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Surgeon General Longmore with the Author's kind Regards.

CHOLERA:

ITS ENDEMIC AREA AND EPIDEMIC PROGRESSION,

WITH

REMARKS ON ITS CLINICAL ASPECTS AND TREATMENT.

BY

SURGEON-MAJOR HAMILTON,

ARMY MEDICAL STAFF.

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CHOLERA:

ITS ENDEMIC AREA AND EPIDEMIC PROGRESSION,

WITH REMARKS ON ITS CLINICAL ASPECTS AND TREATMENT.*

In considering a subject like that of cholera, the first great difficulty that strikes the investigator is the number of views, conflicting one with the other, each put forward confidently and with dogmatic assertion, and, no doubt, from the standpoint of the various writers, in perfect good faith as to their correctness.

Each local observer necessarily receives different impressions in accordance with the facts that come within his observation; and thus we have a number of theories, many of them most conflicting, and each upheld most strenuously by their different advocates.

In opposition to these local observers, we have the statistician surveying the facts from a central office, comparing manifold observations as regards numbers, dates of attack, and progression, and from these various data working out a harmonious relation of one epidemic to another, till he has indications sufficient to map out the natural laws and progressive steps of the disease.

Perhaps the simplest illustration that can be given of the conditions under which such observations of epidemics are carried out, will be the case of a great battle, in which there are several reporters present with the troops in different parts of the field.

The incidents of the fight and the conduct of the troops in his immediate vicinity will naturally be reported as observed by each, and, as a consequence, a number of very different views will be put forward. Overhead, however, in a captive balloon, another

* Read in the Medical Section, January 30, 1885.

reporter has a bird's-eye view of the entire battle-field, and he is, in consequence, able to give a comprehensive report of the entire engagement. It stands to reason that the account of the reporter who enjoyed a complete view of the battle must be more accurate, as a whole, than that of any of the others, who could merely speak of the conduct of the troops in their immediate vicinity.

It is often said that statistics can be made to prove anything; but, from personal knowledge of the records of cholera in India, I assert that statistics of the army in that country are a marvel of accuracy, and from them have been deduced most valuable data. The late Dr. James Bryden's works on epidemic disease in India teem with information of the most instructive kind, and I have no hesitation in saying that to him we owe the greatest portion of our knowledge of epidemic cholera.

The first striking point in connexion with cholera in India (I speak now of the Bengal province) is the fact that there is an endemic area from which the disease is never absent, even while the rest of the Continent is absolutely free. This endemic area, or, as it may be termed, the manufactory of cholera, is one of the most remarkable places in the world, and a more suitable position for the purpose it would be impossible to imagine.

The great rivers Ganges and Bramaputra, draining a large proportion of the Continent of India, pour their waters into the sea below Calcutta, but, contrary to the custom of rivers to unite and discharge by a single mouth, these great bodies of water split up into innumerable channels that pass through an alluvial delta of many miles in extent.

The Sunderbands, as they are called, may be described as a crowded cluster of small marshy islands, separated by narrow channels, in some places containing brackish, in others fresh, water, and generally under the influence of the tide. These islands have obviously been formed by the deposition of the enormous quantities of earth swept down by the rivers during their periodical inundations. This alluvial archipelago is 158 miles long, by 75 miles wide, and contains 6,500 square miles.


TIBET
BAY OF BENGAL
ANDAMAN ISLANDS
KAFIRISTAN
Cabul
Jelelabad
Peshawar
Murree
Ghuznee
Lahore
Mooltan
River Indus
Sutlej Riv.
Umballa
Roorkee
Meerut
Delhi
Bareilly
Lucknow
Agra
Cawnpore
Fyzabad
Gwalia
Allahabad
Benares
Patna
Jhansi
Banda
Nowgong
Hyderabad
Kurrachee
Deesa
Ahmedabad
Mhow
Jubbulpore
Cambay
Satpura Hills
Surat
Kasambagh
Moorshedabad
Dacca
Calcutta
Garo Hills
Manipur
Tipperah Hills
Chittagong
Mouths of the Ganges
Brahmapootra River
ORISSA
Cuttack
Pooree
Akyab
Prome
Irrawaddy Riv.
Bombay
Upper Godavari District
Hyderabad
Krishna Riv.
Rangoon
Gulf of Martaban
Cape Negrais
Bangalore
Madras
Trichinopoly
Palk's Strait
Colombo
MAP shewing the endemic area of cholera thus
the Ground covered by the epidemic of 1878 „
d° d° d° d° 1879 „

Lying between the Bay of Bengal and the inhabited part of the delta, exposed to the influence of frequent heavy rain, alternating with a burning sun, its accumulated and perpetually exhaling malaria, urged on by the S.W. monsoon, spreads disease and death over the whole country. This tract swarms with tigers and other wild animals, whose ravages cause wide destruction both of life and property.

This, then, is the home of cholera, and from this area epidemics take their rise and spread to the extreme north of India, and, under certain conditions, even to the rest of Asia and to Europe.

It will, perhaps, be most convenient to consider next the sanitary conditions of the remainder of the continent of India, over which, from the endemic area already alluded to, cholera becomes epidemic at intervals.

India is a vast alluvial plain, bounded on the north and east by chains of lofty mountains, interposing an icy wall between Hindustan and Thibet. These mountains rise tier after tier to a maximum height of 29,000 feet, with a perpetual snow line at 16,000 feet, and thus present an impassable barrier to cholera in that direction. The plains of India are watered by many great rivers, the principal of which in the Bengal province, the Ganges, flows in a south-easterly direction through a well-marked depression in the plain, commonly alluded to as the Valley of the Ganges, though, to the ordinary observer, this is rather a misnomer, as no actual valley is to be discerned.

The direction in which this vast body of water moves, towards the S.E., is particularly worthy of note, as epidemics of cholera invariably advance up stream, travelling against the current, thus affording a strong argument against the theory of water being the chief vehicle of infection.

I must next briefly consider the general condition of sanitation under which the 250,000,000 of inhabitants exist, and it is briefly summed up as being as bad as it well can be. The excreta of this vast population are daily deposited on the surface of the ground, and, allowing 8 ounces per head per day, it is evident that 125,000,000 lbs.

daily, or a total of 20,000,000 tons a year, are spread on the surface of the land. No doubt the area is a great one, but the dessication and diffusion by the wind of such an enormous amount of human excreta must be regarded as a great possible source of evil, fouling the water and food supply of the entire country. From experience I can say that the environs of every village are practically an open cesspit, and even in the immediate neighbourhood of our military cantonments matters are little better. The native of India is, perhaps, the most extraordinary anomaly in nature; bound down by caste prejudices in a manner inexplicable to Europeans, he will throw away his food if even the shadow of a stranger or lower caste native falls on his cooking place. Even in the matter of drinking he is so particular that a Brahmin would die of thirst sooner than drink out of the vessel of a man inferior to him—yet this same Brahmin may be seen washing and drinking in a tank, the banks of which are covered with human excrement washed by every shower into the water he does not hesitate to use for all domestic purposes.

