quarantine was imposed upon Tangier from 7th September to 12th December, and upon Tetuan from 27th September to 18th December, 1895.

that every patio or open space should have free access on one side at least and that the length and width of these spaces should be equal to the height of the surrounding walls. Such a rule would not only guide those who engage in building speculations but would tend to diminish density of population as well as to ensure more sunshine and better circulation of air around the living rooms.

Overcrowding.

With regard to the specific overcrowding of rooms, several instances were brought to the notice of the Sanitary Commissioners during the year. There is reason to believe that the tendency to overcrowding has materially increased. The difficulty of dealing with the question need not be dwelt upon, but the Table in the Appendix to the Annual Report on the Public Health for the year 1892 (Table IV.) may be referred to for reliable facts as to the proportion of 1-room tenement dwellings here and the number of families occupying them. It is in these that overcrowding is most apt to occur, and any measure that pretends to deal with the question thoroughly will require a more widespread application of the Bye-Laws than appears, as yet, to have been considered practicable.

W. G. MACPHERSON,
Surgeon-Major, A.M.S.,
Health Officer.

Gibraltar, February, 1896.

APPENDIX

TO THE

ANNUAL REPORT ON THE PUBLIC HEALTH

OF

GIBRALTAR,

FOR THE YEAR

1895.

TABLE I.

Deaths registered in Gibraltar during 1895, amongst the Civil Population, showing diseases causing death and ages at death.

CAUSE OF DEATH.	At all ages.	Under 1 yr. of age.	1 year.	2 years.	3 years.	4 years.	Total under 5 years.	OTHER AGE GROUPS. 5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
General Diseases	146	40	20	9	2	7	78	2	1	2	2	8	7	5	7	10	24
Local Diseases	220	35	7	4	1	2	49	...	3	2	5	13	21	26	29	38	34
Poisons (none)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Injuries	8	1	...	...	...	...	1	...	1	...	1	2	1	1	1	...	...
Total...	374	76	27	13	3	9	128	2	5	4	8	23	29	32	37	48	58
CLASS I.																	
GENERAL DISEASES.																	
GROUP A.																	
Influenza	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Whooping Cough	8	5	2	1	...	...	8	...	...	...	...	...	...	...	...	...	...
Diphtheria	2	...	...	2	...	...	2	...	...	...	...	...	...	...	...	...	...
Diarrhœa	33	17	4	...	...	...	21	1	...	...	...	...	1	...	...	4	6
Septicaemia	3	...	...	...	...	...	...	...	...	...	1	2	...	...	...	...	...
Syphilis	7	5	...	1	...	...	6	...	...	...	...	...	...	1	...	...	...
GROUP B.																	
Starvation	2	1	...	...	...	...	1	...	...	...	...	...	...	1	...	...	...
Alcoholism	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...
GROUP C.																	
Malformations	2	1	1	...	...	...	2	...	...	...	...	...	...	...	...	...	...
Immaturity at Birth	3	3	...	...	...	...	3	...	...	...	...	...	...	...	...	...	...
Debility	1	1	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...
Old Age	16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	15
(Natural causes?)	3	...	...	...	1	...	1	...	...	...	...	...	...	1	1	...	...
GROUP D.																	
Rheumatic Fever	1	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...
Rheumatism	1	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...
Malignant newgrowth	15	...	...	...	...	...	...	...	...	1	...	1	2	2	3	4	2
Non-malignant do.	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
Tubercle (not classified)	7	...	1	1	...	1	3	...	...	1	...	1	2	...	...	...	...
" of Lungs	7	...	1	...	...	1	2	1	...	...	1	2	1	...	...	...	...
" of Brain	26	6	10	4	1	4	25	...	1	...	...	...	...	...	...	...	...
" of Intestine	1	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...
Ricketts	1	...	1	...	...	...	1	...	...	...	...	...	...	...	...	...	...
Purpura	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...
Anaemia	1	1	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...
Leucocythaemia	2	...	...	...	...	1	1	...	...	...	...	...	...	...	1	...	...
Totals...	146	40	20	9	2	7	78	2	1	2	2	8	7	5	7	10	24

TABLE I.—*Continued.*

CAUSE OF DEATH.	At all ages.	Under 1 yr. of age.	1 year.	2 years.	3 years.	4 years.	Total under 5 years.	OTHER AGE-GROUPS. 5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
CLASS II.																	
LOCAL DISEASES.																	
NERVOUS SYSTEM.																	
Congestion of Brain	3	...	...	...	...	...	...	...	...	1	...	...	...	...	...	1	1
Hydrocephalus	1	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...
Softening of Brain	2	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	...
Sclerosis	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Apoplexy	16	...	...	...	...	...	...	...	...	...	...	...	2	1	4	5	4
Paralysis	4	...	...	...	...	...	...	...	...	...	...	...	...	1	2	1	...
Hemiplegia	6	...	...	...	...	...	...	...	...	...	...	...	...	1	...	3	2
Eclampsia	1	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...
Infantile Convulsions	8	7	1	...	...	...	8	...	...	...	...	...	...	...	...	...	...
Tetany	1	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...
Epilepsy	1	1	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...
Mania	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...
Dementia	1	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...
General Paralysis of Insane	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
CIRCULATORY SYSTEM.																	
Heart Disease (not specified)	16	...	...	...	...	...	...	...	1	...	...	1	1	3	3	2	5
Endocarditis	2	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1
Pericarditis	4	...	...	...	...	...	...	...	1	...	...	...	...	2	...	1	...
Valvular Disease	10	...	...	...	...	...	...	...	...	...	...	...	1	1	1	5	2
Hypertrophy of Heart	1	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...
Fatty degeneration of Heart	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Dilatation of Heart	1	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...
Angina Pectoris	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...
Syncope	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
Aneurism	2	...	...	...	...	...	...	...	...	...	...	...	...	1	1	...	...
Rupture of blood vessels	1	1	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...
RESPIRATORY SYSTEM.																	
Laryngitis	1	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...
Bronchitis	33	14	...	1	...	1	16	...	...	...	...	1	1	3	4	4	4
Congestion of Lungs	4	3	...	...	...	...	3	...	...	...	...	...	...	...	...	...	1
Pneumonia	23	6	3	2	...	1	12	...	...	...	...	2	...	1	1	3	4
Phthisis	27	...	...	...	...	...	...	...	1	1	1	5	6	5	6	1	1
Emphysema	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...
Pleurisy	3	1	...	...	...	...	1	...	...	...	...	...	1	...	...	1	...
DIGESTIVE SYSTEM.																	
Teething	1	...	1	...	...	...	1	...	...	...	...	...	...	...	...	...	...
Inflammation of Stomach	2	1	1	...	...	...	2	...	...	...	...	...	...	...	...	...	...

TABLE I.—*Continued.*

CAUSE OF DEATH.	At all ages.	Under 1 yr. of age.	1 year.	2 years.	3 years.	4 years.	Total under 5 years.	OTHER AGE-GROUPS. 5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
CLASS II.																	
LOCAL DISEASES—*Cont.*																	
DIGESTIVE SYSTEM—*Cont.*																	
Ulceration of Stomach	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
Obstruction of Intestine	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...
Strangulated Hernia	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
Perforation of Intestine	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
Liver Disease (not specified)	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...
Hypertrophy of Liver	1	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...
Hepatitis	2	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	...
Cirrhosis of Liver	4	...	...	...	...	...	...	...	...	...	...	...	3	...	...	...	1
Obstruction of Bileduct	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Peritonitis	4	...	...	...	...	...	...	...	...	...	1	1	...	1	...	1	...
LYMPHATIC SYSTEM.																	
Lymphadenoma	1	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...
URINARY SYSTEM.																	
Nephritis	4	1	...	...	...	...	1	...	...	...	...	...	1	1	1	...	...
Renal Dropsy	2	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	...
Bright's Disease	4	...	1	...	...	...	1	...	...	...	...	...	1	...	...	...	2
Cystitis	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
GENERATIVE SYSTEM AND PARTURITION.																	
Metritis	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
Post-partum Hæmorrhage	1	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...
ORGANS OF LOCOMOTION.																	
Periostitis	1	...	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...
Abscess	2	...	...	...	...	...	...	...	...	...	...	...	...	1	1	...	...
Gangrene	3	...	...	...	...	...	...	...	...	...	...	...	1	...	...	2	...
Totals	220	35	7	4	1	2	49	...	3	2	5	13	21	26	29	38	34
CLASS IV.																	
INJURIES.																	
Multiple Injuries	3	...	...	...	...	...	...	...	...	...	...	2	...	...	1	...	...
Injuries to Skull	2	...	...	...	...	...	...	...	...	...	1	...	1	...	...	...	...
Murders—																	
Punctured wound	1	1	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...
Injury to Skull	2	...	...	...	...	...	...	...	1	...	...	...	...	1	...	...	...
Totals	8	1	...	...	...	...	1	...	1	...	1	2	1	1	1	...	...

TABLE II.

Sex Mortality amongst the Civil Population, Gibraltar, in 1895, distributed according to Months and Age-groups.

Months.	Deaths at all ages. Males.	Females.	Deaths amongst Males according to Age-groups. Under 5	5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.	Deaths amongst Females according to Age-groups. Under 5	5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
January	25	32	13	...	...	1	...	...	...	3	3	3	2	7	...	1	1	1	3	2	...	5	4	8
February	21	19	8	...	...	...	...	...	...	2	4	4	3	6	1	...	...	...	...	...	1	3	4	4
March	13	22	2	...	...	...	...	...	2	3	2	3	1	7	...	...	...	...	2	...	...	1	7	5
April	14	17	5	...	...	...	...	...	1	1	1	4	2	7	...	...	...	2	...	...	1	1	1	5
May	10	12	2	...	...	...	...	2	3	1	1	...	1	3	...	...	1	...	1	...	1	...	4	2
June	10	12	7	...	...	...	...	...	1	1	1	...	...	3	...	...	...	...	1	1	2	1	2	2
July	14	8	2	...	1	...	...	1	5	2	1	1	1	3	...	...	...	...	2	1	...	...	...	2
August	9	15	2	...	...	...	...	1	...	2	2	2	...	4	...	...	...	1	2	1	1	3	1	2
September	17	11	10	...	...	...	1	...	1	1	3	...	1	3	1	1	...	...	1	1	1	1	2	...
October	14	18	8	...	1	...	...	1	...	...	1	2	1	6	...	...	...	...	2	3	...	...	...	7
November	16	13	7	...	...	1	1	...	1	2	2	...	2	5	...	...	...	1	1	1	1	1	2	1
December	19	13	6	...	...	...	1	2	3	3	...	2	2	2	...	1	...	...	1	2	3	...	...	4
Total deaths	182	192	72	...	2	2	3	7	17	21	21	21	16	56	2	3	2	5	16	12	11	16	27	42
Annual death-rate per 1000 at each age	20·96	18·42	81·44	0·00	2·25	2·17	3·41	4·80	14·23	25·27	42·59	93·75	200·00	59·05	2·29	3·26	1·62	4·41	9·27	9·47	11·00	21·82	67·50	238·63

TABLE III.

Monthly distribution of Births, Deaths and Principal Diseases causing death, amongst the Fixed Civil Population of Gibraltar, during 1895.

Months.	Meteorology. Rainfall in inches.	Meteorology. Mean relative humidity.	Meteorology. Mean temperature in shade (Fahrenheit).	Total Births (Fixed Civil Population).	Deaths from all causes. Total Civil Population.	Deaths from all causes. Fixed Civil Population.	Monthly death-rates per 1000 living. Total Civil Population.	Monthly death-rates per 1000 living. Fixed Civil Population.	Quarterly death-rates per 1000 living. Total Civil Population.	Quarterly death-rates per 1000 living. Fixed Civil Population.	Principal zymotic diseases. Total deaths.	Principal zymotic diseases. Quarterly death-rates (Total Civil Pop.) p. 1000 living.	Deaths from principal zymotic diseases. Small Pox	Measles.	Scarlet fever.	Diphtheria.	Whooping cough.	Enteric fever.	Continued fever.	Diarrhœa.	Tubercular diseases. Total deaths.	Tubercular diseases. Quarterly death-rates (Total Civil Pop.) p. 1000 living.	Respiratory diseases. Total deaths.	Respiratory diseases. Quarterly death-rates (Total Civil Pop.) p. 1000 living.
January	9·41	75	53·6	46	57	54	35·81	38·32	27·64	30·04	9	2·72	...	...	...	1	3	...	...	5	8	3·98	24	11·09
February	14·21	82	58·0	47	40	38	25·13	26·97			2		...	...	...	...	2	...	...	...	7		15	
March	8·93	74	57·0	41	35	35	21·98	24·84			2		...	...	...	...	...	...	...	2	4		14	
April	4·59	74	61·1	39	31	27	19·47	19·16	15·70	16·56	4	1·46	...	...	...	...	2	...	...	2	3	2·30	7	4·18
May	2·07	67	65 0	44	22	22	13·82	15·61			1		...	...	...	...	1	...	...	...	3		8	
June	1·75	62	69·6	38	22	21	13·82	14·90			2		...	...	...	...	...	...	...	2	5		5	
July	0 00	63	74·7	45	22	22	13·82	13·61	15·49	17·50	2	1·88	...	...	...	...	...	...	...	2	4	3·14	2	2·51
August	0·00	70	75·8	43	24	24	15·07	17·03			2		...	...	...	...	...	...	...	2	3		4	
September ...	2·32	75	74·9	38	28	28	17·59	19·87			5		...	...	...	...	...	...	...	5	8		6	
October	7·05	75	69 1	40	32	31	20·10	22·00	19·47	21·76	9	2·93	...	...	...	1	...	...	...	8	7	4·81	4	2·51
November ...	2·09	81	64·1	51	29	29	18·21	20·58			4		...	...	...	...	...	...	...	4	8		2	
December	9·21	83	59·5	49	32	32	20·10	22·71			1		...	...	...	...	...	...	...	1	8		6	
Whole year ...	61·63	73	65 2	521	374	363	19·58	21·47	19·58	21·47	43	2·25	...	...	...	2	8	...	...	33	68	3·56	97	5·07

TABLE IV.

Infectious and Contagious Diseases notified during 1895, under provisions of Section 10, "Medical Ordinance, Gibraltar, 1885."

Months.	Civil: Small Pox. Reported	Civil: Small Pox. Died	Chicken Pox. Reported	Chicken Pox. Died	Scarlet Fever. Reported	Scarlet Fever. Died	Measles. Reported	Measles. Died	Whooping Cough. Reported	Whooping Cough. Died	Diphtheria. Reported	Diphtheria. Died	Enteric Fever. Reported	Enteric Fever. Died	Continued Fever. Reported	Continued Fever. Died	Influenza. Reported	Influenza. Died	Erysipelas. Reported	Erysipelas. Died	Puerperal Fever. Reported	Puerperal Fever. Died	Mumps. Reported	Mumps. Died	Landed: Small Pox. Reported	Landed: Small Pox. Died	Landed: Enteric Fever. Reported	Landed: Enteric Fever. Died	Landed: Scarlet Fever. Reported	Landed: Scarlet Fever. Died	Landed: Measles. Reported	Landed: Measles. Died
January	*8	...	...	...	...	...	...	...	11	†3	1	1	...	...	...	...	12	...	...	...	...	...	...	...	...	...	1	1	...	...	...	...
February	10	...	3	...	1	...	...	...	...	†2	1	...	1	...	1	...	10	...	...	...	...	...	...	...	...	...	...	...	...	...	5	...
March	3	...	6	...	...	...	...	...	...	...	...	...	1	...	...	...	1	...	...	...	1	1	...	...	1	...	1	...	...	...	...	...
April	1	...	11	...	1	...	...	...	...	†2	4	...	...	...	...	...	...	†1	...	...	1	1	3	...	...	...	...	...	...	...	...	...
May	2	...	2	...	...	...	...	...	3	†1	1	...	...	...	2	...	...	...	...	...	...	...	1	...	...	...	...	...	1	...	...	...
June	1	...	8	...	...	...	...	...	2	...	...	...	1	...	3	...	...	...	...	...	...	...	1	...	1	...	...	...	1	...	...	...
July	1	...	1	...	...	...	1	...	...	...	...	...	...	...	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
August	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...
September	1	...	...	...	...	...	1	...	...	...	...	...	2	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...
October	1	...	...	...	2	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...
November	...	...	...	...	...	...	1	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...
December	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...
Totals ...	29	...	31	...	4	...	3	...	16	8	8	2	6	...	11	...	24	1	1	...	3	3	5	...	3	1	3	1	3	...	5	...

"Civil:" = Cases occurring amongst the Civil Population. "Landed:" = Cases landed from the Bay or brought sick into the town for treatment.

* 1 other case in military quarters was notified in January. † Not notified.

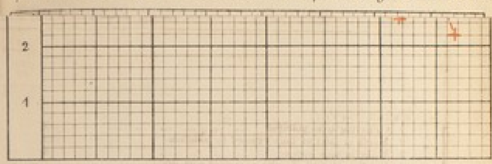
TABLE V.

Statement of the chief sanitary defects dealt with amongst the civil habitations of Gibraltar during 1895.

Description of Defect.	Number of Houses in which the defect was noted.
A.—WATER SUPPLY.	
1. Collecting areas polluted	23
2. Mouth or inlet of tank exposed to pollution	38
3. Water in tank impure	14
4. Overflow of tank directly connected with drain	1
5. Tanks deficient of proper means of drawing water ...	1
6. Wells generally insanitary	2
7. Well water highly polluted	2
8. Insufficient supply of water for flushing, &c.	54
B.—SEWERAGE.	
1. Insufficient W.C. accommodation...	3
2. Insufficient means of flushing	7
3. Situation of W.Cs. insanitary	16
4. Soil pipes leaking	4
5. Soil pipes embedded in walls	17
6. Soil pipes unventilated	5
7. Fittings of W.Cs. insanitary...	43
8. House drains defective	30
9. House drains connected with adjoining houses	6
10. Wash house troughs directly connected with drains ...	6
11. Rain water pipes directly connected with drains	3
12. W.Cs. unventilated	50
C.—KITCHENS.	
1. Sinks untrapped	12
2. Sinks directly connected with drains	13
3. Fireplaces without flues...	16
4. Kitchen accommodation deficient	28
D.—LIVING ROOMS.	
1. Dirty	3
2. Damp	28
3. Overcrowded	27
4. Badly lighted and ventilated...	61
5. Roofs leaking	6
6. Drains under floor...	41
7. Generally unfit for habitation	8
E.—YARDS.	
1. Badly paved	15
2. Close and foul air	1
3. Blocked with stores and refuse	7
4. Surface traps defective	31
5. Fouled by animals...	3
F.—PREMISES GENERALLY.	
1. Unfit for habitation	4
2. In bad repair...	11
3. Deficient of refuse receptacles	45
4. Stores, shops and kitchens occupied as living rooms ...	40
Total	725

Chart 1.

Showing the General Death Rates and the Zymotic Death rates of the total Civil population. Gibraltar, from the Year 1881 to 1895.



The black continuous line indicates the general death rate.
The red interrupted line indicates the Zymotic death rate.

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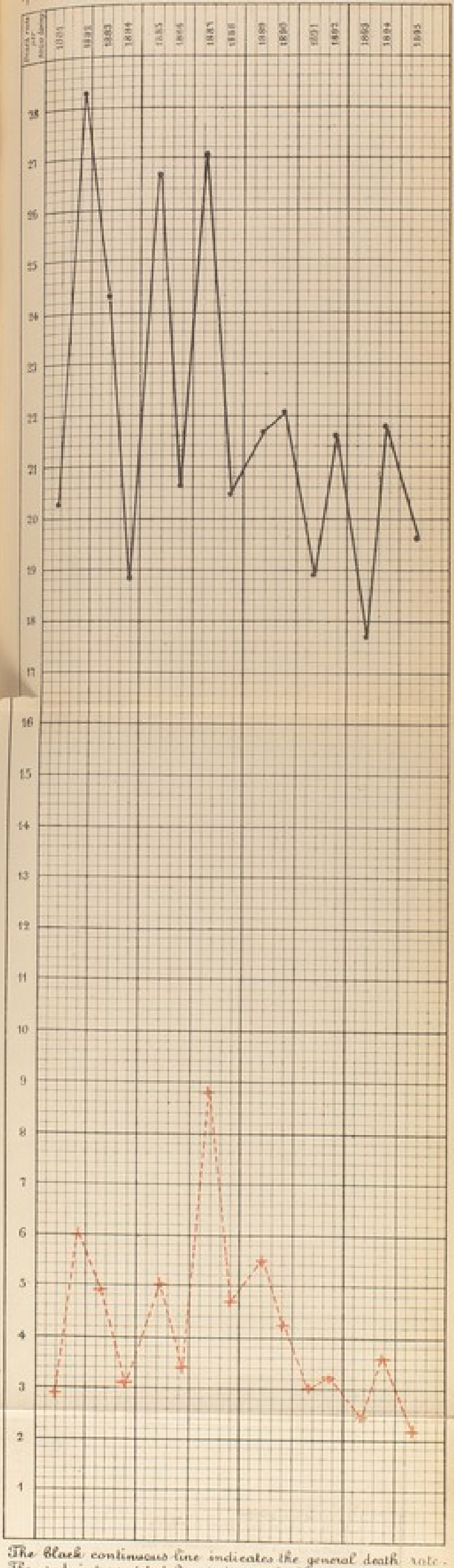
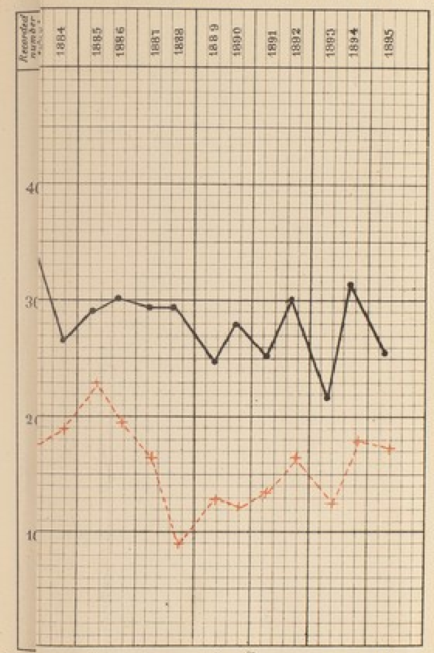
Showing the General Death Rates and the Zymotic Death rates of the total Civil population. Gibraltar, from the Year 1881 to 1895.



The black continuous line indicates the general death rate.
The red interrupted line indicates the Zymotic death rate.

Chart III

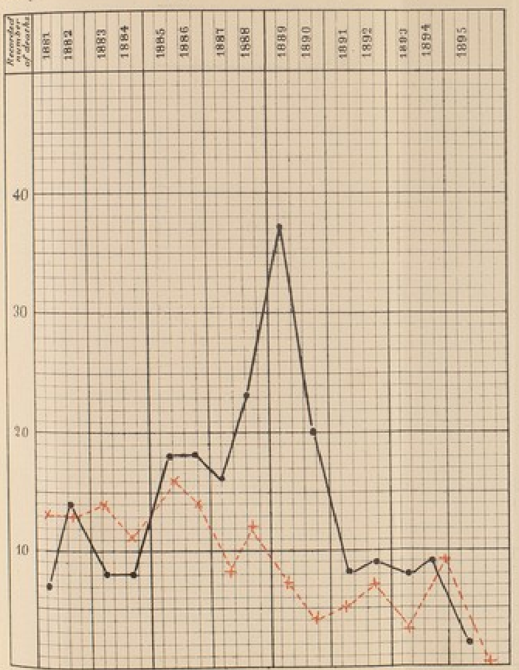
Shewingth rates from Respiratory and Tubercular Diseases
amoval civil population, Gibraltar, from the Year 1881 to 1895.



The tuuous line indicates the Respiratory death rate.
The reted line indicates the Tubercular death rate.

Chart II

Shewing the mortality from Enteric and Continued Fevers and from Diphtheria amongst the total civil population, Gibraltar, from the Year 1881 to 1895.



The black continuous line indicates the number of deaths from Diphtheria.
The red interrupted line indicates the number of deaths from Enteric and Contd. Fevers.

Chart III

Shewing the death rates from Respiratory and Tubercular Diseases amongst the total civil population, Gibraltar, from the Year 1881 to 1895.

The black continuous line indicates the Respiratory death rate.
The red interrupted line indicates the Tubercular death rate.

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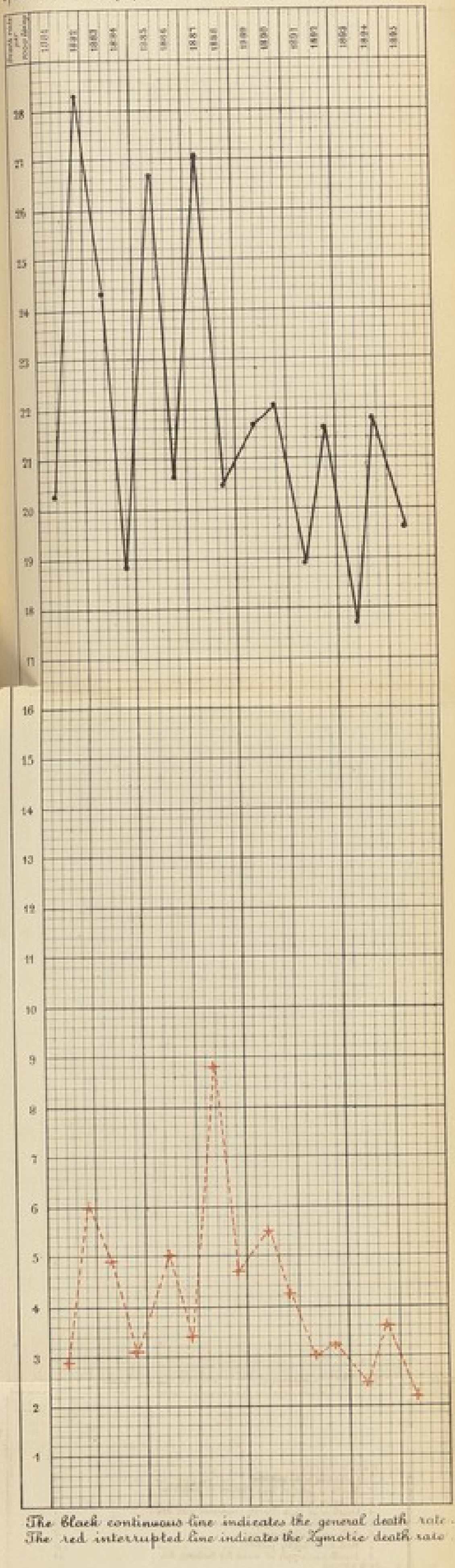
Chart 1.

Showing the General Death Rates and the Zymotic Death rates of the total Civil population, Gibraltar, from the Year 1881 to 1895.



The black continuous line indicates the general death rate.
The red interrupted line indicates the Zymotic death rate.

ANNUAL REPORT

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W. G. MACPHERSON, M.A., M.B., (Edin.) D.P.H. (Camb.)

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FOR THE YEAR 1896.

VITAL STATISTICS.

Population. The population returns of the census taken on 5th April 1891 form the basis for calculating the various rates connected with the vital statistics of the Civil community in Gibraltar.

These returns show a total Civil population of 19,100 composed of a "Fixed Civil" population of 16,906 and a "Resident Alien" population of 2,194. The former is composed of those who reside in Gibraltar without permit, and the latter those who reside here on temporary permit, and who have restrictions placed upon them with regard to marriage. The data connected with the health of the military population are not included in this Report, and deaths amongst persons entering the Colony on daily permit or for the sake of medical or surgical treatment are also excluded from the vital statistics of the locality. These last are classified as non-residents.

The census returns are retained as the basis of calculation because population does not increase in Gibraltar according to the same laws that obtain elsewhere, for reasons stated in previous Reports. It may be of interest, however, to note that the total civil population at the end of 1896 is estimated by the Police Authorities to amount to 18,894, and the same population, estimated according to the Registrar General's formula for estimating populations at intercensal periods, would be 19,563 in the middle of the year.

Births. The births amongst the "Fixed Civil" population, which is taken as the basis for calculating the birth rates, amounted to 540 during 1896. 284 were males and 256 females. The monthly distribution of births is shown in Table III. Appendix.

The birth rate for 1896 is 31·92 per 1,000. The birth rate in 1895 was 30·81 and for the quinquennial period, 1891-95, 29·83. The birth rate in 1896 is accordingly high, and, indeed, has only been exceeded once during the last fifteen years, namely, in 1892 when it amounted to 32·23 per 1,000. A continuance of high birth rates, that is to say, of birth rates higher than the average, most probably indicates that the population taken as the basis of calculation is less than the actual population. In other words, the fixed Civil population has probably increased since the last census.

There were 124 births amongst the military population. This number is an average number, though greatly in excess of the number of births in 1895. (See p. 5 Report for 1895).

Deaths. The number of deaths registered amongst the Civil population in 1896 was 373, of which 345 were amongst the "Fixed Civil" population and 28 amongst the "Resident Aliens." In addition to these, 42 deaths were registered amongst the military population and 38 amongst the "non-residents."

The death rates of the Civil population for the year are 19·52 per 1,000 of "Total Civil" population, 20·40 per 1,000 of "Fixed Civil" population and 12·76 per 1,000 of "resident aliens."

The following figures are given for the sake of comparison with previous years :—

Year.	Estimated death-rates per 1000 living.		
	Total Civil Population.	Fixed Civil Population.	Resident Alien population
1896	19·52	20·40	12·76
1895	19·58	21·47	5·01
1891-95	19·97	22·13	4·39
1881-90	23·03	25·83	2·20

The death rates of the total and fixed civil populations for 1896 are consequently lower than the death rates both of the previous year and of the previous quinquennial period.

The "resident alien" death rate is much higher, but there are many factors connected with this section of the population which render fluctuations in its death-rate of little value as indicating conditions of public health; notably the small numbers dealt with and the element of chance that arises in the possibility of their remaining in Gibraltar for treatment, or going back to their homes in Spain, when taken ill.

Corrected death rate. For comparison with other towns, the death rate corrected according to age and sex distribution is 21·44 per 1,000 of total Civil population. (Factor for correction=1·09809).

Quarterly mortality. The quarterly mortality for the year is shown in Table III., Appendix. The first quarter shows the highest mortality, the third the lowest. For the last three years the quarterly mortality has followed the same course. Formerly the second quarter almost invariably showed the highest mortality, and the change has

been attributed to a lessened zymotic mortality and a near approach to the quarterly mortalities prevalent in England.*

Monthly mortality. The monthly mortality is also shown in Table III. Appendix. The greatest number of deaths occurred in March, namely, 28·90 per 1,000 of total Civil population. A considerable number of the deaths in March occurred at the extremes of life, and there was no prevalence of zymotic disease, or other unusual conditions, to account for the high mortality of the month. Indeed, the explanation of the higher mortality may be found in the abnormally low mortality of the two previous months, deaths which would normally have occurred in January or February being, so to speak, postponed till March. The lowest mortality was in May, namely, 11·93 per 1,000 of total Civil population.

Infantile mortality. The number of children who died under 1 year of age during 1896 was 62. This is equal to an "infantile mortality" of 114·8 per 1,000 births. This is an exceptionally low infantile mortality for Gibraltar, and is by far the lowest yet recorded. The lowest previously recorded was in 1895, when the infantile mortality was 145·8 per 1,000 births. The infantile mortality for the quinquennial period 1891-95 was 166·3 per 1,000 births and for the decennial period, 1881-90, 167·4 per 1,000 births.

The decrease of the infantile mortality in 1896 has been chiefly under the head of respiratory diseases.

Age-group under five years." The deaths amongst children under five years of age numbered 113; equal to a mortality of 61·11 per 1000 of those estimated as living at these ages. This is the lowest mortality recorded for this important age-group, the next lowest being 61·8 recorded in 1881, 62·7 in 1884, 68·1 in 1891 and 69·2 in 1895. The mortality of the age-group for the quinquennial period, 1891-95, was 73·6 and for the decennial period, 1881-90 85·5. The low mortality for the year under review is due to the exceptionally low infantile mortality.

Other age-groups. The mortality of the several age-groups is recorded in table II. Appendix and calls for no special remark.

Sex mortality. The deaths amongst males amounted to 196 and amongst females to 177. These numbers are equivalent to a death-rate of 22·58 and 16·98 per 1,000 of total male and total female Civil population respectively, or a difference of 5·6 per 1,000 between the two.

The marked difference between the death-rates of males and females in Gibraltar has been noticed and commented upon in previous reports. The difference between the male and female death-rates for the quinquennial period 1891-95 was 4·38 or, "corrected" according to the

* See p. 6 & 7. Report on the Public Health of Gibraltar for 1895.

standard of age distribution, 6·31. The "corrected" male and female death rates for 1896 are 25·60 and 17·99 respectively, or a difference of 7·61 per 1,000. The factors for correction are 1·1339 (males) and 1·0598 (females).

DISEASES CAUSING MORTALITY.

General remarks.

The diseases causing death during the year 1896 are tabulated in Table I. Appendix, which corresponds with the Tables published in previous years, compiled from the weekly returns submitted by the Registrar of Births, Deaths and Marriages.

In a few instances the certified causes of death are vague. For example, two of the deaths from heart disease were returned as deaths from "probably heart disease," and one death in the age-group "20 to 25 years" was returned as a death from "probably natural causes."

Zymotic mortality.

The principal zymotic diseases caused 52 deaths, equal to a zymotic mortality of 2·69 per 1,000 of the total Civil population (see Table III. Appendix). Notwithstanding the prevalence of small-pox and diphtheria during the year, this is a low zymotic mortality for Gibraltar, being ·2 per 1,000 below the average for the quinquennial period 1891-95, 2·67 per 1,000 below the average for 1886-90, and 1·81 below the average for 1881-85. The zymotic mortality for the previous year, 1895, was 2·25 per 1,000, the lowest recorded for any one year.

In consequence of the existence of small-pox and diphtheria the zymotic mortality of the last quarter was greatly in excess of the zymotic mortality of the first three quarters of the year.

Small-pox.

Small-pox was epidemic during 1896. The first notified case occurred in May. It had no connection, so far as could be discovered, with any previously known case or with any subsequent case in Gibraltar. The patient was a school teacher and had not been out of Gibraltar. The disease was epidemic in Spain at the time.

The second case was notified in the beginning of July and was definitely known to have contracted the disease in Linea. The third case was his brother, who lived with him and did not submit to re-vaccination. The 4th, 5th, 6th, 7th and 8th cases were all notified in the latter half of July and had all visited Linea, on the occasion of the annual fair there, between the 12th and 14th day previous to their showing the first symptoms of the disease.

These cases mark the commencement of the epidemic and point clearly to the infection being derived from the neighbouring Spanish town. No doubt the Fair helped greatly to disseminate the disease, not only amongst the inhabitants of Gibraltar but also amongst the inhabitants of Linea itself, of whom 9,000 to 11,000 enter and leave

Gibraltar daily. Cases continued to be notified during the subsequent months of the year, reaching their maximum in November.

The total number notified up to the end of December was 60, of whom 3 died. One of the cases notified was extremely doubtful, but has been retained in the Tables as a case of small-pox. Two additional cases were notified, of which one is shown in the Table of cases amongst non-residents, the patient having been a resident of Linea, who came into Gibraltar seeking work at the Docks. He was brought to the notice of the Sanitary Inspector by the Constable on duty and found to be suffering from confluent small-pox. He was admitted to Hospital and died 8 days afterwards. The second case proved to be a case of chicken-pox, and has not been included amongst the small-pox cases.

The disease continued to be prevalent in the early months of the present year, 1897, 20 more cases being notified in January, and the general character of the epidemic up to the end of that month resembles previous small-pox epidemics in Gibraltar, (see graphic charts appended to the Annual Report on the Public Health of Gibraltar for 1894). It will be remembered that the chief characteristic of these epidemics is the tendency of the disease to recrudesce even though it may seem to have entirely disappeared for a month or two.

The monthly distribution of the sixty cases notified in 1896 is shown in Table IV. Appendix.

They were distributed as follows amongst the several age-groups :—

Under 5 years	... ...	... 0 cases	0 deaths.
Age-group	5-10 years...	... 4 "	0 "
"	10-15 " ...	... 6 "	0 "
"	15-20 " ...	...12 "	0 "
"	20-25 " ...	...21 "	1 "
"	25-35 " ...	...11 "	2 "
"	35-45 " ...	... 4 "	0 "
"	45-55 " ...	... 2 "	0 "
	Total ...	...60 cases	3 deaths.

All the cases were reported to have been vaccinated in infancy, but some of the statements, especially those regarding the vaccination of the fatal cases, may be considered questionable. The statements could not be verified.

None of the cases had been previously re-vaccinated, with the exception of one. The case in question was acting as nurse to a previous case, and the operation of re-vaccination was not undertaken until seven days afterwards. Re-vaccination was consequently too late to afford protection. The onset of the disease occurred on the 14th day after first exposure to contagion and on the 7th day after re-vaccination. The attack was extremely mild.

The distribution of the cases according to the nature of the tenement occupied is as follows :—

In 1-room tenements	... ...	24 cases.
" 2-room "	... ...	4 "
" 3-room "	... ...	10 "
" + 3-room "	... ...	22 "
	Total ...	60 cases.

Six of the cases occupied Government quarters.

With regard to the connection between one case and another, there were two well marked *foci* of disease; one in the South district at the foot of Scud Hill and the other in the Town in Irish Town. The former group had its origin in Linea, the first case in the group having slept in a house in Linea where there were cases of small-pox. He occupied a 1-room tenement dwelling in a poor and insanitary locality and was at once removed to Hospital. A brother and sister had, however, already become infected and were attacked with the disease on the 9th and 10th day after his removal to Hospital. They were also removed to Hospital, but 4 days afterwards a member of the family occupying the adjoining tenement was attacked. Unfortunately there was no power to remove this case also to Hospital, and the patient proved a dangerous source of infection to the neighbourhood, being eventually convicted of wilful exposure in the public streets while capable of spreading the infection. Another member of the family was attacked 13 days after this case was notified, and died. Five other cases subsequently occurred in the immediate neighbourhood, one of them also proving fatal. The second group, in Irish Town, originated in a series of concealed cases, the resulting infection being apparently communicated through the mother of two of the concealed cases, who was caretaker of the house where the cases occurred or from whence the contagion evidently came.

These two groups accounted for sixteen of the 60 cases, notified in 1896, as well as for 4 more notified in the first week of January 1897. All the fatal cases occurred amongst these sixteen cases.

Of the remaining 44 cases, 10 had visited infected districts in Spain between the 10th and 14th day previous to being attacked, some having been directly in contact with cases of small-pox there; 13 were probably indirectly affected from cases in Spain by association with workmen and others coming from infected houses in Linea; 13 could not be referred to any definite source of infection; and 8 were contracted from previous cases in Gibraltar.

One of these eight cases contracted the disease from a concealed case; five of them lived with and were in contact with cases in the same family or house, without having been re-vaccinated; one occurred in a family, the previous case in which had been removed to Hospital 11 days previously; and the last of the eight cases in a house, from which a case had been removed to Hospital thirty-one days previously and had been discharged five days previously. With regard to this last case it should be noted that concealed cases were discovered afterwards in adjoining rooms and that the connection between it and the case previously removed to and discharged from Hospital is doubtful.

Taking these facts into consideration one must regard the epidemic as practically dependent upon causes outside Gibraltar, or upon causes at present beyond the control of the Sanitary Commissioners. The two large groups first mentioned have been explained by the existence of concealed cases and by insufficient power to remove cases compulsorily from dangerously infectious localities; while the remaining cases due to definite sources of infection in Gibraltar could have been prevented, in all probability, by the immediate re-vaccination of members of the family or occupants of the building whenever a case of small-pox occurred. Indeed the almost universal neglect of this preventive measure demands serious consideration if the colony is to be relieved of any of the expense and danger of small-pox epidemics in future.

As a set-off against this, it is satisfactory to note the efficiency of the compulsorily vaccination of infants, which renders the age-group under 5-years, the age-group most severely affected in unvaccinated communities, practically immune in Gibraltar.

Chicken Pox. Chicken-pox was slightly prevalent in the months previous to the outbreak of small-pox and again during the last two months of the year. The cases were carefully observed and there was found to be no confusion during the year between the nomenclatures of chicken-pox and small-pox and the differentiation of the one from the other.

Scarlet Fever. Four well-marked cases of scarlet fever were notified. They had no connection with one another and gave rise to no epidemic outbreak, a fact constantly noted in connection with this disease in Gibraltar.

Measles. Five cases of measles were notified. They, too, had no connection with one another and gave rise to no epidemic outbreak.

Diphtheria. Twenty-nine cases of diphtheria were notified, thirteen of whom died. The mortality from this disease was consequently ·68 per 1000 of the total Civil population. The corresponding mortality for 1891-95 was ·36 per 1,000 and, for 1886-90, 1·20 per 1,000. The year 1896 compares, therefore, unfavourably with the past five years, although considerably better than the years previous to 1891. (See Annual Report for 1895, p. 13).

The facts connected with the increase of diphtheria in 1896 are conflicting, and the origin of the cases obscure. Cases occurred throughout the year, January, May and September being the only months exempt, but the disease was most prevalent during the last quarter.

Twenty-three out of the twenty-nine cases occurred in twenty-three different families, who had no connection with one another either as regards relationship or locality or school attendance. Neither had they anything in common as regards milk, food and water supply, except in so far as these latter conditions are common to the population generally.

Three cases occurred in two families relatives of one another and living in adjoining tenements. They occurred almost simultaneously; the two, notified last, not being recognized as diphtheria until one had died and the other had been admitted into the Colonial Hospital, where the child had been taken by the mother for treatment as an out-patient.

Two cases occurred in a family within 18 days of one another. In the interval, or rather at the time the first case was notified, the family moved or were moving into another house, the second case occurring there. It was thought that the contagion had been carried from one house to the other in furniture, especially as the first case proved fatal and had not been in the second house. There are so many other ways in which the contagion might have been conveyed, that the opinion expressed by the medical attendant regarding its conveyance by furniture is open to question, and scarcely throws light upon the source of the disease.

The only other case, notified in 1896, that seemed connected with any other subsequent case, is one which was notified in December but which was considered a very doubtful case. The child was isolated at home but allowed to mix with the other children in the family thirteen days afterwards, with the result that another and fatal case, notified in 1897, subsequently occurred.

The facts regarding school attendance show, in a still more marked manner, how little one case depended upon assoociation with another. 22 out of the 29 cases did not attend any school, and no two cases out of the remaining 7, notified in 1896, attended the same school.

Sanitary defects were noted in all but five of the houses, from which the cases were notified. In nine of the houses the defects were of a grave character and in the others there existed dampness of rooms, bad light and ventilation, insufficient flushing of W.Cs, or polluted water supply.

Twelve of the cases occurred in 1-room tenement dwellings, three in 2-room tenements, one in 3-room tenements and thirteen in tenements

containing more than 3 rooms. According to the estimated distribution of population (see Table IV. Report on Public Health for 1895, the more wealthy classes were attacked in greater proportion than the poorer classes; and this may be attributed in a measure to the fact that the cases connected with previous cases occurred in familes occupying better class houses and consequently not liable to compulsory isolation in Hospital. It should be noted, however, that want of isolation in Hospital has not played the part it generally does in the propagation of this disease amongst families, so far as the facts connected with the cases notified in 1896 are concerned.

The proportion of deaths to notified cases is high. There have probably been many unnotified and undetected cases. In fact the majority of the notified cases were not notified until grave symptoms supervened. It should also be noted in comparing the mortality amongst these cases with the mortality amongst similar groups of cases elsewhere, that the antitoxin treatment, which is now definitely recognized as having a distinct influence on the mortality of diphtheria, has not been universally applied in Gibraltar.

Enteric Fever. Eight cases of Enteric Fever were notified with two deaths. This is equivalent to an Enteric mortality of ·10 per 1,000 of total Civil population. For the quinquennial period 1891-95 this mortality was ·20 per 1,000, for 1886-90, ·34 per 1,000, and for 1881-85, ·57 per 1,000. (See page 14, Annual Report for 1894). The year 1896 compares, therefore, favourably with previous years, a lower mortality being recorded only once previously, namely, in 1895, when there were no deaths out of a total of six notified cases.

Four of the cases, notified in 1896, had been in Spain or Morocco on the date when incubation probably commenced. The remaining four cases used a water, which was found seriously polluted, although no specific enteric micro-organism was detected on bacteriological examination.

Continued Fever. Continued Fever accounted for one death and five notified cases during the year.

Other zymotic diseases. No other zymotic disease was markedly prevalent. The cases of whooping cough, influenza, and erysipelas, the only others of this class of disease notified, are shown in Table IV., Appendix.

Diarrhœal diseases. The number of deaths from diarrhœal diseases, amongst which are included deaths certified as occurring from gastro-enteritis or infantile diarrhœa, was 31, equal to a mortality of 1·62 per 1,000 of total Civil population. This is the lowest mortality previously recorded in Gibraltar from diarrhœal diseases. (See Table on page 15 of Annual Report for 1895). The average for 1891-95 was 1·88 per 1,000, for 1886-90, 2·35, and for 1881-85, 2·15 per 1000.

Tubercular diseases. The tubercular mortality shown in Table III. includes the deaths shown in Table I. as deaths from phthisis, as well as those shown amongst the various forms of tubercle. Apart from the fact, that deaths certified as deaths from phthisis are usually deaths from tubercle of the lungs, it is necessary to include these deaths in estimating the tubercular mortality in order to preserve a continuity of statistics, by which this mortality can be compared with the mortality from the same class of diseases in previous years, published for the first time in the Annual Report for 1891. (See page 15 and Table IX. Appendix of that Report). It should also be noted that cases of acute meningitis in children have been shown as cases of tubercle of the brain throughout these tables.

The total number of deaths from this class of disease in 1896 was 52, equal to a tubercular mortality of 2·72 per 1,000 of total Civil population. The corresponding mortality for 1891-95 was 3·16 per 1,000, for 1886-90, 2·85, and for 1881-85, 3·93 per 1,000. The mortality for 1896 is consequently below the mortality of previous quinquennial periods. In fact, only on three previous occasions has a lower mortality been recorded during the past fifteen years (See page 16 of Annual Report for 1895).

The causes of tubercular disease in Gibraltar have been enumerated in previous reports, and much has still to be done before the conditions, which influence its production and distribution, can be controlled or modified.

Respiratory diseases. The chief respiratory diseases include bronchitis, congestion of the lungs, pneumonia, phthisis and tubercle of the lungs. The last two, which should preferably be excluded, are included for the purpose of comparing the respiratory mortality of the year with that published in previous years

The total number of deaths from these diseases in 1896 was 100. This is equal to a mortality of 5·23 per 1,000 of total Civil population. The corresponding mortality in 1891-95 was 5·38, in 1886-90, 5·71 and in 1881-85, 6·69. The quarterly distribution of deaths from these diseases in 1896 does not show such a marked incidence during the first quarter as formerly, although that quarter continues to account for the largest proportion of the deaths. (See Table III. Appendix). The fact is probably accounted for by the exceptional dryness of the first quarter of the year.

SANITARY CONDITIONS.

General Remarks. The sanitary condition of Gibraltar during 1896 was generally favourable. The various measures that have been gradually introduced during more recent years worked smoothly and well and public opinion has now become of considerable assistance in the carrying out of routine sanitary work. In no previous year have

so many house-owners and tenants voluntarily applied for sanitary inspections of their premises, and the improvements effected have in most cases been thorough and permanent.

Prevention of infectious diseases: Notification. Notification was made applicable during the year to members of the military population not occupying military quarters and in cases, where their children attend civil schools. Towards the end of the year an arrangement was also made, by which information is conveyed to the Health Officer regarding the existence of infectious diseases amongst troops in the Garrison.

The system of dual notification introduced towards the close of 1895 has been of value and led to the notification of some cases of small-pox that, in all probability, would otherwise have been concealed. This was specially noticeable after the first series of prosecutions for non-compliance with the notification clauses had taken place.

Vaccination. The efficiency of primary vaccination and the almost universal neglect of re-vaccination have been referred to already. Unless some measure can be introduced to make the latter compulsory under certain conditions, as, for example, when a case of small-pox has occurred in a crowded building or locality, any marked increase in the number of re-vaccinated persons need not be anticipated, although the hope, expressed in last year's Annual Report, that the people themselves will come gradually to demand re-vaccination, may not be altogether unjustified.

Isolation. The means of isolating cases of small-pox broke down temporarily under the strain of having to provide for a larger number of cases than usual in November and December; and patients, that should have been isolated in Hospital, had to remain in their houses. An additional hut for six more beds has since been constructed in connection with the Small-pox Hospital, and this, it is hoped, will prove ample in future.

In some cases of small-pox and diphtheria, not treated in Hospital, the maintenance of isolation at home during a definite period of convalescence, as recommended by recognized authorities, was not carried out, especially on the approach of the Christmas festivities, and, in some instances, the patients were provided with medical certificates, which prevented any action being taken to restrain convalescents from mixing with the general public at too early a date. It is most desirable, even in the case of mild attacks of dangerous infectious disease, that isolation should be maintained and combined with appropriate disinfectant treatment during the full period recognized as necessary by competent authorities.

Disinfection. The disinfection of articles of bedding and clothing has been put on a more satisfactory basis than formerly, the arrangements made with the Colonial Hospital authorities causing now less delay in having these articles disinfected and returned to owners. The arrangements are not, however, perfect and it is still possible for the poorer classes to be deprived of their bedding for purposes of disinfection for three or four nights at a time, though the necessity of doing so is avoided as much as possible.

The disinfection of rooms occupied by patients has been very thoroughly and effectively carried out by the Sanitary Inspectors according to definite instructions from the Health Officer in each case. The facts already noted with regard to the small-pox and diptheria epidemics are proof of the efficiency of the methods of disinfection employed; which are those recommended by the Local Government Board. The number of individuals in the houses where cases of small-pox and diptheria occurred amounted to 3076, (2189 adults and 887 children), of whom 417 were members of the individual familes where the cases occurred. The small number subsequently attacked in this population has already been noted and not a single case could be definitely attributed to contagion from rooms that had already been disinfected. In consequence of a memorandum on the subject from some of the local medical practitioners a full report on this subject has already been submitted to the Sanitary Commissioners, but it would be useful, in order to avoid possible comment in future, to have the Sanitary Commissioners' responsibility with regard to the disinfection of rooms and houses, other than common lodging houses, more clearly defined. Although neither in the Sanitary Orders in Council nor in the Bye-Laws have the Sanitary Commissioners power to disinfect such houses, it has so far been the custom for them to undertake the responsibility of disinfection by consent or at the request of heads of families and their medical advisers, and it is this responsibility that, it seems advisable, should be placed on a firmer basis.

The disinfection of sewage by sulphate of iron and chloride of lime has been carried out, as in previous years. The reports of trials of the Hermite system of sewage disinfection continue to warrant the belief already expressed that no better system for the requirements of Gibraltar at present exists.

The trial of this system at Netley gave unequivocal evidence of its value as a deodorant, and it is an effective system of deodorization that is chiefly required in this climate. The increased length of sewer and the diminished velocity of the discharge in the new sewerage scheme are likely to make the need of deodorization more necessary than ever.

The disposal of the discharges from patients in Hospital, suffering from such diseases as enteric fever, by means of cremation was referred to in last year's Report; but no practical means have yet been devised for giving effect to this most effective method of removing disease germs from the locality.

School attendance. The regulations regarding school attendance in connection with the occurrence of cases of infectious disease have proved eminently satisfactory; and, notwithstanding the prevalence of diphtheria during the year, no case could definitely be traced to schools. One suspicious case in the earlier part of the year seemed to have its origin in school, and led to the school being voluntarily closed for a time, but this was the only instance in which such a course seemed advisable.