Even in Calcutta, the capital of India, and within a few minutes' walk of the palace of the Governor-General, similar insanitation prevails, and the following remarks from the Calcutta Health Officer's Report will prove how extraordinarily apathetic the people of India are to the filthy condition of their water-supply:—"A circumscribed outbreak was reported from Mooktaram Baboo's-street. A narrow passage led to a shallow tank. It was a small reservoir, closely surrounded by huts and houses, whose drainage found its way into it by numerous shallow ditches. The sloping banks were covered with rubbish and refuse of all sorts, in some places heaped into a sort of dunghill. Broken steps led down to the 'water' from two sides, and paths well-trodden and indicating frequent use gave access to it on the other two. I saw a man, lotah in hand, washing his person and dirty black cloth at one of the ghats, several girls polishing brass dishes with the mire that lay on the brink of the water at the other; an old woman washing rice in a basket at another place, and a young girl bathing in the centre and drinking the fluid. This was turbid and of a dark brown colour, and about 2½

feet in depth." I have touched on these points in order that the sanitary condition of the inhabitants may be understood, conducing, as it must, to the propagation and spread of epidemic disease.

It may be asked—What has the great English Government done to remedy this evil? I fear the answer must be, at all events as regards the mass of the population, little or nothing. In Calcutta and other important towns sanitary measures are carried out fairly well, and the water supply in many places has been improved, but as regards the great bulk of the people, they are as much in the dark as they were 1,000 years ago.

Having briefly described the sanitary condition of this great continent, let us consider the history of cholera as observed in its home.

Cholera, then, is endemic in the area I have indicated—the delta of the Ganges. In this tract it is ever present, and when the meteorology of the season is favourable, it overflows its natural habitat and is carried into what we may call the epidemic area. The two great factors necessary for this overflow of the cholera poison are moisture and wind.

During the fierce heat of the summer months enormous evaporation goes on in the Indian Ocean and Bay of Bengal, and when the monsoon sets in, the S.W. wind carries inland the rain-laden clouds destined to convey the necessary moisture to the arid and parched-up land.

These rain clouds are carried rapidly over the endemic area to the Himalayas, and first impinge on a spur projecting into the plains; the monsoon is thus split into two currents—one passing along the Himalayas and the Valley of the Ganges, to the north-west; the second passing along the mountains and up the valley of the Bramaputra, into Assam.

So enormous is the rainfall at certain places, that at Cherapoonjee the annual deluge is 600 inches; I have myself seen 34 inches of rainfall in 56 hours at Naini Tal, in 1880, when the great land-slip took place. This great rainfall not only floods the low-lying grounds of the endemic area, but also moistens the earth northwards, as far as the influence of the monsoon extends.

Bryden's theory, then, is, that the rainfall, swamping the low-lying endemic area, extinguishes cholera there; and if the prevailing wind be favourable, the disease is conveyed across the continent, or up the Gangetic or Bramaputra valleys.

This cholera, overflowing the endemic area in the autumn, the period of the heaviest rainfall, advances northwards by well-marked steps, and, influenced by the strength and duration of the monsoon, reaches certain points before the commencement of the cold season. This body of cholera dies out in the winter, and, with the exception of a few sporadic cases, it does not show itself again till spring, when another outbreak usually takes place further north. This again dies down, re-appearing when the monsoon is well on, and frequently lasts till September. Put in its shortest terms, "cholera is ever present or endemic in Lower Bengal, and may become diffused or epidemic in any year. When it travels to the N.W. the invasion is frequently confined to a natural area bounded by the line of 80°, east longitude.

"This line bounds the area over which the S.W. monsoon blows, and thus the limit of the extension in a westerly direction may be accounted for.

"It never appears in Northern India before the 20th April in any year. Individual cases west of the line of 80°, especially in the last quarter of the year, very constantly precede the appearance of cholera in the following spring. If the upper provinces be affected as an area, cholera will last till the third week in September. Experience shows that a bad cholera in spring is followed by a worse during the monsoon, usually appearing a fortnight after the beginning of the rains. Cholera, epidemic in the east of India, may be entirely diverted from the N.W. into Western India. This takes place during the prevalence of the N.E monsoon, in the last quarter of the year."*

As an illustration of Bryden's theory, I will take the epidemic of 1878-79. An overflow from the endemic area took place about July (Upper India being up to then free). Appearing first at Hazareebagh, it advanced rapidly, showing itself almost

* Deputy Surgeon-General Marston, A.M.D. Report, 1878.

simultaneously along all the stations of Oudh and the Gangetic provinces, between the 10th and the 16th of August, culminating in the outbreaks at Fyzabad and Lucknow. Dying away after the rains, the disease subsided as an epidemic, but the occurrence of some sporadic cases further north, during the cold season, enabled Bryden to prognosticate a further advance of cholera, which he believed indicated an epidemic in spring.

I was at the time Statistical Officer of British Troops with the Government of India, and in November I received a telegram announcing that a soldier, belonging to a battery of Royal Artillery marching up country, had been attacked between Amballa and Meean Meer.

I showed this telegram to Dr. Bryden, and he then affirmed his belief, from that and other sporadic cases, that the Punjab had been invaded; and he was of opinion there would be an outbreak extending up to Peshawar, and perhaps into Afghanistan, in the next hot weather. This forecast was verified only too truly; in the summer of 1879 an epidemic of cholera swept over the Punjab and right into Cabul through the Khyber, carrying off thousands of natives and many Europeans.

It may be asked—What is the practical outcome of these observations, and, admitting this wave-theory to be correct, of what value is the knowledge?

The answer is, that when indications of the advance of the disease into the northern provinces are present, it would undoubtedly save many lives if the troops were removed during the winter from the territory that experience shows will next be invaded.

Unfortunately, political and military exigencies do not at present permit of such a radical step being taken, though, perhaps, with further experience of the course of epidemics, and with the extension of railways, even this movement may be adopted in the future. From a mere monetary point of view a great saving might be accomplished, and, as it is estimated each British soldier costs £200 in India, the saving of even a few lives would repay the cost of transit of the troops out of the line of danger.

As an illustration of the value of Bryden's knowledge of the progress of epidemic cholera, let us look at the summer of 1879, when we had a large force in Afghanistan up the valley of the Khyber. The peace of "Gundamuck" was signed, and the Government was anxious to withdraw the troops for political reasons. Unfortunately at the time cholera was raging at the Punjab, at Peshawar, and even into the Khyber Pass. Most of the troops were camped on high spurs, and were in good health, and now the question arose what should be done? The cholera was evidently advancing up the Pass, and it seemed certain that if the men were marched out into India they would be attacked by the advancing epidemic and would suffer severely. If, on the other hand, the troops were allowed to remain, and were attacked *in situ*, the losses might be greater; moreover, if once attacked they would have to remain in their camps, as almost certainly the native followers would suffer in great numbers, would then desert, and leave the columns immovable for want of carriage. At this crisis the Government of India consulted Dr. Bryden, and this was his advice:—"If you march the troops out they will certainly be attacked *en route;* but, on the other hand, from past experience, there seems no doubt the disease is rapidly extending into Afghanistan, and if the troops are attacked in camp they will then have to stay there till the epidemic ceases, and the mortality is certain to be enormous"

The Government of India acted on this advice, which met with much opposition, and which, to those not so well informed, seemed almost suicidal; the troops were rapidly marched out into India, and lost many men on the way, but spreading out like a fan in every direction, the disease soon disappeared.