Sewerage. Great progress has been made in the construction of the new sewer, and a considerable section was open for inspection towards the end of the year. Otherwise the sewerage conditions are the same as in previous years and call for no further remark.

Water Supply. A marked improvement has taken place in the public water supply. The filter connected with the Moorish Castle Tank has had the effect of purifying the surface water, collected on the rock, to such an extent that it has been possible to allow all the early rains to enter the tank. The samples collected after filtration showed the water to be of a pure quality even at the very commencement of the rainy season; whereas in former years the degree of organic impurity has been so high as to necessitate the rejection of the first rains altogether.

With the additions now contemplated both in collecting areas and storage tanks, the public water supply will also be placed on a sound footing as regards quantity, and enable the Commissioners to do away with the highly unsatisfactory water-supply to shipping now provided at the Watering Jetty.

With regard to private tanks and wells the conditions are the same as formerly, and filters, such as those detailed in last year's Annual Report, have not as yet been adopted by house owners or tenants.

Bacteriological laboratory. Work was commenced in the new bacteriological laboratory towards the end of the year; and sufficient time has not elapsed to enable any results to be published. It is hoped, however, that the laboratory will not only prove useful for the purpose of scientific investigations, but will also become of valuable assistance in connection with many of the questions of sanitation that are constantly arising.

Milk supply. The number of samples of milk taken for analysis during the year was 171, of which 160 were "up to standard" and 11 adulterated. The amount of added water in the adulterated samples varied from 17 to 42 per cent. This compares favourably with the samples seized during the previous year, when 25 out of 170 samples were found adulterated. The application of the licensing clauses to milk shops has no doubt helped to prevent adulteration, the fear of losing a license acting as a useful deterrent.

Food supplies. The food supply generally was of good average quantity and quality; and no marked prevalence of disease was observed in the carcasses of animals slaughtered for the Markets. The bakeries and ærated water manufactories were periodically and systematically inspected; and a full investigation made into the sanitary conditions of the ice factory.

Habitations. The sanitary condition of habitations has steadily improved and, as already stated, house owners and tenants are more willing than formerly to accept measures of sanitary reform. The plans submitted for the erection of new and the reconstruction of old houses show a much greater appreciation of the requirements of sanitation, and little difficulty is now experienced in obtaining satisfactory modifications of plans which transgress important hygienic principles.

The chief sanitary difficulty in connection with habitations is the prevention of over-crowding; but it is remarkable how limited the outbreaks of infectious and other diseases have been, notwithstanding the fact that the specific density of population is extremely high. This, however, is only further evidence of the efficiency of the sanitary measures in vogue here and of the sanitary supervision exercised under the authority of the Sanitary Commissioners. The importance of maintaining this high standard of sanitation in so crowded a locality cannot be too strongly urged.

W. G. MACPHERSON,
Surgeon-Major, A.M.S.

APPENDIX

TO THE

ANNUAL REPORT ON THE PUBLIC HEALTH

OF

GIBRALTAR,

FOR THE YEAR

1896,

TABLE I.

Deaths registered in Gibraltar during 1896, amongst the Civil Population, showing diseases causing death and ages at death.

CAUSE OF DEATH.	At all ages.	Under 1 year of age.	1 year.	2 years.	3 years.	4 years.	Total under 5 years.	OTHER AGE-GROUPS.									
								5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
General Diseases	147	37	11	10	6	2	66	6	—	3	7	7	10	6	9	7	26
Local Diseases	219	24	14	6	2	—	46	3	2	6	7	11	16	24	28	43	33
Poisons	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—
Injuries	6	1	—	—	—	—	1	—	—	—	2	2	—	1	—	—	—
Grand Total ...	373	62	25	16	8	2	113	9	2	9	16	20	27	31	37	50	59
CLASS I.																	
GENERAL DISEASES.																	
Small-pox	3	—	—	—	—	—	—	—	—	—	1	2	—	—	—	—	—
Whooping Cough	2	1	—	—	1	—	2	—	—	—	—	—	—	—	—	—	—
Diphtheria	13	1	1	4	3	2	11	2	—	—	—	—	—	—	—	—	—
Simple Continued Fever ...	1	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
Enteric Fever	2	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—
Diarrhœa	31	18	5	2	2	—	27	—	—	—	—	—	—	—	1	1	2
Dysentery	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
Erysipelas	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Pyæmia	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—
Tetanus	1	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
Tubercle (not classified) ...	5	2	1	—	—	—	3	—	—	—	1	—	—	—	—	1	—
" of Lungs	16	1	—	—	—	—	1	—	—	1	2	3	7	2	—	—	—
" of Brain	12	2	4	4	—	—	10	2	—	—	—	—	—	—	—	—	—
" of Intestine ...	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
Syphilis	5	5	—	—	—	—	5	—	—	—	—	—	—	—	—	—	—
Starvation	4	4	—	—	—	—	4	—	—	—	—	—	—	—	—	—	—
Alcoholism	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
Vegetable parasites (Thrush)	1	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—
Rheumatic Fever	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—
Rheumatism	3	1	—	—	—	—	1	1	—	—	—	—	—	—	1	—	—
Malignant New growth ...	14	—	—	—	—	—	—	—	—	—	1	—	1	1	6	3	2
Anæmia (pernicious) ...	4	—	—	—	—	—	—	—	—	—	—	1	1	1	—	1	—
Hæmophilia	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Diabetes mellitus	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
Immaturity at Birth ...	1	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—
Debility	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
Old Age	16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	16
(Probably natural causes?)	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—
Total ...	147	37	11	10	6	2	66	6	—	3	7	7	10	6	9	7	26

TABLE I.—*Continued.*

CAUSE OF DEATH.	At all ages.	Under 1 year of age.	1 year.	2 years.	3 years.	4 years.	Total under 5 years.	OTHER AGE-GROUPS.									
								5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
CLASS II.																	
LOCAL DISEASES.																	
NERVOUS SYSTEM.																	
Inflammation of Cord ...	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—
Meningitis	2	—	—	—	—	—	—	—	1	—	—	1	—	—	—	—	—
Congestion of Brain ...	5	—	—	—	—	—	—	—	—	—	—	1	—	1	1	1	1
Softening of Brain ...	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—
Apoplexy	21	—	—	—	—	—	—	—	—	—	—	1	1	1	2	9	7
Paralysis	10	—	—	—	—	—	—	—	—	—	—	—	1	1	2	4	2
Infantile Convulsions ...	5	4	1	—	—	—	5	—	—	—	—	—	—	—	—	—	—
Laryngismus stridulus	1	—	1	—	—	—	1	—	—	—	—	—	—	—	—	—	—
Dementia	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
CIRCULATORY SYSTEM.																	
Pericarditis	2	—	—	—	—	—	—	—	—	—	1	—	—	—	1	—	—
Endocarditis	3	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2	—
Heart Disease (not specified)	15	—	—	—	—	—	—	—	—	—	—	1	1	2	1	6	4
Valvular disease of heart	6	1	—	—	—	—	1	1	—	1	—	—	—	—	1	1	1
Fatty degeneration of heart	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
Atrophy of heart ...	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—
Hypertrophy of heart	1	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—
Angina pectoris	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
Degeneration of arteries	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2
Aneurism	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
Embolism	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
RESPIRATORY SYSTEM.																	
Croup	1	—	1	—	—	—	1	—	—	—	—	—	—	—	—	—	—
Laryngitis	2	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—
Bronchitis	31	7	5	2	—	—	14	1	—	—	1	—	1	1	2	6	5
Asthma	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—
Congestion of Lungs ...	6	1	—	—	—	—	1	—	—	1	—	—	—	—	3	1	—
Pneumonia	29	5	5	2	—	—	12	1	—	—	—	1	—	5	2	4	4
Phthisis	18	—	—	—	—	—	—	—	—	4	2	2	5	1	2	1	1
Gangrene of Lung ...	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—
Atelectasis	1	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—
Pleurisy	3	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	1
DIGESTIVE SYSTEM.																	
Teething	4	3	1	—	—	—	4	—	—	—	—	—	—	—	—	—	—
Ulceration of Stomach	2	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—
Indigestion	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—
Inflammation of Intestines	4	—	—	—	—	—	—	—	—	—	—	1	1	1	1	—	—

TABLE I.—*Continued.*

CAUSE OF DEATH.	At all ages.	Under 1 yr. of age.	1 year.	2 years.	3 years.	4 years.	Total under 5 years.	OTHER AGE-GROUPS. 5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upward.
LOCAL DISEASES—*Cont.*																	
DIGESTIVE SYSTEM—*Cont.*																	
Obstruction of Intestine...	4	—	—	1	1	—	2	—	—	—	1	—	—	1	—	—	—
Internal strangulation of Intestine	1	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
Inflammation of Liver ..	5	—	—	—	—	—	—	—	—	—	—	1	1	1	2	—	—
Acute yellow atrophy ..	2	—	—	—	—	—	—	—	—	—	1	—	—	1	—	—	—
Peritonitis	3	1	—	1	—	—	2	—	—	—	—	—	1	—	—	—	—
Addison's Disease	1	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
URINARY SYSTEM.																	
Nephritis	6	—	—	—	1	—	1	—	—	—	1	—	—	—	2	1	1
Bright's Disease	2	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—
(Uraemia ?)	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—
Renal Calculus	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
ORGANS OF LOCOMOTION.																	
Inflammation of Bone ..	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—
Abscess	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
Gangrene	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Eczema	1	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—
Carbuncle	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
Total Local Diseases.	219	24	14	6	2	—	46	3	2	6	7	11	16	24	28	43	33
CLASS III. POISONS.																	
Mushroom Poisoning ..	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—
Total...	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—
CLASS IV. INJURIES.																	
Accidental—																	
Asphyxia	1	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—
Multiple Injury.. ...	1	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
Suicidal—																	
Asphyxia by submersion	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
Homicidal—																	
Wound of Neck ...	1	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
Wound of Chest ...	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—
Judicial—Hanging	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—
Total..	6	1	—	—	—	—	1	—	—	—	2	2	—	1	—	—	—

TABLE II.

Sex Mortality amongst the Civil Population, Gibraltar, in 1896, distributed according to Months and Age-groups.

Months.	Deaths at all ages. Males.	Females.	Deaths amongst Males according to Age-groups. Under 5 yr.	5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.	Deaths amongst females according to Age-groups. Under 5 yr.	5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
January	18	14	5	1	–	—	2	—	3	2	1	1	3	1	—	—	—	2	1	2	—	1	2	5
February	17	18	7	—	1	—	—	—	—	3	3	2	1	7	—	—	—	—	—	—	—	—	4	7
March..........	15	31	4	1	—	—	2	—	1	1	1	4	1	7	—	—	—	2	2	—	1	6	4	9
April	17	7	6	1	—	1	—	4	—	2	1	1	1	2	1	—	1	1	—	—	—	—	1	1
May	10	9	5	—	—	—	2	—	1	—	2	—	—	2	—	–	—	1	—	1	—	2	2	1
June	21	18	9	—	—	1	—	1	4	3	1	—	2	5	—	—	—	2	—	2	3	—	1	5
July	19	10	7	1	—	–	—	—	2	3	2	4	—	2	—	—	—	—	1	—	1	3	2	1
August	16	6	6	—	—	1	—	—	4	—	3	—	2	1	1	1	—	—	—	—	—	—	2	1
September	16	9	3	—	—	—	—	4	3	1	1	1	3	1	1	—	1	—	—	—	2	—	3	1
October	15	20	6	1	—	1	—	3	—	—	1	2	1	6	1	—	1	—	—	1	1	3	3	4
November	18	12	5	—	—	1	—	1	1	4	3	1	2	4	—	—	—	—	—	1	—	—	5	2
December	14	23	2	—	—	—	2	2	1	4	—	2	1	10	—	—	1	—	1	—	—	3	3	5
Total deaths ..	196	177	65	5	1	5	8	15	20	23	19	18	17	48	4	1	4	8	5	7	8	18	32	42
Annual death-rate per 1000 at each age	22·58	16·98	73·32	3·99	1·12	5·44	9·10	10·29	16·75	27·67	38·53	80·35	212·50	49·72	4·39	1·18	3·23	7·06	2·89	5·52	8·40	24·53	80·00	238·63

TABLE III.

Monthly distribution of Births, Deaths and Principal Diseases causing death, amongst the Civil Population of Gibraltar, during 1896.

Months.	Meteorology. Rainfall in inches.	Meteorology. Mean relative humidity.	Meteorology. Mean temperature in shade (Fahrenheit).	Total Births (Fixed Civil Population).	Deaths from all causes. Total Civil Population.	Deaths from all causes. Fixed Civil Population.	Monthly death-rates per 1000 living. Total Civil Population.	Monthly death-rates per 1000 living. Fixed Civil Population.	Quarterly death-rates per 1000 living. Total Civil Population.	Quarterly death-rates per 1000 living. Fixed Civil Population.	Principal zymotic diseases. Total deaths.	Principal zymotic diseases. Quarterly death-rates (Total Civil Pop.) p. 1000 living.	Deaths from principal zymotic diseases. Small Pox.	Measles.	Scarlet fever.	Diphtheria.	Whooping cough.	Enteric fever.	Continued fever.	Diarrhœa.	Tubercular diseases. Total deaths.	Tubercular diseases. Quarterly death-rates (Total Civil Pop.) p. 1000 living.	Respiratory diseases. Total deaths.	Respiratory diseases. Quarterly death-rates (Total Civil Pop.) p. 1000 living.
January	5·82	78	57·3	49	32	28	20·10	19·87			—		—	—	—	—	—	—	—	—	6		12	
February	3·18	76	56·2	48	35	29	21·98	20·58	23·66	24·13	1	1·04	—	—	—	—	—	—	—	1	4	3·97	13	7·93
March	2·78	76	59·1	55	46	45	28·90	31·94			4		—	—	—	—	—	—	—	4	9		13	
April	0·93	69	62·0	32	24	22	15·07	15·61			3		—	—	—	1	—	1	—	1	5		8	
May	1·59	69	65·9	41	19	19	11·93	13·48	17·17	18·21	5	2·82	—	—	—	—	—	1	—	4	2	2·51	4	4·18
June	0·08	61	70·6	44	39	36	24·50	25·55			6		—	—	—	—	—	—	—	5	5		8	
July	0·00	61	75·4	49	29	26	18·21	18·45			5		—	—	—	2	—	—	—	3	4		10	
August	0·00	67	73·6	29	22	20	13·82	14·19	15·91	16·79	4	2·09	—	—	—	2	—	—	—	2	3	1·88	9	5·02
September	0·14	65	73·7	45	25	25	15·70	17·74			1		—	—	—	—	—	—	—	1	2		5	
October	4·03	70	64·2	35	35	32	21·98	22·71			13		1	—	—	5	—	—	1	6	5		4	
November	6·80	75	57·0	46	30	26	18·84	18·45	21·36	22·47	4	4·82	—	—	—	1	1	—	—	3	2	2·51	7	3·76
December	4·40	78	55·3	57	37	37	23·24	26·26			6		2	—	—	2	1	—	—	1	5		7	
Whole year	29·75	70·4	64·2	540	375	345	19·52	20·40	19·52	20·40	52	2·69	3	—	—	13	2	2	1	31	52	2·72	100	5·23

TABLE IV.

Infectious and Contagious Diseases notified during 1896, under provisions of Section 10, "Medical Ordinance, Gibraltar, 1885."

Months.	Cases occurring amongst the Civil Population. Small-pox. Reported	Small-pox. Died	Chicken Pox. Reported	Chicken Pox. Died	Scarlet Fever. Reported	Scarlet Fever. Died	Measles. Reported	Measles. Died	Whooping Cough. Reported	Whooping Cough. Died	Diphtheria. Reported	Diphtheria. Died	Continued Fever. Reported	Continued Fever. Died	Enteric Fever. Reported	Enteric Fever. Died	Influenza. Reported	Influenza. Died	Erysipelas. Reported	Erysipelas. Died	Cases landed from Bay, &c. Small-pox. Reported	Small-pox. Died	Enteric Fever. Reported	Enteric Fever. Died	Measles. Reported	Measles. Died	Diphtheria. Reported	Diphtheria. Died	Dysentery. Reported	Dysentery. Died
January	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—	—	1	—	—	—	—	—	1	—	2	—	—	—	—	—
February	—	—	1	—	—	—	—	—	—	—	2	—	—	—	—	—	4	—	—	—	—	—	—	—	—	—	—	—	—	—
March	—	—	2	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
April	—	—	5	—	—	—	2	—	—	—	1	1	—	—	1	1	2	—	—	—	1	—	—	—	—	—	1	—	—	—
May	1	—	4	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	1	—	1	—	—	—	1	—	—	—	—	—
June	—	—	3	—	1	—	—	—	—	—	1	—	1	—	3	—	—	—	1	1	—	—	1	1	—	—	—	—	—	—
July	7	—	2	—	—	—	—	—	—	—	3	2	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
August	7	—	1	—	—	—	1	—	—	—	3	2	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
September	1	1	—	—	1	—	1	—	—	—	—	—	1	1	—	—	—	—	—	—	9	1	—	—	—	—	—	—	—	—
October	9	—	—	—	—	—	1	—	—	—	7	5	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
November	23	1	4	—	1	—	—	—	—	1	5	2	—	—	—	—	—	—	—	—	3	—	—	—	—	—	—	—	1	—
December	12	1	5	—	1	—	—	—	2	1	5	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	60	3	27	—	4	—	5	—	2	2*	29	13	5	1	8	2	7	—	2	1	15	1	3	1	3	—	1	—	1	—

* These two deaths were un notified cases.

TABLE V.

Statement of the chief sanitary defects dealt with amongst the civil habitations of Gibraltar during 1896.

Description of Defect.	Number of Houses in which the defect was noted.
A.—WATER SUPPLY.	
1 Collecting area polluted	5
2. Mouth or inlet of tank exposed to pollution...	35
3. Water in tank impure	19
4. Tanks deficient of proper means of drawing water ...	4
5. Insufficient supply of water for flushing &c., ...	58
B.—SEWERAGE.	
1. Insufficient W.C. accommodation	3
2. Insufficient means of flushing	6
3. Situation of W.C. insanitary...	15
4. Soil pipes leaking	8
5. Soil pipes embedded in the walls	29
6. Soil pipes unventilated	3
7. Fittings, &c., insanitary...	50
8. House drains defective	30
9. House drains connected with adjoining houses	11
10. Wash house troughs connected with drains	4
11. Rain gutter pipes connected with drains	2
12. Ventilation of W.Cs. insufficient	48
13. Soil pipes of W.Cs. passing inside living rooms	2
C.—KITCHENS.	
1. Sinks untrapped	10
2. Sinks directly connected with Sewers	13
3. Without flues...	18
4. Accommodation deficient	18
D.—LIVING ROOMS.	
1. Dirty	2
2. Damp	23
3. Overcrowded	9
4. Badly lighted and ventilated	55
5. Generally unfit for habitation	4
6. Roofs leaking...	14
7. Drains under floor...	6
E.—YARDS.	
1. Badly paved	10
2. Blocked with stores and refuse	5
3. Surface drain traps defective...	17
4. Fouled by animals	2
F.—PREMISES GENERALLY.	
1. Unfit for habitation	2
2. In bad repair	12
3. Deficient of refuse receptacles	34
4. Stores, shops and kitchens used as living rooms and being unfit for the purpose	18
Total	604

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FOR THE YEAR 1897.

VITAL STATISTICS.

Population. Owing to the peculiar conditions under which the Civil community in Gibraltar exists, it is impossible to form, with any degree of certainty, an accurate estimate of the population during any one year of an intercensal period, therefore it is necessary to use the Census returns of 1891 for calculating out the various rates in connection with the vital statistics.

These returns show a total Civil population of 19,100 composed of a "Fixed population" of 16,906 and a "Resident Alien" population of 2,194. The Military population is not included in this report nor are "non-residents" and persons entering Gibraltar on daily permit.

Births. The birth statistics deal with the "Fixed" population only. In 1897 there were 530 births, 269 males and 261 females. The birth rate is 31·34 per 1,000, a slight decrease on last year, when it was 31·92, but above the average of the last quinquennial period 29·83. The monthly distribution is shown in Table III.

Deaths. The number of deaths registered during the year was 450 (430 being amongst the "Fixed" population and 20 amongst the "Resident Aliens").

The death rate is 23·56 per 1,000 of "Total" population, and 25·43 per 1,000 of "Fixed" population.

These rates are in excess of the past two years and also of the previous quinquennial period as is shown in the following table :—

Years.	Death-rate per 1000 living.	
	"Total" Population.	"Fixed" Population.
1897	23·56	25·43
1896	19·52	20·40
1895	19·58	21·47
1891-95	19·97	22·13

The increase will be found, on analysis of the Tables in appendix, to be due chiefly to Zymotic and Respiratory diseases; it is most marked in the "Age-group" under 5 years.

Quarterly mortality.

The quarterly mortality is shown in Table III. It is highest in the 2nd and lowest in the 3rd quarter. For the past 3 years the 1st quarter has shown the highest mortality. The increase in the 2nd quarter this year is due to Zymotic disease, Measles being very prevalent then and the majority of deaths from Diarrhœa and Respiratory diseases at this period were probably consequent on concealed or unrecognized cases of measles.

Monthly mortality.

The monthly mortality is also shown in Table III. The largest number of deaths occurred in June, the smallest in November.

In June 32 out of the 56 deaths were due to Zymotic and Respiratory diseases.

Infantile mortality.

There were 98 deaths among children under 1 year of age, equal to an infantile mortality of 184·9 per 1,000 births. This is considerably higher than it has been for some years, as is seen by accompanying table :—

INFANTILE MORTALITY.

1897	.........184·9 per 1000 births.
1896	.........114·8 "
1895	.........145·8 "
1891-95	......166·8 "

The principal causes of death were Zymotic and Respiratory diseases.

"Age-group" under 5 years.

There were 200 deaths of children under 5 years of age, equal to a death rate of 108·11 per 1,000.

In 1896 the death rate was 61·11 and the increase this year is due to the high infantile mortality noted above.

Other Age-groups.

The mortality of the remaining Age-groups is shown in Table III., but does not call for any special remarks.

Sex mortality.

The number of deaths among males was 214, and among females 236, equal to a death rate of 24·65 and 22·64 per 1,000 of total male and female population, a difference of 2·01 per 1,000 between the two. This difference is much less than it has been during the past few years, but may be accounted for by the increase in the

number of deaths from Malignant New Growths, the majority of which were due to Cancer of Uterus and Breast. In 1896 there were 14 deaths under this heading, whereas in 1897 there were 24, 19 of which occurred in females between 25 and 55 years of age.

DISEASES CAUSING MORTALITY.

General diseases.

Table I. appendix shows the various diseases causing death during the year and is similar to the tables published in previous years.

Zymotic mortality.

The principal Zymotic diseases, including Diarrhœa, accounted for 72 deaths, equal to a Zymotic mortality of 3·77 per 1,000 of total population. This is considerably in excess of the rate of the past few years.

Zymotic Mortality.	
1897	......................3·77
1896	......................2·69
1895	......................2·25
1891-95	...............2·89

The increase is chiefly due to the epidemic of Measles which occurred in the 2nd quarter and was followed by a large number of deaths from Diarrhœa in the Age-group under 5 years.

Small Pox.

There were 45 cases of Small Pox notified during the year with 2 deaths. 20 of these cases occurred in January and formed part of the epidemic in the last quarter of 1896. There were no cases in August and September; ten cases were reported in the last quarter. Three of these were traced to infection outside Gibraltar, five followed on a mild concealed case, and in the remaining two no definite history of infection could be obtained.

In addition to these, 3 cases were landed from the Bay, one proving fatal.

Small Pox was said to be prevalent in the neighbourhood throughout the greater part of the year, and considering the large number of persons entering the Garrison on daily permit we can congratulate ourselves on not having suffered from a severe epidemic.

It speaks well for the supervision exercised at the "Gates" that only a very few cases were detected in persons who had entered the Garrison on daily permit.

Chicken Pox. 17 cases were notified. None proved fatal.

Measles. There was an epidemic of Measles which lasted from March till June, 244 out of the 252 cases in the year occurring in these months. 13 cases proved fatal, but there is no doubt this does not represent the true mortality, as many of the fatal cases of Diarrhœa and diseases of the Respiratory system, which occurred during this period, were probably consequent on concealed or unrecognized cases of the disease.

Measles was said to be very prevalent and fatal in the neighbourhood at the time of the epidemic here.

Great difficulty was experienced in persuading the people to isolate their children properly, as they appeared to consider it a very mild disorder, scarcely requiring any attention, and medical advice was often only sought when some complications had arisen.

Diphtheria. There were 65 cases of Diphtheria (including cases returned as Membranous Croup) notified during the year, and of these 18 proved fatal; the disease was most prevalent in the 3rd and 4th quarters.

The origin of most of the cases was obscure, but there can be no doubt many were due to indirect infection, parents conveying the disease to their own children after visiting an infected child.

Bacteriological examination of the throats of suspected and reported cases was commenced towards the end of April, and of the 54 cases notified after this time, 35 were examined and the Diphtheria Bacillus found in 30.

It is hoped that in future all cases of "suspected" sore throats will be examined, as the early recognition of the disease is of the utmost importance both as regards treatment and the prevention of its spread.

The more general use of Antitoxic Serum has had very satisfactory results. A large number of the cases followed a mild course, which was undoubtedly due to the early recognition of the disease, and the immediate use of the Antitoxin.

Enteric Fever. There were 9 cases notified during the year and 1 case proved fatal. This is equivalent to a death rate of 0·05 per 1,000 of total population. In 1896 it was 0·10 per 1,000.

In addition to these, 12 cases were landed from the Bay, 4 of which proved fatal.

Continued Fever. 3 cases were notified, and 2 fatal cases occurred which were not notified.

No definite histories of these cases could be obtained, and their exact nature is somewhat doubtful.

It would be interesting if all cases of fever were tried with "Widals' Serum Test," as some valuable information as to their nature might then be obtained.

Other Zymotic diseases. The cases of Whooping Cough, Influenza, &c., are shown in Table IV., but call for no special remarks.

Diarrhœa. The number of deaths from Diarrhœa (including cases of Gastro-Enteritis in infants) was 31, equal to a mortality rate of 1·62 per 1,000 total population. This is the same as last year, but when the distribution of the cases is considered, it will be found that the greater number occurred in May, June and July, *i.e.*, during and following the epidemic of Measles, to which disease many of them may well be attributed, as previously stated.

Tubercular diseases. The number of deaths from Tubercular diseases, including Phthisis and Acute Meningitis in infants was 59, equal to a mortality of 3·08 per 1,000 total population. In 1896 it was 2·72 per 1,000, and in the quinquennial period 1891-95 3·16 per 1,000.

The principal conditions favouring the prevalence of Tubercular diseases here have been brought to notice in previous reports, and are being gradually remedied as far as possible, but the increasing overcrowding is the greatest difficulty met with.

Respiratory diseases. Include Bronchitis, Congestion of Lungs, Pneumonia, &c.; the number of deaths was 103, equivalent to a mortality rate of 5·39 per 1,000. This is a decided increase on last year, 66 out of the 103 deaths occurred in children under 5 years of age; the incidence was greatest in the 1st and 2nd quarters, and a large number of the cases may be attributed to the epidemic of Measles.

In previous reports, Phthisis and Tubercle of Lung were included under this heading, and for comparison with previous years, if these are included, the deaths in 1897 would be 134, equal to a mortality of 7·01 per 1,000. In 1896 the mortality was 5·23 per 1,000.

SANITARY CONDITIONS.

General remarks. The sanitary condition of Gibraltar is gradually improving, but much yet remains to be done.

House to house inspections are being regularly carried on, and 74 were examined during the year; many sanitary improvements being effected both in these and others (see Table V.). The improvement in plans for new houses, noted in last year's report, has been maintained and greater attention is being paid to the proper construction of house drains.

Overcrowding still remains the great problem to be dealt with.

The difficulty in the majority of common lodging houses, in providing sufficient wash-house accommodation, leads to the open yards being constantly blocked up with tubs, &c., allows of accumulations of rubbish, and prevents these spaces being properly cleaned. It is a question whether some public wash-houses could not be provided in the separate districts. This would abate the above nuisance, and would also tend to diminish the risk of infection, through clothes, which are now sent out to Linea, &c., for washing, owing to want of accommodation here.

Infectious diseases. Notification has been satisfactorily carried out, and cases of Diphtheria and Small Pox have been promptly removed for isolation. It has always been found very difficult to persuade the people in common lodging houses to properly isolate infectious cases in the early stage of the disease.

It is a common occurrence to find, on visiting a reported case, that nearly all the clothes, &c., have been removed from the infected room, with a view of avoiding the inconvenience caused by the delay in disinfecting, and the heavy charges which are made.

There is a danger of the diseases being spread by the continuance of this practice, which would be satisfactorily overcome by the disinfector being kept working daily, and disinfection being performed free of cost. The apparatus should be the property of the Commissioners in order that it may be under their control.

Poor people who have not an abundance of clothes and bedding suffer greatly in being deprived of such things for several days.

This is a subject that merits the earnest consideration of the Sanitary Authorities.

Compulsory removal of infectious cases has not met with any opposition, but as pointed out in previous reports, power is required to order removal of cases in tenants paying more than fifty pesetas per month, when proper and efficient isolation cannot be carried out.

In order to secure efficient isolation, a circular on the subject, calling attention to the various periods deemed necessary in each case, was issued by the Sanitary Authorities to the various medical practitioners, and the periods laid down have been adhered to with satisfactory results.

Disinfection of rooms has been efficiently carried out under the

superintendence of the Sanitary Inspectors, but a "Reception house" for the accommodation of families during the disinfection of their rooms is badly needed, especially in the case of one-room tenements.

Antitoxin. The action of the Sanitary Authorities in making arrangements for a regular supply of Diphtheria Antitoxin, for issue to medical practitioners on payment, has been greatly appreciated, and has undoubtedly proved beneficial to all concerned. The serum is now very generally used.

Vaccination. Primary vaccination has been well carried out but, as in former years, the necessity for re-vaccination has not appealed to the general public, except in a few cases, where owing to Small Pox, the remainder of the family have been persuaded to undergo the operation.

Milk supply. Efficient supervision has been maintained over Dairies, Goat-sheds, and Milk shops; but unfortunately this does not affect the main supply of milk, which is brought in from outside the Garrison and sold in the streets, usually by boys over whom it is very difficult to exercise control, as prosecutions for adulteration have in several cases failed, owing to their being under age. This is a matter of vital public importance as it is well known that milk is, even more often than water, the unsuspected vehicle of Enteric Fever and Diphtheria.

If milk vendors were licensed, efficient control could be exercised over them and the risk noted above would be minimized.

Food supply. This has been of good quality, and there has been no special prevalence of disease in the carcases taken to the Market.

Water supply. The water supply to the Colony consists of "Potable Water" and water for sanitary purposes, termed "Sanitary Water." Potable water is either collected rain water, or condensed sea water.

There are 690 private underground tanks on the "Rock," of an aggregate capacity of 7,535,504 gallons, with roof and terrace collecting areas attached of an aggregate area of 12 acres. 273 of these tanks were inspected, repaired, and cleaned during the year. The roof and terrace collecting areas are periodically visited by the Sanitary Inspectors.

At present the Sanitary Commissioners have Reservoirs for storing rain water capable of containing 1,328,774 gallons. Four new Reservoirs to hold 5,000,000 gallons, to be constructed as tunnels in the Rock, are on the point of being commenced.

The rain water catchment areas belonging to the Commissioners measure $21\frac{1}{2}$ acres, out of which $1\frac{1}{4}$ acre only is adequately prepared by concrete covering. The work of adequately covering an additional area of 14 acres has been commenced.

Upon the completion of the extensive works now in hand, it is understood that there will be ample water for the population and for the shipping. At present the deficiency has to be made up by condensing operations. Last year 3,218,910 gallons were distilled.

All the potable water supplied by the Commissioners is passed through a large "Polarite" filter, and is aerated by falling into the Reservoir from a height of 30 or 40 feet. The "Polarite" filter was constructed two years ago, and has given most excellent results.

The following are the advantages anticipated for the new form of Reservoir (*i.e.*, Reservoirs constructed as tunnels cut in the solid rock):—

1. They will be hidden from view and secure during bombardment.
2. The water will be kept at the lowest and most regular temperature possible in this climate, probably at a temperature of about 50° Fahr.
3. The water will be kept in absolute darkness.
4. The surplus water collected during years of heavy rain can be stored in these Reservoirs, for use during years of low rainfall, without danger of deterioration.

   It is calculated that at the end of two succeeding years of minimum rainfall there will be in stock about 300,000 gallons.
5. The water collected can be freed from all coarse suspended matter by being passed through interceptors before entering the "Storage Reservoir," and on being drawn therefrom can be passed through the "Polarite Filters," at a calculated rate of contact *en route* to the "Distributing Reservoir."
6. The cost of construction will be less than that of any Reservoir which has been built, and less than the estimated cost of any which have been proposed in Gibraltar.

   The water supplied for sanitary purposes (*i.e.*, for flushing, cleansing, &c.), is pumped from the North Front. Roughly speaking it is a mixture of sea water and fresh water in proportions varying from 75°/o of fresh to 25°/o of sea water during the wet seasons, and vice versa in the dry season.

Sewerage. The new main sewer is now completed from Parliament Ramp to Europa Shaft, with the exception of fixing the flushing gate at Little Bay. There are only about 180 feet more to be constructed, namely, from Europa Shaft to the Outfall.

The total length of the sewer will be about 13,300 feet. Ejectors have been fixed at Orange Bastion for raising the sewage from the lower part of Market Street into the main at Parliament Ramp, and a large tank has been constructed at the north end of the Line Wall, capable of holding 16,000 gallons of water for flushing the sewer.

Bacteriological Laboratory. The Bacteriological Laboratory which was opened in 1896, has been completely fitted up during the past year, and as will be seen from Table VI. app. a very fair number of examinations have been made.

The necessary cultures of the various micro-organisms required for carrying out the work, were obtained through the kindness of Professor Wright, of the Army Medical School, Netley, and Dr. Hewlett, of the British Institute of Preventive Medicine.

The value of Bacteriological examinations, as an "aid to diagnosis" in various diseases, and in investigations as to their origin and mode of propagation is now fully recognized. The advantage of having a central laboratory where all work of this nature can be carried out is obvious to all, and the Sanitary Commissioners realizing its importance have now acquired the plant, apparatus, &c. of both the Chemical and Bacteriological laboratories and established them on a firm basis.

The support received from the Civil practitioners, as well as the Naval and Military Medical Officers in the Garrison, is a proof that the attempts to make the laboratory of general use have been successful, and the work of the past year justifies the hope that it will prove of benefit to the community at large. The principal work has been in connection with cases of Diphtheria and various fevers.

There were 61 cases of Diphtheria, including cases diagnosed as Membranous Croup, examined and Loeffler's Bacillus was found in 43.

Cover glass preparations and cultures, were made in the usual manner, from "swabs" supplied to the medical practitioners. Neisser's differential stain was used in all the later cases.

Serum Diagnosis was applied in 37 cases of fever, and the results are shown in Table VI. This was carried out in accordance with Professor Wright's Notes in the *Lancet*, 6th March, 1897. Fresh emulsions were used in the majority of cases, capsules of dead bacteria, kindly supplied by him, being used in the remainder. All cases were tested with emulsions of both Typhoid, and Micro-coccus Melitensis, control experiments of each being also made.

The importance of the accurate diagnosis of various fevers cannot be overrated, and it would be an excellent thing if this "aid to diagnosis" were applied to every case of fever here, as some valuable information would then be obtained.

There were 21 specimens of Sputum examined and Tubercle Bacilli found in 6.

The remaining specimens of water, &c., examined call for no special remarks.

Chemical Laboratory. There were 61 samples of milk analysed during the year, 44 were found up to standard and 17 adulterated, the adulteration varying from 12°/o to 44°/o of water.

There were 67 samples of water from underground tanks examined, with the following results:—

Found pure	49
Of doubtful purity	3
Polluted (roof contamination)	10
Polluted by sewage	5

The water from nine wells was examined and two samples were found polluted. The water in the Moorish Castle Reservoir has been regularly examined and found free from all organic impurity.

H. P. ELKINGTON,
Surgeon-Major, A.M.S.,
Health Officer.

Gibraltar, February, 1898.

APPENDIX

OF THE

ANNUAL REPORT ON THE PUBLIC HEALTH

OF

GIBRALTAR,

FOR THE YEAR

1897.

STATISTICAL TABLES.

TABLE I.

Deaths registered in Gibraltar during 1897, amongst the Civil Population, showing diseases causing death and ages at death.

CAUSE OF DEATH.	At all ages.	Under 1 yr. of age.	1 year.	2 years.	3 years.	4 years.	Total under 5 years.	OTHER AGE-GROUPS.									
								5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
General Diseases	193	57	28	13	7	7	112	6	1	2	3	8	12	12	6	13	18
Local Diseases	255	41	27	9	6	4	87	1	2	6	6	12	22	22	30	35	32
Injuries	2	...	1	...	...	...	1	...	...	...	...	...	...	1	...	...	...
Total	450	98	56	22	13	11	200	7	3	8	9	20	34	35	36	48	50
GENERAL DISEASES.																	
Small Pox	2	...	...	...	...	...	...	...	...	...	...	...	1	1	...	...	...
Measles	13	4	3	3	1	2	13	...	...	...	...	...	...	...	...	...	...
Whooping Cough	4	1	1	2	...	...	4	...	...	...	...	...	...	...	...	...	...
Mumps	1	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...
Diphtheria	18	1	4	2	5	3	15	3	...	...	...	...	...	...	...	...	...
Simple Continued Fever	2	...	...	...	...	...	...	1	...	...	...	1	...	...	...	...	...
Enteric Fever	1	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...
Diarrhœa	31	18	10	1	...	...	29	...	...	...	...	...	...	...	...	2	...
Septicœmia	1	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...
Tetanus	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...
Tubercle (not classified)	9	4	4	...	...	...	8	...	...	1	...	...	...	...	...	...	...
Tubercle of Lung	13	...	...	...	...	...	...	...	1	1	3	2	5	1	...	...	...
Tubercle of Brain	19	5	6	4	1	1	17	2	...	...	...	...	...	...	...	...	...
Syphilis	6	5	...	...	...	...	5	...	...	...	...	1	...	...	...	...	...
Vegetable Parasites (Thrush)	1	1	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...
Rheumatism	2	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1
Malignant new-growth	24	...	...	...	...	...	...	...	...	...	...	2	5	6	6	3	2
Rickets	4	4	...	...	...	...	4	...	...	...	...	...	...	...	...	...	...
Anæmia	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
Idiopathic Anæmia	1	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...
Diabetes Mellitus	3	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	1
Immaturity at Birth	10	10	...	...	...	...	10	...	...	...	...	...	...	...	...	...	...
Debility	5	4	...	...	...	...	4	...	...	...	...	...	...	1	...	...	...
Old Age	20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6	14
Natural Causes (?)	1	...	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...
	193	57	28	13	7	7	112	6	1	2	3	8	12	12	6	13	18
LOCAL DISEASES.																	
NERVOUS SYSTEM.																	
Inflammation of Brain	12	...	...	...	...	...	...	...	1	...	2	...	1	...	2	3	3
Hæmorrhage of Brain	4	...	...	...	...	...	...	...	...	...	...	...	...	...	2	1	1
Apoplexy	16	...	...	...	...	...	...	...	...	...	...	1	2	...	4	7	2
Paralysis	8	...	...	...	...	...	...	...	...	...	...	...	1	1	1	2	3
Eclampsia	5	4	...	...	...	...	4	...	...	...	...	...	...	...	...	1	...
CIRCULATORY SYSTEM.																	
Heart Disease (not specified)	22	...	...	...	...	...	...	...	1	2	...	...	2	2	6	3	6
Pericarditis	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...

TABLE I.—*Continued.*

CAUSE OF DEATH.	At all ages.	Under 1 yr. of age.	1 year.	2 years.	3 years.	4 years.	Total under 5 years.	OTHER AGE-GROUPS.									
								5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
LOCAL DISEASES—*Cont.*																	
CIRCULATORY SYSTEM.																	
Endocarditis	4	...	...	...	...	...	...	...	...	...	...	...	1	...	...	2	1
Valvular Disease	9	...	...	...	...	...	...	...	...	2	1	...	...	2	3	...	1
Angina Pectoris	1	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...
Aneurism	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
RESPIRATORY SYSTEM.																	
Bronchitis	31	9	5	3	2	2	21	...	...	...	...	...	1	1	...	3	5
Asthma	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
Congestion of Lungs	1	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...
Pneumonia	42	7	7	3	4	1	22	...	...	1	...	3	4	5	2	4	1
Broncho-pneumonia	26	11	8	2	...	...	21	...	...	...	...	...	1	2	...	1	1
Phthisis	18	...	...	...	...	...	...	...	...	1	3	4	3	...	6	1	...
Pleurisy	2	...	1	...	...	...	1	...	...	...	...	...	...	...	...	1	...
DIGESTIVE SYSTEM.																	
Disorders of Dentition	16	9	6	1	...	...	16	...	...	...	...	...	...	...	...	...	...
Inflammation of Stomach	1	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...
Inflammation of Intestines	4	...	...	...	...	...	...	1	...	...	...	...	...	1	...	...	2
Obstruction of Intestines	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Inflammation of Liver	7	...	...	...	...	...	...	...	...	...	...	1	1	4	...	...	1
Calculi of gall bladder	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...
Inflammation of Peritoneum	3	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	1
Dropsy	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...
URINARY SYSTEM.																	
Acute Nephritis	3	1	...	...	...	...	1	...	...	...	...	...	...	...	...	1	1
Bright's Disease	9	...	...	...	...	...	...	...	...	...	...	...	3	2	1	3	...
GENERATIVE SYSTEM, &c.																	
Inflammation of Uterus	2	...	...	...	...	...	...	...	...	...	...	1	...	...	1	...	...
Post-partum Hemorrhage	1	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...
ORGANS OF LOCOMOTION, &c.																	
Gangrene	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Total of Local Diseases	255	41	27	9	6	4	87	1	2	6	6	12	22	22	30	35	32
INJURIES.																	
Burn	1	...	1	...	...	...	1	...	...	...	...	...	...	...	...	...	...
Fracture of Skull	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...
	2	...	1	...	...	...	1	...	...	...	...	...	...	1	...	...	...

TABLE II.

Sex Mortality amongst the Civil Population, Gibraltar, in 1897, distributed according to months and age-groups.

Months.	Deaths at all ages.		Deaths amongst Males according to Age-groups.											Deaths amongst Females according to Age-groups.										
	Males.	Females.	Under 5 years.	5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.	Under 5 years.	5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
January	16	21	5	...	..	...	...	1	2	3	1	1	3	5	...	...	2	...	1	1	4	3	3	2
February	21	15	11	...	...	...	...	...	2	3	1	2	2	6	1	...	..	1	1	1	...	1	2	2
March	14	16	7	...	...	...	1	2	1	...	1	1	1	6	...	...	...	...	...	1	3	...	3	3
April	23	24	11	1	...	...	1	1	2	2	2	2	1	7	...	...	...	...	1	2	3	3	4	4
May	27	26	18	...	...	...	1	1	...	2	1	3	1	15	...	1	...	...	1	2	2	2	2	1
June	32	24	19	...	...	...	1	2	3	3	3	1	...	15	...	...	...	...	1	1	...	1	1	5
July	14	18	7	2	...	...	...	...	1	...	1	3	...	7	...	...	1	...	1	1	...	2	2	4
August	15	12	7	1	...	1	1	...	1	...	1	2	1	6	...	...	1	...	...	1	1	...	1	2
September	11	21	7	...	...	...	...	...	...	...	1	2	1	9	...	...	1	1	2	...	1	1	4	2
October	11	22	2	1	...	...	...	1	4	1	1	...	1	5	...	1	...	...	2	1	3	4	3	3
November	12	13	4	...	...	...	...	...	2	1	1	2	2	5	...	...	1	...	...	2	...	...	...	5
December	18	24	9	...	1	1	...	...	...	3	2	...	2	7	1	...	...	2	2	3	...	3	4	2
Total deaths	214	236	107	5	1	2	5	8	18	18	16	19	15	93	2	2	6	4	12	16	17	20	29	35
Annual death-rate per 1000 at each age ...	24·65	22·64	121·04	5·99	1·12	2·17	3·68	3·48	15·07	21·66	32·45	48·82	187·50	96·37	2·29	2·17	4·87	3·33	6·95	12·63	17·00	37·28	72·30	198·86

TABLE III.

Monthly distribution of Births, Deaths and principal diseases causing death, amongst the Civil Population of Gibraltar during 1897.

Months.	Meteorology.			Total Births (Fixed Civil Population).	Deaths from all causes.		Monthly death-rates per 1000 living.		Quarterly death-rates per 1000 living.		Principal zymotic diseases.		Deaths from principal zymotic diseases.								Tubercular Diseases.		Respiratory Diseases.	
	Rainfall in inches.	Mean relative humidity.	Mean temperature in shade (Fahrenheit).		Total Civil Population.	Fixed Civil Population.	Total Civil Population.	Fixed Civil Population.	Total Civil Population.	Fixed Civil Population.	Total deaths.	Quarterly death-rate (Total Civil) per 1000 living.	Small Pox.	Measles.	Diphtheria.	Whooping cough.	Enteric fever.	Continued fever.	Mumps.	Diarrhoea.	Total deaths.	Quarterly death-rate (Total Civil) per 1000 living.	Total deaths.	Quarterly death-rates (Total Civil Population).
January ...	5·92	76	53·4	49	37	37	23·24	26·26			7		1	...	5	...	...	...	...	1	8		6	
February ...	0·20	78	57·0	42	36	33	2[illegible]·61	23·42	21·57	23·42	2	2·72	...	...	1	1	...	...	...	...	1	2·72	19	7·32
March	0·17	73	60·8	49	30	29	18·84	20·58			4		...	1	2	...	...	...	...	1	4		10	
April........	1·77	70	63·3	49	47	45	29·52	31·94			6		...	4	...	2	...	...	...	...	8		10	
May	1·84	69	65·9	33	53	53	33·29	37·61	32·67	35·96	11	7·33	...	4	...	1	1	...	...	5	5	3·56	13	7·74
June	nil.	62	71·5	43	56	54	35·18	38·32			18		1	2	4	...	...	1	...	10	4		14	
July	nil.	65	75·5	50	32	31	20·10	22·00			7		...	2	1	...	...	...	...	4	2		6	
August	nil.	64	75·9	41	27	25	16·96	17·74	19·06	20·82	4	3·56	...	...	2	...	...	...	...	2	8	3·35	3	3·14
September ..	nil.	64	69·7	45	32	32	20·10	22·71			6		...	...	2	...	...	...	1	3	6		6	
October	3·98	75	65·6	42	33	28	20·73	19·87			2		...	...	...	...	...	...	...	2	4		4	
November ...	8·85	82	60·3	41	25	22	15·70	15·61	20·94	21·53	0	1·46	...	...	...	...	...	...	...	...	5	2·72	4	3·35
December ...	4·89	76	55·4	46	42	41	26·38	29·10			5		...	...	1	...	...	1	...	3	4		8	
Whole year..	27·62	71	64·5	530	480	430	...	...	23·56	25·43	72	3·77	2	13	18	4	1	2	1	31	59	3·08	103	5·39

TABLE IV.

Infectious and Contagious Diseases notified during 1897, under provisions of Section 10, "Medical Ordinance, Gibraltar, 1885."

Months.	Cases occurring amongst the Civil Population.																						Cases landed from the Bay or brought sick into Town for treatment.															
	Small Pox.		Chicken Pox.		Measles.		Diphtheria.		Enteric Fever.		Mumps.		Influenza.		Whooping Cough.		Continued Fever.		Scarlet Fever.		Puerperal Fever.		Small Pox.		Enteric Fever.		Scarlet Fever.		Measles.		Diphtheria.		Mumps.		Erysipelas.		Dysentery.	
	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died
January	20	1	2	...	...	...	5	5	...	...	3	...	1	...	7	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...
February	2	...	1	...	3	...	2	1	...	...	...	...	1	...	2	1	...	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...
March	2	...	2	...	40	*1	3	2	1	...	1	...	...	...	1	...	1	...	...	...	...	...	...	...	1	1	...	...	1	...	...	...	4	...	...	...	...	...
April	3	...	...	...	91	4	4	...	...	...	...	...	...	...	...	*2	...	...	...	...	...	...	1	...	1	1	1	...	...	...	...	...	3	...	...	...	...	...
May	4	...	2	...	75	4	3	...	1	1	1	...	...	...	...	*1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
June	3	1	1	...	38	2	6	4	...	...	...	...	...	...	...	...	...	*1	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...
July	1	...	2	...	3	2	4	1	2	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...
August	...	...	...	...	...	...	5	2	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
September	...	...	1	...	...	...	10	2	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	2	1	8	...	...	...	...	...	...	...	...	...	2	2
October	1	...	1	...	2	...	5	...	1	...	...	...	...	...	...	...	1	...	1	...	...	...	2	1	2	...	1	...	...	...	...	...	...	...	...	...	...	...
November	4	...	5	...	...	...	9	...	1	...	...	...	...	...	3	...	...	...	...	...	1	...	...	...	1	...	...	...	...	...	...	...	...	...	1	...	...	...
December	5	...	...	...	...	...	9	1	...	...	...	...	...	...	...	...	...	*1	...	...	...	...	...	...	2	1	1	...	...	...	...	...	...	...	...	...	...	...
Total	45	2	17	...	252	13	65	18	9	1	5	1	2	...	13	4	3	2	1	...	1	...	3	1	12	4	11	...	3	...	1	1	7	...	1	...	2	2

* Those marked with an asterisk were unnotified cases.

TABLE V.

Statement of the chief Sanitary defects dealt with amongst the Civil habitations in Gibraltar during 1897.

Description of Defect.	Number of Houses in which the defect was noted.
A.—WATER SUPPLY.	
1. Collecting area polluted	9
2. Mouth or inlet of tank exposed to pollution	35
3. Water in tank impure	10
4. Insufficient supply of water for flushing, &c.	38
5. Outlet of tank in connection with drain	3
B.—SEWERAGE.	
6. Insufficient W.C. accommodation	2
7. Insufficient means of flushing	4
8. Situation of W.C. insanitary	4
9. Soil pipes leaking	8
10. Soil pipes embedded in the walls	20
11. Soil pipes unventilated	7
12. Soil pipes improperly ventilated	36
13. Fittings, &c., insanitary	50
14. House drains defective	55
15. House drains connected with adjoining houses	2
16. Wash house troughs connected with drains	1
17. Rain gutter pipes connected with drain	6
18. Ventilation of W.Cs. insufficient	42
19. Soil pipes of W.Cs. passing inside living rooms	1
C.—KITCHENS.	
20. Sinks untrapped	5
21. Sinks directly connected with sewers	5
22. Without Flues	8
23. Accommodation deficient	14
D.—LIVING ROOMS.	
24. Dirty	2
25. Damp	19
26. Overcrowded	21
27. Badly lighted and ventilated	46
28. Generally unfit for habitation	4
29. Roofs leaking	18
30. Drains under floor	7
E. YARDS.	
31. Badly paved	15
32. Blocked with stores and refuse	11
33. Surface drain traps defective	32
34. Fouled by animals	5
F.—PREMISES GENERALLY.	
35. Unfit for habitation	2
36. In bad repair	8
37. Deficient of refuse receptacles	26
38. Stores, shops and kitchens used as living rooms and being unfit for the purpose	18
Total	599

TABLE VI.

Record of Bacteriological Work.

Nature of Examination.	No. of Cases.	Results of Examinations.
"Swabs" from Throat.	61	Diphtheria Bacillus found in ......43 Not found in 18
Serum Diagnosis.	37	Gave a reaction with Typhoid ...... 6 " " Micro-Coccus Melitensis.29 Gave a doubtful reaction 2
Sputum.	21	Tubercle Bacilli found in 6
Water.	5	No Typhoid Bacilli found.
Urine.	4	
Foods (Microscopical).	1	Cysticerci Cellulosæ found.
Sections of Tissue.	1	Tubercle Bacilli found.
Blood for Malaria.	1	Plasmodium Malariæ found.

8.5.98

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BY

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BY

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ANNUAL REPORT

ON THE

PUBLIC HEALTH OF GIBRALTAR

FOR THE YEAR 1898.

VITAL STATISTICS.

Population. The various statistical rates are calculated on the census returns of 1891, which showed a Total Civil Population of 19,100, composed of a Fixed Population of 16,906 and a Resident Alien Population of 2,194.

Births. The birth statistics deal only with the "Fixed" population. During 1898 there were 493 births, 216 males and 277 females. It is of interest to note that the number of females is in excess of the males, as during the past few years the opposite has been the case.

Year.	Births. Male.	Births. Female.	Excess of Males or Females.
1894	261	216	45 Males.
1895	278	243	35 Males.
1896	284	256	28 Males.
1897	269	261	8 Males.
1898	216	277	61 Females.

The effect of this increase in the number of females will be seen later on, when dealing with the mortality of the age-group under 5 years.

The birth rate for the year is 29·16 per 1,000, and is the lowest recorded since 1894, when it was 28·21 per 1,000; the rate for the quinquennial period 1891-95 was 29·83 per 1,000. The monthly distribution of births is shown in Table III.

Deaths. There were 340 deaths during the year: 317 occurred in the Fixed population and 13 among the Resident aliens. The death rate is 17·79 per 1,000 total population, and 18·74 per 1,000 fixed population, and is the lowest but one recorded since 1881, the lowest being in 1893, namely 17·75 per 1,000.

Quarterly mortality. The quarterly mortality is shown in Table III. The mortality was highest, 20·93 per 1,000, in the second quarter, and lowest, 16·54 per 1,000, in the third quarter. Respiratory and Tubercular diseases were the chief causes of death in the second quarter.

Monthly mortality. This is also shown in Table III., from which it will be seen that it was highest in April and lowest in September. Out of the 42 deaths in April 12 were due to respiratory and 8 to tubercular diseases.

Infantile mortality. There were 69 deaths among children under 1 year of age, equivalent to an infantile mortality of 139·95 per 1,000 births, a marked improvement on last year, when it was 184·9 per 1,000, but higher than the mortality in 1896, which was 114·8 per 1,000. The principal causes of death were respiratory diseases, diarrhœa and tubercular meningitis.

Age-group under 5 years. In this age-group there were 114 deaths, equivalent to a death rate of 61·11 per 1,000 of those estimated as living at these ages,* and is similar to that of 1896, which was the lowest recorded. It will be seen from the following Table that there has been an increase in the number of deaths of females in this age-group as compared with that of the males, but this is accounted for by the facts noted when dealing with the birth-rate, namely, the change which has taken place in the proportion of births of males and females during the last 5 years.

Number of Deaths recorded in age-group under 5 years.			
Year.	Males.	Females.	Excess Males or Females.
1894	80	69	11 Males.
1895	72	56	16 Males.
1896	65	48	17 Males.
1897	107	93	14 Males.
1898	44	70	26 Females.

Other age-groups. The mortality of the other age-groups is shown in Table II., but calls for no special remarks.

Sex mortality. There were 160 deaths among males and 180 among females, equivalent to a death rate of 18·43 and 17·27 per 1,000 total male and female populations respectively, a difference of 1·16 per 1,000, as compared with 2·01 per 1,000 in 1897.

DISEASES CAUSING MORTALITY.

General remarks. The year under review has on the whole been a very satisfactory one; there was no epidemic with the exception of the outbreak of diphtheria at Catalan Bay.

* The population of this age-group at the last Census was 1,894.

The various diseases causing death are shown in Table I. and are compiled from the weekly death returns. I would call attention to the fact that the certified causes of death in many instances are very vague and not returned in accordance with the Official Nomenclature of Diseases.

Zymotic mortality. There were 26 deaths from the principal zymotic diseases, equal to a zymotic death rate of 1·36 per 1,000 of Total population. This is the lowest recorded since 1881.

A detail of the zymotic diseases and of the notified infectious diseases is given in Tables III. and IV.

Small Pox. Four cases were notified, but there were no deaths from this disease. The first case was traced to direct contact with one which occurred in December 1897, but in the other three cases no definite history could be obtained; two of them, however, were in the habit of frequently visiting Spain, and were in contact with Spanish labourers.

Chicken Pox. There were fifteen cases notified: six occurred in January, one in May, eight in June, and were all of a mild character.

Diphtheria. Thirty-one cases were notified and five proved fatal. The disease was most prevalent in January and September, and in the latter month was chiefly confined to Catalan Bay, where great difficulty was experienced in checking the spread of the disease, owing to the constant communication of relatives with the affected families.

The case mortality is very satisfactory when compared with previous years (as will be seen from the following table) and is—

Year.	No. of Cases.	No. of Deaths.	Mortality.
1894	21	9	42·8 p. ct.
1895	8	2	25·0 "
1896	29	13	44·8 "
1897	65	18	27·6 "
1898	31	5	16·1 "

undoubtedly due to earlier recognition of the disease and its prompt treatment by antitoxin. It may be noted that 3 out of the 5 fatal cases were practically moribund on admission to hospital and there was no chance for treatment.

It has not been found possible to trace out the origin of isolated cases, but in nearly every instance some sanitary defect has been found in the house or its surroundings.

Enteric Fever. There were three cases notified; one proved fatal. In neither of the cases could any definite origin be ascertained, but in one case the sanitary condition of the house was very bad.

Other Continued fevers. One case of Mediterranean fever, and two cases of Simple continued fever were reported, but none fatal.

Measles. Fourteen cases were notified, but none proved fatal. The disease was practically confined to the early months of the year, and was prevalent at the time in the ships in harbour.

Diarrhœa. The number of deaths in children from diarrhœa (under which heading are included all cases of gastro-enteritis) was 18, a decided decrease on the number in 1897, which was 29.

Tubercular diseases. The total number of deaths from tubercular disease was 61, equivalent to a mortality of 3·19 per 1,000 Total population. This shows a slight increase on 1897, and also on the rate for the quinquennial period 1891-95, which was 3·16 per 1,000. The density of the population and the large proportion of one-room tenements, tend to keep up a high mortality rate from these diseases.

Respiratory disease. The deaths from diseases of the respiratory system were 65, equal to a death rate of 3·40 per 1,000 Total population. In 1897 it was 5·39 per 1,000. The highest mortality occurred in April, when the aged were chiefly affected.

SANITARY CONDITIONS.

The general sanitary condition of Gibraltar is on the whole satisfactory. House-to-house inspections are regularly made, and the old grave sanitary defects are being gradually removed. A large block of very insanitary buildings in Library Gardens was demolished during the year, and in the reconstruction and alteration of houses considerable improvements have been effected. Overcrowding remains about the same, and with the rent of houses so high is likely to increase, specially in the one-room tenements. A statement of the chief sanitary defects noted in various houses is given in Table V.

Infectious diseases. No difficulty has been experienced with regard to the notification and removal of infectious cases, but an observation ward in connection with the Isolation Hospital is badly needed, and its provision is under consideration. Disinfection of rooms has been efficiently carried out under the supervision of the Sanitary Inspectors.

Vaccination. Primary Vaccination has been successful, and the sup-

ply of lymph, good and sufficient. A certain proportion of calf-lymph is used, but in accordance with the recent recommendations of the Local Government Board it would be advisable to abolish the practice of arm-to-arm vaccination altogether, and to use only glycerinated calf-lymph.

Milk supply. The Dairies, Goat Sheds and Milk Shops have been inspected regularly; they are well kept and the milk supplied is good, but there is a considerable amount of adulterated milk sold in the streets, and a special report on this subject has been submitted.

The following table shows the number of adulterated samples detected during the past 5 years:—

Year.	Samples examined	Samples adulterated	Percentage of adulterated samples.
1894	161	34	21·1 per cent.
1895	170	25	14·7 "
1896	171	11	6·4 "
1897	61	17	27·8 "
1898	173	25	14·4 "

It should be noted that in 1895, the Milk Shops came under the control of the Bye-Laws regarding milk supplies.

Food supplies. The bakeries have been kept in good condition, but the practice of kneading the dough by mule or horse power is in many instances objectionable and should be abolished; only motor power being used.

A case of mange was detected in a horse used for this purpose in one of the bakeries.

The Market supplies have been satisfactory.

Water Supply. The work of adequately covering an additional area of 14 acres as a catchment for rain water, referred to in last year's report, was completed before the commencement of the present rainy season. The quantity of water collected thereon has fully realized expectations, and for many weeks the existing rain-water Reservoir has been full and overflowing into the Sanitary water compartment. This has had the effect of considerably reducing the pumping operations at the North Front, and has clearly demonstrated the necessity of increased storage accommodation. The construction of the four new reservoirs was commenced last summer, and progress has been so satisfactory that it is understood they will probably be completed by the end of next July. There is consequently, every prospect that before the first rains of next September, the storage accommodation for an additional

5,000,000 gallons of rain water will be in existence. Over and above the advantages derivable from the means of being able to store water in years of heavy rainfall, for use in years of low rainfall, these reservoirs will act as settling tanks, the water being drawn from the compartment which was first filled, after having stood for some time. The inlet to the draw-off pipe will be placed at a distance of about 150 feet from the point where the water enters, thus reducing the liability of removing the precipitated matter with the water. Another advantage will be that the water can be drawn off and passed through the polarite filter at a regular rate; instead of as at present passing it through the filter too rapidly, or permitting it to overflow without being filtered.

Sewerage. Since the last report was submitted, the new main sewer has been completed, but for the erection of a ventilating shaft at Europa, and the tributary sewers have, with a few exceptions, been connected therewith.

Chemical and Bacteriological Laboratories. The work in the two laboratories has greatly increased during the year, and a grant has been sanctioned by the Government to enable Medical Officers of the Navy and Army to make use of the Bacteriological Laboratory; an arrangement which has worked most satisfactorily and been of advantage to all. In the chemical laboratory 91 samples of water were analysed. Of these, 55 were from underground tanks, 3 from wells, one from a spring at Algeciras, and 33 from the Public Supplies, *i.e.*, Moorish Castle Reservoir and the well at Catalan Bay. These latter have maintained their usual standard of purity.

There were 179 samples of milk analysed, and 29 were found adulterated with water, the adulteration varying from 10 to 50 per cent.

In the Bacteriological Laboratory, 236 specimens altogether were examined, nearly double the number in the previous year. Of these 162 were received from the Military Hospital, 22 from the Naval Hospital, and 52 from the Colonial Hospital and civil practitioners. A detailed statement of the work done in both Laboratories is given in Table VI. Appendix.

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GIBRALTAR,
MARCH, 1899.

APPENDIX

TO THE

ANNUAL REPORT ON THE PUBLIC HEALTH

OF

GIBRALTAR,

FOR THE YEAR

1898.

TABLE I.

Deaths registered in Gibraltar during 1898, amongst the Civil Population, showing diseases causing death and ages at death.

CAUSE OF DEATH.	At all ages.	Under 1 yr. of age.	1 year.	2 years.	3 years.	4 years.	Total under 5 years.	OTHER AGE-GROUPS. 5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
General Diseases	127	42	16	10	1	...	69	2	1	1	5	6	8	6	4	9	16
Local Diseases	209	27	14	3	1		45	3	1	3	9	13	15	31	23	32	34
Injuries	4	...		...		...	...	1		...	...	2	1			...	...
Total	340	69	30	13	2		114	6	2	4	14	21	24	37	27	41	50
GENERAL DISEASES.																	
Diphtheria	5	...	1	3	1		5					...			...		...
Enteric Fever	1	...					..	...			1	...			...		...
Diarrhœa	21	14	3	1			18					...			...		3
Erysipelas	2	1					1	...		...	1				...		..
Pyæmia	1	...		1			1	...			...	...			...		...
Tubercle	6	1	1	2	..		4	1			...	...	1		...		..
Tubercle of Brain	23	10	9	2			21	1	1								..
Tubercle of Lung	15	...		...		...	...			1	3	3	4	2	1		1
Syphilis	3	1		...		...	1					...	1	1	...		...
Alcoholism	2			...		...	...					1	...		...	1	...
Rheumatism	1				...		...										1
Malignant new-growth	13	...		...			...	...	...			1	2	2	3	5	...
Rickets	1	1			...		1					...			...		...
Diabetes	1			...	...		...					...			..	1	...
Immaturity at birth	6	6	...	...	...	...	6					...			...		
Debility	14	7	2	1		...	10		...			1	...	1	..	1	1
Old Age	11			...		...	...					...		...	...	1	10
Natural causes	1	1		...		...	1					...			...		...
	127	42	16	10	1	..	69	2	1	1	5	6	8	6	4	9	16
LOCAL DISEASES. NERVOUS SYSTEM.																	
Meningitis	3	...		...	...		...	1		..	1	...		...	...		1
Inflammation of Brain	5	..				...	...					1			1	...	3
Hemorrhage of Brain	4	...		...		...	...		...	1	...		...		2	...	1
Apoplexy	28						...				...	1	1	4	3	9	10
Paralysis	2						...					...	...	...	1	1	...
Eclampsia	3	3			...		3									...	..
CIRCULATORY SYSTEM.																	
Heart Disease (not specified)	19	1			...	...	1				1	1	1	2	2	4	7
Endocarditis	2	...			...		...	1	...	...	...		...		...	...	1
Valvular disease of the Heart	8										...	1	1	3	1	2	...
Fatty degeneration of the Heart	1	...			...								...	1	...	...	...
Hypertrophy of the Heart	1	...					...		...			...	...		.	1	...
Car. forward	76	4	...	...	...	...	4	2	...	1	2	4	3	10	10	17	23

TABLE I.—*Continued.*

CAUSE OF DEATH.	At all ages.	Under 1 yr. of age.	1 year.	2 years.	3 years.	4 years.	Total under 5 years.	OTHER AGE-GROUPS. 5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
Brght. forward	76	4					4	2	..	1	2	4	3	10	10	17	23
Embolism	1	...		...	...	...	...	...								1	
Angina Pectoris	1	...		...	...		...		...		...	...	...	1	...	..	...
Degeneration of arteries	1	...	...	...	...	...		...	...	...						1	..
Aneurysm	3	...	...	...	...		.		...	...			...	2	1		...
RESPIRATORY SYSTEM.																	
Inflammation of Larynx	1	1	...			...	1			...							...
Bronchitis	18	7	2		..	...	9					1	1	2	1	3	1
Congestion of Lungs	3	..	1		...	...	1		.	...	...	1		...		1	
Pneumonia	24	4	1	1	...		6	...	...		1	2	1	6	2	4	2
Broncho-Pneumonia	16	6	6	1	...	.	13	..	1			...		1	.		1
Chronic Inflammation of Lung	1	...			..	...	...	...	...			..	1				...
Phthisis	17	...	...	...	..	...	...			2	5	2	[illegible]	5	1		.
Pleurisy	1	..	...		...		...			...	...						1
Empyæmia	1	...			...	.	...	...	...			1					...
DIGESTIVE SYSTEM.																	
Disorders of Dentition	10	4	4	1	1	...	10	...	...	...			...		...	.	...
Ulceration of Stomach	1	...	...	...	...		...			...	...		...	1			...
Inflammation of Intestines	5	..					...	...	...	...	.	...	1		2	...	2
Strangulated Hernia	2	...	...				...	...	...		...	...	...	...		2	...
Obstruction of Intestines	2	...		...			...	1	...	...		...			...	1	.
Inflammation of Liver	8	...				.	...		.		1	...	1	4	2	...	...
URINARY SYSTEM.																	
Acute Nephritis	1	1	...		...	...	1						...		...		...
Bright's Disease	8	...		...	...	...	...			...		..	2	1	3	1	1
Inflammation of bladder	3	..	...				...					...			1	..	2
GENERATIVE SYSTEM.																	
Inflammation of Prostate	1	...	...	...	...	...	...			...	...				...	1	.
Inflammation of Uterus	1	...	...	...	...		..				...	1	...		...	...	..
ORGANS OF LOCOMOTION, &c.																	
Posterior Curvature of Spine	1	...	...		...		...			.	...	1	...	...			...
Inflammation of connective tissue	1	...	...			...	...	...	...								1
Gangrene	1	...	...	...		...	...				...	...	...	1		...	..
	209	27	14	3	1	.	45	3	1	3	9	13	15	31	23	32	34
INJURIES, &c.																	
Burns	1	...	...	..	...	...	...	1	...	...	...	...	...	...	...		...
Multiple Injury	1	...	...	...	...		...	...			...		1		.		...
Accident	1	...	..	...		...	...	...	...	...		1	.	...	...	...	...
Suicide	1	..	..	..	...	...	...	...	...	.	...	1		...	..		..
	4	...	...	...	...	...	...	1	...	...	...	2	1	...	...	...	..

TABLE II.

Sex Mortality amongst the Civil Population, Gibraltar, in 1898, distributed according to Months and Age-groups.

Months.	Deaths at all ages.		Deaths amongst Males according to Age-groups.											Deaths amongst Females according to Age-groups.										
	Males.	Females	Under 5	5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards	Under 5	5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
January	15	14	4	1	...	...	1	...	2	3	1	2	1	7	1	...	...	1	3	1	1	...	...	...
February	14	15	3	...	...	...	2	1	2	...	2	1	3	4	2	...	...	...	2	1	...	1	2	3
March	11	12	2	...	1	1	...	...	3	3	1	...	...	4	...	...	...	1	1	...	2	2	1	1
April	24	18	7	...	...	...	...	3	2	3	3	6	...	7	...	...	...	...	...	2	1	1	2	5
May	14	15	4	1	...	1	...	...	...	5	2	...	1	7	...	...	...	1	...	1	...	2	1	3
June	14	15	6	...	...	...	...	1	1	2	...	2	2	8	...	...	...	...	...	1	...	1	1	4
July	10	17	4	...	...	1	...	2	...	1	...	1	1	7	...	...	...	2	...	1	...	2	1	4
August	12	18	2	...	...	...	...	...	...	1	4	3	2	5	...	...	...	1	1	...	...	2	6	3
September	7	15	1	1	...	...	1	1	...	1	...	1	1	6	...	...	1	...	1	1	2	2	...	2
October	11	13	3	...	...	...	1	2	...	2	...	1	2	6	...	...	...	...	...	2	2	...	1	2
November	12	12	5	...	...	...	...	...	1	2	...	3	1	4	...	1	...	3	...	...	1	...	1	2
December	16	16	3	...	...	..	...	2	2	3	...	4	2	5	...	...	...	...	1	1	2	1	1	5
Total deaths ...	160	180	44	3	1	3	5	12	13	26	13	24	16	70	3	1	1	9	9	11	11	14	17	34
Annual death-rate per 1000 at each age	18·43	17·27	49·77	3·59	1·12	3·28	5·68	8·23	10·88	31·28	26·36	107·14	200·00	72·53	3·44	1·08	0·81	7·95	5·21	8·68	11·00	19·09	42·50	193·18

TABLE III.

Monthly distribution of Births, Deaths and principal diseases causing death, amongst the Civil Population of Gibraltar during 1898.

Months.	Meteorology.			Total Births (Fixed Civil Population).	Deaths from all causes.		Monthly death-rates per 1000 living.		Quarterly death-rates per 1000 living.		Principal zymotic diseases.		Deaths from principal zymotic diseases.				Tubercular Diseases.		Respiratory Diseases.	
	Rainfall in inches	Mean relative humidity.	Mean temperature in shade (Fahrenheit).		Total Civil Population	Fixed Civil Population.	Total Civil Population.	Fixed Civil Population.	Total Civil Population.	Fixed Civil Population.	Total deaths.	Quarterly death-rate (Total Civil) per 1000 living.	Diphtheria.	Enteric Fever.	Erysipelas.	Diarrhœa.	Total deaths.	Quarterly death-rate (Total Civil) per 1000 living.	Total deaths.	Quarterly death-rate (Total Civil) per 1000 living.
January	4·33	78	54·9	56	29	24	18·21	19·87			2		1	...	1	...	6		5	
February	1·47	73	56·4	48	29	27	18·21	19·16	16·95	17·97	2	0·83	.	1	...	1	2	2·51	7	3·97
March	5·83	72	56·0	38	23	21	14·45	14·90			...		...	...	...	...	4		7	
April	2·09	70	60·2	40	42	40	26·38	28·39			2		1	..	...	1	8		12	
May	3·86	67	63·8	41	29	28	18·21	19·87	20·93	22·23	2	1·88	.	...	...	2	11	4·39	4	3·97
June	0·08	65	69·3	45	29	26	18·21	18·45			5		1	...	...	4	2		3	
July	nil.	65	74·2	38	27	27	16·96	19·16			2		...	...	..	2	3		6	
August	nil.	66	75·8	27	30	29	18·84	20·58	16·54	18·45	3	1·67	.	...	1	2	3	2·30	2	2·30
September	0·38	72	74·0	33	22	22	13·82	15·61			3		...	...	.	3	5		3	
October	3·09	76	67·5	41	24	23	15·07	16·32			2		...	...	...	2	3		7	
November	11·04	78	59·1	48	24	21	15·07	14·90	16·75	16·32	1	1·15	...	...	...	1	8	3·56	3	3·35
December	1·09	78	56·8	38	32	25	20·10	17·74			2		2	...	..	...	6		6	
Whole year......	33·08	72	64·0	493	340	317	17·79	18·74	17·79	18·74	26	1·36	5	1	2	18	61	3·19	65	3·40

TABLE IV.

Infectious and Contagious Diseases notified during 1898, under provisions of Section 10, "Medical Ordinance, Gibraltar, 1885."

Cases occurring amongst the Civil Population.

Months.	Small Pox. Reported	Small Pox. Died	Chicken Pox. Reported	Chicken Pox. Died	Measles. Reported	Measles. Died	Rubella. Reported	Rubella. Died	Diphtheria. Reported	Diphtheria. Died	Enteric Fever. Reported	Enteric Fever. Died	Scarlet Fever. Reported	Scarlet Fever. Died	Mediterranean Fever. Reported	Mediterranean Fever. Died	Continued Fever. Reported	Continued Fever. Died	Influenza. Reported	Influenza. Died	Erysipelas. Reported	Erysipelas. Died
January	1	...	6	...	1	...	3	...	6	1	1	...	...	...	1	...	...	...	...	...	...	*1
February	...	...	...	...	3	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...
March	1	...	...	...	4	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...
April	...	...	...	...	4	...	...	...	1	*1	...	...	...	...	...	...	...	...	...	...	1	...
May	...	...	1	...	1	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...
June	...	...	8	...	...	...	...	...	3	1	...	...	2	...	...	...	...	...	...	...	...	...
July	...	...	...	...	...	...	...	...	4	...	...	...	...	...	...	...	2	...	...	...	...	...
August	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	*1
September	1	...	...	...	...	...	...	...	9	...	...	...	...	...	...	...	...	...	...	...	...	...
October	...	...	...	...	...	...	...	...	5	...	...	...	...	...	...	...	...	...	...	...	...	...
November	1	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
December	...	...	...	...	...	...	...	...	2	2	...	...	...	...	...	...	...	...	...	...	...	...
Total	4	...	15	...	14	...	4	...	31	5	3	1	2	...	1	...	2	...	2		1	2

Cases landed from the Bay or brought sick into town for treatment.

Months.	Small Pox. Reported	Small Pox. Died	Chicken Pox. Reported	Chicken Pox. Died	Measles. Reported	Measles. Died	Enteric Fever. Reported	Enteric Fever. Died	Scarlet Fever. Reported	Scarlet Fever. Died	Erysipelas. Reported	Erysipelas. Died
January	...	...	...	...	...	...	...	...	...	...	...	...
February	...	...	...	...	21	...	1	...	...	...	...	...
March	2	1	...	...	13	...	...	...	5	...	1	...
April	...	...	...	...	1	...	1	1	5	...	...	...
May	...	...	1	...	...	...	2	1	4	...	...	...
June	...	...	...	...	11	1	1	...	...	...	...	...
July	...	...	...	...	...	...	1	1	...	...	...	...
August	...	...	...	...	...	...	2	...	1	...	...	...
September	...	...	...	...	...	...	...	...	...	...	...	...
October	...	...	...	...	...	...	1	...	...	...	...	...
November	...	...	...	...	...	...	...	...	...	...	...	...
December	...	...	...	...	...	...	...	...	...	...	...	...
Total	2	1	1	...	46	1	9	3	15	...	1	...

* Those marked with an asterisk were unnotified.

TABLE V.

Statement of the chief sanitary defects dealt with amongst the civil habitations in Gibraltar during 1898.

Description of Defect.	Number of Houses in which the defect was noted.
A.—WATER SUPPLY.	
1. Collecting area polluted	9
2. Mouth or inlet of tank exposed to pollution	16
3. Water in tank impure	5
4. Insufficient supply of water for flushing, &c.	23
B.—SEWERAGE.	
5. Insufficient W.C. accommodation	1
6. Insufficient means of flushing	1
7. Situation of W.C. insanitary	1
8. Soil pipes leaking	3
9. Soil pipes, embedded in the walls	10
10. Soil pipes unventilated	6
11. Soil pipes improperly ventilated	24
12. Fittings, &c., insanitary	20
13. House drains defective	28
14. House drains connected with adjoining houses ...	8
15. Wash-house troughs connected with drains	1
16. Rain gutter pipes connected with drains	3
17. Ventilation of W.C's, insufficient	22
C.—KITCHENS.	
18. Sinks untrapped	1
19. Sinks directly connected with sewer	4
20. Without flues	6
21 Accommodation deficient	11
D.—LIVING ROOMS.	
22. Dirty	1
23. Damp	8
24. Overcrowded	4
25. Badly lighted and ventilated	22
26 Generally unfit for habitation	2
27. Roofs leaking	15
28. Drains under floor	1
E.—YARDS.	
29. Badly paved ... ... —	7
30. Blocked with stores and refuse	7
31. Surface drain traps defective	13
32. Fouled by animals	1
F.—PREMISES GENERALLY.	
33. In bad repair	15
34. Deficient of refuse receptacles	25
35. Wash-house accommodation deficient	7
36. Stores, shops, and kitchens used as living rooms and being unfit for the purpose	7
Total	338

TABLE VI.
Statement of Chemical and Bacteriological Examinations.

Nature of Examination.	Number of Samples.	Results of Examination.
A—CHEMICAL EXAMINATIONS.		
Samples of Waters from Underground Tanks	55	Of good quality ... ... 32 Of doubtful quality ... ... 5 Polluted by sewage ... ... 10 " by roof contamination. 5 " from vessels in which stored 3
Well Water at Catalan Bay	6	Of good quality.
Other Well Waters	3	Do.
Spring Water from Algeciras ...	1	Do.
Samples of Water from the Reservoir at Moorish Castle	25	Do.
Samples of Milk	179	Up to standard ... ... 150 Adulterated with water: 10—20 per cent. 7 20—30 " 13 30—40 " 6 40—50 " 3
Do. Flour	1	Genuine.
Do. Butter	1	Do.
Do. Beer	7	Do.
Do. Snuff	1	Do.
Chemical Examinations of Urine ...	7	
Toxicological Examinations	3	
Total	290	
B—BACTERIOLOGICAL EXAMINATIONS.		
Swabs from Throat	31	Diphtheria Bacillus found in ... 19 " not found ... 12
Specimens of Sputum	68	Tubercle Bacillus found in ... 29 " not found in ... 25 Diplococcus Pneumoniæ found in 14
Serum Diagnosis	121	Reaction with B. Typhosus ... 27 " M. Melitensis ... 46 No reactions with either ... ... 44 Doubtful reactions 4
Blood for Malaria	5	Plasmodium Malariæ found in .. 4
Other Microscopical examinations	11	
Total...	236	

May 8th

ANNUAL REPORT

ON THE

PUBLIC HEALTH

OF

GIBRALTAR,

FOR THE YEAR

1899,

BY

H. P. Elkington, M.R.C.S., D.P.H., &c.,
MEMBER OF THE SANITARY INSTITUTE,
Major, Royal Army Medical Corps,
MEDICAL OFFICER OF HEALTH.

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PUBLIC HEALTH OF GIBRALTAR

FOR THE YEAR 1899.

VITAL STATISTICS.

Population. The census returns of 1891 furnish the data from which the vital statistics are calculated. These returns showed a total Civil population of 19,100 which was composed of a Fixed Population of 16,906 and 2,194 resident aliens. The Police Census taken in 1899 shows that there has been but very little alteration in the numbers since 1891, and gives the total Civil population as 19,048.

Births. There were 530 births registered during the year; of these 267 were males and 263 were females. The birth-rate per 1,000 per annum was therefore 31·34, a great increase on last year and on the previous quinquennial period, when it was 29·84 per 1,000.

Deaths. During the year there were 420 deaths; 412 occurred among the Fixed Population, and 8 among the resident aliens. The death-rates are 22·03 per 1,000 of total Civil Population and 24 36 of resident aliens. This rate is considerably higher than that of last year, which was exceptionally low, and it is also above the average of the last quinquennial period, which was 19·97. The increase in the death-rate is largely due to the increased number of deaths in the age-groups over 55, which accounted for over ⅓ of the total deaths.

Quarterly mortality. The quarterly distribution of deaths is shown in Table III. The highest mortality was during the last quarter, 24·07 per 1,000, and the lowest in the first, 19·26 per 1,000.

Monthly mortality. The largest number of deaths occurred in May, namely, 47, of which 20 were of children under 5 years old, respiratory diseases and diarrhœa accounting for the majority. In December there were 46 deaths, 20 of which were in age-groups over 55.

Infantile mortality. There were 97 deaths of infants under 1 year of age, equal to an infantile mortality of 183·01 per 1,000 births. This rate is much higher than that of last year, and is also above that of the last quinquennial period, which was 166 3 per 1,000 births. The principal causes of death were returned as Immaturity at birth, Respiratory diseases, and Diarrhœa.

Age-group under 5. In this age-group there were 151 deaths, equal to a mortality of 81·66 per 1,000 of those estimated as living at these ages. This rate is above the average and is mainly attributable to the high infantile mortality noted previously.

Other age-groups. The distribution of deaths according to age-groups is shown in Table II. The mortality in the age-groups above 45 is much greater than in the past few years, especially in the group 65 to 75 years.

Sex mortality. The number of deaths among Males was 208, and among Females 212, equivalent to a death-rate of 23·95 and 20·34 per 1,000 respectively.

DISEASES CAUSING MORTALITY.

General remarks. The health of the population was satisfactory, but Measles was prevalent throughout the greater part of the year. The various diseases causing death are classified in Table I.

Zymotic mortality. The principal zymotic diseases accounted for 55 deaths which is equivalent to a mortality rate of 2·87 per 1,000 total Civil population. This rate is about the average, as for the quinquennial period 1891-1895 it was 2·89 per 1,000. The various infectious diseases are classified in Tables II. and III.

Small Pox. Nine cases of Small Pox were notified and one proved fatal. In two of the cases no definite history of contagion could be obtained, but in the remainder there was a history of contact with cases in the Spanish Lines, where the disease was prevalent.

The fatal case occurred in a man employed as an engine driver on the Dock Works. He bore no marks of vaccination, having been reported as "insusceptible."

Four cases of this disease were also landed from ships in the Bay and removed to the Small Pox Hospital.

One man, a native of Gibraltar, but residing in Linea, was prosecuted for wilfully exposing himself in the streets while suffering from Small Pox and a conviction was obtained.

Chicken Pox. There were four cases of this disease, all of a mild type.

Measles. This disease was prevalent throughout the greater part of the year, and there 274 cases with 24 deaths; the largest number of cases occurring in the months of July and August, namely, 154 with 14 deaths. The epidemic was chiefly confined to the upper part of the town, and among the poorer classes, where some difficulty was experienced in isolating them properly. In many instances no medical attendance was called for until the disease was in an advanced stage, or complications had set in.

Diphtheria. The cases of Diphtheria notified amounted to 21 as

compared with 31 in 1898. The disease was prevalent in the first and third quarters, seven cases occurring in the month of February.

There were five fatal cases, three of which were practically moribund on admission to Hospital. In some of the cases sanitary defects in the houses were found, but in others the origin of the disease could not be traced.

The value of bacteriological examination of cases of suspicious sore throats has been well exemplified during the year.

Scarlet Fever. There were four cases reported; two in September occurred in the same family, and the case in November was a relation of this family. All the cases had recently come from places in Spain, where the disease was said to be present.

Enteric Fever. Four cases were notified, and two of these proved fatal. These latter were only notified when in an advanced stage and proved fatal one and three days respectively after notification. The sanitary condition of the premises, where the cases occurred, was satisfactory, and it was not found possible to trace the source of the disease.

Other continued fevers. There were five cases notified, but none proved fatal.

Diarrhœa. This disease accounted for 20 deaths among children, 17 being under 1 year of age. The number of cases returned under this heading is very unsatisfactory, as it will be seen from Table III. that the largest number occurred in the last quarter of the year, and it is probable that the majority were due to teething or improper feeding; but where no such cause is given, they have to be returned in this manner, with the result that the zymotic mortality rate is higher than would be the case if more accurate diagnoses were made.

Other zymotic diseases. These are shown in Table II., but call for no special remarks.

Tubercular diseases. There were 51 deaths from Tubercular diseases during the year, equivalent to a mortality rate of 2·66 per 1,000, a decided improvement on last year, when it was 3·19 per 1,000. The mortality was greatest in the 2nd quarter.

The following Table shows the distribution of cases of Tubercular disease during the past five years:—

Part affected.	1895	1896	1897	1898	1899
General Tubercle	7	6	9	6	5
Tubercle of Brain	26	12	19	23	10
Do. Lungs (including cases returned as Phthisis)	34	34	31	32	36

From which it will be seen, that though there has been a diminution in the number of cases returned under general Tubercle and Tubercle of brain (probably due to more accurate diagnosis, especially in cases which were formerly returned as Tubercular Meningitis); the cases of Tubercle of lung have remained about the same. Although these diseases are not notifiable, a great deal might be done to prevent their spread if more sanitary precautions were taken; and among other things I would suggest that :—

1. In all doubtful cases advantage should be taken of Bacteriological diagnosis for early detection of the disease.

2. Medical Practitioners should advise their patients as to the precautions they should take with regard to "spitting," and the use of separate feeding utensils, &c., &c.

3. In cases of improvement of the case, removal to other houses, and in all fatal cases a thorough disinfection of the premises should be made.

Respiratory diseases. The deaths due to diseases of the respiratory system were 73, equal to a mortality of 3·81 per 1,000, slightly higher than that of 1898, but comparing favourably with previous years. The mortality was greatest in the first quarter.

SANITARY CONDITIONS.

The sanitary condition of Gibraltar is satisfactory. House-to-house inspections are frequently made, and details of defects found in the houses are noted in Table V.

The wash-house accommodation in the majority of the Common Lodging Houses is insufficient, and there are no available sites to properly increase it except at the expense of living rooms. Owing to this, the washing is carried out in the yards or patios, and occupants of rooms on the ground floor are put to inconvenience and risks from the yards being constantly wet; and there is the further difficulty of keeping these yards clean on account of the obstruction caused by tubs, &c.

If sites could be obtained, public Laundries should be established. This would be especially feasible in Catalan Bay, where a very large amount of washing is done.

Infectious diseases. Disinfection of rooms after the occurrence of infectious cases is now carried out by means of Formic Aldehyde, two Alformant Lamps and a supply of Formalin tablets having been obtained by the Sanitary Commissioners for this purpose. An Equifex Sprayer is also used in certain cases. This method of disinfection has given very satisfactory results, and causes far less inconvenience to the occupants than the use of sulphur.

Vaccination. Primary vaccination is regularly performed, but a large amount of arm-to-arm vaccination is still practised. This is not in accordance with modern ideas, and glycerinated calf lymph should alone be used. Re-vaccination is very rarely performed.

Milk supply. In July of this year additional Bye-Laws for the control of the milk supply were introduced, making it compulsory for street vendors to be licensed. This has resulted in a decided improvement in the quality of the milk sold, and the number of cases of adulteration has greatly diminished, as will be seen from the accompanying table :—

Months.	No. of samples analysed.	No of samples up to standard.	No. of samples adulterated.
January	15	13	2
February	11	5	6
March	13	7	6
April	12	12	0
May	11	10	1
June	11	7	4
*July	15	10	5
August	21	20	1
September	5	5	0
October	26	24	2
November	23	22	1
December	24	24	0
	187	159	28

* New Bye-Laws published.

In four cases the milk was found impoverished by the removal of its butter fat. All these vendors were duly cautioned.

Twelve vendors were prosecuted.

The Milk-shops, Goat-Sheds, and Dairies have been regularly inspected, and are kept in good sanitary condition.

Owing to the large amount of milk brought into the town from Spain and its liability to pollution outside, our milk supply cannot be considered satisfactory, and it would be desirable to have a farm in the place under proper sanitary control, or, failing this, means should be taken to sterilize the milk on its entry into the town.

Other food supplies. Seven seizures of articles of unsound food were made during the year. In one case it was deemed advisable to prosecute, and a conviction was obtained. Owing to the present law being inadequate to deal with certain cases in connection with the sale of unsound food, a special report was submitted in November, recommending an amendment, in accordance with the "Public Health Act, London, 1891."

It would also appear to be advisable to bring into force "The Adulteration of Foods and Drugs Act, 1899."

Bakeries. The bakeries are visitedweekly and on the whole are satisfactorily kept, but there are a few, the condition of which it was necessary to bring to the notice of the Authorities, which will probably ensure their being better looked after in the future.

Special reports on the Public Houses, Music Halls, Theatre, &c., have been submitted during the year.

Water supply. The scheme for the additional supply of rain water, alluded to in my previous report has, during the past year, been brought into practical effect.

Four large reservoirs, each capable of containing 1,300,000 gallons have been constructed in the heart of the lime-stone rock; the water stored in them will be secure during bombardment, and will be protected from the fluctuations of the temperature, thus being available and suitable for use after years of storage. They are supplied from a large collecting area of about fourteen acres which has been constructed for the purpose near the summit of the rock, at a height ranging from 800 feet to 1,240 feet above sea level. Besides acting as storage reservoirs they will also act as settling tanks, in which the water, previously freed from coarse matter in suspension, will be kept for a sufficient time to allow any fine matter which may be in suspension to be precipitated, without danger of afterwards being drawn off in the supply. In addition to the foregoing excellent precautions the water upon being drawn off will be slowly passed through extensive "polarite" filters and will then be aërated by freely falling, in a spray, to a depth ranging from thirty to sixty feet. It is difficult to imagine that a more perfect water for dietetic purposes could be obtained than that from the source indicated after passage through the apparatus and by the system described; indeed, actual experience, based upon chemical analyses and investigations, has demonstrated that the water so collected and treated is perfect. Up to the present time 2,500,000 gallons have been collected and stored in the reservoirs.

The completed scheme leaves but one thing to be desired, in connection with the water supply to the Colony, and that is, the supply, by means of pipes, of such a water direct to each consumer's house or place of business. This is probably the most important hygienic consideration of the present time. The means of distribution as carried out now and in the past leave much to be desired; in fact there is the constant danger of the water being fouled after it leaves the Commissioners' distributing stations before it reaches the consumers, by the more or less careless manner in which it is conveyed by the hawkers.

It is understood that the Commissioners have under consideration a scheme to meet this most desirable end. When a first class dietetic water can be supplied direct to every house in the Colony by means of pipes, when such a water can be abundantly supplied direct to ships which may come alongside the New Commercial Mole, and when all manufacturers in the Colony can be abundantly supplied at their places of business with such a water, all difficulty as to the water supply of Gibraltar for the future will be at an end.

Chemical and Bacteriological Laboratories. The work carried out in the Chemical and Bacteriological Laboratories is steadily increasing, and it is proposed to greatly enlarge the Chemical Laboratory during the coming year, as at present its space is very limited.

Details of the various analyses and examinations will be found in Table VI. Altogether 645 examinations have been made, 372 being chemical and 273 bacteriological.

In the Chemical Laboratory the chief analyses were of samples of water and milk. Of the former 145 analyses were made and 33 samples were found contaminated; of the 193 samples of milk 36 were found to be adulterated with water, 4 had been skimmed, and in 2 samples, which had given rise to sickness, Tyrotoxicon was found. In the Bacteriological Laboratory the examinations were in connection with Fevers (Serum diagnosis), Diphtheria and Tubercle.

H. P. ELKINGTON,
Major, R.A.M.C.,
Health Officer.

Gibraltar, March, 1900.

APPENDIX

TO THE

ANNUAL REPORT ON THE PUBLIC HEALTH

OF

GIBRALTAR,

FOR THE YEAR

1899.

TABLE I.

Deaths registered in Gibraltar during 1899, amongst the Civil Population, showing diseases causing death and ages at death.

CAUSE OF DEATH.	At all ages.	Under 1 year of age.	1 year.	2 years.	3 years.	4 years.	Total under 5 years.	OTHER AGE-GROUPS. 5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
General Diseases	167	60	14	10	5	3	92	1	1	5	3	7	6	6	11	14	21
Local Diseases	251	37	16	3	3	—	59	4	2	8	4	12	19	39	32	47	25
Poisons (none)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Injuries	2	—	—	—	—	—	—	1	—	—	—	—	1	—	—	—	—
Grand Total...	420	97	30	13	8	3	151	6	3	13	7	19	26	45	43	61	46
GENERAL DISEASES.																	
Small Pox	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—
Measles	24	4	10	7	2	1	24	—	—	—	—	—	—	—	—	—	—
Influenza	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—
Diphtheria	5	1	1	1	2	—	5	—	—	—	—	—	—	—	—	—	—
Enteric Fever	2	—	—	—	—	—	—	—	—	1	—	—	1	—	—	—	—
Diarrhœa	23	17	2	—	—	1	20	—	—	—	—	—	—	—	1	1	1
Erysipelas	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
Pyæmia	1	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
Septicæmia	1	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
Tubercle	5	1	—	2	—	—	3	—	—	—	—	—	1	1	—	—	—
" of Brain	10	8	—	—	1	1	10	—	—	—	—	—	—	—	—	—	—
" of Lung	17	—	—	—	—	—	—	—	1	3	2	5	2	2	2	—	—
Syphilis	2	2	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—
Alcoholism	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—
Malignant New-growth ...	17	—	—	—	—	—	—	—	—	—	—	—	1	2	7	6	1
Rickets	2	2	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—
Anæmia	1	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
Diabetes	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Immaturity at Birth ...	22	22	—	—	—	—	22	—	—	—	—	—	—	—	—	—	—
Debility	6	3	1	—	—	—	4	1	—	—	—	—	—	—	—	1	—
Old Age	24	—	—	—	—	—	—	—	—	—	—	—	—	—	1	5	18
Total	167	60	14	10	5	3	92	1	1	5	3	7	6	6	11	14	21
LOCAL DISEASES.																	
NERVOUS SYSTEM.																	
Inflammation of Brain.	6	—	—	—	—	—	—	—	1	—	—	—	2	—	1	1	1
Sclerosis	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—
Apoplexy	25	—	—	—	—	—	—	—	—	—	—	1	2	6	3	8	5
Paralysis	14	—	—	—	—	—	—	—	—	—	—	—	1	5	1	4	3
Eclampsia	5	4	1	—	—	—	5	—	—	—	—	—	—	—	—	—	—
Carried forward...	51	4	1	—	—	—	5	—	1	—	—	1	5	11	5	14	9

TABLE I.—*Continued.*

CAUSE OF DEATH.	At all ages.	Under 1 year of age.	1 year.	2 years.	3 years.	4 years.	Total under 5 years.	OTHER AGE-GROUPS. 5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
Brought forward...	51	4	1	—	—	—	5	—	1	—	—	1	5	11	5	14	9
CIRCULATORY SYSTEM.																	
Heart Disease (not	26	—	—	—	—	—	—	1	—	—	—	—	5	5	4	8	3
specified)	12	—	—	—	—	—	—	—	—	1	—	—	—	2	6	2	1
Valvular disease of heart																	
Fatty degeneration of	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
Heart	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—
Hypertrophy of heart	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—
Rupture of heart	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—
Angina pectoris	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
Aneurysm																	
RESPIRATORY SYSTEM.	1	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—
Laryngitis	21	6	1	—	—	—	7	—	—	—	—	—	—	3	1	6	4
Bronchitis	2	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	1
Congestion of Lungs...	24	2	—	2	1	—	5	2	1	2	—	2	—	2	3	4	3
Pneumonia	21	7	7	1	1	—	16	—	—	—	—	—	1	—	2	—	2
Broncho-Pneumonia....	19	—	—	—	—	—	—	—	—	4	3	4	2	6	—	—	—
Phthisis	4	1	—	—	—	—	1	—	—	—	—	—	—	—	2	1	—
Pleurisy																	
DIGESTIVE SYSTEM.	24	16	7	—	1	—	24	—	—	—	—	—	—	—	—	—	—
Disorders of dentition ..																	
Inflammation of	3	—	—	—	—	—	—	—	—	—	—	—	—	2	—	1	—
Stomach	2	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—
Strangulated Hernia ..																	
Obstruction of	3	—	—	—	—	—	—	—	—	—	—	1	—	1	—	1	—
Intestines	10	—	—	—	—	—	—	—	—	—	—	—	3	4	1	2	—
Inflammation of Liver..	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—
Jaundice	3	—	—	—	—	—	—	—	—	1	—	2	—	—	—	—	—
Peritonitis																	
URINARY SYSTEM.	2	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	—
Acute Nephritis........	11	—	—	—	—	—	—	—	—	—	1	—	2	—	4	3	1
Bright's Disease........	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
Extravasation of Urine.																	
ORGANS OF LOCOMOTION.	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
Caries of Spine	3	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	1
Gangrene																	
	251	37	16	3	3	—	59	4	2	8	4	12	19	39	32	47	25
INJURIES.																	
Accident	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
Suicide	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—
	2	—	—	—	—	—	—	1	—	—	—	—	1	—	—	—	—

TABLE II.

Sex Mortality amongst the Civil Population, Gibraltar, 1899, distributed according to Months and Age-groups.

Months.	Deaths at all ages.		Deaths amongst Males according to Age-groups.											Deaths amongst Females according to Age-groups.										
	Males.	Females.	Under 5 yrs.	5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.	Under 5 yrs.	5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards
January	18	16	1	—	—	—	—	2	2	4	3	3	3	3	1	—	2	—	—	1	1	3	3	2
February	8	13	3	—	—	—	—	—	—	3	—	—	2	4	—	—	—	—	—	1	—	1	2	5
March	15	22	4	—	—	—	—	2	—	2	3	2	2	4	—	—	1	1	1	1	1	3	8	2
April	17	21	5	—	—	1	—	3	4	2	1	—	1	5	—	2	—	—	—	2	2	—	5	5
May	25	22	10	—	—	1	—	—	1	5	5	2	1	10	—	—	1	1	—	1	—	3	3	3
June	15	11	6	—	—	1	—	2	1	1	1	3	—	6	—	—	—	—	1	—	1	—	2	1
July	16	14	5	1	—	1	1	—	1	1	3	3	—	8	—	—	1	—	1	1	—	—	1	2
August	16	24	10	—	—	1	1	—	—	2	—	2	—	12	—	—	—	1	1	1	1	—	6	2
September	19	14	5	—	—	1	—	2	3	3	—	2	3	5	—	1	1	—	—	2	1	1	2	1
October	24	17	14	—	—	1	—	1	1	1	1	2	3	7	—	—	—	—	—	1	2	3	3	1
November	11	16	2	1	—	—	1	1	—	5	1	—	—	8	—	—	—	—	1	—	2	1	2	2
December	24	22	9	2	—	—	1	—	2	2	5	1	2	5	1	—	—	—	1	—	3	5	4	3
Total deaths ...	208	212	74	4	—	7	4	13	15	31	23	20	17	77	2	3	6	3	6	11	14	20	41	29
Annual death-rate per 1000 at each age	23·96	20·34	88·71	4·79	—	7·61	4·53	8·92	12·36	37·30	46·65	89·28	212·5	79·79	2·29	3·96	4·87	2·65	3·47	8·68	14·00	37·28	102·50	164·77

TABLE III.

Monthly distribution of Births, Deaths, and Principal Diseases causing death, amongst the Civil Population of Gibraltar during 1899.

Months.	Meteorology.				Deaths from all causes.		Monthly death-rates per 1000 living.		Quarterly death-rates per 1000 living.		Principal zymotic diseases.		Deaths from principal zymotic diseases.								Tubercular diseases.		Respiratory diseases.	
	Rainfall in inches.	Mean relative humidity.	Mean temperature in shade (Fahrenheit).	Total Births (Fixed Civil Population).	Total Civil Population	Fixed Civil Population.	Total Civil Population.	Fixed Civil Population.	Total Civil Population.	Fixed Civil Population.	Total deaths.	Quarterly death-rates (Total Civil Population) per 1000 living.	Small Pox.	Measles.	Influenza.	Diphtheria.	Enteric Fever.	Diarrhœa.	Erysipelas.	Septicæmia.	Total deaths.	Quarterly death-rates (Total Civil Pop.) p. 1000 living.	Total deaths.	Quarterly death-rates (Total Civil Pop.) p. 1000 living.
January	6·17	78	55·7	49	34	33	21·36	23·42			1		—	—	—	—	—	1	—	—	6		5	
February ...	6·41	78	57·2	44	21	21	13·19	14·90	19·26	21·05	1	0·83	—	—	—	1	—	—	—	—	1	2·51	7	5·23
March	3·06	76	58·0	51	37	35	23·24	24·84			2		—	—	1	—	—	1	—	—	5		13	
April	0·22	67	63·6	42	38	38	23·87	26·97			1		—	—	—	—	1	—	—	—	7		9	
May	2·11	62	67·1	39	47	45	29·52	31·94	23·24	25·78	6	2·30	—	1	—	1	—	4	—	—	8	3·56	8	4·39
June	3·90	67	69·0	36	26	26	16·33	18·45			4		—	—	—	1	—	2	1	—	2		4	
July	0·10	65	74·3	47	30	30	18·84	21·29			5		—	3	—	1	—	1	—	—	7		7	
August	—	65	77·4	47	40	39	25·13	27·68	21·56	24·13	13	5·23	—	11	—	1	—	1	—	—	3	2·23	2	2·72
September ...	0·02	64	75·2	48	33	33	20·73	23·42			7		—	4	—	—	1	1	—	1	4		4	
October	5·45	77	70·2	45	41	40	25·75	28·39			7		—	4	—	—	—	3	—	—	3		6	
November ..	4·05	78	64·5	35	27	27	16·96	19·16	24·07	26·47	2	3·14	—	—	—	—	—	2	—	—	2	1·67	4	2·93
December ..	5·18	78	56·6	47	46	45	29·52	31·94			6		1	1	—	—	—	4	—	—	3		4	
Whole year...	36·67	71	65·7	530	420	412	22·03	24·36	22·03	24·36	55	2·87	1	24	1	5	2	20	1	1	51	2·66	73	3·81

TABLE IV.

Infectious and Contagious Diseases notified during 1899, under provisions of Section 10, "Medical Ordinance, Gibraltar, 1885."