In proof of Bryden's sagacity, it is well known that a violent epidemic of cholera appeared at Cabul in July, and further, that those troops that remained encamped at Lundi Kotal, a few miles up the Pass, suffered severely. Had our army remained to be attacked, there is little doubt their losses would have been tenfold. This, then, is Bryden's theory of cholera—"earth-born" and "air-borne." The theories usually set forth in opposition to this are

two in number—one the "water theory," the other the "human intercourse theory."

It would be quite impossible within the limits of such a paper as this to enter in any way fully into either of these views, but I may briefly touch on the main arguments in opposition to them.

In the first place, it is remarkable that cholera in India, certainly in the Bengal presidency, always advances up stream—*i.e.*, *with* the wind and against the current; in the second place, years will sometimes elapse between epidemics, though it is quite certain the water supply in the interval is just as bad; and, in the last place, why, if water is the cause, should not epidemics localise themselves where the water supply is foul, and why should an epidemic suddenly cease, though not only is the water as dirty as before, but, in addition, the so-called cholera poison has been added to it from the excreta of the sick.

It is never denied—on the contrary, it is admitted freely by all who have gone into the subject—that foul water will intensify a local outbreak, as will any other insanitary item—*i.e.*, overcrowding, bad ventilation, improper food, sewer gas, &c., but when theorists attempt to explain the advance of an epidemic over a vast continent by means of water their arguments utterly fail to convince unprejudiced observers.

In an interesting paper by Pettenkoffer, lately published in the *Lancet*, the various well-known instances quoted by the water theorists—such as the Broad-street pumps and the water supply of Fort William, Calcutta—are thoroughly gone into and their fallacy exposed. Pettenkoffer sums up by saying—"The further one investigates the drinking water theory, the more and more improbable does it become. Robert Koch, too, the famous bacteriologist, has hitherto failed to substantiate the drinking water theory, and I feel convinced that the time is not far distant when he will own that he has gone in the wrong direction."

Remarkable evidence supporting these views, has lately been published by the Cholera Commission that has been investigating Koch's bacillus theory.

Another contribution to the literature of cholera appears in a supplement to the *Gazette of India* of Jan. 24:—"Dr. Koch, it will be remembered, insisted that the comma bacilli which he found in tank-water in Calcutta were the exciting causes of cholera, but his theory has been upset by the investigations which the Special Cholera Commissioners from England recently carried out. Dr. Klein, for instance, having called in the aid of a local expert, Dr. D. D. Cunningham, made a careful examination of tank-water, and the results obtained were very striking. *Thus, on November 14th and 16th, cholera broke out in three houses in Jeleapara Lane, inhabited by well-to-do people. The houses were near to a tank, but the people attacked drank the pure and wholesome water supplied to the town by the water-works. The poor people living in the 'bustees' on the banks of the tank used the latter, which was very dirty and teemed with the comma bacilli, but, strangely enough, not one case of cholera occurred in the 'bustees.'* Again, in *Sahib Bagan*, where a *bad outbreak of cholera took place in the spring, which Dr. Koch at once put down to the use of local tank-water, inasmuch as he had discovered the bacilli in it, only one case of cholera occurred in November, although 200 families used the water for washing, bathing, and drinking purposes. Another tank adjoins and is connected with this one, the water running from one to the other, and yet in the 'bustees' about this second tank not a single case of cholera has occurred during the whole of this year. The people drank the water freely, though the dreaded bacilli abound in it.* Surely, after discoveries such as this, Dr. Koch's theory must be put aside as utterly erroneous and misleading."

The question of human intercourse is even a more plausible theory, and though it is admitted that, under certain circumstances, it may be a factor in spreading an epidemic, yet, equally, it will never account for the advance of an epidemic as a whole.

The best illustration of the fallacy of the human intercourse theory is given by the great fair at Hurdwar, on the Ganges. To this point the natives of India troop in hundreds of thousands to attend a fair and perform a pilgrimage. They come from every point of the compass, or, to use a simple illustration, they resemble

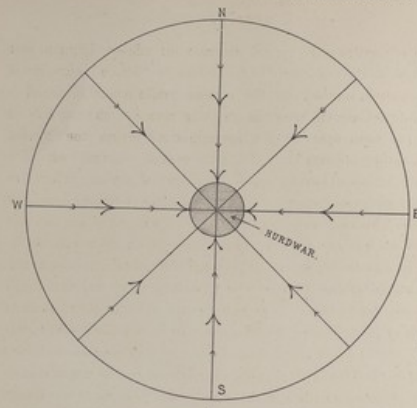

Diagram illustrating the progress of pilgrims to the Hurdwar Fair in 1879.

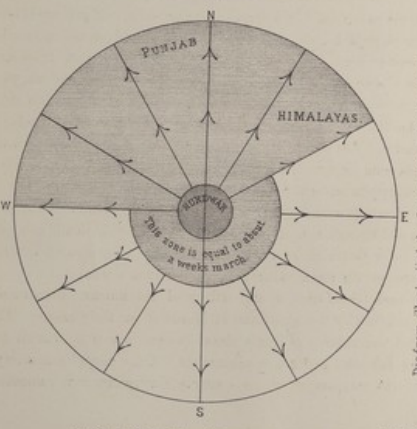

Diagram illustrating the departure of pilgrims from the Hurdwar Fair in 1879. The light shading represents the routes on which the pilgrims carried Cholera with them.

the spokes of a wheel entering the nave. It is equally indisputable that when the fair is over the pilgrims return to their homes, radiating in every direction.

Cholera may rage at Hurdwar, and the pilgrims, in consequence, will die in large numbers, both there and in the immediate vicinity, when the fair breaks up and they are returning to their homes. It is evident that, if human intercourse had the influence claimed for it, cholera would spread equally in every direction—in other words, that the spokes of the wheel would conduct the "materies morbi" to its circumference; but is this the case? Certainly not. Taking an illustration from the epidemic of 1879, it spread to the N.W., the N., and the N.N.E., but to the E., the S., and the S.W., there was no spread of the epidemic. Surely, if human intercourse has the power that is claimed for it to spread cholera, the epidemic should have raged equally in all directions, but this is proved not to have been the case. To put it shortly, cholera in India neither radiates nor retrogrades.

Again, to take an illustration from hospitals. In the epidemic of 1867 cholera was treated in no fewer than sixty-seven hospitals, and out of this number the nurses in eight only were attacked, while those in fifty-nine remained quite free. In another epidemic, at Cawnpore, there were cases of cholera under treatment continuously from May to September, yet not a single attendant was attacked. In my own experience, extending over some sixteen years, I have seen six epidemics, and in no single instance was an attendant attacked in the hospitals of which I held charge.

Of course cholera may (and often does) attack a hospital; but the evidence points to the fact that the building itself has become a centre of disease, exactly the same as a barrack will. Indeed, there is rather reason to expect that cholera would attack a hospital in preference to a barrack, because the former is continuously occupied, while a barrack, for many hours daily, is empty. The air in the former should, therefore, be more suited to receive a specific poison in consequence of the greater amount of human excrementitious matter present.

Another point of great interest is the fact that cholera is never carried out of the endemic area by railways to become epidemic further north, unless there is clear evidence of the advance of the overflow in other directions. Trains daily leave the endemic area for the upper provinces, and it is evident that, if human intercourse alone was sufficient to convey cholera, this must frequently happen, but in practice it is found not to do so. Again, trains run daily from Meean Meer to Mooltan, and though cholera may rage at the former place, it is hardly ever known to break out at the latter. Mooltan is frequently without rain for years, but when it does fall, it is then, and only then, cholera makes its appearance.