Months.	Cases occurring amongst the Civil Population.																								Cases landed from the Bay or brought sick into town for treatment.									
	Small Pox.		Chicken Pox.		Measles.		Rubella.		Scarlet Fever.		Influenza.		Mumps.		Diphtheria.		Simple continued fever.		Enteric fever.		Erysipelas.		Septicæmia.		Small Pox.		Measles.		Scarlet fever.		Mumps.		Enteric fever.	
	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died	Reported	Died
January ...	—	—	1	—	—	—	3	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
February ...	—	—	1	—	1	—	—	—	—	—	—	—	—	—	7	1	—	—	—	—	—	—	—	—	1	—	—	—	—	—	1	—	—	—
March ...	—	—	—	—	—	—	—	—	—	—	—	†1	—	—	1	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—
April ...	—	—	—	—	1	—	—	—	—	—	—	—	—	—	1	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—
May ...	—	—	1	—	13	1	—	—	—	—	—	—	—	—	1	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
June ...	*2	—	—	—	29	—	—	—	—	—	—	—	—	—	2	1	1	—	1	—	2	1	—	—	—	—	1	—	—	—	—	—	1	—
July ...	—	—	—	—	82	5	—	—	—	—	—	—	2	—	3	1	3	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—
August ...	—	—	—	—	72	9	—	—	—	—	—	—	—	—	3	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—
September ...	1	—	—	—	24	5	—	—	2	—	—	—	—	—	—	—	—	—	1	1	—	—	1	1	—	—	—	—	1	—	—	—	—	—
October ...	2	—	—	—	23	3	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
November ...	—	—	1	—	11	—	—	—	1	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—
December ...	4	1	—	—	18	1	—	—	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
Total ...	9	1	4	—	274	24	3	—	4	—	—	1	2	—	21	5	5	—	4	2	4	1	1	1	5	—	1	—	1	—	2	—	3	—

* One concealed case. † Not notified.

TABLE V.

Statement of the chief sanitary defects dealt with amongst the civil habitations in Gibraltar during 1899.

Description of Defect.	Number of Houses in which the defect was noted.
A.—WATER SUPPLY.	
1. Collecting area polluted ...	7
2. Mouth or inlet of tank exposed to pollution ...	8
3. Water in Tank impure ...	6
4. Insufficient supply of water for flushing, &c. ...	12
B.—SEWERAGE.	
5. Insufficient W.C. accommodation ...	3
6. Insufficient means of flushing ...	1
7. Situation of W.C. insanitary ...	1
8. Soil pipes leaking ...	2
9. Soil pipes embedded in the walls ...	9
10. Soil pipes unventilated ...	3
11. Soil pipes improperly ventilated ...	17
12. Fittings, &c., insanitary ...	18
13. House drains defective ...	26
14. House drains connected with adjoining houses ...	1
15. Wash-house troughs connected with drains ...	1
16. Ventilation of W.Cs. insufficient ...	19
17. Soil pipes of W.Cs. passing inside living rooms ...	1
C.—KITCHEN.	
18. Sinks untrapped ...	2
19. Sinks directly connected with Sewer ...	2
20. Without flues ...	8
21. Accommodation deficient ...	7
D.—LIVING ROOMS.	
22. Dirty ...	2
23. Damp ...	7
24. Overcrowded ...	18
25. Badly lighted and ventilated ...	18
26. Generally unfit for habitation ...	1
27. Roofs leaking ...	13
28. Drains under floor ...	5
E.—YARDS.	
29. Badly paved ...	8
30. Blocked with stores and refuse...	7
31. Surface drain traps defective ...	11
32. Fouled by animals ...	4
F.—PREMISES GENERALLY.	
33. In bad repair ...	6
34. Deficient of refuse receptacles ...	22
35. Wash-house accommodation deficient ...	6
36. Stores, shops, kitchens, and wash-houses used as living rooms and being unfit for the purpose ...	20
Total ...	302

TABLE VI.

Statement of Chemical and Bacteriological Examinations.

Nature of Examination.	No. of Samples.	Results of Examinations.
A—CHEMICAL EXAMINATIONS.		
Samples of Water from underground Tanks	87	Pure 59
		Polluted by roof contamination .. 17
		Do. sewage 10
		Do. Sanitary Water ... 1
Well Water	19	Contaminated with sewage 5
Spring Water	3	Pure.
Sea Water...	1	Do.
Water in Reservoir at Moorish Castle	23	Do.
Water at Catalan Bay	12	Do.
Total	145	
Samples of Milk	193	Pure 151
		Adulterated with water: 10·20 o/o ... 6; 20·30 o/o ... 12; 30·40 o/o ... 12; 40·50 o/o ... 4; 50·80 o/o ... 2 — 36
		Skimmed 4
		Tyrotoxicon 2
Do. Urine	24	
Do. Paints	2	
Do. Drugs	1	
Do. Beer	5	
Do. Oil &c....	2	
Total	372	
B—BACTERIOLOGICAL EXAMINATIONS.		
Serum Diagnoses	124	Reacted with M. Melitensis ... 32
		Do. B. Typhosus 18
		No reaction with either 74
Sputum	85	Tubercle Bacillus found in 26
Swabs from throats	41	Diphtheria Bacillus found in ... 12
Various	23	
Total	273	

21.5.11

ANNUAL REPORT

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ANNUAL REPORT

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PUBLIC HEALTH OF GIBRALTAR

FOR THE YEAR 1900.

GENERAL REMARKS.

The year 1900 now under review completes a decennial period and enables us to compare the state of the Public Health with that of the previous decennial period, 1881-1890, and it is very gratifying to be able to record not only that the general death-rate of the population has been lowered, but also that the greatest improvement has taken place in the mortality from the preventible zymotic diseases, which has been reduced by more than a half, as it is in connection with these diseases that the results of efficient sanitary administration are most marked.

The vital statistics are based on the last census returns, which showed a Total Population of 19,100, composed of a Fixed Population of 16,906, and 2,194 Resident Aliens. It is not possible to state how far the population here has varied but it is probable that the fluctuation has been so slight as not to really vitiate the value of the statistics.

Births.

The birth statistics deal only with the Fixed Population.

There were 507 births during the year, namely, 237 males and 270 females, equivalent to a birth-rate of 29·98 per 1,000 of Fixed Population. This rate is lower than that of last year, but higher than that of the previous quinquennial period.

The excess of births over deaths among the Fixed Population is 69; much smaller than it has been during the past five years. The monthly distribution of births is given in Table III. Appendix and calls for no special remarks.

The following table shows the birth statistics for previous quinquennial and decennial periods :—

	Years.	Total No. of Births.	Birth rate per 1,000 Fixed Population.	Excess of Births over Deaths.
	1896	540	31·92	195
	1897	530	31·34	100
	1898	493	29·16	176
	1899	530	31·34	118
	1900	507	29·98	69
Quinquennial periods.	1881-1885	2407	29·40	239
	1886-1890	2446	29·30	351
	1891-1895	2553	29·83	672
	1896-1900	2600	30·75	658
Decennial periods.	1881-1890	4853	29·35	590
	1891-1900	5153	30·29	1330

From the above it will be seen that the birth-rate has been rising slightly during the past ten years.

Deaths. The number of deaths registered during the year was 455, of which 438 were among the Fixed Population and 17 among the Resident Aliens. The death-rate for the year is 23·81 for the total population and 25·90 for the Fixed Civil Population. This rate is somewhat higher than last year's and is also above that of the last quinquennial period, but examination of Table II. shows an increase in the number of deaths in the age-groups 45 years and upwards which accounted for 221 deaths, nearly one half the total number, and 136 of these deaths were in the age-groups 65 and upwards.

The following table is inserted for comparison of the death-rates of previous years and periods :—

	Years.	Estimated Death-rate per 1000. Total Civil Population.	Estimated Death-rate per 1000. Fixed Population.
	1896	19·52	20·40
	1897	23·56	25·43
	1898	17·79	18·74
	1899	22·03	24·36
	1900	23·81	25·90
Quinquennial periods.	1881-1885	23·68	26·54
	1886-1890	22·44	25 10
	1891-1895	19·97	22·13
	1896-1900	21·34	22·96
Decennial periods.	1881-1890	23·06	25·83
	1891-1900	20·65	22 54

This shows a very satisfactory reduction in the death-rate during the last 10 years, see also Chart No. 1.

Quarterly mortality. The quarterly mortality is shown in Table III. This year the first quarter gave the highest and the second the lowest. The high mortality in the first quarter was due chiefly to diseases of the respiratory system.

Corresponding quarterly mortalities of Total Civil Population for previous periods are given for comparison :—

Year.	1st Quarter.	2nd Quarter.	3rd Quarter.	4th Quarter.
1896	23·66	17·17	15·91	21·36
1897	21·57	32·67	19·06	20·94
1898	16·95	20·93	16·54	16·75
1899	19·26	23·24	21·56	24·07
1900	33·29	19·26	21·36	21·35
1891-1895	24·16	19·46	17·48	18·66
1896-1900	22·94	22·65	18·88	20·89
1881-1890	23·20	24·20	23·50	21·10
1891-1900	23·45	21·05	18·18	19·77

From the above it will be seen that during the last decade the highest rate of mortality has shifted from the second to the first quarter and that the third has now become the healthiest. This was commented on by the Health Officer in 1895, where he pointed out "that "this shifting of the mortality from the 2nd to 1st quarter in which "the mortality from respiratory diseases and among old people is "greatest, really means a lowering of the general death-rate so far as "diseases of the earlier periods of life are concerned and a raising of "the death-rate among diseases incident upon old people."

Monthly mortality. The monthly mortality is shown in Tables II. and III. The largest number of deaths occurred in March, namely, 63, there were 55 in February and 23 in September, which was the smallest number recorded. Out of the 63 deaths in March, 32 occurred in the age-groups 55 years and upwards. The mortality in the age-group under 5 years was also heaviest in the months of February and March.

The corresponding monthly mortality of the Total Civil Population for previous periods is given below and confirms what has been stated concerning the shifting of the maximum mortality from the 2nd to the 1st quarter :—

Period.	January	February	March	April	May	June	July	August	September	October	November	December
1891-1895	26·49	24·11	21·64	20·95	18·32	19·08	18·32	17·62	16·23	16·94	18·95	19·98
1896-1900	21·73	22·10	25·02	23·61	22·35	21·98	19·72	19·97	16·98	21·48	17·71	23·49
1881-1890	22·0	23·5	24·3	29·3	22·5	20·7	24·5	25·0	21·1	20·6	19·7	22·9
1891-1900	24·1	23·1	23·4	22·2	20·3	20·5	19·0	18·7	16·6	19·1	18·3	21·7

Infantile mortality.

The number of deaths among children under one year of age was 80, equal to an infantile mortality of 157·81 per 1,000 births.

The following table gives the infantile mortality and the mortality of the age-group under 5 years for previous periods :—

Year.	Infantile mortality per 1000 Births.	Mortality of Age-group under 5 yrs. per 1000.
1896	114·80	61·11
1897	184·90	108·11
1898	139·95	61·11
1899	183·01	81·66
1900	157·81	74·63
1891-1895	166·3	73·6
1896-1900	156·0	77·32
1881-1890	167·80	85·8
1891-1900	161·19	75·46

Age-group under 5 years.

In this age-group there were 138 deaths, 72 being males and 66 females, equivalent to a death-rate of 74·63 per 1,000. This shows a decrease on last year's rate and it is also below the average of the quinquennial period.

Chart No. III. shows the infantile mortality and mortality of age-group under 5 years for the last two decades.

Other Age-groups.

The mortality of the several age-groups is given in Table II.

The following table is inserted for comparison with previous periods and is a continuation of that given in 1895 :—

Mortality per 1000 Total Civil Population at the several Age-groups.

Period.		Under 5 yrs.	5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
1896	M	73·52	5·99	1·12	5·44	9·10	10·29	16·75	27·67	38·53	80·35	212·50
	F	49·72	4·59	1·08	3·23	7·06	2·89	5·52	8·00	24·55	80·00	238·63
1897	M	121·04	5·99	1·12	2·17	5·68	5·48	15·07	21·66	32·45	84·82	187·80
	F	96·37	2·29	2·17	4·87	3·53	6·93	12·63	17·00	27·28	72·50	198·86
1898	M	49·77	3·59	1·12	8·26	5·68	8·23	10·88	31·28	26·36	107·14	200·00
	F	72·53	3·44	1·08	0·81	7·95	5·21	8·68	11·00	19·09	42·50	193·18
1899	M	83·71	4·79	—	7·61	4·55	8·92	12·56	37·30	46·63	89·28	212·5
	F	79·79	2·29	3·26	4·87	2·65	3·47	8·68	14·00	27·28	102·50	164·77
1900	M	81·44	2·39	4·51	8·70	6·82	13·04	16·75	31·28	50·70	138·39	312·50
	F	68·39	5·74	4·34	5·6[illegible]	0·88	5·79	7·89	13·00	28·64	72·50	289·77
1891-95	M	82·58	3·35	3·37	2·37	5·67	7·82	16·05	26·22	38·52	91·96	not recorded
	F	66·13	5·26	1·72	2·59	4·38	6·59	9·77	12·00	26·70	67·50	not recorded
1896-1900	M	81·89	4·55	1·57	5·43	6·36	9·19	14·40	29·83	38·93	99·99	225·00
	F	73·36	3·67	2·38	3·89	4·41	4·86	8·68	12·60	25·36	74·00	217·04

It is unfortunately impossible to compare these death-rates with those of the previous decennial period as, in the census returns of 1881, the population was not then grouped as it is now, and the death-rates of age-group 75 and upwards were not recorded for the year 1891. Still the figures given above show in a sufficiently striking manner the average death-rates of the sexes in the various age-groups.

Sex mortality.

In Table II. is shown the sex mortality distributed according to months and age-groups.

The number of deaths among males was 238 and among females 217, equivalent to a death-rate of 27·41 per 1,000 males and 20·82 per 1,000 females.

The sex mortality for previous periods was as follows :—

Year.	Recorded Death-rates per 1000		Difference.
	Males.	Females.	
1896	22·58	16·98	5·60
1897	24·65	22·64	2·01
1898	18·43	17·27	1·16
1899	23·95	20·34	3·61
1900	27·41	20·82	6·59
1891-1895	22·35	17·97	4·38
1896-1900	23·40	19·61	3·79
1881-1890	25·45	20·80	4·65
1891-1900	22·87	18·79	4·08

Thus it is shown that, although this year there has been a large difference in the mortality rates of the two sexes, yet the average of the past ten years works out very nearly the same as for the previous decade.

DISEASES CAUSING MORTALITY.

The general health of the population during the year has been very good in spite of the epidemics of small pox and measles. The diseases causing death are shown in Table I. which is similar to the Tables published in previous years.

Zymotic diseases.

These accounted for 54 deaths, equal to a zymotic mortality of 2·82 per 1,000 of the Total Civil Population, a decrease on last year's rate and on that of the last quinquennial period. A list of zymotic diseases, arranged according to months, is given in Table III. The following table gives the zymotic mortality per 1,000 of the Total Civil Population of previous periods, and this is also shown in Chart II.

Year.	Zymotic Mortality
1896	2·69
1897	3·77
1898	1·36
1899	2·87
1900	2·82
1891-1895	2·89
1896-1900	2·70
1881-1890	4·93
1891-1900	2·79

This reduction in the zymotic mortality during the past ten years by nearly a half is a most satisfactory proof of sanitary work.

The following table is inserted for comparison of the number of cases and deaths from principal zymotic diseases in previous periods and shows that although the incidence may be greater than in the previous quinquennial period the mortality is less:—

Year.	Small Pox.		Measles.		Diphtheria.		Enteric Fever.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1896	60	3	5	—	29	13	8	2
1897	45	2	252	13	65	18	9	1
1898	4	—	14	—	31	5	3	1
1899	9	1	274	24	21	5	4	2
1900	94	5	142	4	8	3	20	7
1886-1890	93	9	1259	92	285	114	63	33
1891-1895	132	10	397	8	71	35	63	30
1896-1900	212	11	687	41	154	44	44	13

Compulsory notification of infectious diseases only came into operation in 1886, so it is not possible to compare the decennial periods.

Small Pox There were 94 cases notified during the year and 5 proved fatal. The cases were distributed as follows:—First quarter 58, second 22, third 5, and fourth 9. The disease was most prevalent during the months of March and April, when 60 cases were notified.

The epidemic began towards the end of January and these cases were undoubtedly contracted from Linea, where the disease was prevalent. About the middle of February an old man living in Catalan Bay village contracted the disease from a friend, a resident of Linea, who visited him, and who had recently lost a daughter from it. The disease was far advanced before it was recognized (the old man being a chronic invalid) and proved fatal three days after admission to

Hospital. From this focus of infection the sixteen other cases which occurred in the village were traced and the outbreak was only stamped out by vigorous measures taken, including a daily inspection of all the people resident there and the prompt isolation of all cases recognised in the earliest stage.

The other cases were scattered about in various parts of the town and in the majority a history was obtained of being in contact with cases in Linea where the disease appears to have been prevalent throughout the year, many cases of persons suffering from small pox or recovering from it being refused admission to the Garrison. Owing to the lack of accommodation at the isolation Hospital and as a further check on the spread of the disease it was found necessary to cancel the permission hitherto accorded to natives of Gibraltar residing in Linea, of coming to this Hospital for treatment.

All the cases bore evidence of primary vaccination.

During the past 10 years there have been three epidemics, namely, 1894-1895, 1896-1897, 1900. They closely resemble one another, more especially in the fact that in the hot dry months there is a lessened incidence of the disease. Considering the intercourse that pertains between Gibraltar and Linea it is surprising that the disease is not more frequent. This can only be attributed to enforcing primary vaccination, careful watching for cases entering the Garrison and the prompt notification and isolation of cases in the early stage.

Measles. There were 142 cases notified during the year and four proved fatal. The larger number of the cases occurred during the first quarter and the epidemic may be considered as a continuation of that of 1899. It does not call for any special remark, the disease not being of a severe type. During the last 10 years measles were epidemic in 1894-1895, 1897, 1899-1900.

Scarlet Fever. Four cases were reported during the year, none proved fatal. Two cases occurred at a school in Bomb House Lane but no definite origin could be traced. This disease has never shown any tendency to become epidemic here.

Diphtheria. Eight cases were reported during the year and three proved fatal, being in a very advanced stage before receiving treatment. There was a marked reduction of the incidence of the disease this year as compared with the previous years of the period, but a more important point is the great reduction in the case mortality which as previously noted is undoubtedly due to earlier recognition of the disease and its prompt treatment by antitoxin. The provision of a supply of antitoxin by the Sanitary Commissioners, recommended in 1897, has been fully justified by these results.

The number of cases and deaths reported during the last quinquennial period is given in the Table of Zymotic Diseases.

Enteric Fever. There were 20 cases notified during the year and seven proved fatal. Thirteen cases occurred during the first quarter, eight of these being among clerks in the Eastern Telegraph Company at their Quarters in the South. No definite source of the outbreak could be traced, though suspicion fell on food and water.

The remaining cases of enteric were scattered about the town and showed no connection with one another.

Other Infectious Diseases. These are given in Table IV. and do not call for any special remark. Of the four cases of septicœmia which proved fatal only one was puerperal, the others following on injuries or operations.

Diarrhœa. Under this heading are included cases of gastro-enteritis in children and 25 deaths from this cause occurred during the year, twenty of the cases being in children under one year of age. This is about the average for the past five years. The terms "Diarrhœa" and "Gastro-enteritis" are very loosely used and it is unsatisfactory to have to return all cases such as these under this heading as it is probable that in the majority of instances they are due to dentition or irregular feeding. The distribution of the deaths by months is shown in Table III.

Tubercular Diseases. There were 50 deaths from tubercular disease during the year, equivalent to a rate of 2·61 per 1000 Total Civil Population; this is a slight improvement on last year's rate and on the average for the quinquennial period. An examination of the various tubercular diseases shows that there has been a diminution in the number of cases returned as general tubercle and tubercle of brain, but an increase in tubercle of lung and phthisis. The age group most affected is 25-35 years.

The following table gives the total number of deaths and the death rate for previous periods :—

TUBERCULAR DISEASES.

	Year.	Total No. of deaths.	Death-rate per 1000 Total Civil Population.
	1896	52	2·72
	1897	59	3·08
	1898	61	3·19
	1899	51	2·66
	1900	50	2·61
Quinquennial period.	1891-1895	302	average 3·16
	1896-1900	273	" 2·85
Decennial period.	1881-1890	634	" 3·39
	1891-1900	575	" 3·00

This shows that there has been but a very slight reduction in the mortality from these diseases during the past ten years.

The most important factors in keeping up this mortality are, undoubtedly, overcrowding, and the mode of life. This has been alluded to in previous reports, and until the people themselves are educated to appreciate the full value of fresh air and sunlight, one can hope for little improvement.

Respiratory diseases. Under diseases of the respiratory system 87 deaths were returned during the year. Forty-five occurred in the age-group under 5 years and twenty-five in age-groups 55 and upwards. The mortality was highest in the first quarter of the year, forty-nine cases being recorded, of which 24 occurred in the month of February.

The death-rate is 4·55 per 1,000 of the Total Civil Population and is considerably above that of last year and also of the last quinquennial period.

RESPIRATORY DISEASES.

Year.	Total number of deaths.	Death-rate per 1000 Total Civil Population.
1896	74	3·82
1897	103	5·39
1898	65	3·40
1899	73	3·81
1900	87	4·55
1891-1895	369	average 3·86
1896-1900	402	" 4·19
1891-1900	—	" 4·03

Unfortunately we are not able to compare the mortality with that of the previous decennial period, as prior to 1897 cases of phthisis were also included amongst respiratory diseases. In the above table those have been deducted as they are more correctly included among tubercular diseases.

SANITARY CONDITIONS.

The general sanitary condition of Gibraltar may be considered as very satisfactory.

During the last decade the sanitary works of more or less magnitude and importance executed by the Commissioners have been as follows :—

Sanitary water supply. The erection on the North Front of triple expansion Worthington engines of sufficient power to pump 200,000,000 gallons of water per annum 270 feet in height; also two Babcock and Wilcox water tube boilers. This pumping plant, after the lapse of nearly ten years, is in all respects quite up to date, and as far as general condition is concerned is as good as when first erected; in some respects indeed it is in a superior condition. For fuel the total cost of pumping per thousand gallons to a height of 270 feet, and to an average horizontal distance of 2,200 yards, has gradually been reduced to less than $2\frac{2}{10}d$.

New rising and distributing mains have been substituted for old mains in various parts of the Colony.

The supply of water for flushing, cleansing, and other purposes is maintained in a most satisfactory condition.

Fresh water supply. The areas for collecting rain water have been considerably increased in extent, and additional Reservoirs capable of containing 5,200,000 gallons have been constructed in the heart of the Rock in such a manner as to render them bomb proof, to keep the water in them free from the danger of pollution, and being stored as nature stores her water, to eliminate the possibility of its deteriorating through being kept therein from year to year.

The water before being delivered to the public is submitted to a sedimenting process, is then thoroughly filtered through "polarite" filters, and is then aërated; in this manner all the advantages of the purity, &c., of rain water are secured without the disadvantage of its objectionable taste.

The water supplied by the Commissioners is now in all respects a first class water for dietetic purposes. This has been attained by the closest attention to every detail in connection with its collection, storage, and supply, for whereas a few years ago it was a matter of frequent occurrence for hundreds of thousands of gallons to be thrown away as having been analytically demonstrated to be impure it is now no longer necessary to waste even the smallest quantity.

If the water were laid on to every house in the Colony in pipes, the Gibraltar water supply would be second to none. It is sincerely to be hoped that the present wretched system of delivering water to houses in more or less impure kegs, will, before many years have elapsed, be known only as one of the dirty systems of the remote past.

Sewerage. The Sewerage of the Colony is now discharged into a deep swiftly flowing current at the point most remote from the Garrison and Town. The sewers are flushed adequately and with great frequency. Unfortunately the system of ventilation of the sewers remains as it was ten years ago. It is a system which in England gives good results, but in this climate it has been proved during the last thirty years to be utterly unsuitable. During the hot months complaints of stenches are of daily occurrence and, although pallia-

tive measures (representing a very considerable annual outlay) are adopted, in the shape of extensive disinfection and deodorization, it is quite impossible to produce a result which is even remotely satisfactory, when the fundamental principle is wrong and based on an erroneous assumption.

Refuse, removal and destruction. The refuse, which ten years ago was cast into the sea in positions where a large proportion would be drifted by the currents back on to the beaches, is now burnt in a Refuse Destructor. It is understood that during the present year an appliance is to be erected which will prevent the continuance of the annoyance occasioned, during certain winds, by the smoke emitted by the chimney from the smouldering mass.

Roads and Streets. The Roads and Streets of the Colony have been constructed of three different materials, viz.:—

(1) Limestone Macadam.
(2) Wood.
(3) Concrete.

Macadam. Macadam Roads had been constructed throughout the Colony, but for various reasons were replaced by wood and concrete in the principal thoroughfares of the business portion of the City. The Macadam roads still existing, such as are vested in the Commissioners, are good, and maintained in satisfactory condition; but on steep gradients they are at times found to be slippery; this is a condition said to be inseparable from the limestone used in their construction when watered by sea-water. Nevertheless from a sanitary point of view the roads constructed in this manner, when satisfactorily cleansed and maintained, are far superior to other formations of a more expensive character.

Wood. The wood pavements have proved to be quite unsuitable in this climate; they absorb the urine, &c., from animals, and in consequence throw off in hot weather a most disagreeable smell, and the dust from them is most injurious. They appear not to be durable and are said to be twelve times as costly in construction as other forms which are more suitable.

Concrete. The Concrete Roads are rough, noisy and expensive. It would appear that the Commissioners do not contemplate repeating the experiment of covering the surface of their streets with this material.

During the last few months a new form of pavement has been introduced into the Colony known as "Tar Macadam." This is noiseless, impervious, free from dust in summer and mud in winter, is easily cleaned, and forms a really effective sanitary paving. It is understood that the Commissioners are trying it as an experiment in this climate, as it cannot be positively stated what effect the sun may have upon it in the hot months. If it stands the test of the summer satisfactorily its advantages are so great that it is to be hoped it will be used to replace the insanitary wood pavements with as little delay as financial considerations will permit.

Habitations. Great improvements have been carried out during the last decade in the construction and alterations of houses.

Overcrowding is being gradually abated, though the specific density of the population still remains very high.

Infectious diseases. The notification of Infectious diseases has been prompt and satisfactory.

During the outbreak of Small Pox in the early part of the year the accommodation at the Isolation Hospital proved quite inadequate. Marquees had to be used, and owing to their faulty erection, &c., much dissatisfaction and discomfort were caused. The accommodation there requires to be considerably increased, and huts capable of being erected in a short time should be kept in hand. There should also be a more suitable arrangement of the wards. If good and suitable accommodation were provided there would not, I am convinced, be so many objections to the removal of infectious cases from their homes.

Greater powers are also required in ordering the removal of infectious cases, especially when they occur in tenements which have been sublet. The necessity for the removal of a case should depend on the accommodation of the house and the means of efficient isolation, having regard to the danger to the other occupants, and not as at present on the amount of rent paid.

Disinfection of clothing and bedding is carried out at the Colonial and Isolation Hospitals. This has not been done to the entire satisfaction of the public and great hardship and discomforts have been experienced by the detention of articles owing to the apparatus not being kept constantly at work, and it is strongly recommended as a solution of this difficulty, that a disinfecting apparatus be obtained and kept under the control of the Sanitary Commissioners.

The disinfection of rooms by means of Formaldehyde gas and the use of an Equifex Sprayer has been found to work satisfactorily; much less discomfort being occasioned than by the older methods.

Vaccination. This has been satisfactorily carried out and owing to the outbreak of small pox a large number of persons submitted to the operation of re-vaccination, but I regret that arm-to-arm vaccination is still very largely practised. This should not be and the use of glycerinated calf lymph alone should be made compulsory.

Milk Supply. The improvement in the supply of milk sold by street vendors since the additional bye-laws were introduced last year has been considerable as is illustrated in the following table :—

SAMPLES OF MILK ANALYSED.

Year.	No. of samples analyzed.	No. of samples adulterated.	Percentage of adulterated samples.
1896	171	11	6·4 °/o
1897	61	17	27·8 "
1898	173	25	14·4 "
1899	187	28	14·9 "
1900	182	9	4·9 "

The owners of Milk Shops should be licensed in the same way as the street vendors. At present it is only necessary to obtain a certificate of fitness of the premises as a place in which to sell milk and so there is very little hold on the actual owner of the Milk Shop. This should be altered and every possible precaution taken to ensure the milk being sold good and pure in the shops. Sterilized milk is now obtainable in the town and is eagerly sought after. The sanitary condition of Milk Shops, Goat Sheds and Dairies has been satisfactory.

Other food supplies. Systematic inspection of Bakeries, &c., are made. The practice of kneading the dough by mule or horse-power is still in vogue, and undoubtedly is one of the worst features here in connection with the Bakeries. Gas engines or other motive power should be adopted instead.

The Amendment of the Law regarding unsound food, recommended in 1897, was introduced early this year and has been followed by good results, many merchants having requested the destruction of unsound foodstuffs without recourse being had to legal proceedings, but there is no doubt that there is a considerable amount of adulterated foodstuffs sold here (for example, oils, sugar, bread, wines, &c.) which can only be prevented by the adoption of an efficient "Food and Drugs Act."

Chemical and Bacteriological Laboratories. A considerable amount of work has been carried out in these Laboratories during the year and has fully justified the extension of the Chemical Laboratory which is now capable of dealing with any work that may be considered advisable or desirable from a health point of view. A detailed statement of the various examinations is given in Table VI.

H. P. ELKINGTON,

Major, R.A.M.C.,

Health Officer.

APPENDIX

TO THE

ANNUAL REPORT ON THE PUBLIC HEALTH

OF

GIBRALTAR,

FOR THE YEAR

1900.

Deaths registered in Gibraltar during 1900, amongst the Civil Population, showing diseases causing death and ages at death.

CAUSE OF DEATH.	At all ages.	Under 1 year of age.	1 year.	2 years.	3 years.	4 years.	Total under 5 years.	OTHER AGE-GROUPS. 5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
General Diseases	183	52	8	2	3	3	68	1	1	7	4	12	10	13	15	14	38
Local Diseases	263	28	22	10	8	2	70	6	7	6	3	16	19	24	30	44	38
Poisons (none)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Injuries	9	—	—	—	—	—	—	—	—	2	—	1	1	2	1	2	—
Grand Total	455	80	30	12	11	5	138	7	8	15	7	29	30	39	46	60	76
GENERAL DISEASES.																	
Small Pox	5	—	—	—	—	—	—	—	—	1	—	2	—	—	1	1	—
Measles	4	1	2	—	1	—	4	—	—	—	—	—	—	—	—	—	—
Whooping Cough	3	2	1	—	—	—	3	—	—	—	—	—	—	—	—	—	—
Diphtheria	3	—	1	1	—	1	3	—	—	—	—	—	—	—	—	—	—
Simple Continued Fever	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—
Enteric Fever	7	—	—	—	—	—	—	—	—	3	3	1	—	—	—	—	—
Diarrhœa	27	20	3	1	1	—	25	1	—	—	—	—	—	—	—	1	—
Erysipelas	2	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—
Septicæmia	4	—	—	—	—	—	—	—	—	—	—	1	1	1	—	—	1
Tubercle	6	1	1	—	—	—	2	—	1	—	—	—	—	1	2	—	—
" of Brain	3	1	—	—	1	1	3	—	—	—	—	—	—	—	—	—	—
" of Lung	24	—	—	—	—	—	—	—	—	3	1	7	5	4	4	—	—
Syphilis	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—
Congenital Syphilis	1	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—
Alcoholism	2	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—
Malignant New-growth	21	—	—	—	—	—	—	—	—	—	—	1	3	3	4	6	4
Rickets	1	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—
Diabetes	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2
Immaturity at Birth	24	24	—	—	—	—	24	—	—	—	—	—	—	—	—	—	—
Debility	1	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—
Old Age	37	—	—	—	—	—	—	—	—	—	—	—	—	—	1	5	31
Natural causes	3	1	—	—	—	—	1	—	—	—	—	—	1	1	—	—	—
Total	183	52	8	2	3	3	68	1	1	7	4	12	10	13	15	14	38
LOCAL DISEASES.																	
NERVOUS SYSTEM.																	
Neuritis	1	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
Inflammation of Brain	6	1	—	—	—	—	1	2	1	—	—	2	—	—	—	—	—
Sclerosis	2	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—
Apoplexy	20	—	—	—	—	—	—	—	—	—	—	2	1	4	2	6	5
Paralysis	7	—	—	—	—	—	—	—	—	—	—	—	—	2	—	3	2
Eclampsia	9	3	5	1	—	—	9	—	—	—	—	—	—	—	—	—	—
Carried forward	45	4	5	1	—	—	10	2	1	—	—	5	1	6	4	9	7

TABLE I.—*Continued.*

CAUSE OF DEATH.	At all ages.	Under 1 year of age.	1 year.	2 years.	3 years.	4 years.	Total under 5 years.	OTHER AGE-GROUPS. 5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
Brought forward	45	4	5	1	—	—	10	2	1	—	—	5	1	6	4	9	7
CIRCULATORY SYSTEM.																	
Heart disease (not specified)	45	—	—	—	—	—	—	—	2	2	1	2	2	4	10	12	10
Endocarditis	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Valvular disease of heart	24	—	—	1	—	—	1	—	—	1	—	—	1	4	3	5	9
Fatty degeneration of heart	2	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—
Hypertrophy of heart	2	—	—	—	—	—	—	—	1	—	—	1	—	—	—	—	—
Aneurysm	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—
RESPIRATORY SYSTEM.																	
Bronchitis	28	6	2	1	3	—	12	—	—	—	—	—	1	2	5	2	6
Asthma	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—
Congestion of Lungs	3	—	—	—	1	—	1	—	1	—	—	—	—	—	1	—	—
Pneumonia	33	6	4	2	1	2	15	3	2	—	—	1	2	1	1	5	3
Broncho-Pneumonia	22	11	2	1	3	—	17	—	—	—	—	1	—	2	1	1	—
Phthisis	17	—	—	—	—	—	—	—	—	2	2	4	3	2	2	2	—
DIGESTIVE SYSTEM.																	
Disorders of Dentition	13	1	9	3	—	—	13	—	—	—	—	—	—	—	—	—	—
Strangulated Hernia	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
Obstruction of Intestines	1	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
Inflammation of Liver	6	—	—	—	—	—	—	—	—	—	—	—	3	1	1	1	—
Peritonitis	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—
URINARY SYSTEM.																	
Acute Nephritis	7	—	—	1	—	—	1	1	—	1	—	—	2	—	—	1	1
Bright's Disease	4	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2	1
GENERATIVE SYSTEM.																	
Abortion	1	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
Ante Partum Hæmorrage	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—
Post Partum "	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—
ORGANS OF LOCOMOTION.																	
Gangrene	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—
Cellulitis	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—
	263	28	22	10	8	2	70	6	7	6	3	16	19	24	30	44	38
INJURIES.																	
Wound of Abdomen	1	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
Drowning	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—
Accident	6	—	—	—	—	—	—	—	—	1	—	—	1	2	—	2	—
Suicide	1	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
	9	—	—	—	—	—	—	—	—	2	—	1	1	2	1	2	—

TABLE II.

Sex Mortality amongst the Civil Population, 1900, distributed according to Months and Age-groups.

Months.	Deaths at all ages. Males.	Deaths at all ages. Females.	Deaths amongst Males according to Age-groups. Under 5 yrs.	5·10	10·15	15·20	20·25	25·35	35·45	45·55	55·65	65·75	75 and upwards.	Deaths amongst Females according to Age-groups. Under 5 yrs.	5·10	10·15	15·20	20·25	25·35	35·45	45·55	55·65	65·75	75 and upwards.
January	20	21	4	...	...	1	2	4	4	...	1	1	3	5	1	...	1	...	2	1	2	1	1	7
February	36	19	13	1	1	1	...	1	2	5	4	5	3	9	1	1	...	...	...	...	1	3	1	3
March	40	23	11	1	2	...	1	3	2	2	6	7	5	7	...	...	...	...	1	...	1	7	1	6
April	21	16	3	...	...	...	...	4	3	2	2	4	3	3	...	...	1	...	...	2	...	2	4	4
May	13	17	3	...	...	...	...	2	1	3	...	2	2	7	...	...	1	...	3	...	2	1	1	2
June	12	13	5	...	...	1	...	...	2	...	...	4	...	7	...	...	1	...	...	2	1	1	...	1
July	14	25	3	...	...	1	1	2	...	3	...	2	2	10	...	...	...	...	...	...	2	2	5	6
August	18	22	6	...	...	1	1	2	1	4	1	1	1	7	...	...	2	...	2	2	1	1	1	6
September	9	14	6	...	...	...	...	...	...	1	2	...	...	2	...	1	...	...	...	2	...	1	6	2
October	20	18	8	...	...	1	1	...	3	1	3	2	1	5	1	1	1	...	1	...	1	1	2	5
November	24	11	8	...	1	2	...	1	1	4	2	2	3	2	2	...	...	...	...	...	...	1	3	3
December	11	18	2	...	...	...	...	...	1	1	4	1	2	2	...	1	...	1	1	1	2	...	4	6
Total deaths ...	238	217	72	2	4	8	6	19	20	26	25	31	25	66	5	4	7	1	10	10	13	21	29	51
Annual death rate per 1000 at each age ...	27·41	20·82	81·44	4·39	4·51	8·70	6·82	13·04	16·75	31·28	30·70	135·39	312·50	68·89	5·74	4·34	5·98	·88	5·79	7·89	13·00	28·64	72·50	289·77

TABLE III.

Monthly distribution of Births, Deaths, and Principal Diseases causing death, amongst the Civil Population of Gibraltar during 1900.

Months.	Meteorology. Rainfall in inches.	Mean relative humidity.	Mean temperature in shade (Fahrenheit).	Total Births (Fixed Civil Population).	Deaths from all causes. Total Civil Population.	Fixed Civil Population.	Monthly death-rates per 1000 living. Total Civil Population.	Fixed Civil Population.	Quarterly death-rates per 1000 living. Total Civil Population.	Fixed Civil Population.	Principal zymotic diseases. Total deaths.	Quarterly death-rate per 1000 living.	Deaths from principal zymotic diseases. Small Pox.	Measles.	Diphtheria.	Enteric Fever.	Whooping Cough.	Simple continued Fever.	Erysipelas.	Septicaemia.	Diarrhoea.	Tubercular diseases. Total deaths.	Quarterly death rate per 1000 living.	Respiratory diseases. Total deaths.	Quarterly death rate per 1000 living.
January ...	2·84	73	55·6	57	41	41	25·75	29·10			4		—	—	—	2	—	—	—	1	1	5		8	
February ...	6·14	75	58·4	31	55	55	34·55	39·03	33·29	37·14	4	2·72	1	1	—	—	—	1	—	1	—	2	2·51	24	10·26
March ...	8·88	71	56·1	41	63	61	39·58	43·29			5		2	2	—	—	—	—	—	1	—	5		17	
April ...	0·63	66	61·4	44	37	34	23·24	24·13			3		1	1	1	—	—	—	—	—	—	4		7	
May ...	4·39	66	64·1	35	30	29	18·84	20·58	19·26	20·81	4	2·51	—	—	—	—	—	—	1	—	3	6	2·51	3	2·93
June ...	0·05	58	71·9	34	25	25	15·70	17·74			5		—	—	—	—	—	—	—	—	5	2		4	
July ...	—	62	74·5	38	39	36	24·50	25·55			6		1	—	1	1	—	—	—	—	3	4		2	
August ...	0·37	63	74·4	44	40	38	25·13	26·97	21·36	22·47	8	3·35	—	—	1	2	1	—	—	—	4	7	2·93	3	1·23
September ...	4·71	72	70·8	55	23	21	14·45	14·90			2		—	—	—	—	1	—	—	—	1	3		1	
October ...	3·83	74	67·9	43	38	34	23·87	24·13			6		—	—	—	2	—	—	—	—	4	5		4	
November...	1·80	73	58·3	38	35	35	21·98	24·84	21·35	23·18	5	2·72	—	—	—	—	1	—	—	—	4	5	2·51	5	3·76
December...	0·37	75	58·1	47	29	29	18·21	20·58			2		—	—	—	—	—	—	1	1	—	2		9	
Whole year.	34·01	69	64·3	507	455	438	23·81	25·90	23·81	25·90	54	2·82	5	4	3	7	3	1	2	4	25	50	2·61	87	4·55

TABLE IV.

Infectious and Contagious Diseases notified during 1900, under provisions of Section 10, "Medical Ordinance, Gibraltar, 1885."

Months.	Cases occurring amongst the Civil Population.																								Cases landed from the Bay or brought sick into town for treatment.							
	Small Pox.		Chicken Pox.		Measles.		Scarlet fever.		Influenza.		Whooping Cough.		Diphtheria.		Simple continued fever.		Enteric fever.		Mediterranean fever.		Erysipelas.		Septicæmia		Small Pox.		Measles.		Diphtheria.		Enteric fever.	
	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.
January	2	—	—	—	14	—	—	—	6	—	—	—	4	—	—	—	5	2	1	—	—	—	—	*1	1	1	—	—	4	1	—	—
February	13	1	—	—	31	1	1	—	—	—	—	—	1	—	1	1	4	—	1	—	—	—	—	*1	1	—	—	—	—	—	—	—
March	43	2	5	—	42	2	3	—	—	—	—	—	—	—	—	—	4	—	—	—	—	—	—	*1	1	—	—	—	—	—	—	—
April	17	1	8	—	25	1	—	—	—	—	—	—	1	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—
May	3	—	6	—	13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	4	—	—	—	—	—
June	2	—	2	—	11	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
July	3	1	—	—	2	—	—	—	—	—	—	—	1	1	—	—	3	1	—	—	—	—	—	—	—	—	—	—	—	—	2	—
August	2	—	2	—	2	—	—	—	—	—	7	1	1	1	—	—	1	2	—	—	—	—	—	—	1	—	—	—	—	—	—	—
September	—	—	—	—	—	—	—	—	—	—	—	*1	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—	—	—	—	—
October	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1	2	—	—	1	—	1	—	1	—	—	—	—	—	—	—
November	2	—	—	—	—	—	—	—	—	—	—	*1	—	—	1	—	1	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
December	7	—	—	—	2	—	—	—	—	—	4	—	—	—	—	—	1	—	—	—	1	1	1	1	1	—	—	—	—	—	—	—
Total	94	5	23	—	142	4	4	—	6	—	11	3	8	3	3	1	20	7	2	—	4	2	3	4	8	1	4	—	4	1	2	—

*Not notified.

TABLE V.

Statement of the chief sanitary defects dealt with amongst the civil habitations in Gibraltar during 1900.

Description of Defect.	Number of Houses in which defect was noted
A.—WATER SUPPLY.	
1. Collecting area polluted	8
2. Mouth or inlet of tank exposed to pollution	9
3. Water in tank impure	4
4. Insufficient supply of water for flushing, &c.	9
B.—SEWERAGE.	
5. Insufficient W.C. accommodation	1
6. Insufficient means of flushing	1
7. Situation of W.C. insanitary	3
8. Soil pipes leaking	8
9. Soil pipes embedded in the walls	10
10. Soil pipes unventilated	4
11. Soil pipes improperly ventilated	18
12. Fitting, &c., insanitary	15
13. House drains defective	24
14. House drains connected with adjoining houses	3
15. Wash house troughs connected with drains	2
16. Ventilation of W.Cs. insufficient	19
C.—KITCHENS.	
17. Sinks untrapped	5
18. Sinks directly connected with sewer...	5
19. Without flues	4
20. Accommodation deficient	6
D.—LIVING ROOMS.	
21. Dirty...	2
22. Damp	8
23. Overcrowded	15
24. Badly lighted and ventilated	20
25. Roofs leaking	13
26. Drains under floor	1
E.—YARDS.	
27. Badly paved	5
28. Blocked with stores and refuse...	8
29. Surface drain traps defective	9
30. Fouled by animals	5
F.—PREMISES GENERALLY.	
31. In bad repair	6
32. Deficient of refuse receptacles	15
33. Wash-house accommodation deficient	2
34. Stores, shops, kitchens and wash-houses used as living rooms and being unfit for the purpose	7
Total	274

TABLE VI.

Statement of Chemical and Bacteriological Examinations.

Nature of Examination.	No. of Samples.	Result.	
A—CHEMICAL ANALYSES.			
Water from underground Tanks ...	32	Pure	21
		Polluted by collecting area	10
		Do. sewerage	1
Well Waters	15	Polluted	9
PUBLIC WATER SUPPLY.			
Well at Catalan Bay	12	Of good quality.	
Moorish Castle Water. Governor's Parade	12	Do.	
Moorish Castle Water. Main Tank	1	Do.	
Moorish Castle Water. No. 4 Tank	1	Contaminated	
Samples of Milk	182	Pure	173
		Adulterated 10 to 20 o/o ...	5
		Adulterated 20 to 30 o/o ...	2
		Adulterated 30 to 40 o/o ...	1
		Adulterated 40 to 50 o/o ...	1
Wines and Spirits	23		
Miscellaneous	67		
Total	345		

B—BACTERIOLOGICAL EXAMINATIONS.

Serum Diagnoses	65	Reacted with M. Melitensis... ...	13
		Do. B. Typhosus	23
		No reaction with either	29
Sputum	56	Tubercle B. found in	22
Swabs from throat	9	Diphtheria B. found in	6
Various	5		
Total	135		

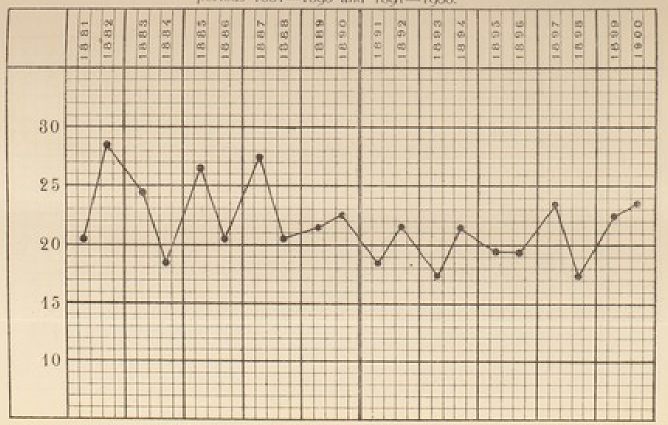
TABLE VII.

Important improvements and Legislative Measures introduced during the last ten years.

Year.	Nature.
1892	Notification of Infectious diseases in accordance with Public Health Act, London, 1891.
	Erection of Destructor at North Front.
	Erection of Pumping Engines at North Front.
1893	Segregation Block, Colonial Hospital, closed for Small Pox cases.
	New Bye-Laws *re* Water, Milk Supply and Buildings.
1895	House-to-House Inspection commenced under the new Laws.
	Amendment Ordinance prohibiting school attendance of infected children.
	Milk Shops brought under control of Bye-Laws (certificates of fitness).
1896	New Main Sewer commenced.
1897	Bacteriological Laboratory improved.
	Supply of Antitoxim for Diphtheria obtained.
1898	Construction of new Reservoirs begun.
	Completion of New Main Sewer.
	Grant from Army and Navy to Bacteriological Laboratory.
1899	Formalin for disinfection introduced.
	Additional Bye-Laws for street milk vendors.
1900	Amendment of Law *re* unsound food.
	Completion of the Reservoirs.!
	Enlargement of Chemical Laboratory.

Chart No. I.

General Death Rate per 1000 of Total Civil Population, Gibraltar, for the Decennial periods 1881—1890 and 1891—1900.

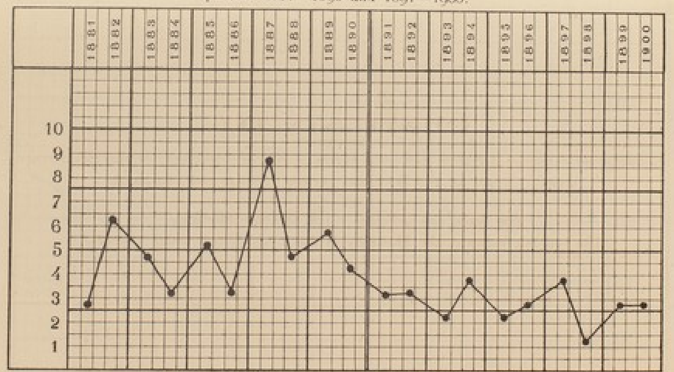


AVERAGE

1881 — 1885 = 23.68	1891 — 1895 = 19.97
1886 — 1890 = 22.44	1896 — 1900 = 21.34
1881 — 1890 = 23.06	1891 — 1900 = 20.65

Chart No. II.

Zymotic Mortality per 1000 of Total Civil population, Gibraltar, for the Decennial periods 1881—1890 and 1891—1900.



AVERAGE	1881 — 1885 = 4.50	1891 — 1895 = 2.89
	1886 — 1890 = 5.36	1896 — 1900 = 2.70
	1881 — 1890 = 4.93	1891 — 1900 = 2.79.

Chart No. III.

Showing the Infantile Mortality (per 1000 Births). And the Mortality of the Age-Group under 5 years for the Decennial periods 1881-90 and 1891-1900.

The black line indicates "The Infantile Mortality."

The red line indicates the Mortality of the "Age-Group under 5 years."

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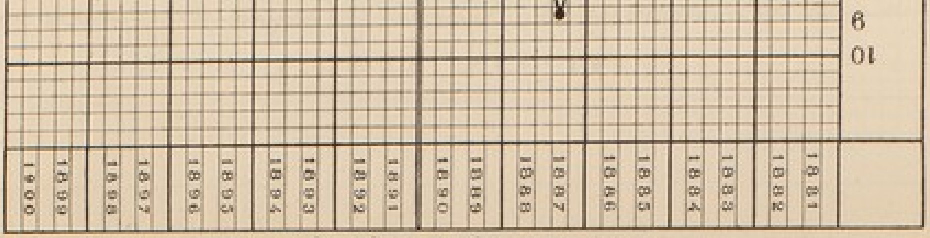
Zymotic Mortality per 1000 of Total Civil population, Gibraltar, for the Decennial periods 1881—1890 and 1891—1900.



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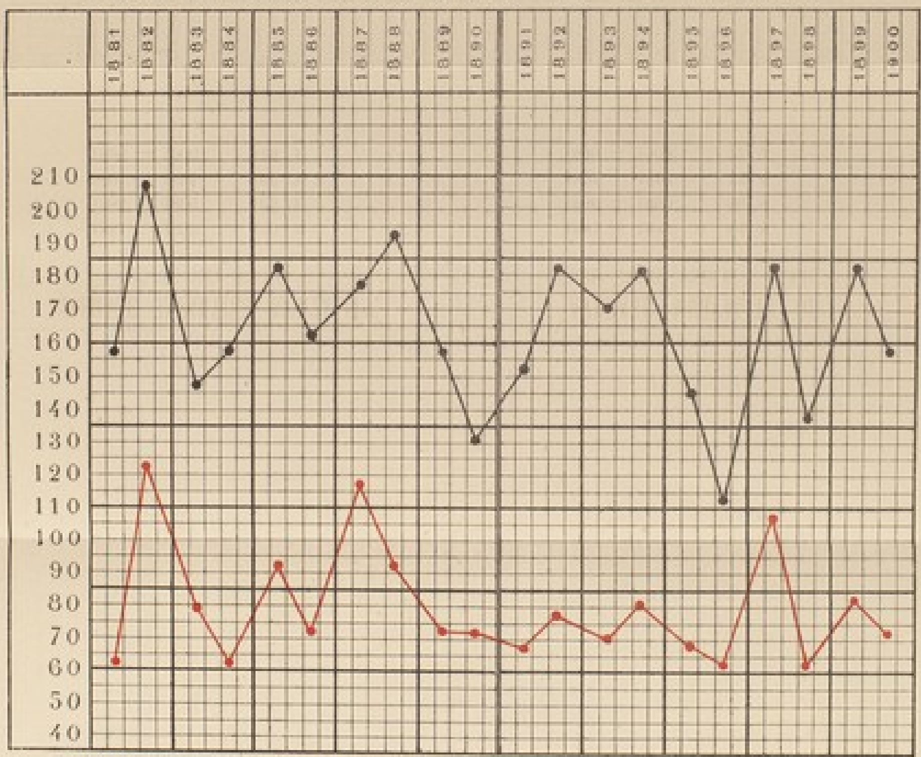

AVERAGE INFANTILE MORTALITY. "PER 1000 BIRTHS."	AVERAGE MORTALITY OF "AGE GROUP UNDER 5 YEARS."
1881 — 1885 — 170.3.	1881 — 1885 — 84.8
1886 — 1890 — 165.4.	1886 — 1890 — 86.8
1891 — 1895 — 166.3.	1891 — 1895 — 73.6
1896 — 1900 — 156.1	1896 — 1900 — 77.3
1881 — 1890 — 167.4	1881 — 1890 — 85.8
1891 — 1900 — 161.2	1891 — 1900 — 75.6

ANNUAL REPORT

ON THE

PUBLIC HEALTH

OF

GIBRALTAR,

FOR THE YEAR

1902,

BY

H. P. ELKINGTON, M.R.C.S., D.P.H., &c.,
MEMBER OF THE SANITARY INSTITUTE,
Major, Royal Army Medical Corps,
MEDICAL OFFICER OF HEALTH.