No theory, therefore, of contagion or water infection is adequate to cover the phenomena of an *epidemic of cholera* as observed in India. On the other hand, Dr. Bryden nowhere denied the truth or accuracy of European observations, nor the manifestations of contagious or infectious properties in this disease; and I have frequently heard him admit that the evidence of contagion, in Europe, would lead to the belief that there the disease may take on a typhus form, and thus be more or less contagious.

There is, however, one great advantage to be gained from a propagation of the non-infectious theory—at all events, till the contrary is proved—viz., that while it is right every precaution should be observed regarding the foul linen and excreta of the sick, nervous people are less likely to suffer from the depression that so predisposes to an attack, and nurses for the sick will be more easily procured and have greater confidence, if a belief in the slightness of risk can be established.

The next point to consider is, what steps can we take to ward off an epidemic of cholera. I observe Dr. Cameron, in his able article on this disease in the *Dublin Journal of Medical Science*, Vol. LXXVI., says:—"The most effectual manner in which to exclude cholera from a county would be to prevent the entry of persons and articles from infected districts." I do not know whether Dr. Cameron still entertains these views, but I see he admits that "in practice it has been found impracticable to effect so rigid a quarantine as this."

Pettenkoffer says:—"Even perfect sanitary cordons and quarantine would also be valueless, for the reason that they are commenced too late."

I go further, and believe that, even if commenced in time, and perfect in every way, quarantine has as much power to keep out epidemic cholera as the proverbial pitchfork has to keep back the tide.

Quarantine may be summed up as impracticable, useless, and vexatious. At the same time, no precautions should be omitted at all ports to examine ships entering; and in the case of cholera having been on board, the vessel should be disinfected, and the crew isolated for at least ten days subsequent to the appearance of the last case.

The next point to consider is the evacuation of infected localities; and here our Indian experience points to the great value of immediately vacating stations and buildings in which cholera has appeared.

I have seen troops attacked by cholera in barracks, and the disease has at once been checked by the removal of the men into tents pitched a few feet from the vacated building. I have even under these conditions, seen the men occupy the verandahs of the barracks during the heat of the day without injury, but we were always most careful to oblige them to sleep in the tents at night.

The regulations drawn up by the sanitary branch of the War Office contain most comprehensive and intelligible instructions on this head, and I would suggest their being republished for the benefit of the public at large.

Should cholera attack large institutions, such as workhouses, lunatic asylums, prisons, &c., the instant evacuation of the block attacked should be at once carried out; if further cases occur, the entire place should be vacated, the inmates being accommodated in huts or tents till the danger is past. Similar steps should be taken with private dwellinghouses wherever practicable.

In India our action is—first evacuation into tents near the barracks, and if that is insufficient, the troops are marched out to selected camps. If cholera again appears, the camp is moved

further off, at right angles to the prevailing wind. As a rule, the regiment is broken up into as many separate detachments as possible, usually limited by the number of medical officers available. So elaborate a system as this could hardly be adopted in this country, but certainly in a modified form the same principle would apply.

It would be superfluous to detail the sanitary measures to be adopted on or before the appearance of an epidemic, but I may shortly say that "*mens sana in corpore sano*" ought to be the object aimed at. Ventilation, water supply, personal cleanliness, food, &c.—all should be well seen to, and, in addition, the use of saline purgatives should be strictly prohibited. As regards this point, Sir Ranald Martin indicated its dangers many years ago, and I believe that, during an epidemic, it would be less dangerous to drink daily of polluted water than to take a seidlitz powder in distilled water every morning. Anything that induces a serious purging should be strictly interdicted, unripe fruit and effervescing salines especially. In the epidemic of 1879, among our troops in the Punjab, I know of two well-marked instances of cholera following immediately the use of Eno's fruit salt.

Before I enter on the treatment of cholera, let us consider for a moment what the disease really is, and what are the causes of the symptoms, as without a clear understanding on this point all treatment is merely empirical. Cholera, I believe, is an "infectious disease," not in the manner the ordinary term infection indicates, as illustrated by scarlet fever or smallpox, but it may be defined as a disease "caused by the reception from without of specific infective material into previously healthy bodies, which material acts like a poison." What this "specific infective material" may be, we are at present quite unable to define. Koch's theory of a "comma bacillus" seems to have come to a "*full stop*," and the labours of the Commission, lately sent to India by the English Government, have quite exploded his arguments—*vide* the report of the *Lancet* of 3rd January.

Acknowledging, then, our ignorance of the cause of cholera, let us look to the effects produced by this specific infection on the

human body. Briefly, then, there is a stage of premonitory diarrhœa, which, as a rule, is characterised by a rapid invasion, copious loose bilious motions, absence of pain, and apathetic prostration. This premonitory stage of cholora is almost invariably noticed, and it is during this stage that treatment, at all events as regards medicines given internally, is of any avail. The chief danger of this premonitory diarrhœa lies in its painless nature, and the apathy which seems to blind the patient to his condition. Cholera is associated in the public mind with cramps in the limbs and colicky pains, so that when a person is merely attacked by a simple painless purging too frequently little or no notice is taken till all chance of checking it has passed away. In such a case the patient becomes the victim of the most terrible disease known to man—malignant cholera. It is impossible to impress too strongly on the public the urgent necessity of at once attending to every case of diarrhœa the instant it sets in, when cholera is epidemic, or its advent expected. In such cases every moment is of the utmost value—even the time lost in procuring medical aid may be followed by a fatal result.

The simplest rules should be laid down, so that on the appearance of an attack of diarrhœa the patient may be placed in the best possible condition to check the invasion of, what may be, an attack of cholera. The recumbent position, warm blankets over the body, hot bottles to the feet and legs, and sinapisms to the epigastrium, are remedies within the reach of all. If to those be added a simple astringent mixture (it is inadvisable for obvious reasons to call it a cholera mixture) of dilute sulphuric acid, tincture of opium, spirits of chloroform and peppermint, and doses are administered every hour or two, there is a reasonable hope of the diarrhœa being held in check. I can say from experience that many cases that would, arguing from analogy, have passed into true cholera, have, by these means, been arrested in time.

I would suggest that, on the appearance of an epidemic, instructions of this nature should be widely distributed, and, in the case of the poorer classes, a supply of a simple astringent should be issued gratis. The cost of such precautions would be infinitesimal in pro-

portion to the advantage gained, and much confidence would be inspired among the population.

If unhappily the premonitory diarrhœa passes into true cholera, we next have a series of symptoms of the most definite and urgent nature. The face becomes blue and cadaverous; the voice degenerates into a whisper; the skin is cold and shrunken; the pulse feeble or imperceptible; the kidneys cease to act; the purging becomes watery (rice water), mixed with flakes of mucus there is a total absence of bile in the evacuations; incessant vomiting sets in; violent cramps attack the limbs; the tongue and breath get cold (generally a fatal sign); and yet, withall, the intellect remains clear, almost to the end.

This condition generally ends in death; but reaction may happily set in, the functions may be gradually restored, and, with great care, the patient may recover.

Let us now consider for a moment what is the mechanical cause of the terrible train of symptoms above enumerated—in other words, what changes within the body are going on.