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ON THE

HEALTH OF THE CIVIL POPULATION OF GIBRALTAR

FOR THE YEAR 1902.

VITAL STATISTICS.

Population. The Civil Population of Gibraltar as ascertained by the Census taken in March, 1901, consisted of 20,355 persons, divided into a Fixed Population of 17,373 and 2,982 Resident Aliens.

Births. The number of births during the year among the Fixed Civil Population amounted to 505, of which 246 were Males and 259 Females. This is equivalent to a birth-rate of 29·06 per 1,000 of the Fixed Population, somewhat smaller than the rate in 1901 and also below the average of the last decennial period which was 30·29 per 1,000.

Deaths. There were 474 deaths recorded during the year, 461 in the Fixed Civil Population and 13 among the Resident Aliens. The death-rates were 23·20 per 1,000 Total Population and 26·53 per 1,000 Fixed Civil. These rates are higher than those of 1901 and also above the average of the last decennial period, which were 20·65 and 22·54 per 1,000 respectively. The increase is accounted for by the high rate of mortality which marked the First Quarter of the year.

Quarterly Mortality. The Quarterly and Monthly Mortality is given in Table 3, from which it will be seen that the rate in the First Quarter was very high, 35·37 per 1,000 Total Civil Population, the highest rate recorded here for many years. The Third Quarter was the healthiest, the rate of Mortality being 16·73 per 1,000 Total Civil Population.

Monthly Mortality. The months of February and March show the largest number of deaths, 68 being recorded in February and 75 in March. In February 17 deaths were due to Zymotic Diseases and 18 to Respiratory affections, 37 deaths occurring among children under 5 years of age. In March Zymotic Diseases accounted for 25 deaths and Respiratory affections 12, there being 41 deaths among children under five years of age.

These two months were extremely trying to the old and very young owing to the unfavourable climatic conditions. The smallest number of deaths occurred in July.

Infantile Mortality. There were 91 deaths of children under 1 year of age, which is equivalent to a Mortality of 180·19 per 1,000 births, this is very high and considerably above the average and is accounted for by the epidemic of Measles in February and March and accompanying Respiratory affections.

Age group under five years. In this age group there were 180 deaths, equivalent to a death-rate of 93·50 per 1,000. Of these deaths 97 occurred among Male children and 83 among Female.

Other age groups. The Mortality in the other age groups arranged accorded to sex is given in Table 2, but does not call for any special notice.

Sex Mortality. The number of deaths of Males was 236 and of Females 238, the Mortality-rates being 25·09 and 21·73 per 1,000 respectively.

DISEASES CAUSING MORTALITY.

The general health of the Population was good, but the epidemic of Measles and the prevalence of diseases of the Respiratory organs were responsible for the large number of deaths during the First Quarter of the year, specially in the age groups under 5 and over 45 years.

The diseases causing death are classified in Table 1.

Zymotic Mortality. There were 95 deaths attributable to Zymotic Diseases and 43 occurred during the First Quarter. The Zymotic Mortality was 4·66 per 1,000 Total Population, a rate considerably in excess of that of recent years, but it must be borne in mind that over one half of these deaths were due to "Measles," a disease in which it is almost impossible to get the parents to exercise sufficient care with their children in the early stages and in which medical aid is often not called for until complications have supervened.

The various Zymotic Diseases notified during the year are given in Table 4 and in this Table are also given the cases landed from Ships in the Bay or brought into the Town for treatment.

Small Pox. Eleven cases occurred during the year, but none proved fatal. In nearly all the cases a history of having been in Linea or adjacent parts within the period of incubation was obtained and this, as in former years, is undoubtedly the place where the disease is contracted.

Chicken Pox. There were 45 cases notified, the majority of which occurred during the first four months of the year. They were all of a mild nature.

Measles. Measles was epidemic during the early portion of the year reaching its height in March, when 251 cases with 22 deaths were recorded, and declining in May. Altogether 576 cases were notified and 49 deaths, but it is doubtful if these represent the actual total number of cases and deaths, as the large number of fatal cases of affections of the Respiratory organs which occurred among children in the months of February and March were in all probability, in many cases, really the sequelæ of "Measles" apparently mild or un-recognized.

Diphtheria. Seventeen cases occurred and 9 proved fatal. This number is above that of the last two years. It was not possible to trace definitely the origin of any of the cases.

Enteric Fever. There were ten cases reported and one proved fatal. They were all from different portions of the Town and as far as could be ascertained had no connection with each other. The cause of these isolated cases is very difficult to ascertain.

Other infectious diseases. These are given in Table 4 in which is also shown the number of cases landed from the Bay.

Two cases of Septicæmia occurred after Parturition, and my experience here leads me to suggest that the Authorities should be approached with a view to some legislation regarding "Midwives." The other diseases notified call for no special remarks.

Diarrhœa. This disease caused 33 deaths of which 25 were in infants under one year of age. The diagnosis in these cases is very unsatisfactory and renders our statistics somewhat misleading as many of the cases are undoubtedly due to errors in feeding or other causes and not to Diarrhœa proper (or epidemic Diarrhœa of children) as indicated by the Nomenclature of Diseases. More care should be taken in the transmission of the Death Certificates and the terms Gastro-enteritis and Diarrhœa should not be used as freely as at present without further explanations.

Tubercular Diseases. There were 55 deaths from Tubercular Diseases, equivalent to a death-rate of 2·70 per 1,000 Total Population. This rate is about the average and shows no improvement. The establishment of a Sanatorium is essential before any reduction in this Mortality can be expected.

The Mortality was heaviest in the First Quarter. Tubercle of Lung and Phthisis accounted for 45 of the deaths.

Respiratory Diseases. Diseases of the Respiratory organs caused 72 deaths, a death-rate of 3·53 per 1,000 Total Population. The Mortality was highest in the First Quarter. 39 deaths occurred in children under five years of age.

SANITARY CONDITIONS.

The general sanitary condition of Gibraltar is satisfactorily maintained and improvements are being gradually made in the conditions of Streets and Ramps in the upper portions of the Town which have always been the most difficult to deal with.

House-to-House Inspections still continue. Overcrowding remains about the same; if anything it is tending to increase in certain localities owing to rise in rents and consequent sub-letting of rooms originally intended to form part of separate flats. A special report on this subject has been submitted to the Authorities and steps are being taken towards preventing this practice, as if it continued it will be likely to affect the health of the Town prejudicially.

The new paving of the Main Street has proved of undoubted value from the "sanitary point of view," but unless special care is taken in flushing and scavenging it is apt to become very greasy and dangerously slippery.

Table 5 gives a list of sanitary defects found in different houses during the year.

Infectious Diseases. Cases of Infectious Diseases have been promptly notified and removed to Hospital or isolated in their own houses according to circumstances. The difficulty which the Sanitary Authorities experience in not being able to order removal of cases in houses where the rent exceeds 50 pesetas monthly has been alluded to in previous reports. This is a matter deserving special attention of the Authorities.

Disinfection of houses and of bedding and clothing has been satisfactorily carried out.

Vaccination. Arm-to-arm vaccination is still performed in a large number of cases. This should be prohibited and a supply of Glycerinated Calf Lymph should be obtained regularly for the use of the Public Vaccinators.

Mi k Supplies. Periodical inspections are made of Milk Shops, Dairies, Cow Sheds, and Goat Sheds, and samples are frequently taken both from the Shops and Street Vendors for analyses. During the year 296 samples were examined and only 5 were found adulterated with water. In several cases, however, the fat was found to have been abstracted in one instance over 20 %

The Milk Bye-Laws require strengthening to enable the Authorities to deal more effectively with such vendors of adulterated milk as avoid punishment or loss by keeping out of the Garrison for some time and sending in their milk by other men. The sale of skimmed milk unless clearly described as such should be punishable.

Other Food Supplies. Efficient supervision has been exercised over the various articles of food sold in the Town and frequent inspections are made of Bakeries and Shops where food is sold.

A Food and Drugs Act is needed. Owing to a severe outbreak of Foot and Mouth Disease in Morocco the Sanitary Commissioners detailed one of the Inspectors to go to Tangier in August to examine all Cattle prior to their embarkation. With the assistance of the Authorities there the system worked most satisfactorily and though the price of Meat was raised to a certain extent at no time was any scarcity experienced. The outbreak lasted from August to the middle of December.

Chemical and Bacteriological Laboratories. Mr. Abrines, the Analyst, reports that 438 Chemical Analyses were made, 81 being samples of Water from the Public Supplies and Private Tanks. In the Bacteriological Laboratory 64 specimens were examined for diagnosis in cases of Fever, Diphtheria, and Tubercle.

A list of the various examinations is given in Table 6.

H. P. ELKINGTON,
Major, R.A.M.C.,
Health Officer.

APPENDIX

TO THE

ANNUAL REPORT ON THE PUBLIC HEALTH

OF

GIBRALTAR,

FOR THE YEAR

1902.

TABLE I.

Deaths registered in Gibraltar during 1902, amongst the Civil Population, showing diseases causing death and ages at death.

CAUSE OF DEATH.	At all ages.	Under 1 year of age.	1 year.	2 years.	3 years.	4 years.	Total under 5 years.	OTHER AGE-GROUPS. 5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
General Diseases	240	58	31	16	8	2	115	7	2	4	6	11	11	9	13	20	42
Local Diseases	228	33	18	8	4	2	65	7	3	4	7	24	21	23	28	27	19
Poisons	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Injuries	6	—	—	—	—	—	—	—	—	—	—	1	1	2	—	1	1
Grand Total	474	91	49	24	12	4	180	14	5	8	13	36	33	34	41	48	62
General Diseases.																	
Measles	49	8	20	12	6	—	46	3	—	—	—	—	—	—	—	—	—
Mumps	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—
Diphtheria	9	2	3	2	2	—	9	—	—	—	—	—	—	—	—	—	—
Enteric Fever	1	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
Diarrhœa	36	25	5	2	—	1	33	1	—	—	—	—	—	—	2	—	—
Septicæmia	2	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—
Tubercle	3	—	—	—	—	—	—	—	—	—	—	2	—	1	—	—	—
" of Brain	7	—	2	—	—	1	3	3	1	—	—	—	—	—	—	—	—
" of Lung	30	—	—	—	—	—	—	—	1	3	5	7	8	3	3	—	—
Syphilis	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
Alcoholism	1	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
Malignant new-growth	16	—	—	—	—	—	—	—	—	—	1	—	1	2	7	4	1
Rickets	1	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—
Leucocythæmia	1	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—
Diabetes	4	—	—	—	—	—	—	—	—	—	—	—	—	1	1	2	—
Immaturity at Birth	18	18	—	—	—	—	18	—	—	—	—	—	—	—	—	—	—
Debility	4	3	—	—	—	—	3	—	—	—	—	—	—	—	—	1	—
Old Age	53	—	—	—	—	—	—	—	—	—	—	—	—	—	—	12	41
Natural causes	3	—	1	—	—	—	1	—	—	—	—	—	—	1	—	1	—
Total	240	58	31	16	8	2	115	7	2	4	6	11	11	9	13	20	42
Local Diseases.																	
Nervous System.																	
Inflammation of Brain	11	—	1	1	—	—	2	5	—	—	1	1	1	1	—	—	—
Congestion of Brain	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Apoplexy	8	—	—	—	—	—	—	—	—	—	1	2	—	1	1	2	1
Paralysis	11	5	2	1	1	1	10	—	—	—	—	1	—	—	—	—	—
Eclampsia	2	—	—	—	—	—	—	1	—	—	—	1	—	—	—	—	—
Epilepsy	10	—	—	—	—	—	—	—	—	—	—	1	1	—	3	5	—
Locomotor Ataxia	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—
Carried forward	44	5	3	2	1	1	12	6	—	—	2	6	2	2	5	7	2

TABLE I.—*Continued.*

CAUSE OF DEATH.	At all ages.	Under 1 year of age.	1 year.	2 years.	3 years.	4 years.	Total under 5 years.	OTHER AGE-GROUPS. 5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
Brought forward	44	5	3	2	1	1	12	6	—	—	2	6	2	2	5	7	2
Circulatory System.																	
Heart Disease	28	—	—	—	—	—	—	1	—	1	—	2	2	4	10	6	2
Endocarditis	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—
Valvular disease of Heart	29	—	—	—	—	—	—	—	—	1	2	4	2	7	3	2	8
Angina Pectoris	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—
Aneurysm	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
Respiratory System.																	
Bronchitis	16	8	6	—	—	1	15	—	—	—	—	—	—	—	—	—	1
Asthma	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—
Congestion of Lungs	1	—	—	1	—	—	1	—	—	—	—	—	—	—	—	—	—
Pneumonia	27	2	2	1	1	—	6	—	1	2	—	5	3	5	2	2	1
Broncho Pneumonia	18	6	5	4	2	—	17	—	—	—	—	1	—	—	—	—	—
Phthisis	15	—	—	—	—	—	—	—	1	—	2	1	3	2	3	1	2
Digestive System.																	
Disorders of Dentition	14	12	2	—	—	—	14	—	—	—	—	—	—	—	—	—	—
Ulcer of Stomach	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—
Inflammation of Intestines	2	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	—
Strangulated Hernia	2	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—
Obstruction of Intestines	2	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1	—
Inflammation of Liver	8	—	—	—	—	—	—	—	—	—	—	1	2	1	2	1	1
Peritonitis	4	—	—	—	—	—	—	—	—	—	1	1	1	1	—	—	—
Disease of Suprarenal Capsules	1	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
Urinary System.																	
Bright's Disease	8	—	—	—	—	—	—	—	—	—	—	1	1	1	1	3	1
Nephritis	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—
Lymphatic System.																	
Goitre	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—
Organs of Locomotion.																	
Caries of Spine	1	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—
Total	228	33	18	8	4	2	65	7	3	4	7	24	21	23	28	27	19
Injuries.																	
Rupture of Liver	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—
Drowning	2	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1
Accident	1	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
Suicide	2	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—
Total	6	—	—	—	—	—	—	—	—	—	—	1	1	2	—	1	1

TABLE II.

Sex Mortality amongst the Total Civil Population in Gibraltar during 1902, distributed according to Months and Age-groups.

Months.	Deaths at all ages.		Deaths amongst Males according to Age-groups.											Deaths amongst Females according to Age-groups.										
	Males.	Females.	Under 5 years.	5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.	Under 5 years.	5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75 and upwards.
January	13	24	1	—	1	1	—	1	3	1	1	2	2	2	—	1	2	1	3	3	1	2	2	7
February ..	42	26	22	1	—	—	2	2	1	6	1	3	4	15	1	—	—	—	—	1	1	3	1	4
March	34	41	18	1	—	—	1	3	3	1	1	3	3	23	3	—	—	2	2	—	1	—	6	4
April	21	19	9	—	1	—	—	1	3	1	5	—	1	9	—	—	1	—	1	—	2	2	2	2
May	26	25	13	1	—	—	—	1	—	5	5	1	—	11	—	—	—	—	3	4	—	2	1	4
June	14	15	7	1	—	—	—	—	3	1	—	—	2	3	—	—	1	1	1	2	1	1	2	3
July	7	13	1	2	—	—	—	1	—	—	2	1	—	3	—	—	—	—	1	2	—	1	3	3
August	25	13	8	2	—	—	—	4	3	1	2	3	2	1	—	1	1	1	1	1	2	1	1	3
September ...	12	16	6	—	—	—	1	1	—	1	—	2	1	2	—	1	—	—	3	—	—	3	2	5
October	18	20	8	1	—	1	1	1	2	3	1	—	—	2	—	—	1	1	2	—	2	—	5	7
November ...	8	14	3	1	—	—	1	—	1	1	—	1	—	7	—	—	—	1	1	—	1	1	2	1
December ...	16	12	1	—	—	—	—	2	1	1	6	2	3	5	—	—	—	—	1	—	1	1	3	1
Total Deaths ...	236	238	97	10	2	2	6	17	20	22	24	18	18	83	4	3	6	7	19	13	12	17	30	44
Annual death-rate per 1000 at each age.	25·09	21·73	100·83	11·06	2·42	2·14	5·80	10·10	15·51	23·99	44·52	76·92	216·86	86·18	4.47	3·36	5·22	5·23	9·96	9·32	10·49	24·85	77·29	204·65

TABLE III.

Monthly distribution of Births, Deaths, and Principal Diseases causing death, amongst the Civil Population of Gibraltar, during 1902.

Months.	Meteorology.				Deaths from all causes.		Monthly death-rates per 1000 living		Quarterly death-rates per 1000 living.		Principal zymotic diseases.		Deaths from principal zymotic diseases.						Tubercular diseases.		Respiratory diseases.	
	Rainfall in inches.	Mean relative humidity.	Mean Temperature in shade (Fahrenheit.)	Total Births (Fixed Civil Population).	Total Civil Population.	Fixed Civil Population.	Total Civil Population.	Fixed Civil Population	Total Civil Population.	Fixed Civil Population.	Total Deaths.	Quarterly death-rate per 1000 living.	Measles.	Mumps.	Diphtheria.	Enteric Fever.	Septicæmia.	Diarrhœa.	Total deaths.	Quarterly death-rate per 1000 living.	Total deaths.	Quarterly death rate per 1000 living.
January	·03	74	55·8	44	37	37	21·81	25·55			1		—	—	—	—	—	1	7		4	
February	10·54	77	55·9	43	68	66	40·08	45·58	35·37	40·06	17	8·45	11	—	1	—	—	5	4	3·53	18	8·64
March	4·61	70	57·8	54	75	71	44·21	49·04			25		22	—	1	—	—	2	7		22	
April	4·67	76	61·8	43	40	39	23·58	26·93			14		11	—	1	—	—	2	4		6	
May	2·10	64	63·2	36	51	49	30·06	33·84	23·58	26·93	14	6·09	4	—	3	—	1	6	7	2·95	10	4·12
June	·67	61	67·6	37	29	29	17·09	20·03			3		1	—	—	—	1	1	4		5	
July	·60	64	73·4	47	20	18	11·79	12·43			2		—	—	—	—	—	2	2		0	
August	·42	62	75·7	42	38	37	22·40	25·55	16·73	19·10	4	1·96	—	—	—	—	—	4	8	2·75	3	1·17
September	·98	69	70·5	33	28	28	16·01	19·34			4		—	—	—	—	—	4	4		3	
October	2·55	71	64·7	42	38	38	22·40	26·24			4		—	1	—	—	—	2	5		1	
November	7·85	80	59·8	37	22	22	12·96	15·19	17·12	20·02	5	2·16	—	—	2	1	—	3	0	1·57	0	·19
December	4·65	79	55·3	47	28	27	16·01	18·64			2		—	—	1	—	—	1	3		0	
Whole year	39·07	71	63·5	505	474	461	23·20	25·53	23·20	26·53	95	4·66	49	1	9	1	2	33	55	2·70	72	3·53

TABLE IV.

Infectious and Contagious Diseases notified during 1902, under provisions of Section 10, Medical Ordinance, Gibraltar, 1885."

Months.	Cases occurring amongst the Civil Population.																Cases landed from the Bay or brought sick into Town for treatment.											
	Small Pox.		Chicken Pox.		Measles.		Mumps.		Diphtheria.		Enteric Fever.		Septicæmia.		Fever.		Small Pox.		Measles.		Mumps.		Diphtheria.		Enteric Fever.		Erysipelas	
	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.	Reported.	Died.
January	1	—	5	—	29	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
February	1	—	9	—	156	11	—	—	2	1	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
March	2	—	11	—	251	22	—	—	4	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—
April	2	—	9	—	94	11	—	—	1	1	—	—	—	—	—	—	2	—	—	—	—	—	—	—	1	—	—	—
May	1	—	3	—	29	4	—	—	5	3	—	—	1	1	—	—	—	—	—	—	—	—	—	—	1	1	—	—
June	—	—	3	—	9	1	—	—	—	—	1	—	1	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—
July	—	—	—	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
August	3	—	—	—	3	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	—	—
September	—	—	—	—	—	—	—	—	—	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	—	—
October	1	—	2	—	—	—	—	1	2	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
November	—	—	2	—	1	—	—	—	2	2	3	—	—	—	1	—	3	—	—	—	—	—	1	1	—	—	1	—
December	—	—	1	—	1	—	—	—	1	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—
Total	11	—	45	—	576	49	—	1	17	9	10	1	2	2	1	—	6	—	1	—	1	—	1	1	8	5	1	—

TABLE V.

Statement of the chief sanitary defects dealt with amongst the Civil habitations in Gibraltar during 1902.

Description of Defect.	Number of Houses in which the defect was noted.
A.—WATER SUPPLY.	
1. Collecting areas polluted	3
2. Mouth of inlet of tank exposed to pollution	5
3. Water in tank impure	23
4. Insufficient supply of water for flushing, &c.	32
B.—SEWERAGE.	
5. Insufficient W.C. accommodation	3
6. Soil pipes leaking	2
7. Soil pipes embedded in the walls	2
8. Soil pipes unventilated	1
9. Soil pipes improperly ventilated	7
10. Fittings, &c., insanitary	7
11. House drains defective	12
12. Ventilation of W.C.'s insufficient	4
C.—KITCHENS.	
13. Sinks untrapped	2
14. Sinks directly connected with sewer	1
15. Without flues	3
16. Accommodation deficient	6
D.—LIVING ROOMS.	
17. Damp	4
18. Overcrowded	8
19. Badly lighted and ventilated	5
20. Roofs leaking	10
21. Drains under floor	3
E.—YARDS.	
22. Badly paved	3
23. Blocked with stores and refuse	4
24. Surface drain traps defective	4
25. Fouled by Animals	1
F.—PREMISES GENERALLY.	
26. In bad repair	3
27. Deficient of refuse receptacles	10
28. Wash-house accommodation deficient	1
29. Stores, shops, Kitchens and Wash-houses used as living rooms and being unfit for the purpose	5
Total	174

TABLE VI.

Chemical and Bacteriological Examinations.

Nature of Examination.	No. of Samples	Results of Examination.	
A—CHEMICAL ANALYSES.			
Water from underground Tanks	51	Pure	25
		Doubtful	3
		Polluted — Roof contamination	17
		Polluted — Sewage	6
Water from Wells	6	Pure	2
		Polluted with Sewage	4
Public Water Supplies:—			
Moorish Castle	12	Of good quality.	
Catalan Bay Wells	12	Do. do.	
Samples of Milk	296	Up to Standard	291
		Adulterated	5
Miscellaneous Analyses	61		
B—BACTERIOLOGICAL EXAMINATIONS.			
Serum Diagnoses	14	Reaction with B. Typhosus	4
		Do. M. Melitensis	2
		No reaction with either	8
Sputum	37	Tubercle Bacilli found in	12
Swabs from throat	12	Diphtheria Bacilli found in	5
Miscellaneous	1		

From the PROCEEDINGS OF THE ROYAL SOCIETY, VOL. 54.

ON THE ALLEGED INCREASE OF CANCER.

BY

GEORGE KING, F.I.A., F.F.A.

AND

ARTHUR NEWSHOLME, M.D., M.R.C.P.

[*From the* PROCEEDINGS OF THE ROYAL SOCIETY, VOL. 54.]

"On the alleged Increase of Cancer." By GEORGE KING, F.I.A., F.F.A., Hon. Sec. Institute of Actuaries, and ARTHUR NEWSHOLME, M.D., M.R.C.P., Medical Officer of Health for Brighton. Communicated by Dr. J. S. BRISTOWE, F.R.S. Received February 27,—Read May 4, 1893.

During the last few years the minds of medical men and of the general public have been exercised over the rapid and striking increase in the mortality from cancer, as shown by the statistics contained in the Registrar-General's Annual Reports. The following table, taken from these reports, shows how great this increase in registered mortality has been. The registered death-rate of males from this disease was 2·7 times, for females 2·0 times, and for both sexes together 2·2 times, as high in 1891 as in the average for the decade 1851–60.

Table A.—Mortality from Cancer in England and Wales per Million living at all ages.

	1851–60.	1861–70.	1871–80.	1881.	1882.	1883.	1884.
Males	195	244	315	364	364	381	405
Females ...	434	523	622	668	692	702	707
Persons ...	317	387	473	520	534	549	563
	1885.	**1886.**	**1887.**	**1888.**	**1889.**	**1890.**	**1891.**
Males	411	424	456	450	488	512	518
Females ...	713	733	748	761	790	830	855
Persons ...	572	572	615	621	656	676	692

That cancer has really increased in this country appears to be now generally assumed in medical circles.

Sir Spencer Wells, in his Morton Lecture (November, 1888), gives the Registrar-General's figures, showing that the mortality from cancer had increased from 488 per million of the population in 1877 to 615 per million in 1887 in England and Wales, and from 350 per million in 1877 to 430 per million in 1887 in Ireland, as proof of this increase; and further quotes the statement of Dr. Fordyce Barker, that the mortality from cancer in the city of New York had risen from 400 per million in 1875 to 530 per million in 1885.

The attitude taken by the Registrar-General's Department has become somewhat modified of late years, doubts having been formerly cast on the reality of the increase, whereas now the generally received medical opinion appears to have been adopted. Thus, Dr. Ogle (p. xiv, Supplement to the 45th Annual Report (1882) of the Registrar-General) points out that the deaths ascribed to *malignant disease* in the decennium 1851-60 amounted to 317 annually per million persons living; in the next decennium it had risen to 387; and in the decennium 1871–80 to 473; but adds: "there can be very little doubt that a considerable part in this apparent increase is simply due to improved diagnosis and more careful statement of cause on the part of the medical men."

In the 46th Annual Report (1883) of the Registrar-General (p. xviii), are the following remarks, bearing on the same point: "How much, if any, of this increase (in cancer) was real cannot be stated with any accuracy; but that some part of the apparent increase was only apparent, and due to improved diagnosis and more careful statement of cause, can, as we stated in previous reports, scarcely be doubted. Year by year the number of deaths ascribed to "abdominal disease" and other imperfectly stated causes has been undergoing diminution, and there has been, of course, a corresponding addition to the mortality under the more definite headings. Moreover, the increase of mortality from cancer has been considerably greater in the male than in the female sex. Now, were the rise not only apparent but real, there would seem to be no reason why males should have suffered more than females; whereas the difference is readily intelligible on the hypothesis that the rise was, at any rate in great measure, really due to improved diagnosis. For the cancerous affections of males are in a much larger proportion internal or inaccessible than are those of females, and consequently are more difficult of recognition, so that any improvement in medical diagnosis would add more to the male than to the female figures."

In the 52nd Annual Report (1889) of the Registrar-General (p. xiii), attention is again drawn to the increasing mortality from cancer, which now amounted to 656 per million persons living, "showing a further increase upon the ever-growing rates previously recorded." Then follow these remarks (the italics are ours):—

"Some of the increase is most certainly attributable to increased accuracy in statement of cause, and to the system introduced some years back into this office of writing for further information in cases where some vague cause, such as 'tumour,' had been given as the cause of death in the original certificate; a system which added, for instance, in the year 1889 no less than 421 deaths to the heading 'Cancer.' Nevertheless, in face of the constant and great growth of mortality under this heading, and the expressed belief of medical practitioners specially engaged in dealing with this class of diseases that they are becoming more and more common, *it seems scarcely*

possible to maintain the optimistic view that the whole of the apparent increase can be thus explained; and it must be admitted, as at any rate highly probable, that a real increase is taking place in the frequency of these malignant affections."

It is evident, therefore, that although the view that the increase in cancer was chiefly, if not entirely, apparent has, until recently, been held in the English General Register Office, it is now reluctantly accepted as a probable fact that cancer has really increased; and it must be admitted that the figures on which this conclusion is based, as shown in the preceding table, look, at first sight, to be overwhelming in the weight of their evidence.

A more careful investigation, however, shows that the ratios prepared in the usual manner from the returns of the Registrar-General at the best only approximately represent the truth, and that, in fact, they may even be very misleading. Cancer is, *par excellence*, a disease of mature life. In a population of 1,000,000 adult males, aged from 25 to 35, about 95 would die annually from cancer; while there would be about 2,530 deaths among 1,000,000 males from 55 to 65, and 4,405 deaths in 1,000,000 males aged from 65 to 75. Therefore, to take the deaths from cancer at all ages in a community, and to compare them with the total population in order to arrive at the cancer death-rate, may introduce an error sufficiently serious to vitiate the results. If there be a larger proportion of lives, below, say, 50 years of age, the fraction formed by dividing the number of deaths from cancer by the total population will give an unduly small ratio; whereas, if the lives above 50 years of age be in excess, the ratio will be unduly large. Now the age distribution of one district may differ materially from that of another, and the age distribution of the males in a community may differ from that of the females, and the age distribution of the same district may possibly differ at different periods. That this consideration is of great importance is shown by Table I (Appendix), which gives the age distribution per million of population of each sex according to the census of 1881 in the several divisions of the United Kingdom.

It will be noticed that the average age of females in England and Scotland is higher than that of males, while the converse is the case in Ireland; and that the average age of the population in Ireland is much higher than in either England or Scotland. Consequently the death-rate from cancer given by the Registrar-Generals of the three divisions of the United Kingdom in their Annual Reports are unduly unfavourable to the female sex in Great Britain and to the male sex in Ireland; and similarly the death-rate from cancer in Ireland is exaggerated as compared with that of the sister kingdom.

To rectify this error it is necessary to assume a standard of age distribution, to be applied to each set of statistics examined. It is not of importance what standard is selected, because, all the observations being treated alike, the comparisons instituted between them will be entirely trustworthy. It is desirable, however, to adopt a standard which is not purely arbitrary, and in the following investigations we have therefore used that given by the "English Life Table, No. 3, Persons," as the most suitable. This represents a stationary population unaffected by changes in the birth-rate or by migrations; and, although no existing community conforms to it, yet, for purposes of comparison of one community with another, it answers every purpose. The following is the age distribution according to this standard :—

Table B.—Age Distribution according to the English Life Table, No. 3, Persons.

Ages.	Population.
25—35 …………	260,259
35—45 …………	232,106
45—55 …………	199,912
55—65 …………	158,812
65—75 …………	102,196
75 and upwards……	46,715
	1,000,000

These considerations showing that a source of fallacy lurks in the rates of mortality usually quoted (especially when one country is compared with another), and that this fallacy specially affects the question of cancer, we came to the conclusion that it was desirable to investigate the alleged increase of cancer altogether afresh, and to avail ourselves in doing so of all the materials that could be turned to good account.

In order to be useful, the materials must extend over a long period of time, and must be presented in such form that, at any rate for several intervals of years, the deaths from cancer and the population may be grouped according to age and sex.

The records of life assurance offices of old standing might throw much light upon the subject, and doubtless if access could be had to them, and if the experience were collated in a suitable manner, an immense amount of most valuable information would be obtained. Unfortunately these sources, with one conspicuous exception, are not available. This exception is the Scottish Widows' Fund Life Assurance Society. For many years that institution has been accustomed at each septennial investigation to prepare a very complete statement of its mortality experience, distinguishing the deaths according to age and according to the causes of death, and at the same time giving the number of lives at risk in each interval of age. Through the

courtesy of the manager, Mr. A. H. Turnbull, these statistics have been placed at our disposal, and he has also kindly given us the figures for the four years 1888–91, which have elapsed since the last septennial valuation, thus enabling us to bring the investigation approximately up to date.

So far as we know, the British Empire Mutual is the only other office which has abstracted its experience in such a form as in the present connexion could be of any service. The experience of that Society, distinguishing diseases, was published for the two periods 1847–72 and 1872–78, and the following figures are extracted from the reports :—

Table C.—Experience of the British Empire Mutual Life Office.

Ages of lives.	Period 1847–72.		Period 1873–78.	
	Lives at risk.	Deaths from cancer.	Lives at risk.	Deaths from cancer.
25—35	42,448	1	13,151	1
35—45	61,136	8	18,397	3
45—55	43,887	18	19,332	6
55—65	17,410	12	12,825	15
65—75	3,973	4	4,225	9
75 and over	556	0	646	2
Total……	169,410	43	68,576	36

Unfortunately these facts are so scanty as not to afford trustworthy averages, and we have not seen our way to make further use of them. They show an apparent increase of about 50 per cent. in the death-rate from cancer in the period 1873–78 over 1847–72; but it must be remembered that, the office having been founded only in 1847, the lives assured had, in the earlier of the two periods, on the average much more recently passed the medical examination than in the later period. Cancer being a disease of comparatively slow development, this is a disturbing factor the effects of which it is impossible to measure. A life office must have been established for many years, and must for a long period have been transacting a business approximately uniform, before it is safe to base any conclusions upon its experience of such a disease as cancer.

The Scottish Amicable Life Assurance Society and the Clergy Mutual Life Office have each published their experience, giving the deaths from cancer and the lives at risk according to age; and in the collective experience of thirty American offices, published in 1881, similar particulars are given; but in each of these cases only one period of time is investigated, and therefore, for present purposes, their figures cannot be utilised. On two occasions the Australian Mutual Provident Society, which is the largest life office in the British Dominions, has investigated its mortality experience, and on each occasion has tabulated its cancer figures; but, for various reasons which we need not particularise, this information could not be successfully utilised.

The returns of the Scottish Widows' Fund, above mentioned, extend over four septennia and a broken period of four years, making a total period of thirty-two years during which it is possible to minutely investigate the causes and progressive rates of mortality. The figures, so far as they bear upon the present inquiry, are given in Table II in the Appendix.

The Scottish Widows' Fund statistics being only available in the form given in Table II, we proceeded to extract the Registrar-General's data for the same periods and in the same form, in order that trustworthy comparisons might be instituted; and we also treated in precisely the same way the valuable statistics of Frankfort-on-the-Main, to be described more minutely later on.

For England, Scotland, and Ireland respectively, the census enumerations of 1861, 1871, and 1881 were available for both males and females, the populations being classified in the same age periods as in the data supplied by the Scottish Widows' Fund. We had also the total populations, both male and female, enumerated in 1891, but information as to the age distribution of these populations had not hitherto been published. It was therefore necessary to assume that the age distribution in 1891 was the same as in 1881. A source of inaccuracy has been thus introduced, but its magnitude cannot be serious.* From the figures in the four census enumerations, the number of males and females respectively living in the middle of the years 1861, 1871, 1881, and 1891, were calculated for each age period 25—35, 35—45, 45—55, 55—65, 65—75, and 75 and over; and from these figures again the numbers living in each age group in the middle of each year from 1860 to 1891 inclusive were worked out. These were then classed into septennial periods, as with the Scottish Widows' Fund, with a broken period at the end. In this way was obtained with great accuracy the population in age groups in each division of the United Kingdom, passing through a year of life in each of the septennia under review. The deaths from cancer, arranged according to age, are given in the annual returns of the Registrar-General, and these were extracted and summed for the

* Owing to the steady fall in the birth-rate between 1881 and 1891, the average age of the population is probably somewhat higher at the latter date. This would tend to slightly exaggerate the apparent increase in the death-rate from cancer.

septennial periods. The annual returns for England and Wales and for Ireland came down to 1890 inclusive, but for Scotland the last year available was 1889, and the several observations were therefore closed at these points respectively. In the case of Ireland, we could not obtain the deaths from cancer prior to 1864, and we have therefore been limited to the three years 1864–66 for Ireland, instead of the seven years 1860–66.

For purpose of reference, and in case other inquirers desire further to investigate our figures, we give them in Tables II to V in the Appendix, arranged as above described.

From the figures in Tables II to V may be at once obtained the death-rates from cancer for each period of years, and for each age interval. As the resulting rates are necessary to the subsequent calculations, they are given in Tables VI to IX in detail, and are expressed as rates per million, in order to reduce the number of decimal places. The numbers, as might have been expected, run irregularly, but, on account of the method of grouping of the figures later on, this irregularity is not of any practical importance.

The rates of mortality given in Tables VI to IX, notwithstanding the considerable numbers on which they are based, do not run with sufficient regularity to disclose the general law by which they are governed; and, even though they did run regularly, it would not be easy to discover from them that law. Moreover, it is not the object of the present inquiry to ascertain the liability to cancer at different ages, but to discover whether cancer is on the increase or not in the community generally. It is therefore necessary so to group the figures that the total cancer experienced at all ages in any particular period of years may be compared with the total cancer experienced in any other period. If we take the rates of mortality given in Tables VI to IX and multiply them into the populations of Table B, we shall have the desired results. The sum of the products for any particular period of years will give the number of deaths from cancer per annum among 1,000,000 persons aged 25 and upwards. Then by comparing the sum for, say, the period 1860–66 with that for the period 1881–87, we can ascertain in which direction the apparent death-rate from cancer is progressing. It will be observed also that by pursuing this course the observations for all the different localities and all the different periods of years are reduced to one common standard, and the errors are eliminated which would arise from variations in the age distribution of the populations. Tables X and XI display these results in their final form, the ratios for ages under 55 and over 55 respectively, as well as for all ages, being given in them. Some persons may be glad to be able to investigate the matter for these two great periods of life, although we do not propose to include this branch of the subject in our inquiry.

In Tables X and XI the death-rates have been corrected for age distribution, and a single illustration will indicate how important is this correction, and how serious an error may result from its omission. Taking from Tables III and V the total population at risk for all ages, and the total deaths from cancer, and dividing the second by the first for each period of years for England and Ireland respectively, we shall have the death-rates from cancer in the form usually presented by the Registrar-General. They are given in the following table, and alongside them are placed the corrected rates from Table X.

Table D.—Comparison of Corrected and Uncorrected Cancer Death-rates.

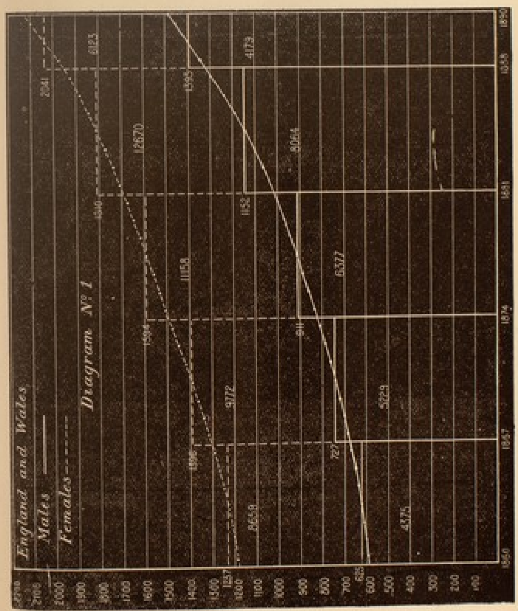
Period.	Not corrected.		Corrected.	
	England.	Ireland.	England.	Ireland.
1860–66	498	553	625	614
1867–73	597	627	747	661
1874–80	719	680	911	699
1881–87	902	807	1,152	824
1888–90	1,091	894	1,393	912

It will be observed that by the uncorrected figures Ireland stands a little above England for the first two periods, and a little below it for the other three, but that no very great difference appears between the rates for the two countries. The corrected figures, however, show that Ireland stands below England throughout, so that in the first two periods the position of the countries is reversed by the correction, and in the last three periods the difference in favour of Ireland is very great indeed. It is evident that the ordinary method of presenting the statistics exaggerates the rate of cancer in Ireland as compared with England, a result which, as already explained, might have been expected, owing to the age distribution of the populations of the two countries.

Much light may be thrown on the subject by a careful analysis of Tables X and XI. It is, however, difficult from arrays of figures to ascertain their exact teaching, and it is, therefore, desirable to aid the mind by translating the figures into a graphic form. In Tables X and XI the rates of mortality from cancer are given for five periods of years, and from them the rates may be obtained for each individual year. If these subdivided results be then plotted out in curves, the forms and directions of the curves will show at a glance, far more conclusively than could the most elaborate examination of

tabulated figures, the nature of the progression of the rates of mortality.

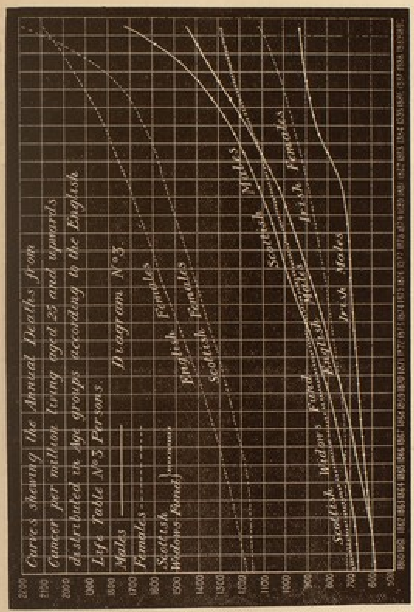
This distribution into individual years might be accomplished by skilful application of analytical processes; but the method would be very difficult on account of the nature of the material available, and the results could scarcely fail to be unsatisfactory and untrustworthy. The end can be much more satisfactorily attained by a modification of the late Joshua Milne's graphical method of constructing mortality tables, which has been fully described, and of which the beautiful accuracy has been demonstrated and illustrated by one of us (G. K.) in two papers in the 'Journal of the Institute



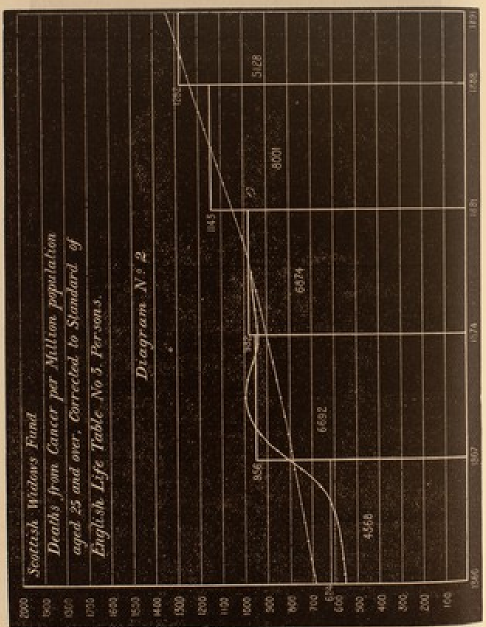
of Actuaries,' vol. xxiv and vol. xxx. As showing the application of the method to the present inquiry, the accompanying diagram, No. 1, relating to England and Wales, is submitted, of which a very few words of explanation will suffice. Along the abscissa axis are marked off equal lengths to represent each of the periods of seven years under review, with a portion of proportionate length for the three years 1888–90; and along the ordinate axis the rates of mortality per million are marked off. Rectangles are then erected, the areas of which are to represent the number of deaths from cancer in each of the septennial periods. Thus the area of the rectangle for the septennium 1860–66 is 4,375 for males, as its base is 7 and its altitude 625. Similarly for the other rectangles.

Through the tops of the rectangles must then be drawn a continuous curve in such a way that the area cut off is exactly equal to the area added. The length of the ordinate of the curve which is central to any particular year will then give the deaths from cancer in that year; and the accuracy of the drawing of the curve will be proved, if there be no sudden change of direction, and if the sum of the numbers for the seven years of a septennium is equal to the area of the rectangle for that septennium. Diagram No. 1 shows the curves for England and Wales, that for males being in an unbroken line, and that for females in a dotted line. Similar curves were prepared for all the observations so far discussed, and they are collected in Diagram No. 3 so that they may be easily compared. The curves for males are in continuous lines, while those for females are broken, and that for the Scottish Widows' Fund is marked by crosses.

The only curve which proved at all intractable was that for the Scottish Widows' Fund in its earlier portion. It will be seen from Table X that the death-rate from cancer in the first septennium was very light, while in the second it was comparatively heavy, very nearly equal to that in the third, and that the rates in the third, fourth, and fifth exhibit an almost uniform upward progression. These peculiarities are better seen by the help of Diagram No. 2, where the deaths are represented by the rectangles. The second and third rectangles being of nearly the same altitude, while the first is much lower, and the fourth considerably higher, there is indication of a rapid rise in the curve between the first and second periods and of a slight fall between the second and the third, and effect has been given to this in the undulating curve shown in the diagram. The most unpractised eye will, however, at once perceive that the undulating line cannot represent the real law of the curve, and more especially so when the other six curves are examined (Diagram 3). Except for the one bend in the Scottish Widows' Fund curve, they all partake of one character, and the conclusion is forced upon us



that the twist in the Scottish Widows' Fund curve is abnormal, and that it must be removed if we are to arrive at the true teaching of the facts. The data are given in septennial periods, and the shape of the figure suggests that were it possible to rearrange them into, say, quinquennial periods, the abnormality would disappear. The abnormality is introduced by insisting on the rule that the area of each portion of the curve must be exactly equal to the area of its corresponding rectangle, a rule which is to a certain extent arbitrary. Where, as in the case of the Scottish Widows' Fund experience, the original facts are few, and insufficient when grouped into short periods to form trustworthy averages, it is better to enlarge the rule, and to redistribute the deaths slightly as between the adjacent periods, while still arranging that the curve shall in general outline follow the summits of the rectangles, and that the area of the curve shall exactly equal the areas of the rectangles in the aggregate. In Diagram No. 2 the correction of the curve on these principles is shown, and it is this corrected curve which is repeated in Diagram No. 3. How slight the correction really is becomes apparent when



we state that it is equivalent to the transfer of only seven deaths in the Scottish Widows' Society from the second to the first septennium,

and of one death from the third to the second septennium. Where the data are so scanty such slight adjustments are unavoidable. It may be added, however, that the general deductions to be drawn from the forms of the curves are the same whether we adopt the original or the corrected curve of the Scottish Widows' Fund.

In Table XII the distributed rates of mortality, as derived from the curves, are given for each of the seven sets of observations so far considered.

We are now in a position to examine more attentively the nature of the seven curves, and to attempt to derive from them the lessons which they are capable of conveying.

The *Irish* curves are the lowest of all, and are consistent with each other. In each of them there is a moderate upward gradient from the beginning to the end of the observations.

The *English* curves for males and females are far apart, the female mortality from cancer being very heavy. The two curves are, however, consistent with each other. They both show a decided and slightly increasing gradient from beginning to finish.

The *Scottish* curves are much nearer each other than the English, the males in Scotland having a higher apparent mortality from cancer than in England, and the females having one lower. The gradient in the Scottish curves is much the same as in the English, except that for the last year or two the rise is more rapid. The experience for the last period is for two years only in Scotland, while for England and Ireland it extends over three years, and this may account for the difference. Probably for this reason the curves at the end are more to be depended on for England and Ireland than for Scotland.

The correction for age distribution which we have introduced brings out the fact that Ireland seems to enjoy a great comparative immunity from cancer. Probably deficient accuracy in diagnosis and certification may account for much, if not all, of this difference. Ireland is a poor country, the majority of whose inhabitants cannot afford to pay much for medical attendance. The resulting deficient medical attendance would tend to produce defective diagnosis, and thus to lower the cancer curve. Probably also, owing to the poverty of the patients and consequently of the medical attendants, the average skill of the general practitioners over large tracts in Ireland is less than in Scotland and England, and this again would lead to defective diagnosis.

It is probable that in Scotland the general practitioner has been in the past better educated than in England, and this would cause the curves for the sexes to approximate, because in the female, cancer being more commonly accessible in position, is more easily diagnosed than in the male, and improvement in diagnosis would raise the curve for males in greater proportion than that for females.

This argument is, however, scarcely consistent with the fact that the curve for English females is the highest of the seven. It appears therefore probable that, apart from diagnosis, there is some cause in English female life more favourable to cancer than among Scottish women.

The *Scottish Widows' Fund curve* has the easiest gradient of all, and this seems strongly to point in the direction so frequently indicated by the Registrar-General, that the apparent increase of cancer in the community is due to increased accuracy in diagnosis and certification. The policy holders in the Scottish Widows' Office are insured on the average for substantial sums, and are, therefore, presumably well-to-do, and able to secure, on the whole, better medical attendance than the mass of the people. The diagnosis throughout has, therefore, probably been good, as suggested by the fact that the curve begins comparatively high. But even among the most highly skilled members of the medical profession diagnosis has been improving, and therefore the Scottish Widows' Fund curve rises like the others. Among the class of practitioners attending assured lives there is not, however, the same scope for improvement in diagnosis and certification of death as in the profession as a whole, and the gradient of the Scottish Widows' Fund curve is consequently easy. This curve might have been expected to be below those for English and Scottish males, because, although there is a small admixture of females who suffer more severely from cancer than males, yet the lives are select. Persons with marked cancerous family histories are excluded. Cancer, moreover, is a disease whose development is usually gradual and slow, and may be preceded for several years by non-malignant disease of the part subsequently affected with cancer; hence, for two, or even three or four, years after an initial medical examination, cancer among insured lives should be comparatively rare. Notwithstanding these considerations, the Scottish Widows' Fund curve is above all the other curves for males at the commencement, though it falls below those for England and Scotland at the finish. This, as we have already remarked, points to good diagnosis on the part of the medical attendants of the assured lives, and to an improvement in diagnosis on the part of the medical profession generally during the last thirty years.

Another reason for thinking that the apparent increase in cancer is at any rate mostly due to improved diagnosis is derived from a comparison of the curves for males and females respectively. It will be noticed that the curves for females are always the higher, and that in each pair of curves the difference is practically constant throughout the entire period. Now, if there were a real increase of cancer, there is no sufficient ground for thinking that this would be confined to any one set of organs of the body, or would affect one sex more than another; and in such case the difference between the cancer in males and females would be a percentage of the total, and would increase at the same rate as the curves themselves rise, and consequently the curves for males and females would tend to widen their distance apart. This, however, is not so. In each of the three pairs the curves for males and females do not diverge, but, if anything, tend to approximate.

It may be urged that, notwithstanding what has been said above, cancer may have increased more in certain parts of the body than in others, and that, although it has really increased in both sexes, it has increased in such greater proportion among males, that the curves for the two sexes remain parallel. This view, however, is contradicted by the Frankfort statistics, to be discussed presently, which confirm in a remarkable manner the conclusion we have drawn that it is only the cancer of organs common to both males and females which has apparently increased, while cancer of the special female organs, which is most easy of all to diagnose, has practically remained constant.

The chief weakness of the figures already given for cancer consists in (1) the absence of distinction between *carcinoma* and *sarcoma*, the two chief varieties of malignant disease, which are, however, pathologically distinct; and (2) the absence of statement of the part of the body primarily affected by the cancer.

An accurate statement of the site of the primary cancer in each case would enable us to ascertain whether the increase of cancer had been general, or chiefly in the cancer of inaccessible parts the diagnosis of which is comparatively difficult. Unfortunately medical certificates of death commonly omit any statement of the organ affected by cancer, and comparisons founded on those cases in which the position is stated in successive years are open to the fallacy that the non-localised cancers may have been transferred in increasing numbers to the more definite headings as time goes on.

There are no statistics available in which an accurate distinction is made between carcinoma and sarcoma, and the general terms "cancer" or "malignant disease" must therefore be regarded as including these two forms of malignant new growths in unknown proportions. It may be added, moreover, that no such statistics would be trustworthy unless each death were followed by an autopsy and by a microscopical examination of the diseased parts.