I omit all mention of what may be the cause of the conditions, for the simple reason that I believe we know nothing whatever on the subject, and the best thing we can do, under the circumstances, is to acknowledge this fact, and hope for enlightenment in the future. Eminent authorities such as Dr. George Johnston, have put forward various theories, but none of them will bear the light of investigation, and they completely fail when put to the crucial test. What we really observe is an exosmose into the intestinal tract of the watery portions of the blood, and to this cause, I believe, all the observed symptoms are due.

It is sometimes alleged, as an argument *per contra*, that persons die of cholera without having had any purging. This is quite true, but can a case be quoted in which *post mortem* examination has not revealed the fact that the small intestines were distended by the rice water fluid, which, from some mechanical cause probably, had been penned up and not evacuated?

The blood, in fact, is drained of its serum, and to this cause, I

hold, all the symptoms may be traced; the diarrhœa, as is evident; the suppression of urine, because there is no water to eliminate; the absence of bile, because the gall bladder has been mechanically emptied, and there is no secreting action of the liver progressing; the lividity of the face and skin on account of the non-arterialisation of the blood, caused by its tarry condition, which renders it unable to circulate in the minute vessels; and the general collapse and loss of temperature, to nervous shock, the result of the above conditions

When we come to treat a patient in this state, what is the usual course? As to remedies, there is no known disease in which so many vaunted cures have been put forward, or in which so many drugs have been employed with alleged success. Calomel and opium is the sheet anchor of many; strychnine was used till unfortunate patients died of its toxic effects. Hypodermic injections of chloral at another time were believed a certain cure. Arsenic, iron, and every known astringent, has been employed without success. Tourniquets on the main arteries of the limbs were advocated with a view to confining the circulation of the blood-supply to the nervous centres. At one time even plugging the rectum was advocated, and some twenty years ago a circular was sent round to medical officers in India pointing out that this line of treatment had been recommended by an Italian practitioner. Have any of these numerous remedies stood the test of an epidemic of true cholera? The answer is only too evident.

Let us, then, face the truth and acknowledge we know nothing whatever of the causation of true Asiatic cholera, or of its treatment by drugs in the Algide stage. The most we can do is not to interfere with Nature's efforts to effect reaction, and, if happily this takes place, to guide matters to a favourable issue.

During an epidemic in India most of those who pass into collapse, certainly nearly all in the commencement of the epidemic, die. In the last great outbreak in India, in 1879, in Southern Afghanistan no fewer than 88 per cent. of those attacked died, and of the 833 British soldiers who suffered from the disease that year, 654 met

their death, or a total mortality of nearly 75 per cent. of deaths to attacks—practically an entire British regiment disappeared in a few weeks, at a cost to the Government of £130,000. As the epidemic subsides, the deaths, in proportion to attacks, become fewer, and towards its close the great majority of the cases recover. This fact is one of the main causes of such a number of different remedies being put forward as specifics. In the commencement of an outbreak practitioners prescribe medicines that bear a repute for their efficacy, yet all the patients die. Other drugs are tried, apparently with more success, till at last nearly all the patients recover. It is at once assumed that "post hoc" is "propter hoc," and regrets are loud that such a successful line of treatment had not before been adopted. In the next epidemic it is prescribed with confidence, but, lo, the mortality is as great, or greater than ever.

As I have shown, the death-rate of the last great epidemic in India was as high as 88 per cent., and here it must be remembered the sick soldier was placed under the best possible conditions—conditions it would be absolutely impossible to equal in any civil community.

Skilled medical aid and unlimited nursing was at immediate command, yet of those who passed into collapse but a very small percentage indeed recovered.

What a burlesque on our science it is to see practitioners under such conditions adopting the most opposite lines of treatment. One man orders castor-oil to eliminate a "materies morbi;" another, calomel to restore the secretion of the bile; a third, diuretics, with a view to getting the kidneys to act; a fourth, brandy and beef-tea, to keep up the vital powers—all with the same results. If, now, we would only remember that an exosmose into the intestinal tract has reversed the laws of nature, we would see the inutility (to say the least) of our proceedings. If no absorption is going on, how can we expect our drugs and stimulants to be assimilated—in other words when an exosmose from the blood is progressing, how can we expect a reversal of this action in favour of our

remedies. This is the point that is too often forgotten, and this is what should be our guide in determining our line of treatment.

The simplest proof, perhaps, of this view, is the effect, or rather the want of effect, of stimulants on a patient suffering from collapse. Champagne, brandy, and beef-tea, may be given *ad libitum*, and (supposing them to be retained) without the least effect on the circulation. The voice does not gain in strength; no flush comes to the face, and the pulse is just as imperceptible, or thready, as it was before.

What lesson should be learned from this? I reply that if no absorption is going on it is useless to administer drugs, stimulants, or food, and I go even further, and believe that their administration may be positively hurtful. Let us take an ordinary case that has passed into collapse, and we will suppose the usual treatment—Calomel, 2 grs.; opium, gr. i.—every hour—with small and repeated doses of brandy and beef-tea.

If Nature comes to the rescue and gets rid of our drugs and stimulants, no harm, perhaps, is done; on the other hand, let us suppose the vomiting has either ceased, or has never set in, several doses of medicine, with some ounces of brandy and beef-tea, have been retained, what will be the condition of the patient should reaction set in? Nature restores the natural action of the intestinal tract, endosmose recommences, and at the very moment we should be most desirous of keeping the absorbents at rest, they are called on to assimilate so many grains of calomel and opium, and so many ounces of brandy and beef-tea. The result is too often disastrous to the patient, and our well-meant efforts cause a fatal termination from secondary fever. What, then, should be our line of treatment? When the premonitory diarrhœa has passed into the stage of true, or malignant cholera, our efforts should be directed to keeping up the warmth of the body with hot bottles and well-warmed blankets. Sinapisms to the legs and epigastrium should be applied. The cramps may be relieved by frictions with stimulating liniments, or hypodermic injections may be cautiously used; for these, I think, a combination of morphia, atropine and chloral is the most valuable.

As to internal treatment, what line should we adopt? If medicines and stimulants are not absorbed, why give them to be a possible source of danger hereafter? Endeavour to assuage the terrible thirst by means of ice to suck, and soda-water to drink; and by this proceeding I believe the patient is placed under the best possible conditions for recovery in the event of reaction setting in. Then even our utmost care must be exercised, and only the smallest quantities of easily-assimilated food should be allowed, till by degrees the necessary repair takes places and recovery becomes assured.

By adopting the line of treatment I have indicated, we can, at all events, do no harm; and we shall have the satisfaction of knowing that when absorption recommences, its first effort will not be directed to the assimilation of poisonous doses of opium, or other drugs.

I trust I may not be regarded as a pessimist, but I must, in conclusion, confess that at present the outlook, as regards the prevention and treatment of cholera, is dark indeed. Let us, however, not despair, and perhaps in the near future light may be thrown on this, the greatest pestilence that has ever attacked mankind.

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CHOLERA, ITS EPIDEMIC PROGRESSION AND CAUSATION.

By ~~Brigade~~-Surgeon-Colonel J. B. Hamilton, M.D.

The first great difficulty that strikes the investigator when he comes to consider the subject of cholera, is the number of theories, each conflicting with the other, and each put forward confidently and with dogmatic assertion, and, no doubt from the standpoint of the various writers, in perfect good faith as to their correctness.

Each local observer necessarily receives different impressions in accordance with the facts that come under his observation, and thus we have several theories, each of them conflicting with the other, and each strenuously upheld by its advocates.