The town of Frankfort-on-the-Main is the only one known to us which has for a long series of years kept an accurate record of deaths from all causes, in which deaths from cancer are classified according to the parts of the body primarily affected.* In the original the Frankfort figures are given in great detail, but we have summarised them somewhat. Thus, Table XIII shows both for males and females at all ages the total number of deaths from cancer of various parts of the body in the same year periods as we have adopted throughout this paper.

The subdivisions in Table XIII are still too minute, and the numbers consequently too small, for the purposes of useful investigation in the present connexion, and we therefore proceeded to group them, as shown in Table XIV, in three broad classes, which may be called "accessible cancer," comprising cancers of external parts of the body and other parts in which the nature of the disease is easily demonstrable during life by physical examination; "inaccessible cancer," comprising cancers of internal parts and other parts in which, as in the case of cancer of the bones, diagnosis is less easily made; and "cancer, position undefined," comprising simply the first line of Table XIII. In Table XIV only deaths at age 20 and over are included.

Under "Accessible cancer" we have included only the four headings Tongue, Mamma, Uterus, and Vagina, cancers of which are all capable of careful and exact diagnosis.

Under "Inaccessible cancer" come cancers primarily affecting any other parts of the body.

It will be seen from Table XIII that the great majority of cancers coming under this second head are of parts of the body in which the difficulties of diagnosis are great.

The classification cannot be regarded as perfect. Thus it may be pointed out that the first group embraces a large excess of women, among whom it is shown by the Registrar-General's returns in Great Britain that the apparent increase in cancer has been in less ratio than among men. In the next place, it may be argued that we have placed under the "inaccessible" division cancer of certain parts that might be more appropriately described as accessible. The following are the doubtful cases here referred to:—

* 'Statistiche Mittheilungen über den Civilstand der Stadt Frankfurt-am-Main (1860—1889).

Table E.

Part affected.	1860—1866.	1867—1873.	1874—1880.	1881—1887.
Cancer of pharynx	..	..	1	1
" œsophagus ..	8	8	18	39
" rectum	21	28	39	32
" prostate and bladder	8	10	6	16
" penis	..	..	1	1
" larynx and trachea	1	..	1	5
" thyroid	1	..	..	..
" bone	2	2	6	6
Total	41	48	72	100

Of the cancers enumerated above, cancer of the pharynx, thyroid gland, larynx, trachea, and penis are most accessible, but their number is so small (twelve in all) that their transference to the "accessible" group would have no appreciable effect; and since, before the paper took its present shape, they had been included with other cancers in their appropriate physiological system, and a considerable amount of calculation had been based upon that classification, they have been allowed to remain in the "inaccessible" group.

Cancer of the prostate and bladder may be regarded as intermediate between the "accessible" and "inaccessible" groups, but as cancer of these organs appears to have increased in a smaller proportion than the population, the effect of introducing it into the "inaccessible" group is rather to diminish the already striking difference which we shall show to exist between the increase in "accessible" and "inaccessible" cancer respectively.

Cancer of the œsophagus has, we think, been properly placed in the "inaccessible" group. The majority of cases of stricture of the œsophagus in persons over 50 are undoubtedly due to cancer, and yet certificates stating the cause of death at these ages as "stricture of œsophagus," without any definition of the cause of stricture, are still common. There can be no doubt that in the past they have been much more common, and that therefore cancer of the œsophagus is rightly placed in the class of "inaccessible" cancers which have been largely affected by improved diagnosis and certification of deaths.

Cancer of bone has also been placed in the same group. The number under this head is small, and, as the vertebræ and other inaccessible bones are a favourite seat of cancer of bone, the classification appears to us correct.

Cancer of the rectum is more accessible than that of other parts of the intestines, and we have, therefore, extracted it separately, in order to ascertain whether its increase is in the same ratio as that of cancer of the upper parts of the intestine. The result is as follows:—

Table F.—Cancer of Rectum and other parts of Intestines in Septennial Periods.

Period.	Cancer of rectum.	Cancer of remaining parts of intestines.
1860-66	21	15
1867-73	28	19
1874-80	39	36
1881-87	32	47

Thus, while cancer of the rectum increased (in absolute amount and not relatively to the population*) 52·4 per cent., cancer of the rest of the intestines increased 213·3 per cent. It is evident, therefore, that by including cancer of the rectum in the group of "inaccessible" cancers we have further diminished the sharp contrast between "accessible" and "inaccessible" cancers.

In Table XIII we give the deaths from cancer in Frankfort during the period under review, grouped according to age and sex; and in the sub-headings, α, β and γ, in Table XIV, the same facts are classified as above described.

Census enumerations of the city of Frankfort have been taken at frequent but irregular intervals, and we have been able to avail ourselves of the returns for 1864, 1867, 1871, 1875, 1880, and 1885. From these we calculated the population in the middle of each year from 1860 to 1889 inclusive for both males and females, arranged according to age; and a summary of the results is given in Table XIV. On account of the military element which prevails on the Continent, there were some causes of disturbance, but, owing to the frequency of the censuses, these were not of much practical importance, and, moreover, they scarcely affected the ages which, in an inquiry into cancer, are principally concerned.

From the populations of Table XV and the deaths of Table XII the annual death-rates were calculated, corresponding to those in Tables VI—X, but it is scarcely necessary to reproduce them here. From these again were calculated the annual deaths from cancer in 1,000,000 living aged 25 and over, the population being as before

* The population of Frankfort increased from an average of 53,550 in the years 1860-66 to an average of 92,500 in the years 1881-87; *i.e.*, it nearly doubled. Therefore the *rate* of mortality from cancer of the rectum really diminished.

distributed in age groups, according to the English Life Table No. 3, Persons, as shown in Table B. A very slight adjustment was required in consequence of the Frankfort statistics being prepared for the decades 20—30, 30—40, &c., and not for 25—35, 35—45, &c., as at home. The final results are given in Table XVI.

The first thing that strikes one in examining this table is, the marked prevalence of cancer in Frankfort as compared with the United Kingdom, and we have failed to discover any facts in explanation of this, unless it be the extremely careful certification for which that city is noted.

Nevertheless the same general laws prevail as with all the other statistics available. Cancer preponderates greatly in the female sex, and, looking at the column relating to the total cancer, the progressive apparent increase for both sexes is observable. The Frankfort figures are, however, very instructive on account of the sub-division of which they are capable.

The cancer of undefined position does not show much sign of progressive change. No doubt on account of paucity of data, the numbers run irregularly, but from beginning to end of the thirty years under review there is no marked tendency to increase or decrease. This fact is of great importance, because, although in any one year there may be accidental fluctuations, yet, taken over such a long series of years, the figures become trustworthy. On the other hand, the rates of mortality from "inaccessible" cancer, both for males and females, steadily rise, though, perhaps, not quite so rapidly as in the United Kingdom. One very remarkable fact becomes apparent, namely, that males and females suffer almost equally from "inaccessible" cancer, the average for the thirty years being 1,641 for males and 1,640 for females. The excessive mortality from cancer of females is confined to "accessible" cancer, that is, practically to cancer of the female sexual organs.

The numbers relating to "accessible" cancer run somewhat irregularly, probably because of the paucity of data, among males there having been only 31 deaths in this category during the thirty years; but no well marked law of variation can be detected. There is, if anything, a tendency to decrease, at any rate as regards males, but the sequence of the numbers is not such that we could say with certainty whether or not that tendency would continue were the duration of the observations to be extended.

Taking a general view of the Frankfort figures, the one result of surpassing importance to be derived from them is that *in those parts of the body in which cancer is easily accessible and detected there has been no increase in the mortality from it between* 1860 *and* 1889.

It may be mentioned that in 1887 Dr. Grimshaw, the Registrar-General for Ireland, began to tabulate the deaths from cancer in

Ireland, according to the primary seat of the disease, whenever this is given in the death certificate. The number of years as yet available does not allow of any valid deductions being drawn, and the great variation during the four available years under the head of cancer of unspecified parts causes a further difficulty in utilising the figures.

In the 52nd Annual Report (1889) of the Registrar-General for England, the subject of the part of the body affected by cancer is also discussed, and in the words of the Registrar-General, "a sufficiently large sample of those cases of cancer in which the seat of disease is more or less clearly specified" is taken out to warrant the assumption that "such samples fairly represent the bulk" (p. 15). This method, however, does not appear to us to furnish trustworthy results, and we only refer to it here in passing.

To summarise, the conclusions arrived at from the whole investigation are as follows:—

1. Males and females suffer equally from cancer in those parts of the body common to man and woman, the greater prevalence of cancer among females being due entirely to cancer of the sexual organs, viz., the mamma, ovaries, uterus, and vagina. This is shown by the Frankfort statistics, and may not unreasonably be accepted as a probable general law, seeing that in other respects, where comparison is possible, the Frankfort statistics are confirmed by those of the United Kingdom.

2. The apparent increase in cancer is confined to what we have called "inaccessible" cancer. This is shown (*a*) by the Frankfort statistics; (*b*) by the fact that the difference between the rates for males and females respectively is approximately constant, and does not progressively increase with the apparent increase in cancer in each of the sexes; (*c*) because the apparent increase in cancer among the well-to-do assured lives, who are presumably attended by medical men of more than average skill, is not so great as among the general population.

3. The increase in cancer is only apparent and not real, and is due to improvement in diagnosis and more careful certification of the causes of death. This is shown by the fact that the whole of the increase has taken place in inaccessible cancer difficult of diagnosis, while accessible cancer easily diagnosed has remained practically stationary.

Table 1.—Age Distribution of Population, 1881.

	Males.			Females.		
	England.	Scotland.	Ireland.	England.	Scotland.	Ireland.
25—35	329,343	331,560	267,966	323,414	308,369	276,664
35—45	256,363	251,086	238,453	249,403	244,905	243,902
45—55	186,820	186,487	193,671	186,897	189,069	188,308
55—65	130,641	128,238	155,272	133,194	136,285	157,686
65—75	70,493	71,981	95,822	75,865	82,514	88,429
75 and over	26,340	30,648	48,816	31,227	38,858	45,011
	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000

Table II.—Statistics of the Scottish Widows' Fund Life Office.

Age.	1860—1866.		1867—1873.		1874—1880.		1881—1887.		1888—1891.	
	Population at risk.	Deaths from cancer.	Population at risk.	Deaths from cancer.	Population at risk.	Deaths from cancer.	Population at risk.	Deaths from cancer.	Population at risk.	Deaths from cancer.
25—35	12,921	..	26,299	3	40,102	2	48,224	2	32,298	2
35—45	19,611	6	29,368	6	46,986	10	64,820	12	43,401	16
45—55	19,665	12	24,671	18	33,418	16	45,424	32	30,393	32
55—65	12,305	12	16,641	34	20,964	41	25,397	69	17,019	35
65—75	4,732	11	7,160	25	10,208	41	12,345	40	8,273	28
75 & over	1,202	1	1,798	2	2,714	6	3,770	15	2,510	16
Total...	70,436	42	105,937	88	154,392	116	199,980	170	133,894	129

Note.—The "population at risk" in the above table is not identical with the "number of lives at risk" as shown in the Scottish Widows' Fund reports. The figures as given by the Scottish Widows' Fund produce the function known to actuaries as "rate of mortality," viz., the probability of dying in a year. A slight adjustment has therefore been introduced, so that the resulting function may be that known to actuaries as the "central death-rate" and called the "rate of mortality" by the Registrar-General. It is the ratio between the deaths in a year and the population in the middle of that year.

Table III.—Population and Deaths from Cancer. England and Wales.

Males.

Age.	1860—1866.		1867—1873.		1874—1880.		1881—1887.		1888—1890.	
	Population at risk.	Deaths from cancer.	Population at risk.	Deaths from cancer.	Population at risk.	Deaths from cancer.	Population at risk.	Deaths from cancer.	Population at risk.	Deaths from cancer.
25—35	10,065,013	603	11,026,867	729	12,120,353	840	13,209,827	983	5,967,814	566
35—45	8,127,262	1,604	8,599,671	1,862	9,416,398	2,326	10,283,966	2,953	4,645,998	1,551
45—55	6,096,059	3,132	6,654,352	4,073	7,044,307	5,108	7,480,991	7,147	3,379,692	3,951
55—65	4,067,022	4,512	4,441,718	6,032	4,835,955	8,088	5,237,894	11,174	2,366,329	5,988
65—75	2,204,804	3,936	2,450,509	5,273	2,636,088	7,184	2,824,396	9,999	1,275,981	5,621
75 & over	852,983	1,855	917,480	2,395	983,176	3,084	1,055,489	3,921	476,838	2,095
Total ...	31,413,143	15,642	34,090,597	20,364	37,036,277	26,630	40,092,563	36,177	18,112,652	19,772

Females.

Age.	1860—1866.		1867—1873.		1874—1880.		1881—1887.		1888—1890.	
	Population at risk.	Deaths from cancer.	Population at risk.	Deaths from cancer.	Population at risk.	Deaths from cancer.	Population at risk.	Deaths from cancer.	Population at risk.	Deaths from cancer.
25—35	11,210,266	1,772	12,156,572	2,053	13,205,566	2,304	14,331,599	2,463	6,502,206	1,209
35—45	8,709,350	5,700	9,331,309	6,784	10,154,306	8,187	11,051,894	9,309	5,014,213	4,502
45—55	6,458,701	9,552	7,147,098	11,578	7,698,205	13,991	8,282,058	16,694	3,757,546	8,277
55—65	4,382,534	9,540	4,851,654	12,109	5,377,469	15,403	5,902,299	19,044	2,677,856	9,555
65—75	2,562,017	6,881	2,835,339	8,747	3,095,421	11,304	3,361,830	14,753	1,525,252	7,945
75 & over	1,113,831	3,041	1,208,216	3,723	1,290,244	4,710	1,383,783	6,110	627,817	3,312
Total...	34,436,708	36,486	37,530,188	44,994	40,821,211	55,899	44,313,463	68,373	20,104,890	34,800

Table IV.—Population and Deaths from Cancer. Scotland.

Males.

Age.	1860—1866.		1867—1873.		1874—1880.		1881—1887.		1888—1889.	
	Population at risk.	Deaths from cancer.	Population at risk.	Deaths from cancer.	Population at risk.	Deaths from cancer.	Population at risk.	Deaths from cancer.	Population at risk.	Deaths from cancer.
25—35	1,383,589	96	1,502,275	108	1,653,863	142	1,790,464	156	530,505	29
35—45	1,087,934	233	1,150,259	266	1,255,343	329	1,355,898	430	401,744	86
45—55	848,151	497	893,309	584	948,729	794	1,007,054	1,044	298,385	271
55—65	597,247	707	629,657	934	658,899	1,209	692,502	1,624	205,183	461
65—75	311,774	642	355,699	838	373,072	1,095	388,706	1,363	115,171	565
75 & over	136,116	326	143,341	423	154,400	550	165,505	723	49,044	450
Total . . .	4,364,811	2,501	4,674,540	3,153	5,044,306	4,119	5,400,129	5,340	1,600,032	1,862
					Females.					
25—35	1,726,740	237	1,804,835	241	1,889,282	333	1,982,381	299	585,116	25
35—45	1,314,243	807	1,393,974	820	1,485,077	1,008	1,574,353	1,199	464,699	206
45—55	1,006,538	1,328	1,070,748	1,611	1,144,345	1,869	1,215,463	2,153	358,753	552
55—65	745,462	1,445	785,837	1,669	830,411	2,071	876,125	2,491	258,595	809
65—75	427,081	1,147	480,346	1,388	507,408	1,668	530,467	2,106	156,568	870
75 & over	207,854	641	219,467	781	234,727	906	249,799	1,097	73,729	716
Total . . .	5,427,918	5,605	5,755,207	6,510	6,091,250	7,855	6,428,588	9,345	1,897,458	3,178

Table V.—Population and Deaths from Cancer. Ireland.

Males.

Age.	1864—1866.		1867—1873.		1874—1880.		1881—1887.		1888—1890.	
	Population at risk.	Deaths from cancer.	Population at risk.	Deaths from cancer.	Population at risk.	Deaths from cancer.	Population at risk.	Deaths from cancer.	Population at risk.	Deaths from cancer.
25—35	1,069,519	60	2,402,441	135	2,191,639	165	2,012,328	149	824,695	56
35—45	810,010	136	1,838,579	312	1,832,674	396	1,790,695	477	733,865	199
45—55	735,980	360	1,599,339	829	1,523,696	822	1,454,603	1,065	596,046	540
55—65	614,298	562	1,419,863	1,627	1,285,188	1,597	1,166,028	1,678	477,864	775
65—75	290,878	559	756,266	1,472	755,818	1,491	719,589	1,690	294,903	701
75 & over	132,009	342	327,464	853	357,385	935	366,700	1,001	150,292	480
Total . . .	3,652,694	2,019	8,343,952	5,228	7,946,400	5,406	7,509,943	6,060	3,077,665	2,751
					Females.					
25—35	1,171,915	101	2,709,747	286	2,494,890	302	2,284,409	261	930,913	112
35—45	909,481	308	2,019,910	771	2,039,629	836	2,013,894	923	820,678	416
45—55	812,882	708	1,785,658	1,496	1,664,419	1,510	1,554,855	1,744	633,616	869
55—65	667,354	731	1,533,696	1,867	1,416,704	1,981	1,302,003	2,076	530,576	952
65—75	310,299	573	773,450	1,405	767,154	1,519	730,158	1,608	297,545	720
75 & over	152,464	266	370,723	690	379,451	824	371,655	876	151,452	388
Total . . .	4,024,395	2,687	9,193,184	6,515	8,762,247	6,972	8,256,974	7,488	3,364,780	3,457

Table VI.—Annual Death-rate from Cancer per Million living at each Age Period. (See also Table II.)

Scottish Widows' Fund.

Ages.	1860—1866.	1867—1873.	1874—1880.	1881—1887.	1888—1891.
25—35	Nil	114·07	49·87	41·47	61·92
35—45	305·95	204·30	212·83	185·13	368·66
45—55	610·22	729·60	478·78	704·47	1052·87
55—65	975·21	2043·15	1955·73	2716·86	2056·53
65—75	2324·60	3491·62	4016·46	3240·18	3384·50
75 and over	831·95	1112·35	2210·76	3978·78	6374·50

Table VII.—Annual Death-rate from Cancer per Million living at each Age Period. (See also Table III.)

England and Wales.

Males.

Ages.	1860—1866.	1867—1873.	1874—1880.	1881—1887	1888—1890.
25—35	59·91	66·11	69·31	74·41	94·84
35—45	197·36	216·52	247·02	287·15	333·84
45—55	513·78	612·08	725·13	955·36	1169·04
55—65	1109·41	1758·03	1672·47	2133·30	2530·50
65—75	1785·19	2151·80	2725·25	3540·23	4405·24
75 and over	2174·72	2610·41	3136·77	3714·87	4393·53

Females.

25—35	158·07	168·88	174·47	171·86	185·94
35—45	654·47	727·02	806·26	842·30	897·85
45—55	1478·94	1619·96	1817·44	2015·68	2202·77
55—65	2176·82	2495·85	2864·36	3226·54	3568·15
65—75	2685·78	3084·99	3651·85	4388·38	5208·98
75 and over	2730·22	3164·17	3650·47	4415·43	5275·42

Table VIII.—Annual Death-rate from Cancer per Million living at each Age Period. (See also Table IV.)

Scotland.

Males.

Ages.	1860—1866.	1867—1873.	1874—1880.	1881—1887.	1888—1889.
25—35	69·39	71·89	85·86	87·13	54·66
35—45	214·17	231·25	262·08	317·13	214·06
45—55	585·98	653·75	836·91	1036·69	908·22
55—65	1183·77	1483·35	1834·88	2345·12	2246·77
65—75	2059·18	2355·93	2935·09	3506·51	4905·75
75 and over	2395·02	2951·01	3562·18	4368·45	9175·42

Females.

25—35	137·25	133·53	176·26	150·83	42·73
35—45	614·04	588·25	678·76	761·58	443·30
45—55	1319·37	1504·56	1633·25	1771·34	1538·66
55—65	1938·40	2123·85	2493·95	2843·20	3128·44
65—75	2685·67	2889·58	3287·30	3970·09	5556·76
75 and over	3083·90	3558·65	3859·80	4391·53	9711·24

Table IX.—Annual Death-rate from Cancer per Million living at each Age Period. (See also Table V.)

Ireland.

Males.

Ages.	1864—1866.	1867—1873.	1874—1880.	1881—1887.	1888—1890.
25—35	56·10	56·19	75·29	74·04	67·90
35—45	167·90	169·70	216·08	266·38	271·17
45—55	489·14	518·34	539·48	732·16	905·97
55—65	914·87	1145·89	1242·62	1439·07	1621·80
65—75	1921·77	1946·41	1972·70	2348·56	2377·05
75 and over	2590·73	2604·87	2616·23	2729·75	3193·78

Females.

25—35	86·18	105·55	121·07	114·25	120·31
35—45	338·65	381·70	409·88	458·32	506·90
45—55	870·98	837·79	907·22	1121·65	1371·49
55—65	1095·37	1217·32	1398·32	1594·47	1794·28
65—75	1846·61	1816·54	1980·05	2202·26	2419·80
75 and over	1744·67	1861·23	2171·56	2357·03	2561·87

Table X.—Annual Deaths from Cancer in 1,000,000 living, aged 25 and over. Population distributed in age groups according to English Life Table No. 3, Persons (as shown in Table B).

Males.

		Under 55.	Over 55.	Total.
England and Wales.	1860-66	165	460	625
	1867-73	189	558	747
	1874-80	220	691	911
	1881-87	277	875	1152
	1888-90	336	1057	1393
Scotland	1860-66	185	510	695
	1867-73	204	615	819
	1874-80	250	757	1007
	1881-87	304	934	1238
	1888-89	246	1287	1533
Ireland	1864-66	152	462	614
	1867-73	158	503	661
	1874-80	178	521	699
	1881-87	227	597	824
	1888-90	262	650	912
Scottish Widows' Fund.*	1860-66	193	431	624
	1867-73	223	733	956
	1874-80	158	824	982
	1881-87	195	948	1143
	1888-91	312	970	1282

* The returns of the Scottish Widows' Fund include both males and females, and, owing to the form in which they have been prepared, it is not possible to discriminate the sexes. The proportion of females, however, is very small.

Table XI.—Annual Deaths from Cancer in 1,000,000 living, aged 25 and over. Population distributed in age groups according to English Life Table No. 3, Persons (as shown in Table B).

Females.

		Under 55.	Over 55.	Total.
England and Wales.	1860-66	489	748	1237
	1867-73	537	859	1396
	1874-80	595	999	1594
	1881-87	644	1166	1810
	1888-90	696	1345	2041
Scotland	1860-66	443	726	1169
	1867-73	472	798	1270
	1874-80	530	912	1442
	1881-87	570	1063	1633
	1888-89	422	1519	1941
Ireland	1864-66	275	445	720
	1867-73	285	466	751
	1874-80	307	525	832
	1881-87	360	588	948
	1888-90	423	652	1075

Table XII.—Deaths from Cancer per Million of persons aged 25 and upwards, distributed in age groups according to the English Life Table No. 3.

Year.	England and Wales.		Scotland.		Ireland.		Scottish Widows' Fund experience.
	Males.	Females.	Males.	Females.	Males.	Females.	Persons.
1860	587	1185	668	1155	591	717	695
61	597	1200	672	1157	599	718	708
62	608	1215	678	1160	607	719	723
63	619	1235	690	1163	614	720	740
64	637	1254	704	1169	622	721	756
65	655	1273	718	1181	629	722	763
66	672	1297	735	1198	636	723	783
67	685	1320	754	1212	643	727	800
68	705	1342	772	1226	649	733	816
69	725	1366	792	1247	655	740	830
1870	747	1394	815	1269	661	750	847
71	767	1421	840	1288	667	759	862
72	790	1450	865	1311	673	769	880
73	810	1479	895	1337	679	780	900
74	832	1507	924	1365	684	793	918
75	857	1537	957	1393	691	802	938
76	880	1565	980	1418	697	817	958
77	908	1594	1007	1440	699	832	972
78	940	1623	1036	1466	701	842	992
79	965	1652	1059	1492	703	860	1015
1880	995	1680	1086	1520	718	878	1038
81	1020	1705	1117	1542	737	891	1061
82	1058	1737	1147	1562	762	907	1085
83	1101	1775	1186	1589	800	935	1115
84	1143	1805	1224	1618	837	943	1143
85	1197	1840	1270	1657	860	965	1172
86	1245	1880	1329	1698	880	989	1200
87	1300	1928	1393	1765	892	1015	1225
88	1341	1985	1476	1870	902	1040	1250
89	1393	2038	1590	2012	912	1073	1270
1890	1445	2100	1740	2197	922	1112	1290

Table XIII.—Deaths from Cancer in Frankfort-on-Main at all Ages.

Part of body affected.	1860—1866.		1867—1873.		1874—1880.		1881—1887.		1888—1889.	
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
Position undefined	33	29	18	30	42	20	58	55	19	17
Nervous system	5	3	8	5	4	1	10	10	..	..
Heart	..	1	..	..	..	..	..	..	..	..
Respiratory organs	2	3	2	1	8	4	8	3	1	2
Tongue	4	..	4	..	1	4	7	1	4	1
Œsophagus and pharynx	6	2	5	3	15	4	30	11	11	1
Stomach	36	55	46	58	80	73	104	121	34	29
Intestines	19	17	18	29	38	37	22	57	22	21
Intra- and retro-peritoneal	5	5	6	16	9	18	9	20	1	6
Liver	23	27	36	40	51	57	67	72	14	36
Pancreas and spleen	..	1	1	1	4	1	1	4	..	1
Kidneys	1	1	4	2	4	2	7	3	3	..
Prostate, urinary bladder, and penis	7	1	10	4	7	1	14	5	3	4
Uterus	..	69	..	96	..	117	..	159	..	64
Ovaries	..	9	..	9	..	17	..	20	..	12
Mamma	..	43	..	42	..	60	..	41	..	21
Vagina	..	1	..	2	..	5	..	5	..	3
Bone	2	..	2	..	5	1	5	1	..	..
Total	143	267	160	338	268	422	342	588	112	218

Table XIV.—Deaths from Cancer in Frankfort-on-Main over 20 Years of Age.

Age.	1860—1866.		1867—1873.		1874—1880.		1881—1887.		1888—1889.	
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
20—30	3	5	5	3	7	5	6	15	1	3
30—40	10	13	17	32	19	40	34	50	4	20
40—50	18	51	20	65	47	92	57	123	26	41
50—60	50	86	40	95	60	112	94	143	39	61
60—70	36	70	47	80	79	99	88	151	24	61
70—80	19	35	26	54	43	67	46	75	16	24
80 and over	4	4	3	5	5	5	5	20	2	6
Total.....	140	264	158	334	260	420	330	577	112	216

Table XIV—*continued.*—Deaths from Cancer in Frankfort-on-Main over 20 Years of Age.

Age.	1860—1866.		1867—1873.		1874—1880.		1881—1887.		1888—1889.	
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
α. Accessible Cancer.										
20—30	0	1	0	0	0	0	0	4	0	0
30—40	0	6	1	19	0	21	1	26	0	12
40—50	0	36	2	28	0	53	4	63	2	23
50—60	6	40	0	51	0	51	1	62	0	27
60—70	3	25	6	30	0	46	0	34	2	21
70—80	0	7	0	14	1	14	1	13	0	5
80 and over	1	0	0	1	0	1	0	4	0	1
Total....	10	115	9	143	1	186	7	206	4	89
β. Inaccessible Cancer.										
20—30	1	4	3	3	6	5	1	10	0	3
30—40	4	6	13	11	17	15	21	21	4	5
40—50	14	9	15	33	40	36	44	46	18	14
50—60	34	36	35	34	50	54	80	64	32	32
60—70	27	39	38	44	71	50	78	104	20	37
70—80	16	23	25	36	32	50	42	59	13	15
80 and over	1	4	3	3	4	4	3	14	2	5
Total....	97	121	132	164	220	214	269	318	89	111
γ. Cancer, Position Undefined.										
20—30	2	0	2	0	1	0	5	1	1	0
30—40	6	1	3	2	2	4	12	3	0	3
40—50	4	6	3	4	7	3	9	14	6	4
50—60	10	10	5	10	10	7	13	17	7	2
60—70	6	6	3	6	8	3	10	13	2	3
70—80	3	5	1	4	10	3	3	3	3	4
80 and over	2	0	0	1	1	0	2	2	0	0
Total....	33	28	17	27	39	20	54	53	19	16

Table XV.—Population at Risk in Frankfort-on-Main.

Males.

Age.	1860—1866.	1867—1873.	1874—1880.	1881—1887.	1888—1889.
20—30	90,404	76,174	90,222	96,183	28,630
30—40	42,294	49,166	69,410	87,654	27,072
40—50	29,201	30,964	40,993	57,471	19,306
50—60	18,924	20,036	23,860	30,224	10,102
60—70	10,850	11,556	12,918	16,158	5,224
70—80	3,700	4,228	5,116	6,292	1,973
80 and over	617	750	919	1,137	366
Total ...	195,990	192,874	243,438	295,119	92,673

Females.

Age.	1860—1866.	1867—1873.	1874—1880.	1881—1887.	1888—1889.
20—30	74,536	85,365	108,009	133,871	41,545
30—40	40,880	50,361	70,137	91,459	28,576
40—50	27,260	31,019	41,705	60,116	20,364
50—60	19,645	21,320	26,813	34,575	11,467
60—70	12,172	13,881	16,524	21,439	6,926
70—80	4,272	5,288	7,008	8,957	2,786
80 and over	1,110	944	1,077	1,904	732
Total ...	179,875	208,178	271,273	352,321	112,396

Table XVI.—Frankfort.

Annual Deaths from Cancer in 1,000,000 living, aged 25 years and over. Population distributed in age groups according to English Life Table No. 3, Persons, as shown in Table C.

Males.

	Accessible.	Inaccessible.	Position undefined.	Total.
1860-66	126	1118	359	1603
1867-73	88	1421	137	1646
1874-80	14	1913	363	2290
1881-87	35	1865	305	2205
1888-89	74	1888	356	2318

Females.

1860-66	1081	1323	293	2697
1867-73	1214	1540	254	3008
1874-80	1220	1588	131	2939
1881-87	981	1820	272	3073
1888-89	1329	1930	256	3515

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THE SANITARY INSTITUTE.

CONGRESS AT SOUTHAMPTON, 1899.

THE BEHAVIOUR OF THE BACILLUS TYPHOSUS IN SEWAGE.

BY

W. H. HORROCKS, M.B., B.Sc. (London), Assistant Professor of Hygiene, Army Medical School, Netley.

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PARKES MUSEUM, MARGARET STREET,
LONDON, W.

[Excerpt from Vol. XX., Part IV., of The Journal of The Sanitary Institute.]

"*On the Behaviour of the Bacillus Typhosus in Sewage*," by W. H. HORROCKS, M.B., B.Sc. (London), Assistant-Professor of Hygiene, Army Medical School, Netley.

THE conveyance of enteric fever by drinking water has for many years been a cardinal doctrine of modern hygiene, and after the discovery of the bacillus typhosus by Eberth and Gaffky, diligent search was made for this organism in water supplies suspected to have caused enteric fever. With the advance of our knowledge of the reactions of the bacillus typhosus and the discovery of organisms closely allied to it, we have gradually had to multiply the tests to which a suspected organism must be subjected, and now-a-days attach great importance to the sedimentation test with typhoid serum.

In 1898, Dr. Houston isolated from Thames mud four organisms which he called Bacillus Typhosus Simulans, *a*, *b*, *c*, and *d*. They all resembled the true bacillus typhosus in morphology and the appearance of their surface colonies; they did not clot milk or produce gas in shake cultures, but the flagellæ only numbered from three to nine, and they all failed to sediment with typhoid serum. These four organisms appeared so closely related to the bacillus typhosus that the question at once arose as to whether the variations observed, especially in relation to the power of sedimentation, might not have been caused by prolonged existence in sewage-polluted water.

From this point of view I thought it would be interesting to study the behaviour of the bacillus typhosus in sewage under varying conditions. A recent culture of the bacillus typhosus isolated from the spleen of a fatal case of enteric fever, was obtained from Professor Wright, and gave the following re-actions:—

Morphology.—Long thin motile rods.

Surface Colonies on Gelatine.—Greyish white delicate films with a wavy outline and faint surface markings, the centre slightly more opaque than the margin.

Indol-reaction.—No indol was produced in peptone and salt solution after five days' incubation at 37° C.

Potato.—Transparent colourless growth.

Litmus Milk.—Incubated at 37° C. showed feeble acidity but no clot formed.

Shake Gelatine.—No gas formation.

Flagella.—About 10 disposed all round the bacillus.

Sedimentation.—Complete agglutination with typhoid serum in dilution of 1 in 40.

A specimen of sewage obtained from Yeovil was treated as follows:—

(*a*) Placed in sterile test-tubes and sterilised by heating to 65° C. for ten minutes on four successive days.

(*b*) Placed in test-tubes and sterilised in the auto-clave at 120° C. for fifteen minutes.

(*c*) Filtered through a Berkefeld bougie into sterile test-tubes.

All the test-tubes were inoculated with one loopful of a 48-hours growth of the bacillus typhosus, and then kept in the laboratory cupboard at a temperature which varied between 16° and 22° C.

The day following, one loopful was removed from each of the tubes and plated out in gelatine; after 72 hours' incubation at 22° C. all the plates were densely-crowded with colonies. Four days later a loopful was again removed and rubbed over an agar slope; after 24 hours at 37° C. a growth appeared covering nearly the whole surface. An emulsion in normal salt solution was then made from the agar growth, and sedi-

mentation tubes, according to Prof. Wright's method, were prepared with typhoid serum in dilutions of 1-20 and 1 in 40. Controls of the emulsion were made in the same dilutions with normal salt solution. Both the tubes prepared with typhoid serum were completely agglutinated in 24 hours, while the control tubes were unaffected.

Ten days after inoculation, a loopful was withdrawn and inoculated on agar; a growth resulted in 24 hours, which treated in the same way, agglutinated completely with typhoid serum in a dilution of 1 in 40.

At the end of three weeks the same results were obtained.

After two months, a loopful was removed and plated out in gelatine; very few colonies appeared and those which did grow, were black in color with granular contents, and the margin was only slightly wavy. In fact they appeared so unlike the original colonies that it was feared some pollution had occurred. However, one of the colonies was fished and inoculated on agar; after 24 hours a growth appeared which, when tested with typhoid serum, agglutinated completely in a dilution of 1 in 40. Besides the change in the appearance of the colonies, the bacillus typhosus appeared to have less resistance to carbolic acid, for while the original culture gave a copious growth in broth containing ·05 per cent. carbolic acid after 24 hours incubation at 37° C., the agar growth prepared from the discolored colonies showed no growth after 24 hours incubation at 37° C. in ·05 per cent. carbol. broth, but after 48 hours there was a slight loss of transparency, and after 72 hours there was a marked growth.

Experiments on the same lines were made with the same sewage in dilution of 1 in 10; identical results were obtained.

These experiments appeared to show that the bacillus typhosus will be found alive after 60 days' immersion in strong and diluted sewage containing its usual toxines and salts, but freed from other living organisms. The power of sedimentation will be unchanged, but the colonies may present a dark granular crumpled appearance and the bacillus will show diminished resistance to carbolic acid. This last fact appears to me important in relation to Parietti's test for the detection of the bacillus typhosus in water.

Having arrived at these conclusions, I thought it would be interesting to repeat the experiments on the same lines, but to add B. Coli to all the tubes after the inoculation of the B. Typhosus. A typical B. Coli was isolated from a normal stool and gave the following re-actions:—

Morphology.—Very short rods, feebly motile.

Surface Colony on Gelatine.—Greyish white film with a transparent margin and irregular outline. The whole colony was thicker than the colony of B. Typhosus.

Shake Gelatine.—Abundant gas formation.

Litmus Milk.—Milk clotted and marked acid re-action after 24 hours, at 37° C.

Indol.—Marked indol re-action after three days at 37° C.

Potato—Yellowish brown slimy growth.

Flagella.—One to three, readily breaking off.

Sedimentation—No re-action with typhoid serum in dilutions of one in ten and upwards, but with serum obtained from a rabbit immunised with the same bacillus, complete agglutination was readily obtained in dilutions up to 1 in 40.

Before adding this specimen of B. Coli to the tubes containing the bacillus typhosus, I thought it would be wise to see if any change occurred in its re-actions, after existence in sterile sewage. After immersion for 42 days in sewage filtered through a Berkefeld bougie, there was no difference in the sedimentation tests, but the colonies showed a tendency to grow out as very thin films with leaf-like projections strongly resembling the bacillus acidi lactici, the production of indol appeared to be delayed, and the bacillus seemed less resistant to carbolic acid, for whereas the original coli grew well in 0·2 °/₀ carbolic acid broth, after 24 hours' incubation at 37° C., the coli from the sewage showed no growth in 0·15 °/₀ carbol broth after 24 hours at 37° C., but grew well in 0·1 °/₀ carbol broth. The other re-actions of the bacillus however, appeared unchanged. A fresh 24 hours' culture of this B. Coli was now added to the test tubes containing the B. Typhosus innoculated 24 hours earlier.

After 14 days, loopfuls were removed and plated in Holtz's potato-gelatine, and rubbed over the surface of gelatine solidified in Petri dishes.

In the potato-gelatine plates colonies appeared which resembled the bacillus typhosus, but on fishing them and innoculating into glucose gelatine they all gave marked gas formation. The same result was obtained with the ordinary gelatine plates. Of course it was impossible to examine all the colonies, but on the ordinary gelatine most of the colonies were discrete, and being on the surface could easily be fished. A great many colonies were examined, but they all gave the reactions of the bacillus coli. The potato-gelatine method proved very disappointing. Many of the colonies which appeared like small clear drops of water, and should have been bacillus typhosus, proved to be the bacillus coli. The experiment was repeated again, but in a slightly different manner. A large loopful of a twenty-four hours' growth on agar of the bacillus typhosus was added to 10 cc. of sterile sewage, and incubated at 37° C. for 48 hours; the

sewage was then found quite opaque, and one loopful plated out in gelatine produced innumerable colonies of the bacillus typhosus. A very small quantity of an agar growth of bacillus coli was now introduced into the mixture of sewage and bacillus typhosus, and the tube kept at the laboratory temperature. At the end of five days the bacillus typhosus could still be isolated, and agglutinated well with typhoid serum.

It is well known that the bacillus typhosus will not grow well in a broth-culture of B. coli which has been filtered through a bougie, but tends to disappear. It is, however, interesting to note that the bacilli which do survive still retain their agglutinating action when mixed with typhoid serum.

Working on the same lines with a mixture of bacillus fluorescens liquefasciens and bacillus typhosus in sterilised sewage, I have not been able to isolate the bacillus typhosus after the 7th day; but when last isolated it agglutinated well with typhoid serum.

These experiments appear to show that prolonged immersion in sterile sewage does not destroy the agglutinating action of the bacillus typhosus with typhoid serum, and that though the presence of other organisms may cause its rapid disappearance in raw sewage, if the bacillus be found it will still retain its specific characteristics.

With regard to the value of the agglutination test as a means of diagnosis, I think that at present our knowledge warrants us in considering it of the first importance. When properly employed the test easily enables us to distinguish the bacillus typhosus from the bacillus sulcatus and the various forms of coli.

In the performance of the test, however, there are errors which it is important to guard against. In the first place it must be remembered that the normal serum of the horse (diluted from 1 in 30 to 1 in 50) has been found occasionally to have an agglutinating action with the bacillus typhosus. I tested the normal serum of one of the horses at Netley, but failed to discover any complete agglutinating action in a dilution above 1 in 10. Still, in making my experiments a dilution of at least 1 in 160 was always used so as to avoid this source of error. In the second place, when testing the bacillus coli and the bacillus fluorescens liquefasciens with serum from a normal and an immunised horse, I noticed that after 24 hours distinct sedimentation occurred in the capillary tubes. Yet when the tubes were opened and the sedimented portion examined in a hanging drop, no traces of clumping were observed in the case of the bacillus coli, and in the case of the bacillus fluorescens liquefasciens the clumps were small and made up of bacilli which, though adhering together, still possessed sufficient mobility to cause the clumps as a whole to move in the field, contrasting very strongly with the motionless clumps of the bacillus typhosus. This false clumping may have been partially due to the sticky nature of the agar growth of the bacillus fluorescens liquefasciens, which would, perhaps, cause the bacilli to adhere together after they had been precipitated by the serum. Control tubes of the emulsions of the bacillus coli and bacillus fluorescens liquefasciens put up in dilutions of 1 in 10 did not show the slightest trace of sedimentation.

I have not found that typhoid serum completely sedimented the bacillus typhosus without at the same time producing distinct agglutination. Still, when using a typhoid serum as a means of diagnosis of a bacillus, it appears to me that we are hardly justified in considering the sedimentation produced by the slow method in capillary tubes as necessarily indicating agglutination. The macroscopic appearances should always be checked by a careful microscopic examination.

[*This discussion also applies to the paper by* Dr. Arthur Ransome.]

Dr. A. Angell (Southampton) said he thought the moment had arrived when it would be somewhat useful to throw a little heterodoxy into the consideration of the subject of micro-organisms. As a "Naturalist" he felt in great difficulty in his own mind to believe that there was such a thing as a pathogenic germ, *i.e.*, a pathogenic germ *ab initio*. He believed that germs were pathogenised by the dirty conditions under which they were very frequently caused to grow and work. Of course there could be generic differences, they could see differences in many directions. They had to admit that man was the dirtiest of all the animals, and creatures which men call domestic animals, he had made dirty to suit his objects. He cited the pig as an instance of this, and went on to refer to the outbreak in Dawson city, suggesting that it was far more likely that the

bacillus of typhus was manufactured there by the social conditions which existed, than that it was carried there. Nearly all the papers which had been read at the Congress indicated that he was right in so thinking, and the biologist ought to search for the conditions under which the ordinary germs became pathogenised or changed from their normal state into one which is abnormal, rather than to make fruitless efforts to discover specific disease germs.

Sir Joseph Ewart asked whether Dr. Ransome's experiments had proved that the tubercle bacilli, which were non-virulent, would take on virulence if passed through the body of an animal?

Dr. A. Ransome (Bournemouth) replied that although they had no direct proof that non-pathogenous germs became pathogenised, yet he thought most of the pathogenic organisms must have originated in another form, and become pathogenised by environment. That was merely an expression of opinion, he had no proof, and did not know that anyone else had obtained proof that virulent bacilli, cultivated on various organic media, at ordinary temperature, remained virulent. It was exceedingly difficult to answer the other question as to whether these cultivations would become virulent if they could make them pass through some small animal, either with the specified disease or in some other way, but the fact that they had not managed to make these cultivations produce tubercle, made the question difficult. The important thing was to recognise tubercle as a "filth-disease," whether truly saprophytic or not. All the means that medical officers had been accustomed to put in force in order to do away with filth, could be adopted with express reference to tubercular disease.

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THESIS

FOR THE

Degree of Doctor of Science of Edinburgh University.

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ON THE

RELATIVE EFFICIENCY OF CERTAIN FILTERS FOR REMOVING MICRO-ORGANISMS FROM WATER, WITH SPECIAL REFERENCE TO THE NORDTMEYER-BERKEFELD AND PASTEUR-CHAMBERLAND FILTERS.

BY

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ARMY MEDICAL STAFF, D.SC., M.D., C.M., F.L.S.,

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1st AUGUST 1894.

EDINBURGH:
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PREFACE.

THE experiments forming the subject of this Thesis were made in the Public Health Laboratory of Professor Sir Douglas Maclagan, in the University of Edinburgh, between October 1893 and June 1894. They were carried out at the suggestion and under the direction of Dr Hunter Stewart, to whom I am indebted for much valuable advice and universal courtesy. I am also indebted to my brother, Mr Charles S. S. Johnston, Architect, Edinburgh, for the drawings of the filters and autoclave. The experiments were made for the purpose of testing the relative efficiency of the different filters experimented with for removing micro-organisms from water, with special reference to the selection of the best filter for sterilizing drinking-water. The results of the experiments have conclusively proved that the Pasteur-Chamberland Filter (cylinders stamped "B") is undoubtedly the best and the only one on which reliance can be placed for permanently sterilizing drinking-water.

HENRY HALCRO JOHNSTON.

LEITH FORT,
SCOTLAND, 1st *August* 1894.

NOTE.

In Plate V. the filtering cylinder is shown by mistake as contained in its metal case. The Nordtmeyer-Berkefeld and Pasteur-Chamberland filtering cylinders were sterilized alone without their metal cases.

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1 Litre = 1 pint 15 ounces 2 drachms 11 minims ($1\frac{3}{4}$ pint nearly).

1 cubic centimetre (1 cc.) = 16.949 minims (17 minims nearly).

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Laveran, *Des Filtres Maignen, Archives de Médicine Militaire*, No. 15, 1886. In this article the filter is described by Laveran.

THE PASTEUR-CHAMBERLAND FILTER.

Chamberland, *Comptes Rendus*, Tome 99, p. 247, 1884. The filter is first described in a note by Chamberland.

Miguel, *Revue d'Hygiene*, p. 536, 1884, experimented with the unfiltered Seine water at $\frac{1}{2}$ atmosphere pressure, and with the water of the Ourcq at 3 to 4 atmospheres. His experiments extended over one week, and all the cultures made with the filtered water were sterile. He does not state which kind of cylinder he used.

Kübler, *Zeitschrift für Hygiene*, Band 8, 1890, sterilized the cylinders for 1 hour in steam at 100° C. He experimented with unfiltered Berlin water without pressure, and the results of his experiments were that the cylinders only sterilized the

filtered water for 4 days of continuous filtration. He does not mention the kind of cylinders he used, but from the rate of filtration (183 cubic centimetres per hour for each cylinder, on the first day of filtration), he appears to have used the same kind as those used in the experiments forming the subject of this Thesis, viz., those stamped "B," in which the rate of filtration is only one-third of that in the cylinders stamped "F." If he used the slow filtering cylinders stamped "B," the results of his experiments are entirely antagonistic to those obtained by the method adopted in this Thesis, in which the chances of accidental contamination of the filtered water, and the cultures made with it, were reduced to a minimum. If he used the fast filtering cylinders stamped "F," his results are also antagonistic to those obtained by Guinochet, who experimented with "F" cylinders, and came to the conclusion that the few bacterial colonies, occasionally found in some of the cultures made with filtered water, were due to accidental contamination during the process of making the cultures.

GUINOCHET, *Archives de Médicine Expérimentale*, Tome 5, p. 646, 1893, working in the Laboratory of Professor Straus, Paris, with cylinders stamped "F" for rapid filtration, at pressures of 10 to 40 mètres, for periods extending over several weeks of continuous filtration, obtained results which are very satisfactory, considering that he did not sterilize the cylinders. He came to the conclusion that the few bacterial colonies and moulds occasionally found in some of his cultures made with the filtered water, were due to accidental contamination during the process of making the cultures.

It is very important that experimenters, in publishing their results, should mention the particular kind of cylinder used, the method of preparation for experiment, and the pressure and rate of filtration of the water at the time of making the experiments; because the different results obtained by different experimenters may be due to the use of different kinds of cylinders, or to the different methods adopted of preventing accidental contamination of the cultures.

METHOD OF PREPARING AND STERILIZING THE NUTRIENT JELLY AND APPARATUS USED IN MAKING THE CULTURES.

THE nutrient jelly was made by the well-known process of Koch. It contained 10 per cent. of gelatine, 1 per cent. of peptone, and ½ per cent. of sodium chloride. The reaction of the broth from which the jelly was prepared was, through all stages of its preparation, alkaline to litmus and turmeric paper. This was necessary on account of the amphoteric reaction of animal fluids. The test tubes, containing 10 cubic centimetres each of the nutrient gelatine jelly, were sterilized by steam at 100° C., in Hunter Stewart's autoclave (Plate V.) for one hour on three consecutive days. The plugs of cotton-wool were then scorched in a Bunsen flame, and the mouths of the test tubes covered with indiarubber caps, which had been previously sterilized by immersion in corrosive sublimate solution, 1-1000, for 2 hours, and allowed to dry between folds of filter paper. Several gross of these tubes were prepared, and in every tube the nutrient jelly remained permanently sterile. Esmarch's roll culture tubes, containing 7 cubic centimetres each of nutrient gelatine jelly, were prepared in the same manner as the test tubes.

The following glass apparatus, after having been well washed in distilled water, was sterilized by dry heat at 160°-180° C., for 1½ hour:—Petri's capsules, collecting flasks plugged with cotton-wool, and dropping tubes plugged with cotton-wool at the upper end. The collecting flasks were 200 cc. Bohemian glass vessels, having mouths ¾ inch in diameter; and the dropping tubes were made of pieces of $\frac{3}{16}$-inch glass tubing, 11 inches long, and tapered at the lower or dropping end. Fifteen drops of water from each of these dropping tubes measured 1 cubic centimetre.

Forster's boxes were well moistened inside with corrosive sublimate solution, 1-200, the day before they were used, and at the same time three sheets of filter paper moistened with the corrosive sublimate solution were placed in each box. One sheet was placed at the bottom of the box, and the other two sheets were placed, in the experiments, above the first and second pairs of Petri's capsules respectively, to prevent the entrance of micro-organisms from the air during the period of incubation of the plate cultures. During the short time occupied in pouring the melted jelly from the test tubes into Petri's capsules, the latter were placed on a glass slab moistened with corrosive sublimate solution, 1-200.

The nutrient jelly in the test tubes and in Esmarch's tubes was melted by placing the lower ends of the tubes in a beaker containing some warm corrosive sublimate solution, 1-200. Before making the cultures, the hands were well washed in distilled water, and then in corrosive sublimate solution, 1-200, after which they were allowed to dry.

The iron tongs used for removing the cotton-wool covering the lower end of the filter-nozzles, at the beginning of each series of experiments, was sterilized by heating to redness in a Bunsen flame.

THE ATKINS PATENT WATER FILTER.

6-GALLONS.

MANUFACTURERS :—
THE ATKINS FILTER AND ENGINEERING COMPANY, Ltd.,
33 Bouverie Street, London, E.C.