Again, we have the statistician surveying the facts connected with the various outbreaks from a central office, comparing manifold observations as regards numbers, dates of attack, and progression, and from these data working out the relation of one epidemic to another, till he has indications sufficient to map out the laws that appear to indicate the progressive steps of the disease.

This is especially the case in India, and, no doubt, had anything like unanimity prevailed among the recorders of cholera as it appears in that country, much greater weight would have been given to their writings and reports.

Unfortunately, exactly the opposite is the case, and it is impossible to consult the numerous authors of books on cholera without at once becoming aware of the great diversity of views held by different writers.

This fact has, I am convinced, gone a long way to discredit Indian opinion on the subject, and we, who have spent many years

in the midst of the disease are not, as we ought to be, regarded as reliable authorities on the subject.

In fact, there is rather an impatience shown by the profession at home against Indian medical officers when they attempt to put forward their views, chiefly, I believe, for the above reasons.

My object in reading this paper is to attempt to show that no theory hitherto propounded will cover all the ground of epidemic cholera, and that in every case the explanation given falls short in some material particular.

The theories usually put forward to explain outbreaks of cholera are mainly three, viz. :—

1. Propagation by drinking water, food, &c., into which the poison has entered.
2. Human intercourse.
3. Conveyance of the disease by the air.

We have now added the so-called vibrio, or cholera bacillus, which has latterly taken possession of most European authorities, and against which it is almost a heresy to say a word.

Before I proceed further, there is one point worthy of consideration, viz., whether cholera as seen in Asia is identical in every respect with cholera as observed in Europe? I think I am correct in saying that all writers and observers agree in considering cholera identical from a clinical and pathological point of view, both in India and Europe, so that the only questions to be settled are, is the epidemic progression the same, that is, are the influences that spread the disease similar in both countries, and are the actual causes of individual infection identical?

No doubt the climate of Europe is vastly different from that of India. Still we see the disease in both countries prevalent at the same season, viz., in summer, that it dies out as winter advances, and that warm damp weather is generally favourable to its development.

We also observe outbreaks of cholera occurring along certain well-defined lines, and becoming localised in certain towns and tracts of country; also that the disease is most intense and fatal in the commencement of an epidemic, gradually becoming less virulent till most of the later cases recover. (This fact accounts for the number of the so-called specifics which are vaunted by various persons, but which when tried in the commencement of the next epidemic fail signally.) We also see that as a rule cholera does

not retrograde or work backwards, though here and there recrudescences or revivifications occur, exactly as they do in the East; in fact, the behaviour of cholera as an advancing epidemic seems to be the same both in Asia and Europe. Having said so much, let me now briefly glance at the so-called theories put forward by various authorities.

First, the water theory, with which, of course, is associated the introduction of poison in food, &c.

This view seems to be the one most generally adopted, no doubt in consequence of the discovery of the vibrio or bacillus, which seems to be very generally accepted (I submit on insufficient proof) as the exciting cause of the disease.

A well-known writer in a late number of the 'Nineteenth Century Review,' in a paper on cholera, commences by saying, "Cholera is a filth disease carried by dirty people to dirty places," and then goes on to show that polluted water is the chief, indeed almost the only, cause of cholera epidemics.

In support of this, he adduces the outbreak in East London in 1866, caused, he asserts, through the accident of a broken pump and filter bed out of order, in consequence of which the water of the Lee, polluted by a cholera-stricken family, was distributed direct, unfiltered, through the mains.

Admitting for the sake of argument that the water of the Lee was so polluted, and was the actual cause of the outbreak, I would ask if it can be truly contended that the want of filtration had any appreciable effect?

For my own part, I am a total disbeliever in filters, at all events as generally used, and in India we have frequently found water that has been passed through filter beds and then through the Government filters to be far more impure than that taken direct from the well.

Anyhow, I beg to doubt the efficacy of the rough filtration in use by water companies in removing a bacillus so minute as that of the cholera vibrio.

No bacteriologist would expect to sterilise a fluid by means of any ordinary filter of commerce, much less by means of the common filter beds used by water companies.

Before I leave this part of the subject, I would like to draw attention to a most valuable paper on the "Purification of Drinking Water by Alum," by the State Geologist of New Jersey, pub-

lished in 1884. I feel convinced that such a system, if brought into general use in this country, viz., precipitating the organic matter by adding 2½ grains of alum to a gallon of water, and then passing it through filtering paper, or cotton, would be infinitely more reliable than the use of ordinary filters, besides being far cheaper.

To revert to the paper in the 'Nineteenth Century,' I would ask if it is not rather illogical to first assert that cholera is a filth disease, spread by dirty people, and then to show that the cleanest people, living under the best sanitary conditions in other respects, may be attacked wholesale if their water supply is polluted by cholera dejecta.

I am not, I regret to say, a bacteriologist, but I have, within the past few days, consulted one of the most eminent authorities in London, Dr. Crookshank, of King's College, and he assures me that it has never yet been proved that bacilli have caused or propagated any disease except anthrax, tuberculosis, actinomycosis, and certain septic diseases.

He further informed me that zymotic diseases (except, perhaps, enteric fever, and that is doubtful) have not been traced to a bacillus, or that these diseases can be propagated by means of bacilli.

Koch declared that he had proved the comma bacillus to be the cause of cholera in India, but Peffenkofer, Klein, and Surgeon-Major D. D. Cunningham have asserted, after full consideration of the facts and examination of the water on which Koch based his theory, that cholera was not caused by the comma bacillus. They showed that in an outbreak in Calcutta the inhabitants of certain houses who drank only the pure and wholesome water supplied by the water works suffered severely, while the villagers living close by, on the banks of a filthy tank, the water of which they drank, escaped completely, though the water in question teemed with the cholera bacilli of Koch.

Other similar instances were shown of native communities freely using the tank water in which Koch discovered the dreaded bacillus who escaped without a single case of cholera during the whole year.

It is stated by numerous sanitary authorities that there has been a marked and notable decrease of cholera in Calcutta and other places after the introduction of a pure water supply. Surely this is only

what might have been expected, and is it not the same everywhere? Introduce pure water and the public health improves. Impure water not only induces general ill-health in a population, and increases its receptivity of diseases, but it also induces diarrhœa, dysentery, and other bowel affections, the very conditions most favourable to an attack of cholera. I trust I may not here be taken as decrying in any way the great value of a pure and wholesome water supply; quite the contrary, I look on it as the greatest factor in the health of any community, but at the same time I think we should not accord to water an undue influence as a cause of cholera, lest we should be tempted to overlook other equally vital factors.

The case of Fort William, Calcutta, is also frequently quoted as an instance of the value of a pure water supply, and Mr. Macnamara in his work alludes to the improved condition of the health of the garrison as being due to that cause.

Mr. Macnamara shows that, while from 1826 to 1864 the average annual mortality among the British troops was 20 per 1,000, after the introduction of a pure *tank* supply in 1863 the mortality fell to 1 per 1,000.

I have consulted official documents on this point and find that from 1863 to 1872 the mortality was 19 for the decade, out of an average strength of 900, or 2 per 1,000 per annum, roughly.

In 1872 or 1873, the pipe water was introduced, and in the next decade the mortality fell to 10, or 1 per 1,000, while in the last ten years the mortality was 16, or, roughly, 1·5 per 1,000.

Now, this would be a highly satisfactory improvement if it could be all attributed to the water supply, but during the period under review the general sanitation was immensely improved. New palatial barracks were completed, the dry earth system was introduced and perfected, and, most important of all, on the appearance of cholera in the Fort, it is at once vacated and the troops are placed under canvas.

Surely some, if not much, of the improvement may be attributed to these changes.

However, here is a remarkable fact: in 1871 this pipe water was used in the Great Alipore Jail for the first time, and its consumption was followed by an outbreak of cholera among the prisoners, which caused a mortality equal to that of the seven previous years collectively.

Surely we might as well lay to the door of the pipe water supply the increased mortality in the jail as the improvement in the health of the troops! We know that one would be false, may not the other be also?

The history of the epidemic progression in cholera in the Bengal Presidency of India is very uniform, and, starting from the Delta of the Ganges, which is regarded as its chief endemic area, it invariably makes its way in a N.W. direction, corresponding with one branch of the monsoon current, or in a N.E. direction towards Assam with the other branch, or in both directions simultaneously.

It is most important to note that both these directions of advance are against the currents of the Ganges and Bramaputra respectively.

Put in the shortest possible way, "cholera is ever present or endemic in Lower Bengal. Heavy rainfall swamping the low-lying endemic area extinguishes cholera there, and with the monsoon current the disease advances up the valleys of the Ganges or Bramaputra, or both."

Now this fact certainly tells against the theory of propagation by water, and would incline us to regard the air, *plus* heat and moisture, as being the chief factor in progression.

To show the difficulties that beset the investigator, I may here quote an instance given by Mr. Macnamara where cholera made its way to Bombay from the East of India towards the end of the rains in 1849, in spite of the S.W. monsoon which blew during the week with a force equivalent to a velocity of 15 miles an hour, in a direction contrary to that in which the cholera advanced. These are the pitfalls which beset the steps of the investigator, and upset all theories.

We see cholera thus advancing in Bengal in a N.W. direction (I will at present disregard the N.E. current), dying down in the winter, and again breaking out and resuming its upward course as the weather gets warm, the outbreaks culminating during the monsoon. This is what took place during the great epidemic of 1878–79. An overflow from the endemic area occurred in July, and advanced rapidly to Oudh, causing great mortality. During the winter it subsided,* but reappeared in the summer of 1879, and then the epidemic swept over the Punjab and right into

* A few cases indicative of its advance occurring in the Punjab.

Cabul through the Khyber, carrying off tens of thousands of natives and many Europeans.

Here it is worthy of remark that while the epidemic was raging in the North-West Province and Oudh in 1878, the railways ran daily into the Punjab carrying numbers of natives from the infected districts into those that up to that time remained free, and though numerous cases occurred in the trains, and many were attacked and died far up in the Punjab, the disease never became epidemic there during 1878, and, in fact, refused to break out in the uninvaded districts.

Next year, when cholera was raging in the Punjab, in a similar way many people suffering from the disease were carried south by the railway to the country which had been swept by the epidemic in 1878; again it refused to break out in the districts that had suffered during the previous year.

Thus we see cholera advancing against the flow of the rivers, and actually refusing to ignite in uninvaded districts, or break out again in the country over which it had passed the previous year, though the bacillus (if there be one) must have been sown broadcast over the area.

To consider next the case of the Hurdwur fair. Taking Hurdwur as a centre, it will be evident that the pilgrims flock to it from every point of the compass, and that when the fair is over they return to their homes over the same routes, but these pilgrims do not carry cholera with them in every direction.

If cholera has been epidemic at the fair, the Punjab has been invaded, and those travelling north and north-west carry the disease with them to their very villages, but those travelling south only suffer for a few days, limited, apparently, to the period of incubation. In other words, those who have been infected at the fair develop the disease no matter in what direction they travel, but whereas those proceeding south lose the disease after about a week's march, those travelling upwards continue to suffer, and apparently spread the disease among the population up to the furthest limits of the Empire.

When it is asked why cholera does not retrograde, the answer usually given is, that all who were susceptible have been attacked. This seems to me to be a singularly weak argument, and not at all borne out by the usual conduct of the disease.

I ask how is this susceptibility to be determined, and how can we show who are, and who are not, susceptible?

In small-pox we know that the unprotected are susceptible.

In enteric fever we know that the young are most liable to be attacked.

The children of consumptive parents are more likely than others to suffer from tubercle; but in cholera we see no such indications of susceptibility.

In an outbreak of cholera we see the strongest and the weakest suffer equally, the temperance man and the drunkard, the healthy woman and the delicate child, the old man and the baby in arms. We also see the disease sweeping down one side of a street, or attacking the end of a barrack room; and in India we frequently observe that the inhabitants of particular barracks, even certain beds in certain rooms, are attacked out of all proportion to others in successive epidemics.

The only persons particularly susceptible in my experience are those suffering from looseness of the bowels, though it is often a subject of remark that fear seems to have a strong predisposing influence.

I consider there is no immunity, and no particular susceptibility, and, further, that one attack gives no protection against a second.

Reverting to the common idea of infection by water, I may quote some instances that came under my immediate observation, *per contra*. In 1870 I sailed in a hired transport from Calcutta with invalids round the Cape. About eight days after we sailed there was a well-marked case of cholera among the men. The ship was fumigated, and there were no further cases. The man attacked had come down by train from Upper India, which was free from cholera, and as far as humanly seemed possible was not exposed to infection before going on board.

We had a water supply taken from the Hoogly, and we drank this water for the rest of the voyage.

Again, when in charge of a hospital ship during the Burmese War of 1866, cholera broke out on board after we had been a week at sea, and we had six cases and two deaths. Suffice it to say I landed the troops, while we fumigated the ship and threw overboard every article that could possibly have been contaminated; we

had not another case! In this instance our water was distilled from the deep sea off an uninhabited coast, and we had not a drop of shore water on board.

In another instance, in the autumn of 1890, cholera had been raging in the native city of Lucknow, which lies about 3 miles to the west and windward of the infantry barracks.

It next attacked the jail, lying between the city and the barracks, and then, skipping clean over the barracks, it broke out among the enteric fever patients in a detached block.

I telescoped the ordinary sick in the next block, and transferred the enteric patients who had not been attacked to the end of this building.

Next day the disease again appeared among the same body; the ordinary sick were again closed up, and the remainder of the enteric cases moved on.

A third time the disease appeared among this body, and, finally, the few survivors were put into tents a few yards outside the hospital wards.

The disease then ceased, but the survivors nearly died from the heat in the tents, the fear of which had prevented my putting them under canvas before.

Now what could water have had to say to this outbreak?

In the first place, these patients got no water but lime water that had been in bottles in stock for weeks, and if by any possibility and against orders they did get water, it was the same water that every one else in the hospital had, taken from one well. The European orderlies, eleven in number, and about an equal number of native servants, employed in the enteric fever block, who *did* all drink water, escaped entirely, and not a single person was attacked in the rest of the hospital, barracks, or regimental lines.

It might be said the milk or food supply was the cause, but here there seemed even less probability, as the milk was taken from cows milked under strict supervision, and it, as well as the rest of the food, was common to all in the hospital.

I may here say that the supply of potable water for the European barracks is remarkably good, and no pains are spared to keep it pure and free from pollution.