Description and Method of Preparation for Experiment.— This filter is made of stoneware, and consists of two parts, an upper and a lower, separated from each other by a stoneware diaphragm, in the centre of which is an aperture fitted with a cork containing a metal tube. The lower portion consists of a reservoir capable of holding about 2½ gallons of filtered water, and it is provided with a metal tap near the bottom. The upper portion contains the filtering material, which consists of a block of wood charcoal, 6 inches high and 5¾ inches in diameter, and fits on to the metal tube; this block being surrounded with granulated animal charcoal. The filter has a small aperture at the back of the upper rim connected with an air passage reaching to the lower part of the filter. As it was impracticable to sterilize the lower reservoir and make cultures with the filtered water at any particular time, I employed Messrs John Ford & Co., Flint Glass Manufacturers, Edinburgh, to make a cylindrical glass vessel (Plate I.), open at the upper end, and closed at the lower end, with a flat bottom, perforated at the centre by a 1⅝-inch circular aperture. The internal dimensions are—height, 11½ inches; and diameter, 11 inches. This vessel corresponds to the upper reservoir and perforated diaphragm of the Atkins Filter, and it is supported on a wooden bench, through which a circular aperture is bored opposite the aperture in the bottom of the glass vessel. The block of wood charcoal is a cylinder, 6 inches high and 5¾ inches in diameter, and it contains a central cylindrical cavity, 3½ inches long and 1¼ inch in diameter, which is closed at the top and open at the bottom. The lower 1¼ inch of this cavity is firmly plugged with a perforated cork containing a metal tube. The thickness of the wood charcoal, between the outer surface and internal cavity of the block, is 2¼ inches. The superficial filtering area of the external surface of the block is 160 square inches, and that of the wall of the internal cavity 10 square inches, so that, in a given time, the quantity of water filtering through 1 square inch of the wall of the internal cavity is equivalent to the quantity of water filtering through 16 square inches of the external surface of the block. The metal tube referred to has an internal diameter of $\frac{1}{12}$ inch, and has a ⅞-inch flange situated 1½ inch from the upper end and 2 inches from the lower end. The upper portion of this tube is pushed through the perforated cork in the block of wood charcoal, and the lower portion through a perforated cork, for which was substituted a perforated indiarubber stopper, and the flange on the tube is in contact with the cork above and indiarubber stopper below. In the first series of experiments the lower end of the metal tube, which projects ¾ inch beyond the indiarubber stopper, was connected to a glass nozzle by means of a piece of ⅜-inch indiarubber tube. Before sterilizing the block of wood charcoal, the lower end of the glass nozzle was covered with cotton-wool secured with cord, and a screw-clip was applied to the indiarubber tube, without compressing it. The block of wood charcoal, thus prepared, was placed in distilled water, contained in an earthenware jar covered with white paper, and boiled at 100° C. in the autoclave for 1 hour on three different occasions, viz., 23rd, 24th, and 28th November 1893. Between the first and last boilings the prepared block was left immersed in the boiled distilled water in the earthenware jar covered with sterilized paper. After the third boiling, on 28th November, the indiarubber tube was compressed by means of the screw-clip, to prevent the entrance of air through the nozzle during cooling, and the prepared block of wood charcoal, held by the right hand between several folds of sterilized paper, was quickly transferred, while hot, to the glass vessel, and the indiarubber stopper inserted

into the aperture in the bottom of the vessel. The block of wood charcoal was then surrounded with 14 lbs. of granulated animal charcoal, which, with the lid and interior of the glass vessel, had previously been well washed with distilled water, but not sterilized. On 30th November the filter was filled with Edinburgh main water, and the first series of experiments was made between that date and 8th December 1893, after which the filter was allowed to stand full of water, containing innumerable micro-organisms, until 15th May 1894, when it was prepared for the second series of experiments.

In the second series of experiments the same block of wood charcoal and granulated animal charcoal were used as in the first series. The block of wood charcoal was prepared in the same manner, except that for the glass nozzle was substituted one of gun-metal, ¼ inch in diameter, 4½ inches long, and tapered at the lower end, with a terminal bore of $\frac{1}{16}$ inch. The indiarubber tube connecting the gun-metal nozzle with the metal tube of the filter is secured at both ends with silked copper wire. The block was partly surrounded with a piece of folded calico secured with an indiarubber band, to prevent the block becoming contaminated when lifted in the hand. On 15th May 1894 the granulated animal charcoal was placed in distilled water, contained in two tin pails covered with tin lids, and boiled at 120° C. (15 lbs. steam pressure to the square inch) in the autoclave for 1 hour. The steam was then turned off, and the charcoal allowed to cool in the closed autoclave until the following day, when the prepared block of wood charcoal was boiled in the same manner at 120° C. for 1 hour and, while hot, quickly transferred to the glass vessel, the lid and interior of which had been previously well washed several times with distilled water, sterilized by boiling at 120° C. for 1 hour, in the autoclave. The indiarubber band and calico were then removed from the block of wood charcoal, after which the block was surrounded with the cool granulated animal charcoal, and the mouth of the glass vessel was covered with the lid of the Atkins Filter. The second series of experiments with *Bacillus violaceus* was made between 17th and 23rd May 1894.

MAIGNEN'S TABLE "FILTRE RAPIDE."

3-PINTS.

MANUFACTURERS:—

MAIGNEN'S "FILTRE RAPIDE" and "ANTI-CALCAIRE" CO., Ltd., 43 Commercial Street, London, E.C.

Description and Method of Preparation for Experiment.—Plate II. represents this filter as prepared for use in the experiments. The glazed porcelain filtering frame is nearly cylindrical, 3 inches high, 3 inches in diameter at the lower end, and 2½ inches at the upper end. The side of the filtering frame is perforated with 70 $\frac{3}{16}$-inch holes, which in the aggregate occupy a superficial area of 5.37 square inches. The filtering frame is inclosed in a cylindrical jacket of asbestos cloth, secured at each end with asbestos cords, which are lodged in circular grooves at each end of the filtering frame. The superficial filtering area of the asbestos cloth is 21 square inches. The top of the filtering frame is flat, entire, and uncovered with asbestos cloth. The bottom of the frame is provided at the centre with a wide obconical porcelain nozzle, 1¼ inch long, fitted into the upper end of a piece of ⅜-inch indiarubber tube, and secured to the glass vessel by means of a perforated indiarubber stopper, which is inserted into a short cylindrical aperture at the centre of the bottom of the glass vessel. This indiarubber stopper takes the place of the asbestos washer supplied with the filter. The glass vessel is supported on a wooden bench, through which a circular aperture is bored to receive the short cylindrical tube at the bottom of the vessel. The lower end of the indiarubber tube was connected to glass and gun-metal nozzles in the first and second series of experiments respectively, in exactly the same manner as described for the Atkins Filter. The lower ends

of the nozzles were covered with cotton-wool secured with cord, and a screw-clip was applied to the indiarubber tube, without compressing it. On 24th November 1893 the filtering frame, thus prepared, was sterilized by steam at 100° C. for 1 hour in the autoclave, and then quickly transferred, while hot, by means of sterilized iron tongs, to the glass vessel. A charge of powdered carbo-calcis, which had been previously boiled with a litre of distilled water in a sterilized glass flask, plugged with cotton-wool, for ½ hour in the autoclave at 120° C. (15 lbs. steam pressure to the square inch), and allowed to cool, was then allowed to filter rapidly through the asbestos cloth, on which the powdered carbo-calcis was deposited in a thin film. The filtering frame was surrounded with granular carbo-calcis, which, with the porcelain screen, glass cover, and interior of the glass vessel had previously been well washed with distilled water, but not sterilized. The indiarubber tube was then closed by means of the screw-clip.

On 30th November the filter was filled with Edinburgh main water, and the first series of experiments was made between that date and 8th December 1893, after which the filter was allowed to stand full of water, containing innumerable micro-organisms, until 15th May 1894, when it was prepared for the second series of experiments. In the second series of experiments the powdered carbo-calcis was washed off the asbestos cloth and a fresh charge used. On 16th May 1894 the prepared filtering frame, provided with a gun-metal nozzle, and the powdered and granular carbo-calcis were sterilized by boiling at 120° C. for 1 hour in the autoclave, and, while hot, they were transferred to the glass vessel, which, with its cover and the screen, had previously been well washed several times with distilled water, sterilized by boiling at 120° C. for 1 hour in the autoclave. The second series of experiments with *Bacillus violaceus* was made between 17th and 23rd May 1894.

FIRST SERIES OF EXPERIMENTS WITH THE ATKINS PATENT WATER FILTER AND MAIGNEN'S TABLE "FILTRE RAPIDE."

TABLES I. AND III.

ON 30th November 1893, these two filters, after having been prepared in the manner described, were filled with Edinburgh main water, containing 160 micro-organisms in each cubic centimetre, and, by means of the screw-clips compressing the indiarubber tubes, were allowed to filter slowly through the cotton-wool covering the lower ends of the glass nozzles. On the following day, after 24 hours' continuous slow filtration, the cotton-wool was removed from the nozzles with sterilized iron tongs, and some of the filtered water was received into sterilized collecting flasks, the cotton-wool plugs and necks of the flasks having been previously scorched in a Bunsen flame. Two plate cultures were then made with the filtered water from each filter, in the following manner:—Two test tubes, containing each 10 cc. of sterilized gelatine jelly, were placed in a beaker of warm corrosive sublimate solution, 1-200, until the jelly was melted. The indiarubber caps were then removed, and the cotton-wool plugs and mouths of the test tubes scorched in a Bunsen flame. By means of a sterilized dropping tube 10 and 20 drops of the filtered water were transferred from the collecting flask to the two test tubes respectively, and after mixing the water and melted jelly together by shaking, two cultures were made in sterilized Petri's capsules, which were then placed in a sterilized Forster's box, and transferred to the incubator at 19° C.

Both filters were then allowed to filter slowly continuously until 8th December, when fresh sterilized glass nozzles were inserted into the indiarubber tubes, and plate cultures made in the same manner as in the first experiment. During the week's filtration the total quantity of water that passed through the Atkins Filter was 12 litres, and Maignen's Filter 4½ litres. In the Atkins Filter, when the filter was nearly full, the rate of filtration was 17 litres per hour, which is at the rate of 106 cc. per

hour for each square inch of the outer filtering surface of the block of wood charcoal, and 1700 cc. per hour for each square inch of the inner filtering surface of the block. In Maignen's Filter the rate of filtration, when the filter was full, was 9 litres per hour, which is at the rate of 428 cc. per hour for each square inch of filtering surface of the asbestos cloth. The rate of filtration was calculated from the time taken to fill a ½-litre flask. The extreme porosity of these filters is therefore very evident, since they filter without any pressure, except that of the column of water in the filters themselves.

In No. 1 experiment the cultures were examined at the end of 4 days' incubation, and in No. 2 experiment at the end of 3 days.

Results.—In all the cultures from both filters the number of colonies of micro-organisms was so enormous as to be quite uncountable, and the jelly was quickly liquefied.

Conclusions.—In this series of experiments the granulated animal charcoal in both filters was not sterilized, but merely washed in distilled water, and if the block of wood charcoal in the Atkins Filter, and abestos cloth covered with powdered carbo-calcis in Maignen's Filter, were properly sterilized, it is evident that these filtering materials alone, exclusive of the granulated animal charcoal, were not only useless in removing micro-organisms from the water, but that they formed a suitable nidus for the rapid growth and multiplication of micro-organisms. As the Edinburgh main water placed in the filters only contained 160 micro-organisms in each cubic centimetre, it is probable that the large numbers of micro-organisms found in the filtered water were derived from the multiplication of the micro-organisms in the pores of the unsterilized granulated animal charcoal, as well as from the micro-organisms present in the Edinburgh main water. As will be noticed in the second series of experiments, it is also doubtful whether boiling at 100° C. for 1 hour on three different occasions was sufficient to sterilize the whole thickness of the block of wood charcoal in the Atkins Filter.

SECOND SERIES OF EXPERIMENTS WITH THE ATKINS PATENT WATER FILTER AND MAIGNEN'S TABLE "FILTRE RAPIDE."

TABLES II. AND IV.

ON 17th May 1894, 5 cc. of a somewhat old broth culture of *Bacillus violaceus*, made on 27th March 1894, was added to a large pailful of distilled water, which had been previously boiled at 120° C. in the autoclave for 1 hour and allowed to cool to 21° C. The water was then well stirred with a sterilized metal spoon, and a plate culture made with 1 cc. of the water in sterilized gelatine jelly, from which it was ascertained that each cubic centimetre of the water contained 12 *Bacilli violacei* and 33 other micro-organisms. Both filters, after having been prepared in the manner described, were then filled with this water, and as soon as filtration was established the cotton-wool covering the lower ends of the gun-metal nozzles was removed with sterilized iron tongs. The lower ends of the nozzles were sterilized in a Bunsen flame, and immediately after the rapid filtration of 2 litres of water from the Atkins Filter and ½ litre from Maignen's Filter, the indiarubber tubes were compressed by the screw-clips until the filtered water fell in drops from the nozzles. 1 cc. (19 drops) of the filtered water from each filter was then received direct from the nozzles into test tubes containing sterilized gelatine jelly, with which plate cultures were made in sterilized Petri's capsules and placed in a sterilized Forster's box in the incubator at 19° C. The indiarubber tubes were then still more compressed by the screw-clips until just sufficient water was allowed to flow to keep the nozzles full of water. On the following day (18th May) plate cultures were made in the same manner, immediately after the rapid filtration of 1 litre of water from the Atkins Filter and ½ litre from Maignen's Filter. Plate cultures were again made in the same manner on 23rd May. In experiments Nos. 1 and 2 the cultures were examined at the end of 4 days' incubation, and in experiment No. 3 at the end of 2 days.

Results.—In the case of the Atkins Filter, in experiment No. 1, in which the culture was made after the rapid filtration of 2 litres of water immediately after placing the unfiltered water in the filter, there were no *Bacilli violacei*, but there were 3150 other micro-organisms in 1 cc. of the filtered water. In this series of experiments the whole of the filtering material had been previously boiled at 120° C. for 1 hour, and as the unfiltered water only contained 33 other micro-organisms in 1 cc. at the time the experiment was made, it is evident that, during boiling, sufficient heat did not penetrate the charcoal to kill all the micro-organisms lodged in its deeper pores during and after the first series of experiments. In experiment No. 2, made at the end of 1 day, and in experiment No. 3, made at the end of 6 days, the number of colonies of *Bacillus violaceus*, and especially of other micro-organisms, was so enormous as to be quite uncountable, and the jelly quickly liquefied.

In the case of Maignen's Filter, sterilization was more easily accomplished. In experiment No. 1, made after the rapid filtration of ½ litre of water immediately after placing the unfiltered water in the filter, the plate culture contained no *Bacilli violacei* and only 4 colonies of other micro-organisms in 1 cc. of the filtered water. In experiment No. 2, made on the following day, immediately after the rapid filtration of ½ litre of water, there were 7 colonies of *Bacillus violacei* and 26 colonies of other micro-organisms in the plate culture made with 1 cc. of the filtered water. In experiment No. 3, made at the end of 6 days, the number of colonies of *Bacillus violacei* and other micro-organisms was so enormous as to be quite uncountable, and the jelly quickly liquefied.

Conclusions.—Although the Atkins Filter was not sterilized by boiling for 1 hour at 120° C., still the enormous numbers of *Bacilli violacei* and other micro-organisms found in the filtered water, after 1 day's filtration, conclusively proves that this filter not only allows micro-organisms to pass through its pores, but the charcoal forms a suitable nidus for the growth and multiplication of micro-organisms, which are found in much greater numbers in the filtered water than in the unfiltered.

Maignen's Filter is of some service in removing micro-organisms from water on the first and second days of filtration, but after that it forms a suitable nidus for the growth and multiplication of micro-organisms, which are found in much greater numbers in the filtered water than in the unfiltered. These filters are, therefore, useless for sterilizing water, and no reliance can be placed on them for removing pathogenic micro-organisms from drinking-water.

THE NORDTMEYER-BERKEFELD FILTER.

MANUFACTURERS:—
THE BERKEFELD FILTER COMPANY, Ltd., 121 Oxford Street, London, W.

Description.—This filter (Plate III) is composed of diatomaceous earth called "Kieselguhr," and it consists of a hollow cylinder, $7\frac{1}{2}$ inches long and 1 inch in diameter, which is open at the lower end only, where it is provided with a glazed porcelain nozzle. At the junction of the cylinder with the nozzle, the latter is provided with a circular flange, $1\frac{1}{2}$ inch in diameter, on which is supported a circular indiarubber washer. The internal cavity of the cylinder is cylindrical in shape, $6\frac{1}{8}$ inches long and $\frac{3}{8}$ inch in diameter, and opens into the porcelain nozzle at its lower end. The filtering material is $\frac{5}{16}$ inch thick between the outer surface and internal cavity of the cylinder. The superficial filtering area of the outer surface of the cylinder is 24.34 square inches, and that of the wall of the internal cavity 8.1 square inches, so that the quantity of water filtering through 1 square inch of the wall of the internal cavity is equivalent to the quantity of water filtering through 3 square inches of the outer surface of the cylinder. The cylinder is enclosed in a metal case, and is retained in position by means of a metal cap, which is screwed on to the lower end of the case and provided at its centre with a circular aperture, through which projects the nozzle of the cylinder. The upper end of the metal case is provided with a stop-cock, which, when the filter is in use, is screwed on to a water supply-pipe, from which the water enters the metal case, filters through the cylinder into its internal cavity, and escapes through the nozzle at the lower end of the cylinder.

THE PASTEUR-CHAMBERLAND FILTER.

MANUFACTURERS:—

THE PASTEUR-CHAMBERLAND FILTER COMPANY, 58 Rue Notre-Dame-de-Lorette, Paris.

AGENTS:—

Messrs J. DEFRIES & SONS, 147 Houndsditch, London, E.C.

Description.—This filter (Plate IV.) is composed of very fine grained unglazed porcelain, and it is constructed and used in the same manner as the Nordtmeyer-Berkefeld Filter. The cylinder stamped "B" is 8 inches long and 1 inch in diameter. The internal cavity is $7\frac{7}{8}$ inches long and $\frac{10}{12}$ inch in diameter. The filtering material is $\frac{1}{12}$ inch thick between the outer surface and internal cavity of the cylinder. The superficial filtering area of the outer surface of the cylinder is 25.92 square inches, and that of the wall of the internal cavity 21.15 square inches, so that the quantity of water filtering through 1 square inch of the wall of the internal cavity is equivalent to the quantity of water filtering through 1.22 square inch of the outer surface of the cylinder. The two cylinders experimented with were stamped "B" on the upper end.

Method of Preparation for Experiment.—Both filters were prepared in exactly the same manner, and used under the same conditions in each series of experiments. The porcelain nozzle of each filter is connected to a gun-metal nozzle by means of a short piece of $\frac{3}{8}$-inch indiarubber tube, secured at each end with silked copper wire. The gun-metal nozzles are $4\frac{1}{2}$ inches long, $\frac{1}{4}$ inch in diameter, tapered at the lower end, with a terminal bore of $\frac{1}{16}$ inch, and, except in the first series of experiments, provided with a circular flange $\frac{7}{8}$ inch in diameter, 1 inch from the lower end of the nozzle; 19 drops from each of these gun-metal

nozzles measured 1 cubic centimetre respectively. Before sterilizing the cylinders, the indiarubber washers were placed on them, and the lower ends of the gun-metal nozzles were covered with cotton-wool secured with cord, to prevent the entrance of air micro-organisms during cooling of the cylinders before filtration was established. The two cylinders thus prepared were placed in distilled water in a tin trough, and sterilized by boiling in the autoclave. In the first series of experiments both prepared cylinders were boiled at 115° C. ($12\frac{1}{2}$ lbs. steam pressure to the square inch), for $\frac{1}{4}$ hour; in the second series of experiments, at 120° C. (15 lbs. steam pressure to the square inch), for $\frac{1}{2}$ hour; in the third series, with the Nordtmeyer-Berkefeld Filter, at 120° C. for 1 hour; and in the last series, with both filters, at 115° C. for 1 hour. In all the series of experiments, the sterilized prepared cylinders were transferred to their metal cases while hot, and as soon as they were cool the stop-cocks were turned full on, and the water allowed to filter continuously day and night until the end of each series of experiments.

Plate IV. shows the method adopted of fixing up the filters for experiment in the laboratory. A metal water-pipe soldered to the end of a main water-tap is fixed along the top of a range of shelves for bottles. This supply-pipe is provided with (1) a gun-metal tap for supplying unfiltered water; (2) a water pressure gauge; (3) a short branch to which is fixed the Nordtmeyer-Berkefeld Filter; and (4) a terminal end to which is fixed the Pasteur-Chamberland Filter.

Method of Making the Experiments.—As soon as filtration was established in both filters, after having been prepared and fixed up in the manner described, the cotton-wool covering the lower ends of the gun-metal nozzles was removed with sterilized iron tongs. The gun-metal tap for unfiltered water and the gun-metal nozzles of the filters were invariably sterilized in a Bunsen flame and allowed to cool, before collecting water for making cultures with in each experiment. After sterilizing the nozzles, 10 minutes' filtration was allowed before collecting the filtered water for making cultures with, so as to ensure the escape of all water heated in the Bunsen flame during sterilization of the nozzles. Only the lower ends of the nozzles, including the flanges, were heated in the Bunsen flame, and the subsequent 10 minutes' filtration was ample for the purpose of allowing all heated water to escape from the nozzles.

In the first series of experiments and in the first ten experiments of the second series with both filters, collecting flasks and dropping tubes were used in the same manner as described for the Atkins and Maignen's Filters; but in all the other experiments with both filters, 1 cubic centimetre (19 drops) of filtered water was received direct from the gun-metal nozzles into each tube of sterilized gelatine jelly. This method considerably lessened the chance of air micro-organisms accidentally entering the cultures, especially in the experiments made before the gun-metal nozzles were provided with flanges. The diameter of the mouths of the collecting flasks is ¾ inch, and in the case of the Pasteur-Chamberland Filter, after three day's filtration, the mouth of the collecting flask had to be left uncovered for 1 minute, until sufficient water was received to fill the dropping tube; after a week's filtration, for 2 minutes; after a fortnight's filtration, for 3 minutes; and after three weeks' filtration, for 4 or 5 minutes. On referring to Table X., second series of experiments with the Pasteur-Chamberland Filter, it will be observed that out of the first 10 experiments, in which collecting flasks and dropping tubes were used, 4 of the 10 plate cultures contained in all 7 bacterial colonies, but that in the remaining 15 experiments, the 6 plate cultures and 12 of the 13 roll cultures were absolutely sterile. In the 1 exception the roll culture contained only 1 bacterial colony. In the third series of experiments (Table XI), made with the same cylinder, stamped "B," that was used in the second series, 28 roll cultures, made on 28 consecutive days of continuous filtration, were absolutely sterile. In the case of the Nordtmeyer-Berkefeld Filter, in which the rate of filtration is greater than in the Pasteur-Chamberland Filter, the mouths of the collecting flasks were not left uncovered so long as in the case of the latter filter. In every experiment with each filter, in which 10-drop and

20-drop plate cultures were made, the filtered water was allowed to fall into each test tube of sterilized gelatine jelly respectively from the same dropping tube, without filling the dropping tube a second time. If, therefore, the filtered water contained micro-organisms in any number, it is very improbable that bacterial colonies would occur in only one of the two cultures made with filtered water from the same dropping tube. On referring to Table V., first series of experiments with the Nordtmeyer-Berkefeld Filter, it will be observed that when micro-organisms once appeared in the plate cultures, they were present in considerable numbers in both the 10-drop and 20-drop cultures in each experiment, and continued to occur in large numbers in every subsequent culture; whereas, on referring to Table IX., first series of experiments with the Pasteur-Chamberland Filter, it will be observed that out of 56 plate cultures, only 7 cultures contained 1 bacterial colony each, the remaining 49 cultures being absolutely sterile; but that in no instance did the 10-drop and 20-drop cultures, made with filtered water from the same dropping tube, both contain bacterial colonies. It is, therefore, pretty certain that the few bacterial colonies found in the cultures of the first and second series of experiments with the Pasteur-Chamberland Filter, were due to air micro-organisms having accidentally fallen into the cultures during the time the cultures were being made. The plate cultures were made with sterilized gelatine jelly in the same manner as described for the Atkins and Maignen's Filters. The roll cultures were made in Esmarch's tubes, which were rotated in Houston's frame until the jelly solidified, after which the mouths of the tubes were covered with sterilized indiarubber caps.

In the first and second series of experiments with both filters, and in the third series with the Nordtmeyer-Berkefeld Filter (Tables V., VI., VII., IX., and X.), the plate and roll cultures were incubated at 19° C. In the last series of experiments with both filters (Tables VIII. and XI.), the cultures were incubated at 21° C. The plate cultures of Edinburgh main water (Table XII.), made simultaneously with the first series of experiments with both filters, were incubated at 19° C.

In counting the bacterial colonies in the plate cultures, Petri's capsules containing the cultures were placed on a black slab divided into squares, and the number of colonies in each square was counted with the aid of a lens. The actual number of colonies in each plate culture was counted, except when the number exceeded 3000, when it was estimated approximately from the number of colonies counted in part of the culture. The number of bacterial colonies in the roll cultures was counted by means of the ingenious apparatus designed by Dr J. Buchanan Young, and figured and described by him in the *Proceedings of the Royal Society of Edinburgh*, vol. xx., p. 28, 1892-93.

In Tables V. IX., and XII., the number of bacterial colonies in 1 cubic centimetre of water is calculated from the number of colonies actually present in the 10-drop and 20-drop cultures respectively, 15 drops from each of the dropping tubes used being equivalent to 1 cubic centimetre of water. In Table XII., however, the number of moulds actually present in the 10-drop and 20-drop cultures with unfiltered Edinburgh main water is recorded, instead of the calculated number in 1 cubic centimetre of the water. Each colony is held to represent one micro-organism in the water at the time of making the cultures.

The rate of filtration of each filter was calculated on the first day from the time taken to fill a ½-litre flask, and after that from the time taken to fill a 100-cc flask. In the second series of experiments with the Nordtmeyer-Berkefeld Filter (Table VI.), the rate of filtration, immediately after turning on the water at a pressure of 21 lbs. to the square inch, was 30 litres per hour, which is at the rate of 1.233 litre per hour for each square inch of the outer filtering surface of the cylinder, and 3.703 litres per hour for each square inch of the inner filtering surface of the cylinder. At the end of 24 hours' continuous filtration, the rate of filtration at 20 lbs. pressure was only 1.333 litre per hour, which is at the rate of 0.055 litre per hour for each square inch of the outer filtering surface and 0.165 litre per hour for each square inch of the inner filtering surface.

In the second series of experiments with the Pasteur-Chamberland Filter (Table X.), the rate of filtration, immediately after turning on the water at a pressure of 21 lbs. to the square inch, was 6 litres per hour, which is at the rate of 0.231 litre per hour for each square inch of the outer filtering surface of the cylinder, and 0.284 litre per hour for each square inch of the inner filtering surface of the cylinder. At the end of 24 hours' continuous filtration, the rate of filtration at 20 lbs. pressure was 1.143 litre, which is at the rate of 0.044 litre per hour for each square inch of the outer filtering surface, and 0.054 litre per hour for each square inch of the inner filtering surface.

On comparing the rates of filtration through each square inch of the outer filtering surfaces of these two filters, it will be observed that, immediately after turning on the water, the rate of filtration through the Nordtmeyer-Berkefeld Filter is 5⅓ times greater than that through the Pasteur-Chamberland Filter; but that at the end of 24 hours' continuous filtration, the rate of filtration is only 1¼ times greater than that through the Pasteur-Chamberland Filter.

In the first series of experiments (Tables V. and IX.), during 31 days' continuous filtration at pressures varying between 17 lbs. and 46 lbs. to the square inch, the Nordtmeyer-Berkefeld Filter maintained a slight superiority over the Pasteur-Chamberland Filter in the rate of filtration; but, after the first day's filtration, the difference between the rates of filtration through the two filters was steadily diminished. This diminution is caused by the greater deposit of sediment, in a given time, on the Nordtmeyer-Berkefeld Filter than on the Pasteur-Chamberland Filter, when both filters are used under the same conditions of pressure and continuous filtration, without cleansing the filters.

FIRST SERIES OF EXPERIMENTS WITH THE NORDTMEYER-BERKEFELD AND PASTEUR-CHAMBERLAND FILTERS AND EDINBURGH MAIN WATER.

TABLES V., IX., AND XII.

THIS series of experiments was commenced simultaneously with both filters on 29th January 1894. The Pasteur-Chamberland cylinder was stamped "F," and it had a narrow flange supporting the indiarubber washer, in consequence of which the indiarubber washer was forced down over the flange by the increased water-pressure (40 lbs. to the square inch) during the first night, and on the following morning the unfiltered water was discovered escaping from the lower end of the metal case and flowing down over the indiarubber tube and gun-metal nozzle. The cylinder was removed from the metal case and another cylinder, stamped "B," with a broader flange, after having been prepared and sterilized in the same manner, was substituted for it. The experiments with the Pasteur-Chamberland Filter were, therefore, one day behind the corresponding experiments with the Nordtmeyer-Berkefeld Filter. In each experiment 10-drop and 20-drop cultures were made in sterilized Petri's capsules with unfiltered Edinburgh main water drawn from the nozzle for the purpose, and with filtered water from each of the two filters. The filters were never cleaned throughout the whole series of experiments. The plate cultures made with filtered water were examined and the number of bacterial colonies counted at the end of 7 days' incubation. The bacterial colonies in the plate cultures made with unfiltered Edinburgh main water were counted at the end of 7 days' incubation, except when the cultures showed signs of liquefying before the expiration of that time.

Results.—In the case of the Nordtmeyer-Berkefeld Filter (Table V.), although micro-organisms were constantly present in considerable numbers in the unfiltered water, all the plate cultures made daily with the filtered water during the first 10 days' continuous filtration were absolutely sterile; but in the eleventh day's culture there were 590 micro-organisms per cubic centimetre of filtered water in the 10-drop culture, and 770 in the 20-drop culture. In the next 4 days' cultures the numbers varied between 101 and 941. After the fifteenth experiment the filter was allowed to filter continuously day and night for 16 days longer, after which the last experiment was made on 1st March. In this experiment the 10-drop culture contained 147 micro-organisms per cubic centimetre of filtered water, and the 20-drop culture 165. The number of micro-organisms in the

plate cultures made with filtered water do not bear any relation to that in the plate cultures made simultaneously with unfiltered water. When micro-organisms first appeared in the plate cultures made with filtered water on the eleventh day of continuous filtration, there had accumulated 11 days' deposit of micro-organisms on the outer surface of the filter from the water which had passed through the filter in that period. It is not, therefore, to be expected that there should be any relation between the numbers of micro-organisms present in the filtered and unfiltered water at any particular time; but it is most probable that the micro-organisms gradually grow through the pores of the filter from the bacterial mud deposited on the outer surface of the cylinder.

In the case of the Pasteur-Chamberland Filter (Table IX.) the 10-drop and 20-drop plate cultures were made daily during the first 14 days' continuous filtration, and then on every other day during the next 28 days' continuous filtration. Of the total 56 plate cultures made with filtered water in 28 experiments, extending over a period of 6 weeks' continuous filtration, only 7 cultures contained 1 micro-organism each, the remaining 49 cultures being absolutely sterile. The 7 cultures containing micro-organisms occurred in experiments Nos. 1, 10, 14, 17, 21, 25, and 26. On removing the filtering cylinders from their metal cases at the end of the series of experiments, both cylinders were coated on the outer surface with a copious deposit of brown slimy mud. By means of a sterilized platinum wire a little quantity of this mud was transferred to a test tube of sterilized nutrient gelatine jelly and a plate culture made. The number of micro-organisms in this culture was uncountable, and the jelly was liquefied at the end of 5 days' incubation at 19° C. Some moulds were also present in the culture.

Conclusions.—The Nordtmeyer-Berkefeld Filter sterilized the filtered water during the first 10 days' continuous filtration, but after that the filtered water invariably contained large numbers of micro-organisms which had grown through the pores of the filter.

In the case of the Pasteur-Chamberland Filter, it is pretty certain, for the reasons previously mentioned, that the filtered water was absolutely sterilized during 6 weeks' continuous filtration at pressures varying between 17 lbs. and 39 lbs. to the square inch, and that the 7 plate cultures, containing 1 bacterial colony each, were accidentally contaminated during the process of making the cultures.

SECOND SERIES OF EXPERIMENTS WITH THE NORDTMEYER-BERKEFELD AND PASTEUR-CHAMBERLAND FILTERS AND *BACILLUS VIOLACEUS* AND EDINBURGH MAIN WATER.

TABLES VI. AND X.

THIS series of experiments was commenced simultaneously with both filters on 9th April 1894, and extended over a period of 3 weeks' continuous filtration in the case of the Nordtmeyer-Berkefeld Filter, and 6 weeks in the case of the Pasteur-Chamberland Filter. New cylinders were used in both filters of the same pattern as those used in the first series of experiments—viz., the cylinder stamped "B" in the case of the Pasteur-Chamberland Filter. The space between the sterilized cylinder and its metal case, in each filter, was filled with water containing approximately 20,000 *Bacilli violacei* in each cubic centimetre. The metal case was then screwed on to the Edinburgh main water supply-pipe, and the stop-cock turned full on. The first 100 cubic centimetres of filtered water from each filter was received into a sterilized collecting flask, and by means of sterilized dropping tubes 10-drop and 20-drop plate cultures were made with the filtered water. In the case of the Nordtmeyer-Berkefeld Filter, 20 plate cultures were made, each with 1 cubic centimetre of filtered water. The first 19 experiments were made on the first 19 days of continuous filtration, and the last experiment at the end of 21 days' continuous filtration. Eight roll cultures were also made with 1 cubic centimetre of filtered water simultaneously with the last 8 plate cultures.

In the case of the Pasteur-Chamberland Filter, 25 experiments were made, the first 16 daily, the next 8 every other day,

and the last experiment 11 days after the previous one. One plate culture was made with 1 cubic centimetre of the filtered water in each of the first 16 experiments, and 1 roll culture was made with the same quantity of filtered water in each of the last 13 experiments.

Both filters were allowed to filter continuously day and night, without cleansing, throughout the whole series of experiments; and the cultures were made at pressures varying between 18 lbs. and 36 lbs. to the square inch; but at night the pressure was greater, usually between 40 lbs. and 46 lbs.

The water, containing *Bacilli violacei*, which was placed in the filters at the beginning of this series of experiments, was prepared in the following manner:—On 9th April 1894, to a litre of distilled water, which had been previously sterilized by boiling at 120° C. in a sterilized glass flask plugged with cotton-wool for ½ hour in the autoclave and allowed to cool, 1 cubic centimetre of a broth culture of *Bacillus violaceus*, made on 27th March 1894, was added by means of a sterilized dropping tube. The *Bacilli violacei* were then well mixed with the water by shaking the flask. 10-drop and 20-drop plate cultures, in sterilized gelatine jelly, were made with this water, and at the end of 3 days' incubation at 19° C. the mean of the two cultures was approximately 20,000 *Bacilli violacei* in each cubic centimetre of the water.

The number of micro-organisms in the Edinburgh main water was not ascertained in this series of experiments, but a reference to Table XII. will show that they are always present in considerable numbers.

In the first 8 experiments with both filters the cultures were incubated at 19° C. for 7 days before they were examined and the number of bacterial colonies counted. In all the remaining cultures, with both filters, the cultures were incubated at the same temperature, and the bacterial colonies were counted at the end of 14 days' incubation.

Results.—In the case of the Nordtmeyer-Berkefeld Filter no *Bacilli violacei* occurred in any of the cultures. The first 3 plate cultures were sterile, but in the remaining 17 plate cultures the number of other species of micro-organisms in 1 cubic centimetre of the filtered water varied from 4 to 172. All the roll cultures contained other species of micro-organisms, but the number of bacterial colonies was not counted, except in the last culture, which contained 17 colonies. At the end of 3 weeks' continuous filtration, 2 plate cultures in sterilized gelatine jelly were made with some of the mud deposited on the outer surface of the cylinder, but no *Bacilli violacei* occurred in either culture at the end of 10 days' incubation at 10° C. Other species of micro-organisms, however, were present in these cultures in large numbers.

In the case of the Pasteur-Chamberland Filter, no *Bacilli violacei* occurred in any of the cultures. Of the 16 plate cultures 12 were sterile and 4 contained from 1 to 3 bacterial colonies each, but these 4 non-sterile cultures occurred in the first 10 experiments in which collecting flasks and dropping tubes were used. In the remaining 15 experiments, in which the filtered water was received direct from the gun-metal nozzles into the test tubes and Esmarch's roll culture tubes, all the plate cultures and 12 of the 13 roll cultures were sterile. The 1 non-sterile roll culture contained only 1 bacterial colony. At the end of 6 weeks' continuous filtration the cylinder was washed in a litre of distilled water by means of a soft nail-brush. A plate culture in sterlized gelatine jelly was made with $\frac{1}{10}$ cubic centimetre of the muddy water in which the cylinder had been washed, and at the end of 2 days' incubation at 19° C. the number of colonies of other species of micro-organisms was uncountable, and the jelly quickly liquefied. No *Bacilli violacei* were observed in this culture.

Conclusions.—No *Bacilli violacei* occurred in any of the cultures made with the filtered water from both filters; but as no colonies of this species of Bacillus occurred in the plate cultures made with the bacterial mud deposited on the outer surfaces of the cylinders of both filters, it is possible that these Bacilli may have been killed out by the hosts of other species of micro-organisms deposited on the cylinders from the Edinburgh main water, before the *Bacilli violacei* had time to grow

through the pores of the Nordtmeyer-Berkefeld Filter. It is not improbable, however, that this filter may prevent the larger species of micro-organisms from passing through its pores, while the smaller species are allowed to grow or pass through. The advantage, therefore, of using ordinary Edinburgh main water for testing the sterilizing power of filters is very apparent, because it always contains considerable numbers of different species of micro-organisms of different sizes.

With reference to the other species of micro-organisms derived from the Edinburgh main water, they occurred, in the case of the Nordtmeyer-Berkefeld Filter, in every culture made with the filtered water, after the second day of continuous filtration, in numbers varying from 4 to 172 micro-organisms in each cubic centimetre of filtered water.

In the case of the Pasteur-Chamberland Filter, it is pretty certain, for the reasons previously mentioned, that the 5 non-sterile cultures, containing from 1 to 3 bacterial colonies each, were accidentally contaminated during the process of making the cultures; and that the filtered water was absolutely sterilized during 6 weeks' continuous filtration at pressures varying between 18 lbs. and 36 lbs. to the square inch.

THIRD SERIES OF EXPERIMENTS WITH THE NORDTMEYER-BERKEFELD FILTER AND EDINBURGH MAIN WATER.

TABLE VII.

THIS series of experiments was commenced on 1st May 1894, and extended over a period of 3 weeks' continuous filtration without cleansing the filter. The experiments were made simultaneously with those of the latter part of the second series with the Pasteur-Chamberland Filter. The cylinder used in the second series of experiments was also used in the third series. 14 experiments were made, the first 13 daily, and the last experiment eight days after the previous one. One plate culture was made with 1 cubic centimetre of the filtered water in each experiment, and 1 roll culture was made with the same quantity of filtered water in each of the first 8 experiments. The filtered water was received direct from the gun-metal nozzles into the test tubes and Esmarch's roll culture tubes, and the chance of air micro-organisms accidentally falling into these tubes, during the time the filtered water was being received, was reduced to a minimum by means of the circular flange, $\frac{7}{8}$-inch in diameter, on the gun-metal nozzle, 1 inch from its lower or dropping end. This flange covered the mouth of the tubes, without touching them, during the time the filtered water was being received from the lower end of the nozzle, which was inside the mouth of the tubes.

The cultures were made at pressures varying from 14 lbs. to 34 lbs. to the square inch, and they were all incubated at 19° C. for 14 days before the bacterial colonies were counted.

Results.—In the first 3 experiments all the plate and roll cultures were sterile. In experiment No. 4, made at the end of 3 day's continuous filtration, there were 220 colonies in the plate culture and 7 colonies in the roll culture. The remaining 10 plate cultures contained from 3 to 776 colonies each, with the exception of experiment No. 11, in which the plate culture was sterile. In No. 5 experiment the roll culture was sterile, but in the remaining 3 experiments the roll cultures contained from 2 to 80 colonies in each culture.

Conclusions.—In this series of experiments the Nordtmeyer-Berkefeld Filter sterilized the filtered water during 2 days' continuous filtration, at pressures varying between 15 lbs. and 20 lbs. to the square inch; but in all the subsequent experiments, with one exception, there were from 3 to 776 micro-organisms in each cubic centimetre of the filtered water. These micro-organisms were undoubtedly derived from the Edinburgh main water, with which the filter was constantly supplied, and they undoubtedly passed through the pores of the filter.

FOURTH AND THIRD SERIES OF EXPERIMENTS WITH THE NORDTMEYER-BERKEFELD AND PASTEUR-CHAMBERLAND FILTERS RESPECTIVELY, AND *MICROCOCCUS SP.* AND EDINBURGH MAIN WATER.

Tables VIII. and XI.

These two series of experiments were commenced simultaneously on 25th May 1894, and in the case of the Nordtmeyer-Berkefeld Filter extended over 10 days' continuous filtration, and in the case of the Pasteur-Chamberland Filter, over 28 days' continuous filtration, without cleansing the filters in either case. The cylinder used in the second and third series of experiments with the Nordtmeyer-Berkefeld Filter, and the cylinder used in the second series with the Pasteur-Chamberland Filter, were also used in the present series of experiments with both filters respectively.

On 25th May 1894 the space between the sterilized cylinder and its metal case, in each filter, was filled with a diluted broth culture containing approximatety 47,250 *Micrococci sp.* in each cubic centimetre. The metal case was then screwed on to the Edinburgh main water supply-pipe, and the stop-cock turned full on. After 50 cubic centimetres of water had passed through the filter, the stop-cock was screwed down until the filtered water fell in drops from the gun-metal nozzles. In the case of the Nordtmeyer-Berkefeld Filter, 1 plate culture and 1 roll culture were then made with 1 cubic centimetre (19 drops) of filtered water received direct from the gun-metal nozzles into the test tube and Esmarch's tube respectively. In the case of the Pasteur-Chamberland Filter, 1 roll culture was made in the same manner. The stop-cocks of both filters were then turned full on, and both filters were allowed to filter continuously day and night until the end of the series of experiments.

In the case of the Nordtmeyer-Berkefeld Filter, 10 experiments were made on 10 consecutive days, at pressures varying between 14 lbs. and 46 lbs. to the square inch; 1 plate culture was made with 1 cubic centimetre of filtered water in each experiment; and 1 roll culture was made with the same quantity of filtered water, in experiments Nos. 1 and 8.

In the case of the Pasteur-Chamberland Filter, 28 experiments were made on 28 consecutive days, at pressures varying between 12 lbs. and 46 lbs. to the square inch; 1 roll culture was made with 1 cubic centimetre of filtered water in each of the 28 experiments.

The diluted broth, containing *Micrococcus sp.*, which was placed in the filters at the beginning of the series of experiments, was prepared in the following manner:—On 19th May 1894, 100 cc. of sterilized broth were inoculated by means of a sterilized platinum wire, with part of a colony of *Micrococcus sp.*, taken from the roll culture made on 30th April 1894, in experiment No. 20 of the second series of experiments with the filtered water from the Nordtmeyer-Berkefeld Filter. After 6 days' incubation at 21° C., the 100 cc. of broth were mixed with an equal quantity of distilled water. A plate culture in sterilized gelatine jelly, made with 1 cc. of the diluted broth culture, after 7 days' incubation at 21° C., contained approximately 47,250 *Micrococci sp.* This *Micrococcus* was easily recognised by its occurring in yellow globose slow-growing non-liquefying colonies in the plate and roll cultures made with the filtered Edinburgh main water, taken from the Nordtmeyer-Berkefeld Filter. The species was not identified.

The cultures made with the filtered water from both filters were incubated at 21° C. In the case of the Nordtmeyer-Berkefeld Filter, the cultures in the first 4 experiments were incubated for 14 days, but in the remaining 6 experiments the cultures had to be examined at the end of from 2½ to 7 days, on account of the enormous numbers of micro-organisms liquefying the jelly. In the case of the Pasteur-Chamberland Filter, the cultures were examined at the end of 14 days' incubation.

Results.—In the case of the Nordtmeyer-Berkefeld Filter, the plate and roll cultures in the first 4 experiments were sterile, except in experiment No. 2, in which the plate culture contained

1 colony of another species of micro-organism. In this experiment the culture was probably accidentally contaminated during the process of making the culture. In experiment No. 5, made after 4 days' continuous filtration, there were 40 colonies of *Micrococcus sp.*, and 1 colony of another species of micro-organism in the plate culture. In the next experiment the plate culture contained 254 colonies of *Micrococcus sp.*, and 3 colonies of other species of micro-organisms. In the remaining 4 plate cultures and in the roll culture made in experiment No. 8, the number of colonies of *Micrococcus sp.* and other species of micro-organisms was uncountable, and the jelly was more or less liquefied.

In the case of the Pasteur-Chamberland Filter, the 28 roll cultures, made on 28 consecutive days of continuous filtration, were all absolutely sterile, notwithstanding that plate cultures made with the mud deposited on the cylinder during 27 days' continuous filtration contained enormous numbers of *Micrococci sp.*, and other species of micro-organisms.

Conclusions.—In this series of experiments both filters were put to a very severe test, because the diluted broth culture with which the filters were filled contained approximately 47,250 micro-organisms of *Micrococcus sp.*, which had passed through the Nordtmeyer-Berkefeld Filter in the second series of experiments with that filter. The enormous number of *Micrococci sp.*, and other species of micro-organisms in the filtered water from the Nordtmeyer-Berkefeld Filter, after the third day of continuous filtration, conclusively proves that this filter cannot permanently sterilize water, whereas the entire absence of micro-organisms from the filtered water from the Pasteur-Chamberland Filter, when subjected to precisely the same conditions, conclusively proves that the latter filter can permanently sterilize water containing micro-organisms.

GENERAL CONCLUSIONS.

The Pasteur-Chamberland Filter is the best and the only one on which reliance can be placed for permanently sterilizing water. Its use is therefore recommended for sterilizing drinking-water, water used for surgical dressings, and wherever sterilized water is required for any particular purpose.

This filter is most likely to prove of valuable service in reducing the number of cases of such diseases as cholera and enteric fever in countries in which the drinking-water is contaminated with the pathogenic micro-organisms of these diseases.

These conclusions have been arrived at from the results of the three series of experiments made with the Pasteur-Chamberland cylinders stamped "B," which are intended for slow filtration. The cylinders stamped "F," for rapid filtration, were not experimented with, on account of the flange being too narrow to support the indiarubber washer when exposed to high water-pressures in the filter.

THE ATKINS PATENT WATER FILTER.

TABLE I.—RESULTS OF THE FIRST SERIES OF EXPERIMENTS WITH EDINBURGH MAIN WATER.

Number of Experiment.	Date of Culture.	Temperature of Water ° C.	Rate of Filtration. Litres per hour.	Date of Counting Micro-organisms.	Micro-organisms in 1 cc. of Filtered Water.		Micro-organisms in 1 cc. of Unfiltered Water.			Remarks.
					10-drop Plate Culture.	20-drop Plate Culture.	10-drop Plate Culture.	20-drop Plate Culture.	Mean.	
1	1st Dec. 1893	Not recorded	Not recorded	5th Dec. 1893	Uncountable	Uncountable	237	83	160	Culture made after 1 day's slow filtration.
2	8th Dec. 1893	Not recorded	17·000	11th Dec. 1893	Uncountable	Uncountable	Not	recorded		Culture made after the continuous slow filtration of 12 litres of water between 1st and 8th Dec. 1893.

TABLE II.—RESULTS OF THE SECOND SERIES OF EXPERIMENTS WITH BACILLUS VIOLACEUS.

Number of Experiment.	Date of Culture.	Temperature of Water ° C.	Rate of Filtration. Litres per hour.	Date of Counting Micro-organisms.	Micro-organisms in 1 cc. of Filtered Water.		Micro-organisms in 1 cc. of Unfiltered Water.		Remarks.
					Plate Culture.		Plate Culture.		
					Bacillus Violaceus.	Other Micro-organisms.	Bacillus Violaceus.	Other Micro-organisms.	
1	17th May 1894	21·0	20·000	21st May 1894	0	3150	12	33	Culture made after the filtration of 2 litres of water, immediately after placing the unfiltered water in the filter.
2	18th May 1894	18·5	20·000	22nd May 1894	Uncountable	Uncountable	Not	recorded	Culture made after the filtration of 1 litre of water.
3	23rd May 1894	20·0	19·000	25th May 1894	Uncountable	Uncountable	Not	recorded	Culture made after the filtration of 2 litres of water.

MAIGNEN'S TABLE "FILTRE RAPIDE."

TABLE III.—RESULTS OF THE FIRST SERIES OF EXPERIMENTS WITH EDINBURGH MAIN WATER.

Number of Experiment.	Date of Culture.	Temperature of Water ° C.	Rate of Filtration. Litres per hour.	Date of Counting Micro-organisms.	Micro-organisms in 1 cc. of Filtered Water.		Micro-organisms in 1 cc. of Unfiltered Water.			Remarks.
					10-drop Plate Culture.	20-drop Plate Culture.	10-drop Plate Culture.	20-drop Plate Culture.	Mean.	
1	1st Dec. 1893	Not recorded	Not recorded	5th Dec. 1893	Uncountable	Uncountable	237	83	160	Culture made after 1 day's slow filtration.
2	8th Dec. 1893	Not recorded	9·000	11th Dec. 1893	Uncountable	Uncountable	Not	recorded		Culture made after the continuous slow filtration of 4·250 litres of water between 1st and 8th Dec. 1893.

TABLE IV.—RESULTS OF THE SECOND SERIES OF EXPERIMENTS WITH BACILLUS VIOLACEUS.

Number of Experiment.	Date of Culture.	Temperature of Water ° C.	Rate of Filtration. Litres per hour.	Date of Counting Micro-organisms.	Micro-organisms in 1 cc. of Filtered Water. Plate Culture.		Micro-organisms in 1 cc. of Unfiltered Water. Plate Culture.		Remarks.
					Bacillus Violaceus.	Other Micro-organisms.	Bacillus Violaceus.	Other Micro-organisms.	
1	17th May 1894	21·0	9·000	21st May 1894	0	4	12	33	Culture made after the filtration of ½ litre of water, immediately after placing the unfiltered water in the filter.
2	18th May 1894	18·5	9·000	22nd May 1894	7	26	Not	recorded	Culture made after the filtration of ½ litre of water.
3	23rd May 1894	20·0	8·200	25th May 1894	Uncountable	Uncountable	Not	recorded	Culture made after the filtration of ½ litre of water.

THE NORDTMEYER-BERKEFELD FILTER.

TABLE V.—RESULTS OF THE FIRST SERIES OF EXPERIMENTS WITH EDINBURGH MAIN WATER.

Number of Experiment.	Date of Culture at 1 p.m.	Temperature of Water at 1 p.m., ° C.	Pressure of Water in Main and Rate of Filtration. 1 p.m.		Midnight.		Date of Counting Micro-organisms.	Micro-organisms in 1 cc. of Filtered Water.		Micro-organisms in 1 cc. of Unfiltered Water.	Remarks.
			Lbs. per Square Inch.	Litres per Hour.	Lbs. per Square Inch.	Litres per Hour.		10-drop Plate Culture.	20-drop Plate Culture.		
..	29th Jan. 1894	Not recorded	20	25·714	40	2·377	..	..	..	..	No cultures made.
1	30th	6·0	22	0·714	42	1·111	6th Feb. 1894	0	0	242	
2	31st	4·5	19	0·454	40	0·705	7th	0	0	17	
3	1st Feb. 1894	5·0	18	0·308	41	0·500	8th	0	0	4	
4	2nd	6·5	18	0·278	44	0·444	9th	0	0	17	
5	3rd	8·0	17	0·208	46	0·414	10th	0	0	39	
6	4th	7·5	29	* 0·304	44	0·400	11th	0	0	15	
7	5th	6·3	17	0·214	42	0·380	12th	0	0	646	
8	6th	7·0	17	0·193	..	..	13th	0	0	1528	
9	7th	8·0	18	0·189	..	..	14th	0	0	158	
10	8th	7·5	18	0·170	..	..	15th	0	0	302	
11	9th	7·0	20	0·176	..	..	16th	590	770	156	
12	10th	9·0	18	0·132	..	..	17th	356	384	485	
13	11th	7·3	25	0·165	..	..	18th	131	101	316	
14	12th	7·1	20	0·141	..	..	19th	941	831	2420	
15	13th	6·8	20	0·130	..	..	20th	437	481	4372	
..	14th	6·9	22	0·129	..	..	..	..	..	..	No cultures made with the filtered water.
..	15th	7·7	22	0·138	..	..	..	..	..	1345	
..	16th	6·4	22	0·133	..	..	..	..	..	..	
..	17th	7·1	20	0·114	..	..	..	..	..	1124	
..	18th	6·0	31	0·174	..	..	..	..	..	..	
..	19th	6·8	21	0·116	..	..	..	..	..	5927	
..	20th	6·1	18	0·101	..	..	..	..	..	..	
..	21st	5·5	21	0·108	..	..	..	..	..	699	
..	22nd	5·8	22	0·115	..	..	..	..	..	..	
..	23rd	6·6	23	0·120	..	..	..	..	..	841	
..	24th	6·4	19	0·090	..	..	..	..	..	..	
..	25th	6·7	39	0·150	..	..	..	..	..	11,340	
..	26th	5·6	18	0·080	..	..	..	..	..	..	
..	27th	7·1	21	0·092	..	..	..	..	..	379	
..	28th	6·0	21	0·088	..	..	..	..	..	..	
16	1st March 1894	6·5	23	0·097	..	..	8th March 1894	147	165	1290	

THE NORDTMEYER-BERKEFELD FILTER.

TABLE VI.—RESULTS OF THE SECOND SERIES OF EXPERIMENTS WITH BACILLUS VIOLACEUS AND EDINBURGH MAIN WATER.

Number of Experiment.	Date of Culture at 2 p.m.	Temperature of Water, ° C.	Pressure of Water in Main. Lbs. per Square Inch.	Rate of Filtration. Litres per Hour.	Date of Counting Micro-organisms.	Micro-organisms in 1 cc. of Filtered Water. Plate Culture. Bacillus Violaceus.	Plate Culture. Other Micro-organisms.	Roll Culture. Bacillus Violaceus.	Roll Culture. Other Micro-organisms.	Bacilli Violacei in 1 cc. of Unfiltered Water.	REMARKS.
1	9th April 1894	10·0	21	20·000	16th April 1894	0	0	..	..	20,000	Culture made with 1 cc. from first 100 cc. of filtered water.
2	10th	10·3	20	1·333	17th	0	0	..	..	..	
3	11th	10·7	21	0·923	18th	0	0	..	..	..	
4	12th	11·4	21	0·727	19th	0	4	..	..	..	
5	13th	10·6	21	0·585	20th	0	4	..	..	..	
6	14th	10·0	25	0·616	21st	0	10	..	..	..	
7	15th	8·8	36	0·666	22nd	0	14	..	..	..	
8	16th	9·4	32	0·600	23rd	0	15	..	..	..	
9	17th	9·8	21	0·363	1st May 1894	0	30	..	..	..	
10	18th	10·0	23	0·387	2nd	0	51	..	..	..	
11	19th	10·1	19	0·308	3rd	0	172	..	..	..	
12	20th	10·0	20	0·300	4th	0	102	..	..	..	
13	21st	10·0	27	0·338	5th	0	43	0	Present	..	Number of micro-organisms in roll cultures not counted.
14	22nd	9·6	35	0·381	6th	0	70	0	Present	..	
15	23rd	10·1	21	0·246	7th	0	12	0	Present	..	
16	24th	10·4	20	0·224	8th	0	12	0	Present	..	
17	25th	10·0	21	0·228	9th	0	27	0	Present	..	
18	26th	10·3	22	0·231	10th	0	27	0	Present	..	
19	27th	10·5	23	0·238	11th	0	9	0	Present	..	
..	28th	9·8	23	0·235	..	..	..	..	..	..	No cultures made.
..	29th	10·3	36	0·292	..	..	..	..	..	..	
20	30th	11·0	22	0·212	14th	0	19	0	17	..	Two *micrococci sp.* in the roll culture, from one colony of which the unfiltered water, containing 47,250 *micrococci sp.* and used in the Fourth Series of Nordtmeyer-Berkefeld and Third Series of Pasteur-Chamberland Experiments, derived its micro-organisms.

THE NORDTMEYER-BERKEFELD FILTER.

TABLE VII.—RESULTS OF THE THIRD SERIES OF EXPERIMENTS WITH EDINBURGH MAIN WATER.

Number of Experiment.	Date of Culture at 1 p.m.	Temperature of Water, ° C.	Pressure of Water in Main. Lbs. per Square Inch.	Rate of Filtration. Litres per Hour.	Date of Counting Micro-organisms.	Micro-organisms in 1 cc. of Filtered Water. Plate Culture.	Roll Culture.	REMARKS.
1	1st May 1894	11·1	15	24·000	15th May 1894	0	0	Cultures made after the filtration of 1 litre of water, immediately after placing the unfiltered water in the filter.
2	2nd	10·8	19	1·538	16th	0	0	
3	3rd	10·7	20	0·882	17th	0	0	
4	4th	10·1	19	0·674	18th	220	7	
5	5th (mid-day)	10·5	14	0·500	19th	8	0	3 *Micrococci sp.* in plate culture.
6	6th	10·0	34	0·685	20th	3	80	
7	7th	11·1	22	0·468	21st	22	2	1 *Micrococcus sp.* in plate culture.
8	8th	10·8	20	0·421	22nd	8	4	
9	9th	10·5	18	0·358	23rd	352	...	
10	10th	10·6	20	0·375	24th	36	...	
11	11th	11·3	18	0·338	25th	0	...	
12	12th	11·7	18	0·315	26th	34	...	
13	13th	10·4	34	0·444	27th	776	...	
14	21st	11·7	22	0·200	4th June 1894	102	...	

THE NORDTMEYER-BERKEFELD FILTER.

Table VIII.—Results of the Fourth Series of Experiments with Micrococcus sp. and Edinburgh Main Water.

Number of Experiment.	Date of Culture at 2 p.m.	Temperature of Water, ° C.	Pressure of Water in Main, Lbs. per Square Inch.	Rate of Filtration, Litres per Hour.	Date of Counting Micro-organisms.	Micro-organisms in 1 cc. of Filtered Water. Plate Culture. Micrococcus sp.	Plate Culture. Other Micro-organisms.	Roll Culture. Micrococcus sp.	Roll Culture. Other Micro-organisms.	Micrococci sp. in 1 cc. of Unfiltered Water.	Remarks.
1	25th May 1894	11·4	21	27·272	8th June 1894	0	0	0	0	47,250	Culture made after the filtration of 50 cc. of water, immediately after placing the unfiltered water in the filter.
2	26th	11·6	21	2·182	9th	0	1	...	...	...	
3	27th	10·8	36	1·463	10th	0	0	...	...	...	
4	28th	11·6	19	0·760	11th	0	0	...	...	...	
5	29th	10·9	17	0·631	5th	40	1	...	...	...	
6	30th	10·8	20	0·540	6th	254	3	...	...	...	
7	31st	11·3	21	0·472	5th	Uncountable	Uncountable	...	...	...	All the cultures partly liquefied.
8	1st June 1894	11·0	16	0·353	5th	Uncountable	Uncountable	Uncountable	Uncountable	...	
9	2nd (mid-day)	11·7	14	0·308	5th	Uncountable	Uncountable	...	...	...	
10	3rd (midnight)	11·8	46	0·600	6th	Uncountable	Uncountable	...	...	...	

THE PASTEUR-CHAMBERLAND FILTER.

Table IX.—Results of the First Series of Experiments with Edinburgh Main Water.

Number of Experiment.	Date of Culture at 1 p.m.	Temperature of Water at 1 p.m., ° C.	Pressure of Water in Main and Rate of Filtration. 1 p.m. Lbs. per Square Inch.	1 p.m. Litres per Hour.	Midnight. Lbs. per Square Inch.	Midnight. Litres per Hour.	Date of Counting Micro-organisms.	Micro-organisms in 1 cc. of Filtered Water. 10-drop Plate Culture.	20-drop Plate Culture.	Micro-organisms in 1 cc. of Unfiltered Water.	Remarks.
..	30th Jan. 1894	6·0	22	5·000	42	2·000	6th Feb. 1894	..	..	242	No culture made with the filtered water.
1	31st	4·5	19	0·600	40	0·800	7th	0	1	17	
2	1st Feb. 1894	5·0	18	0·333	41	0·600	8th	0	0	4	
3	2nd	6·5	18	0·286	44	0·444	9th	0	0	17	
4	3rd	8·0	17	0·205	46	0·400	10th	0	0	39	
5	4th	7·5	29	0·285	44	0·353	11th	0	0	15	
6	5th	6·3	17	0·191	42	0·333	12th	0	0	646	
7	6th	7·0	17	0·176	..	..	13th	0	0	1528	
8	7th	8·0	18	0·176	..	..	14th	0	0	158	
9	8th	7·5	18	0·154	..	..	15th	0	0	302	
10	9th	7·0	20	0·160	..	..	16th	1	0	156	
11	10th	9·0	18	0·117	..	..	17th	0	0	485	
12	11th	7·3	25	0·149	..	..	18th	0	0	316	
13	12th	7·1	20	0·125	..	..	19th	0	0	2420	
14	13th	6·8	20	0·114	..	..	20th	1	0	4372	
..	14th	6·9	22	0·110	..	..	..	..	..	..	
15	15th	7·7	22	0·120	..	..	22nd	0	0	1345	
..	16th	6·4	22	0·118	..	..	..	..	..	..	
16	17th	7·1	20	0·103	..	..	24th	0	0	1124	
..	18th	6·0	31	0·140	..	..	..	..	..	..	
17	19th	6·8	21	0·104	..	..	26th	1	0	5927	
..	20th	6·1	18	0·091	..	..	..	..	..	..	
18	21st	5·5	21	0·097	..	..	28th	0	0	699	
..	22nd	5·8	22	0·103	..	..	..	..	..	..	
19	23rd	6·6	23	0·106	..	..	2nd March 1894	0	0	841	
..	24th	6·4	19	0·080	..	..	..	..	..	..	
20	25th	6·7	39	0·131	..	..	4th	0	0	11,340	
..	26th	5·6	18	0·070	..	..	..	..	..	..	
21	27th	7·1	21	0·082	..	..	6th	0	1	379	
..	28th	6·0	21	0·079	..	..	..	..	..	..	
22	1st March 1894	6·5	23	0·089	..	..	8th	0	0	1290	
..	2nd	6·7	20	0·068	..	..	..	..	..	..	
23	3rd	7·2	22	0·082	..	..	10th	0	0	7480	
..	4th	6·3	34	0·103	..	..	..	..	..	..	
24	5th	6·2	23	0·075	..	..	12th	0	0	3591	
..	6th	6·4	20	0·068	..	..	..	..	..	..	
25	7th	7·1	23	0·088	..	..	14th	0	1	1629	
..	8th	6·4	23	0·084	..	..	..	..	..	..	
26	9th	6·7	24	0·090	..	..	16th	1	0	971	
..	10th	7·0	20	0·063	..	..	..	..	..	..	
27	11th	6·2	28	0·100	..	..	18th	0	0	159	
..	12th	5·8	20	0·059	..	..	..	..	..	..	
28	13th	6·2	21	0·065	..	..	20th	0	0	126	

THE PASTEUR-CHAMBERLAND FILTER.

TABLE X.—RESULTS OF THE SECOND SERIES OF EXPERIMENTS WITH BACILLUS VIOLACEUS AND EDINBURGH MAIN WATER.

Number of Experiment.	Date of Culture at 2 p.m.	Temperature of Water, ° C.	Pressure of Water in Main. Lbs. per Square Inch.	Rate of Filtration. Litres per Hour.	Date of Counting Micro-organisms.	Micro-organisms in 1 cc. of Filtered Water. Plate Culture. Bacillus Violaceus.	Plate Culture. Other Micro-organisms.	Roll Culture. Bacillus Violaceus.	Roll Culture. Other Micro-organisms.	Bacilli Violacei in 1 cc. of Unfiltered Water.	Remarks.
1	9th April 1894	10·0	21	6·000	16th April 1894	0	0	..	..	20,000	Culture made with 1 cc. from first 100 cc. of filtered water.
2	10th	10·3	20	1·143	17th	0	0	..	..	..	Collecting flasks and dropping tubes used in making the cultures.
3	11th	10·7	21	0·846	18th	0	0	..	..	..	
4	12th	11·4	21	0·666	19th	0	2	..	..	..	
5	13th	10·6	21	0·534	20th	0	3	..	..	..	
6	14th	10·0	25	0·559	21st	0	1	..	..	..	
7	15th	8·8	36	0·615	22nd	0	0	..	..	..	
8	16th	9·4	32	0·566	23rd	0	0	..	..	..	
9	17th	9·8	21	0·342	1st May 1894	0	1	..	..	..	
10	18th	10·0	23	0·363	2nd	0	0	..	..	..	
11	19th	10·1	19	0·289	3rd	0	0	..	..	..	
12	20th	10·0	20	0·283	4th	0	0	..	..	..	
13	21st	10·0	27	0·328	5th	0	0	0	0	..	Cultures made by running 1 cc. (19 drops) of water direct into the test-tubes containing the gelatine jelly from the filter-nozzle, without the use of collecting-flasks and dropping-tubes, thereby considerably lessening the risk of air micro-organisms accidentally entering the cultures.
14	22nd	9·6	35	0·363	6th	0	0	0	0	..	
15	23rd	10·1	21	0·231	7th	0	0	0	0	..	
16	24th	10·4	20	0·214	8th	0	0	0	0	..	
..	25th	10·0	21	0·216	..	..	..	..	..	..	
17	26th	10·3	22	0·218	10th	..	..	0	1	..	
..	27th	10·5	23	0·229	..	..	..	..	..	..	
18	28th	9·8	23	0·224	12th	..	..	0	0	..	
..	29th	10·3	36	0·275	..	..	..	..	..	..	
19	30th	11·0	22	0·205	14th	..	..	0	0	..	
..	1st May 1894	11·1	18	0·162	..	..	..	..	..	..	
20	2nd	10·8	20	0·165	16th	..	..	0	0	..	
..	3rd	10·7	20	0·155	..	..	..	..	..	..	
21	4th	10·1	19	0·153	18th	..	..	0	0	..	
..	5th (mid-day)	10·5	13	0·120	..	..	..	..	..	..	
22	6th	10·0	33	0·218	20th	..	..	0	0	..	
..	7th	11·1	22	0·153	..	..	..	..	..	..	
23	8th	10·8	29	0·146	22nd	..	..	0	0	..	
..	9th	10·5	18	0·129	..	..	..	..	..	..	
24	10th	10·6	20	0·144	24th	..	..	0	0	..	
25	21st	11·7	22	0·113	4th June 1894	..	..	0	0	..	

THE PASTEUR-CHAMBERLAND FILTER.

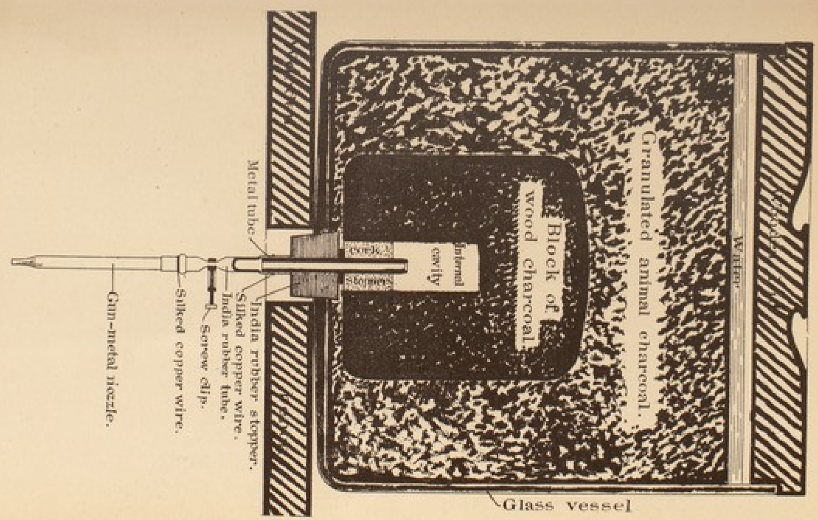
TABLE XI.—RESULTS OF THE THIRD SERIES OF EXPERIMENTS WITH MICROCOCCUS SP. AND EDINBURGH MAIN WATER.

Number of Experiment.	Date of Culture at 2 p.m.	Temperature of Water ° C.	Pressure of Water in Main. Lbs. per Square Inch.	Rate of Filtration. Litres per Hour.	Date of Counting Micro-organisms.	Micro-organisms in 1 cc. of Filtered Water. Roll Culture. Micrococcus sp.	Roll Culture. Other Micro-organisms.	Micrococci sp. in 1 cc. of Unfiltered Water.	Remarks.
1	25th May 1894	11·4	21	4·615	8th June 1894	0	0	47,250	Culture made after the filtration of 50 cc. of water, immediately after placing the unfiltered water in the filter.
2	26th	11·6	21	0·909	9th	0	0	..	
3	27th	10·8	36	0·759	10th	0	0	..	
4	28th	11·6	19	0·438	11th	0	0	..	
5	29th	10·9	17	0·400	12th	0	0	..	
6	30th	10·8	20	0·361	13th	0	0	..	
7	31st	11·3	21	0·348	14th	0	0	..	
8	1st June 1894	11·0	16	0·261	15th	0	0	..	
9	2nd (mid-day)	11·7	14	0·235	16th	0	0	..	
10	3rd (midnight)	11·8	46	0·430	17th	0	0	..	
11	4th	11·3	19	0·240	18th	0	0	..	
12	5th	11·3	21	0·261	19th	0	0	..	
13	6th	11·6	19	0·235	20th	0	0	..	
14	7th	12·8	20	0·244	21st	0	0	..	
15	8th	11·7	19	0·222	22nd	0	0	..	
16	9th (7 p.m.)	11·9	31	0·279	23rd	0	0	..	
17	10th (9 p.m.)	12·0	42	0·333	24th	0	0	..	
18	11th	11·6	22	0·210	25th	0	0	..	
19	12th	13·3	19	0·200	26th	0	0	..	
20	13th	15·0	23	0·218	27th	0	0	..	
21	14th	13·8	23	0·218	28th	0	0	..	
22	15th	13·0	18	0·179	29th	0	0	..	
23	16th (mid-day)	14·0	12	0·132	30th	0	0	..	
24	17th (10 p.m.)	12·4	41	0·285	1st July 1894	0	0	..	
25	18th	13·0	14	0·138	2nd	0	0	..	
26	19th	12·9	15	0·143	3rd	0	0	..	
27	20th (6 pm.)	15·5	22	0·190	4th	0	0	..	
28	21st	15·1	20	0·182	5th	0	0	..	

TABLE XII.—MICRO-ORGANISMS IN EDINBURGH MAIN WATER.

Number of Experiment.	Corresponding Number of Experiment in First Series of Experiments.		Date of Culture at 1 p.m.	Temperature of Water, ° C.	Pressure of Water in Main. Lbs. per Square Inch.	Date of Counting Micro-organisms.	Micro-organisms, including Moulds, in 1 cc. of Edinburgh Main Water.			Moulds in Edinburgh Main Water.		REMARKS.
	Nordtmeyer-Berkefeld Filter.	Pasteur-Chamberland Filter.					10-drop Plate Culture.	20-drop Plate Culture.	Mean.	10-drop Plate Culture.	20-drop Plate Culture.	
1	1	..	30th Jan. 1894	6·0	22	4th Feb. 1894	209	275	242	0	0	20-drop culture liquefied on 5th Feb.
2	2	1	31st	4·5	19	7th	19	15	17	0	0	
3	3	2	1st Feb. 1894	5·0	18	8th	5	3	4	1	2	
4	4	3	2nd	6·5	18	9th	17	17	17	2	1	
5	5	4	3rd	8·0	17	10th	46	32	39	3	5	3 *Bacilli violacei* in 20-drop culture, from one colony of which were derived the *Bacilli violacei* used in the Second Series of Experiments with all the Filters.
6	6	5	4th	7·5	29	11th	8	22	15	1	0	
7	7	6	5th	6·3	17	12th	662	630	646	0	0	Both cultures liquefied on 11th Feb.
8	8	7	6th	7·0	17	13th	1530	1526	1528	1	0	
9	9	8	7th	8·0	18	14th	115	201	158	4	4	
10	10	9	8th	7·5	18	15th	276	328	302	0	4	
11	11	10	9th	7·0	20	16th	134	178	156	1	2	
12	12	11	10th	9·0	18	17th	472	498	485	1	0	
13	13	12	11th	7·3	25	18th	250	382	316	0	0	
14	14	13	12th	7·1	20	18th	2420	Liquefied	2420	0	0	20-drop culture liquefied on 17th Feb.
15	15	14	13th	6·8	20	20th	4224	4320	4372	0	2	
16	..	15	15th	7·7	22	22nd	920	1770	1345	1	4	
17	..	16	17th	7·1	20	22nd	1101	1147	1124	0	0	Both cultures liquefied on 23rd Feb.
18	..	17	19th	6·8	21	26th	6885	4969	5927	6	5	
19	..	18	21st	5·5	21	28th	699	Liquefied	699	14	0	20-drop culture liquefied on 25th Feb.
20	..	19	23rd	6·6	23	2nd March 1894	1058	624	841	3	11	
21	..	20	25th	6·7	39	4th	11,160	11,520	11,340	17	32	1 *Bacillus violaceus* in 20-drop culture.
22	..	21	27th	7·1	21	6th	349	409	379	4	5	
23	16	22	1st March 1894	6·5	23	8th	855	1725	1290	10	24	1 *Bacillus violaceus* in 20-drop culture.
24	..	23	3rd	7·2	22	10th	7235	7725	7480	0	0	
25	..	24	5th	6·2	23	12th	3780	3402	3591	2	6	
26	..	25	7th	7·1	23	14th	1227	2011	1619	1	1	
27	..	26	9th	6·7	24	16th	756	1186	971	4	4	1 *Bacillus violaceus* in 20-drop culture.
28	..	27	11th	6·2	38	18th	110	208	159	2	4	
29	..	28	13th	6·2	21	20th	97	165	130	11	0	1 *Bacillus violaceus* in 20-drop culture made after running off 300 litres of water from the main.

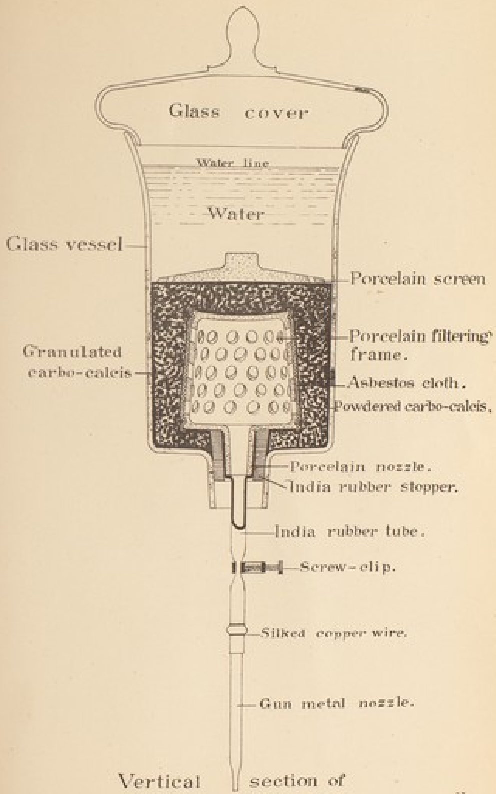
PLATE I.



Vertical Section of the
ATKINS PATENT WATER FILTER.

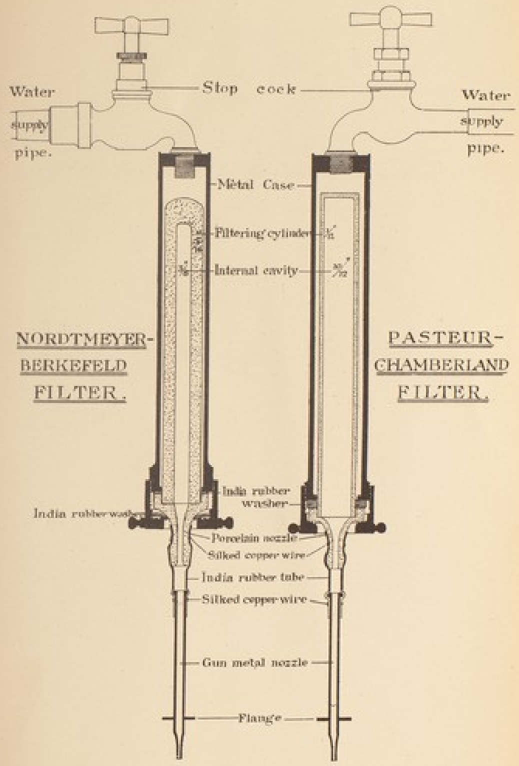
0 1 2 3 4 5 6 7 8 9 10 11 12 Inches.

PLATE II



Vertical section of
MAIGNEN'S TABLE "FILTRE RAPIDE."

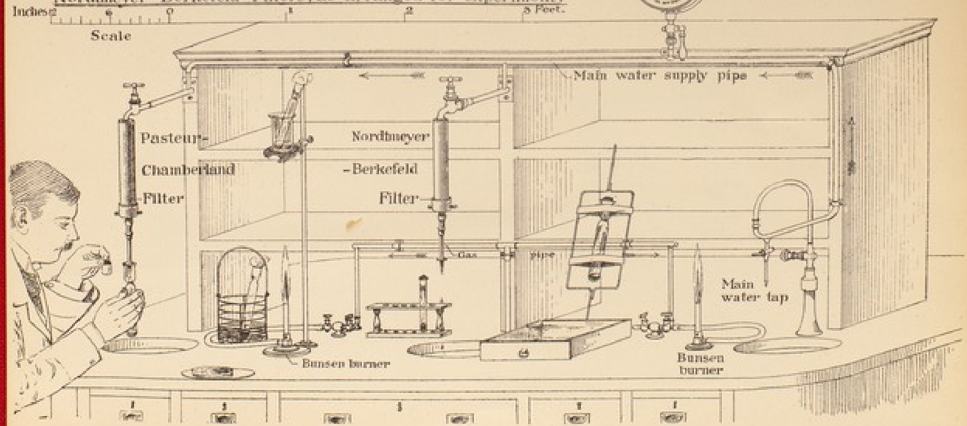
PLATE III



Vertical Sections.

PLATE IV.

GENERAL VIEW of the Pasteur-Chamberland and Nordtmeyer-Berkefeld Filters, as arranged for experiment.



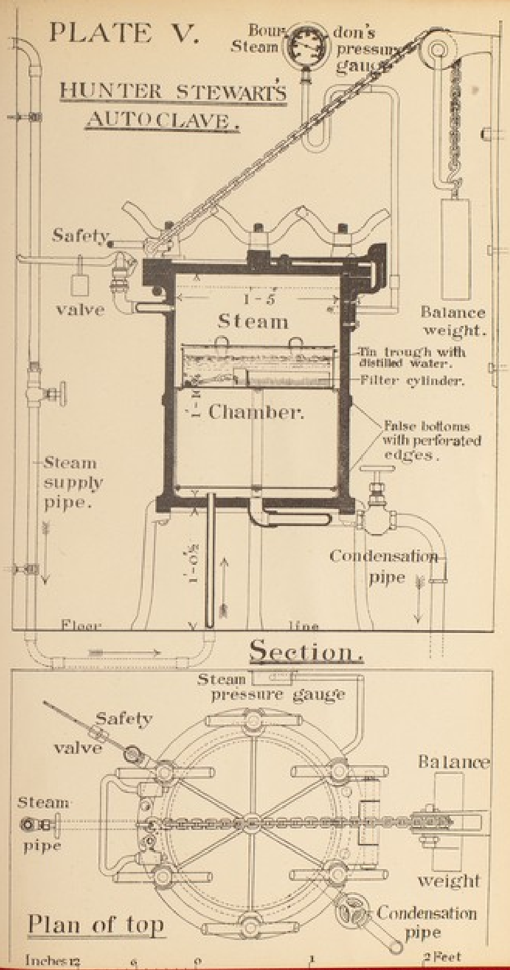


PLATE V.
HUNTER STEWART'S AUTOCLAVE.
Bour- don's
Steam
Safety
valve
1 - 5
Steam
Chamber.
Balance weight.
Tin trough with distilled water.
Filter cylinder.
False bottoms with perforated edges.
Steam supply pipe.
Condensation pipe
1 - 0½
Floor
line
Section.
Steam pressure gauge
Safety valve
Balance
Steam pipe
weight
Condensation pipe
Plan of top
Inches 12
6
0
1
2 Feet

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Medical Responsibility in relation to the Contagious Diseases Acts.

AN ADDRESS GIVEN TO A MEETING OF MEDICAL WOMEN, IN LONDON, APRIL 27th, 1897,

By Dr. ELIZABETH BLACKWELL.

THIRD EDITION.

perversion of the sexual instinct, the gradual destruction of so-called Christian civilization is taking place.

I felt moreover that the reference made in these Reports to the employment and training of women in India, to examine and treat Indian prostitutes, in the military hospitals under the Medical Officer, demanded the notice of Women Physicians.

Since 1870, a body of highly educated and reliable Women Physicians has grown up in Great Britain and Ireland;—a body recognised by the State as of equal standing with their professional brethren. During that period also, a most important and beneficent Medical movement for the help of our Indian sisters has been established in India, known as the Dufferin Fund, and promoted by our European Women Physicians. All Women Physicians willingly help the most degraded persons who voluntarily seek their help. But any proposition that women should be medically trained, in order to prepare the most helpless class of Her Majesty's subjects,—poor Indian women—for the use of vicious soldiers, would be so gross an insult, as well as extreme folly, that I felt sure that these responsible gentlemen could not realise the meaning of their suggestion. But it laid upon disciplined, and far-seeing Medical Women, who must carefully consider any practical measures which concern the relation of the sexes, the imperative duty of helping in the solution of an urgent and most difficult problem.

It is for these reasons, my friends, that as the oldest Woman Physician, I have thought it right to accept this invitation; and I earnestly desire to be aided in what I may suggest, by the serious thought of every experienced physician.

I propose to say a few words under the three following heads—

1st. On the growing and dangerous character of this sexual evil, which produces venereal disease.

2nd. On the error of Governments in their endeavours to cope with disease.

3rd. On the right principle which must guide all practical methods of dealing with it.

I.

On the Gravity of the Evil of Venereal Disease.

The Royal College of Physicians—our highest Medical Authority—makes the following statement—

"The increase of venereal disease appears to us to be a
"matter of serious moment, and to call for the gravest consider-
"ation. The constitutional form of the disease is one of the
"most serious, insidious, and lasting of all the contagious
"diseases that afflict humanity. Other contagious complaints,
"*e.g.*, small-pox or scarlatina are transmissible only for a limited
"time, and not by inheritance. With syphilitic disease it is far
"otherwise: it is the most lasting in its effects, and most varied
"in the character of its specific manifestations, it frequently
"gives rise to consequences far removed from its initial
"symptoms, most seriously implicating and affecting various
"organs of the body, it complicates other diseases, its con-
"tagious properties extend over lengthened periods of time,
"during which the sufferers are often a source of danger to
"innocent people, while they may be, and frequently are, as
"parents, the source whence specific infection is transmitted
"to their children. . . . .

"About 13,000 soldiers return to England from India every
"year, and of these, in 1894, over 60 per cent. had suffered from
"some form of venereal disease."*

Lord George Hamilton's Despatch quotes from a War Office Report—

"Of the fatal character of this form of disease" (syphilis)
"the committee, after a visit to the Military Hospital at Netley,
"where invalids from India are sent for treatment, have drawn
"a dreadful picture. During their short term of military
"service a great part (in some cases more than half) of their
"time has been spent in hospital, either in India, or at home.
"Before reaching the age of 25 years these young men have
"come home presenting a most shocking appearance; some lay
"there having obviously but a short time to live; others were
"unrecognisable from disfigurement by reason of the destruction
"of their features, or had lost their palates, their eyesight or
"their sense of hearing; others, again, were in a state of extreme
"emaciation, their joints distorted and diseased. Not a few are
"time expired, but cannot be discharged in their present con-
"dition, incapacitated as they are to earn their livelihood, and

*In the alarming statistics of disease, circulated by the Press, no distinction was drawn between gonorrhœa and syphilis. Yet the larger part of the Government returns of Army Venereal Disease refer to gonorrhœal affections, which are generally considered of minor importance constitutionally.—See Report of Departmental Committee, 1897, page 27.

"in a condition so repulsive they could not mix with their fellow-
"men. Their friends and relatives refuse to receive them, and
"it is inexpedient to discharge them only to seek the asylum
"of the poor-house; so they remain at Netley in increasing
"numbers."

The Government Departmental Committee (p. 11) uses almost the very words of the French Surgeon Diday, who in writing some years ago of the dangerous prevalence of venereal disease, so wide-spread in Paris:—warns his readers how this most insidious disease may be spread by ordinary contact; by wet-nurses to infants; or by infants to nurses; by public conveniences; by unsuspected touch; and even by the kiss of relations!

These Reports show that wherever a standing Army exists, either in Europe or America; whether in temperate or tropical climates; at home or abroad; there exists a focus of the most insidious and dangerous diseases that afflict human beings—diseases which specially injure the procreative power, and which are annually spread in varying amounts amongst the Civil population, notwithstanding the most rigorous measures which the wit of the Military mind has been able to devise; measures which often trample under foot every principle of justice and mercy.

When we consider also that not only are the standing armies of every civilised country nurseries of the various forms of venereal disease; but that the same dangerous diseases prevail in all our large towns,—the gravity of this scourge which is sapping the vitality of Christendom is evident.

The more careful study of venereal disease is specially incumbent upon Women Physicians, on account of the result of important modern researches. These show that many of the female complaints which have so largely increased, and which we are naturally called upon to treat, are now considered by experienced and clear-headed physicians to be often due to gonorrhœal infection derived from husbands of former loose life; infection conveyed either directly, or from recrudescent and insidious forms of trouble, hitherto unsuspected.*

* See Dr. T. More Madden in *Medical Annual*, 1897; Dr. J. W. Sinclair's "Gonorrhœal Infection in Women"; Dr. T. Gaillard Thomas, see Appendix; Researches of Sänger and other German Investigators; also Dr. Lawson Tait on Diseases of Women; "The Pathology and Treatment of Diseases of the Ovaries, 1877 and 1883," &c.

II.

The Errors of Official Bodies in Dealing with this Subject.

Before I venture to criticise any procedure or suggestion of the Government, I ask your consideration of certain scientific axioms, which must be laid down as necessary data, before any wise course of practical action can be initiated with rational hope of success. The first refers to the causes of disease.

Axiom 1.

"In combatting serious disease it is essential to ascertain the chief cause of the disease, which must be directly attacked, and steadily removed, or no cure is possible."—

We may as well expect to cure typhoid fever whilst allowing sewer gas to permeate the house; or cholera, whilst bad drinking water is being taken; as try to cure venereal disease whilst its chief cause remains unchecked.

—I shall shew later that Promiscuous Intercourse, or the resort of many men to one woman is a prolific source of venereal disease.

The second axiom refers to the physiological rank and scope of our human faculties.

Axiom 2.

"The sexual organs are not essential to individual life; although they are essential to the continuance of the race. Neither is their full exercise by sexual congress *ever* indespensable to individual health."—

The blind obstinacy with which these scientific facts are ignored, in education, in social sentiment, and in government organizations, is a potent cause of national degeneracy, of impaired procreative power, and enfeebled offspring.

Hunger is the primary instinct and indispensable condition of human life. It is that which ensures the continuance of the individual. The sexual instinct with all its grand power to perpetuate the race, is only a later development, growing with the unfolding of the intellectual and moral nature. It is shared equally under varying aspects, by each of the two necessary factors in procreation, woman as well as man.

This fact of the powerful sexual attraction necessarily existent and dominating in woman, as Mother of the race, seems to be quite overlooked. In any true meaning of the word—strength—this potent social force in women, demands serious study, although it may exhibit itself in less spasmodic form than in men.*

There are two branches of the Medical Art which urgently require fuller consideration. These are:—

1st The physiological life of the organs of generation, in both men and women.

2nd The immense influence which the mind can exercise over the body in controlling disease.

The susceptibility of our sexual nature to mental control and direction to noble ends, is a great and encouraging scientific truth.

From these data of true physiology the possibility of continence is evident. With further physiological study, its great advantage, up to the full consolidated adult age, can be proved. By scientific study of the biological facts that underlie these data, it can be shewn, from positive medical experience, that promiscuous intercourse between the sexes, or the resort of many men to the same woman, can not be made physically safe. The gradual elimination of this destructive practice, is essential to the progress of the race, or Christian civilization.

These statements are supported both by historical experience and sound medical knowledge.

The human race in advancing through lower stages of development, passes from polygamy and concubinage to the

* See "The Human Element in Sex" (Churchill).

higher state of Christian Marriage. The scientific basis which underlies this advance has not yet been realised.

Polygamy, although morally degrading to both parties, from its injustice and tyranny, does not produce the physical curse of syphilitic disease.

But promiscuous intercourse inevitably tends to give rise to varying forms of venereal disease, no matter what precautions may be taken.

In the female subject, irritation, congestion, or inflammation of the parts, are the result of unnatural repetition of the sexual act. By such irritation the natural and healthy secretions of those organs are rendered morbid.

The natural secretions of the male organs also become morbid in licentious men, developing into blenorrhagia, or purulent gonorrhœa; and thus the danger of promiscuity is intensified.

Neither is it possible when such injurious practices are allowed, to cleanse or disinfect the female parts, as if they were a plane surface. The woman's structure is designed for the passage of a child's head. It is consequently composed of immensely distensible or elastic tissue forming folds or rugæ, which may retain diseased products. It is also abundantly supplied with active secretory and absorbent glands, whose action may become unhealthy.

The special danger of specific disease, also, from the congress of different races, is a well-known fact. The alarming epidemic of venereal disease, which spread like the plague through Europe, in the 15th century, was brought from America by the licentious conquerors of Peru. This gravest form of racial injury is now being emphasized by the contrast between the condition of our white and coloured troops in India.

Although medical investigation has failed to determine precisely the originating cause of the specific virus which produces the form of venereal disease named syphilis, yet it is always connected more or less directly with promiscuous intercourse, especially with the advance of armies.*

* See Hirsch, Geographical and Historical Pathology, vol. ii., chap 2, The New Sydenham Society.

We know, however, that morbid changes may take place in the natural secretions of the male and female organs under impure sexual intercourse, leading to advanced forms of degeneration in the various results of gonorrhœa, producing, particularly when the epidermis is abraded, sores, ulcers, &c. And the poison of diseased secretion is thus conveyed from one to the other partner in vice.

Nor can the presence of infectivity, once acquired, be detected by inspection, and no infected immoral person, still carrying on impure sexual relations, can ever be pronounced healthy or "sound" by means of examination, or ocular investigation. Neither can the absence of the so-called venereal germ gonococcus, be relied on, as proving health. Its specific significance is denied by many competent investigators; and it is absent in some of the worst forms of disease.

"Mediate Contagion" is also an important and well-established medical fact. Thus a famous French harlot, called "Casse-noix," presented none of the grosser signs of venereal disease, yet continued to infect the men who resorted to her.

When to the difficulty of pronouncing the parts with their secretions healthy, is added the existence of uncleanliness, of drunkenness, &c., in either party, the danger of these promiscuous relations is evident.

Now these positive Medical facts appear to be unknown in their full significance to our Government advisors, judging from the latest Reports and Proposals with regard to Disease in the Indian Army, which seem designed to allay national panic. A mistake was certainly made by Government in withdrawing a subject of such vital importance to the nation, from full consideration by our Parliamentary representatives, on account of its painful character. The consequence is, that an active but irresponsible Press has thrown a mass of unsifted and shocking statistics, broad-cast amongst the people, creating wide-spread alarm.

The Army statistics imperatively demand a far more searching examination both into facts, and their causes, than has yet

been given, before rational or permanent legislation can be adopted. Any thoughtful person examining the Reports referred to, will see that such facts as the following require elucidation:—The actual number of individuals affected (not the repeated return of the same soldier), and the varying category of their complaints;—the variations in different Cantonments, with the causes of such difference;—the effect produced by the introduction of the short service system, and by increased restrictions on marriage;—the closure of voluntary hospitals and dispensaries;—the influence of Malaria, and tropical climate on the constitution;—the mixture of different races;—and the causes which have produced the improved health results which are obtained in the Army in England.

These points have not been sufficiently investigated by unprejudiced enquiry. The well-meaning effort of Government to meet a very serious state of things must inevitably fail, because the necessary bases for legislation are not yet established.

It is clear that until all these essential facts have been carefully looked into by a competent commission, and the results presented to Parliament,—no legislation,—which apparently destroys the foundations of morality, which perverts and weakens our youth; and which, under the misleading phrase, "voluntary submission," reduces our helpless Indian sisters to virtual slavery of the most destructive character;—can be permanently accepted by the British nation. We must look forward therefore to a longer and more arduous struggle than the one that was prematurely quieted in 1888. Neither can the struggle between right and wrong methods of practical action be confined to our Indian Army. It concerns our work in Great Britain as well as in India and in Africa. The dire diseases in question are connected with all large towns as well as with every military station, and as Physicians we must study them in these two relations.

III.

On the Principle which must guide all Practical Methods of dealing with Venereal Diseases in the Army.

On this vast subject, I can only refer to-day, to two practical methods of gradually extirpating venereal disease from our Army in India.

The First, is the steady discouragement, by Government, of promiscuous intercourse.

The Second, is the removal of the idleness, which curses our soldiery, in an Army of Occupation.

The first indispensable condition in the prevention of disease, is the steady discouragement of promiscuous intercourse.

Now I assert positively that such discouragement has never been seriously and steadily tried in the Army, by Government;—but only by unofficial efforts. Efforts which are most valuable; but which are entirely lacking in the force of organisation, and in the important recognition and help, which Government alone can afford.

In the "Memorandum of the Army Sanitary Commission," No. 2, published this year; on the first page appears the following noteworthy statement—so utterly misleading, as to amount to virtual falsehood—

"The efforts to teach the soldiers habits of self control, having so signally failed, those responsible for the maintenance of the efficiency of the Army in India, may well be excused if they look about for some effective means of arresting the progress of the disease, and preserving their battalions fit for service."

Now what are the *Government* efforts here referred to, which are said to have failed?

In examining the circulars issued from the Quarter-Master General's Department from 1870 to 1884, for the adoption of stringent measures, "to reduce the chances of Venereal Disease," it is found that the recommendation consists in instructing the soldiers how to cleanse themselves after dangerous sexual indulgence! No circular is issued from the Quarter-Master's

Department, requiring that the soldier shall be taught,—how to control his ignorant instincts, and honouring such control—(*that*, is left to scattered individual effort) but official instruction is confined to the vain endeavour, of teaching him how to satisfy lust without extreme risk! Surely this is adding hypocrisy to culpable disregard of the national welfare.

It is encouragement to continence which the young soldier needs, and remember, that numbers of these soldiers are enlisted between 18 and 25 years of age—an age when every Physician knows, that the male organisation is being consolidated, and when continence is invaluable in helping the physical forces to build up a fine strong manhood. Encouragement to self-control therefore, must be afforded from the soldier's first introduction to Her Majesty's Service.

It must begin with the Recruiting Sergeants, who should be moral men, and understand that continence, in the soldiers, will be regarded with the highest honour; as preservative of physical efficiency, and moral bravery.

The Inspectors of recruits, and especially the Medical Staff, must give the important instructions needed by soldiers, of how to restrain their passions.

The sexual organs are not a permissible subject of trade; and purchase of the female body should be discouraged in all the mainfestations that official influence or human law can legitimately reach. The Army Surgeons must *themselves* know, the physical reasons why the practice of immorality can never be rendered safe; and by object lessons taken from the military hospitals, they can teach ignorant soldiers that no death is to be feared, in comparison with the shocking results of incontinence. They can indicate the rational means of physical exercise, and mental discipline, by which the eager passions of youth can be controlled; whilst at the same time they insist upon the necessity of a non-stimulating diet, in tropical climates.

The Chaplains of the Army have the next, and still higher duty to perform, towards each undisciplined youth who is given up body and soul, to the absolute direction of the Army

Authorities. No Chaplain should be appointed to our Indian Army, who is not only himself a moral man, but who has also learned the physical possibility, and immense advantage of self control; and is thus able from the basis of physiological knowledge, to rise to the higher plane of religious instruction. Without such physiological knowledge, as a sound support of well grounded spiritual faith, his sacred calling may seem a badge of hypocrisy, more deadly and destructive from the profound responsibility of the position which he has ventured to fill.

The immense influence which commanding officers may exert by their own example and sympathy, cannot be enlarged on here. But until such influences are brought to bear on the recruits, by the *Government*, it is not true to state, that efforts to teach self control have signally failed—for, they have not been made !—

Our responsibilities to the People of India, where England has become the Paramount Power, are very weighty. These responsibilities are due to its women, as well as to its men. It is stated that, according to the last census, there were the enormous number of 38,047,354 girls under 15 years of age in our Indian Empire. What is the duty of a Christian Government to this helpless mass of human beings? The formation of poor young Indian women into a class purchasable by white soldiers; a class despised by their own people, with no refuge before them; but when used up, turned out to die, is a dire and dastardly disgrace to any government calling itself civilised! The removal of temptation by forbidding our soldiers to purchase our young Indian sisters, and if necessary, excluding them entirely from the cantonment, is a distinct duty on the part of any government that seriously means to banish venereal disease from our army.

The second urgent preventive measure, which should engage our military authorities, is the removal of that dangerous idleness, which is a constent temptation to the soldiers through so many weary hours of every day. This subject can only be referred to here, for although of extreme importance, its practicability and adaptations, must first of all be thoroughly

discussed by military men intimately acquainted with the exigencies of army life. But it is a paramount duty to provide constant useful employment and healthy recreation for our soldiers in every army of occupation, during the cooler hours of the evening in tropical climates, when such employment becomes possible as well as imperative.

The remarkable organisation of an army, is the most powerful training school—in good or evil—for the poorer classes of men, that we possess. The conversion of an Army of Occupation into a school of the industrial arts needed in its maintenance; with rewards for industry, sobriety, and self control, must surely be in the power of any government that resolutely determines to accomplish such a noble transformation. The saving in health and even in money would be a great economic gain. The government that carried out such a grand result would be a mighty benefactor to our race.

It is impossible now to go fully into the various branches of this vital subject, but I would say to my younger medical sisters, who will carry on, here, the grand work of medicine, when I have entered upon another sphere of life, that I most earnestly counsel them to recognise, that the redemption of our sexual relations from evil to good, rests more imperatively upon them, than upon any other single class of society. It will be a cowardly dereliction of duty to refuse any longer to study this grave subject of venereal disease, now again forced upon our attention—because the subject, which concerns both sexes equally— is a repulsive one.

To us, medical women,—the special guardians of home life—has been opened the path of scientific medical knowledge, which, as science, embraces both mind and body; and it is by our advance, independently, but reverently in that path, guided by our God-given womanly conscience, that we shall be able to detect clearly the errors in relation to sex, which lie at the root of our present degeneracy.

It is not conspicuous public action that is required from us, but the thorough realisation of true physiology.

We must ourselves recognise the truth; and instruct parents, that it is a physiological untruth to suppose that sexual congress is ever indispensable to male health. We must warn our young men, that no loose woman picked up in the streets, or in a brothel, or in her own house, can be pronounced physically safe; no matter how attractive she may seem to be. We must warn our poor young woman patients, that yielding to the solicitations of a supposed lover may unfit them to become healthy wives and mothers. We must persistently arouse the conscience of parents to the very grave risks that their daughters run, in uniting themselves to men of former loose life.

This is the confidential but imperative duty of true physicians. It is by quiet but never-ceasing effort to spread the true view of scientific medicine amongst our patients, and wherever the opportunity occurs, that our influence as Christian physicians will gradually permeate society, and cause truth to prevail over error.

If you perceive that the principles I have laid down are sound, then hold to them firmly, as the most precious Truth.

Meet together to mature practical applications of those principles by inter-communication of experience and mutual encouragement; feeling sure that where two or three meet together, in the everlasting Spirit of The Christ, you will find, as I have found during a long life, that light and strength will be given you, and as earnest followers of The Great Physician, you will take part in that mighty work of regeneration, which from our present small beginnings will, I fully believe, grow and transfigure the 20th century.

Rock House,
Hastings.

Copies may be obtained from the

National Vigilance Association, 267, Strand, London, W.C.

APPENDIX.

The following testimony is by Dr. T. GAILLARD THOMAS,

a recognised Gynæcological Authority of New York.

"Until the last twenty years specific urethritis was regarded, in the male, as an affection of the most trivial import, as rapidly passing off, leaving few serious sequelæ, and offering itself as an excellent subject for jest and good natured badinage. About two decades ago, Dr. Emil Noeggerath published a dissertation upon this affection, which will forever preserve his name in the list of those who have accomplished good for mankind, and give him claim to the title of benefactor of his race. This observer declared, first, that out of growing young men, a very large proportion prior to marriage have specific urethritis; second, that this affection very generally causes urethral stricture, behind which a "latent" or low grade urethritis is for many years prolonged; third, that, even as late as a decade after the original disease had apparently passed away, the man may transmit it to a wife whom he takes to himself at that time; and fourth, that the disorder affects, under these circumstances, the ostium vaginæ and urethra, and thence passes up the vagina into the uterus, through the Fallopian tubes, where it creates specific catarrh, and by this disease produces oöphoritis and peritonitis, which becomes chronic, and often end in invalidism and sometimes even in death. For this essay, Dr. Noeggerath was assailed by ridicule and by contradiction. The matter has now been weighed in the balance and admitted to its place among the valuable facts of medicine.

My estimate of specific urethritis as a factor in the diseases of women, and I take no peculiar or exaggerated views concerning the matter, will be vouched for by all progressive practitioners of gynæcology to-day. Specific vaginitis, transmitted to virtuous women by men who are utterly ignorant of the fact that the sins of their youthful days are at this late period bringing them to judgment, is one of the most frequent, most active, and most direful of all the causes of serious pelvic trouble in women—one which meets the gynæcologist at every turn, and one which commonly proves incurable except by the dangerous procedure of cœliotomy.

Think for a moment of the terrible position in which a high-minded, upright, and pure man finds himself placed without any very grave or unpardonable fault on his part. At the age of nineteen or twenty, while at college, excited by stimulants, urged on by the example of gay companions, and brought under the influence of that fatal trio lauded by the German poet—"Wein, Weib, und Gesang"—the poor lad unthinkingly crosses the Rubicon of virtue! That is all! On the morrow he may put up the prayer, "Oh, give me back yesterday!" But yesterday, with its deeds and its history, is as far beyond our reach as a century ago, and returns at no man's prayer!

Four or five years afterwards this youth goes to the marriage-bed suffering, unknowingly, from a low grade of very slight latent urethritis, the sorrowful memento of that fatal night, which has existed behind an old stricture, and a result is effected for the avoidance of which he would most gladly have given all his earthly possessions.

All this sounds like poetry, not prose; like romance, not cold reality. But there is not a physician in this room who does not know, and who will not at once admit, that every word that I have uttered is beyond all question true, and even free from exaggeration.

I mentioned, in speaking of the grave duties demanded by puberty, that one of the important functions of the physician in regard to the development of the girl during the thirteen years which precede it, is to instruct her and her guardians how to prepare her for the approaching issue. In language no less strong I would here insist upon the physician's duty to instruct men in all stations of life as to the importance of a "clean bill of health" in reference to gonorrhœa, both acute and chronic, before the marriage contract be entered upon.

Until a very late period the plan universally followed has been this: The man about to be married went to his physician, told him the history of a gonorrhœa, and asked if, now that all discharge appeared to have ceased, any danger would attend his consummating the tie. The physician would ask a few questions, examine the virile organ carefully as to discharge, and if the "outside of the platter" appeared clean, gave his consent to the union. The evil which has resulted from this superficial and perfunctory course has been as great as it has been wide-spread. To-day the question of stricture, a slight, scarcely perceptible "latent gonorrhœa," with its characteristic "gonococcus," is looked into, and not until all trace of disease is eradicated is permission given for the union. A marital quarantine is as necessary to-day in social life as a national quarantine is for contagious diseases in general.

Few men, however eager for matrimony they may be, would run the great risks attendant upon precipitancy if they only knew of them clearly and positively. In no field of medicine is the old adage, "Prevention is better than cure," more important than in this one. If physicians would do their duty fully in the matter, how many unfortunate women now languishing from "pyo salpinx" would in the next generation be saved!"

J. F. NOCK, Printer, 7, Silchester Road, St. Leonards.

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