Certain wells are selected, the water is carefully analysed by experts, and, if found pure, the selected wells are covered in, only

a tube through which the water is pumped being allowed to enter them.

The water is then passed through a filter bed, and finally through Macnamara's filters. Yet, with all these precautions, it not infrequently happens that cholera attacks the European barracks, while the filthy native bazaar close by, with its water supply resembling liquid sewage, and contaminated in every possible way, escapes without a case.

I had written so far of this paper when the account of Pettenkofer's experiments on himself, and also of those of Professor Emmerlich, appeared in the 'British Medical Journal.' As will be remembered, these gentlemen, having first neutralised the gastric juice with bicarbonate of soda, each swallowed a cubic centimetre of fresh bacillus cultivation, with the result that after two days they were attacked by colic and diarrhœa, though otherwise feeling perfectly well.

I would here draw attention to the remark that both these Professors are stated to have suffered from colic. Now, it is an admitted fact that the premonitory diarrhœa of cholera is a painless diarrhœa, and in this lies its great danger.

This fact goes a long way to prove that neither had an attack of Asiatic cholera in any form, though it is quite possible that the milliards of bacilli made themselves very unpleasant before they were finally got rid of.

Similar experiments have been carried out in India with the same results, and this fact seems proved, viz., that the comma bacillus alone is not capable of producing cholera in a healthy person, even when that person is specially prepared by having the gastric juice neutralised, *unless there is some other factor present in addition*.

Whether the vibrio or comma bacillus is a factor in producing an attack of cholera seems to be still an undecided question, though the evidence appears to bear out the statement that it is always present in the dejecta.

Admitting that the bacillus is a factor, and the evidence seems to show it is, that it is not the only factor I am convinced, but what the other factor or factors may be is still hidden from us.

For the general public the theory of a bacillus may suffice, and it should be our duty to show them how to prevent the multiplication of this factor by sanitation and attention to the public health,

but for the profession of medicine to rest satisfied with our present knowledge would be contrary to all our best traditions.

We are, so to speak, on the track, and perhaps Pettenkofer's equation is closer to the truth than has been generally admitted. As you know, Pettenkofer says that "x" represents a specific germ disseminated by human intercourse, that "y" is a factor dependent on time and place, and "z" is the individual predisposition.

The "y" seems to be the difficulty, and whether or not it is some peculiar condition of the atmosphere, which seems possible, we have yet to discover.

In the present state of our knowledge it would be absurd to assert that polluted water, food, &c., can have no influence in causing outbreaks of cholera. At the same time I am convinced that water in which the vibrio or comma bacillus is present will not of itself alone cause cholera. There is a "something," an "entity"—what it is I know not—that must be present in addition; in short, there must be this influence, in addition to polluted water or food, to cause an attack. This may seem to be an empirical statement, but I know it is a view held by many observers in common with myself, and is indeed almost identical with Pettenkofer's equation.

I must next briefly allude to "human intercourse," which has been adopted by many writers on the subject as a creed.

First, what are we to understand by "human intercourse" causing cholera?

If it is infection from the sick to the healthy, it is certainly incorrect, for if one thing more than another has been proved regarding cholera, it is its non-infectious or contagious nature, so far as the words infection and contagion are generally understood.

Personally I can state that I have never seen cholera break out among attendants, though of course now and then it happens that they are attacked, but not out of proportion to the rest of the population.

In one great epidemic in India, of which careful records on this subject were kept, it would appear from the returns that the safest places to reside in were the wards of cholera hospitals.

On the other hand, there is much evidence of communicability from man to man under certain conditions.

It has frequently happened that troops when moved into camp

carry cholera along with them, and so well is this understood, that they are always broken up into as small bodies as possible, and the camps are moved at right angles to the wind on the occurrence of fresh cases.

Even under these circumstances we see cholera cleaving to a body of men and troops, even conveying it with them by train, while the villages near which they encamp, and from which they obtain their water supply, may remain free. In fact, it would appear as if a body of men carried about with them some infective material which keeps the disease alive notwithstanding all precautions.

A very remarkable instance of what was looked on as "human intercourse" occurred at Allahabad last year. I was P.M.O. of the district, and am able confidently to state that up to the morning of the 18th of May there was not a single suspicious case among the European troops, not even one of diarrhœa. At 7 A.M. on that date cholera broke out in the S.W.B.'s (24th Regiment), and, to make a long story short, in four days we had altogether, out of some 800 men, 53 cases and 32 deaths.

There was absolutely no insanitary reason for the outbreak: the barracks, water supply, and food all being in perfect order. I may also mention that the prisoners in the cells were the most severely attacked of all, and several died, while not a single person in, or connected with, the hospital was affected.

I at once had the regiment moved out into camp by rail 40 miles off, and placed under canvas on a bare plain on which cholera camps are always pitched, as the site has been singularly healthy. The heat was terrific, 110—115° in the tents, yet there was not a case of sunstroke.

During the first 24 hours after going into camp there were 9 cases, in the next 24 hours 5 cases, and on the third day 3 cases, but after that the outbreak ceased.

This would seem to prove that the period of incubation is limited to three or four days, as almost certainly these men were infected in barracks.

I may mention that a battery of Royal Artillery occupying the same lines was sent into camp as a precaution, and had not a single case.

Now, what was the cause of this outbreak? It was confined to the regiment, and the native troops and civil population escaped

at the time, though the regimental bazaar and servants of the corps left behind suffered severely.

We knew that cholera was epidemic across the Ganges a few miles off, and the natives from the villages in that district came in daily, carrying fruit, vegetables, grain, &c., for sale. The road lay through the men's barracks, and no doubt some fruit was purchased from the villagers by them. This, of course, was at once set down as the cause of the outbreak, "human intercourse" and "infected articles of food."

I, however, traced these people to their daily destination, and found that they passed on into the native city of Allahabad, which, like all native cities, was in a very insanitary state. These villagers sold their fruit, vegetables, and grain to the residents, spent the best part of the day in the bazaars, used the latrines as a matter of course, drew water from the wells* with their brass lotahs and cotton strings, the same, remember, that they used in their infected villages, and yet the inhabitants of the native city remained absolutely free, and even when cholera did appear, two or three months later, the outbreak was not severe.

Instances like this could be quoted indefinitely, and this it is that causes such confusion among theorists; each seeks to fit the facts into his peculiar views, and when they tell against him they are ignored or minimised.

I must allude briefly to the last theory, viz., that cholera is propagated and conveyed by the air. All of you are familiar with the arguments on this point, how ships at sea have been attacked, how the monsoon current carries the disease with it, and so on. Any number of statements have been brought forward to bear on this point, but when they are closely looked into, we find fallacies on all sides.

A very remarkable instance of cholera being (presumably) carried by air occurred at Subathoo and Kasauli, two hill stations near Simla, a few years ago. Subathoo is 4,250 feet above the sea, Kasauli is 6,300 feet high; the stations are 17 miles apart as the crow flies, and separated by deep valleys.

The population of the intervening country was free from cholera, as also were the bazaars and barracks, yet on the same day, the 12th September, after a heavy fall of rain, cholera broke out on the top of each hill simultaneously, lasted for three days, and

* The new water supply had not then been brought in.

ceased on the same day, the 15th, after which there were no further attacks.

I have merely quoted this instance to show how arguments in favour of any theory can be adduced, and what extraordinary paradoxes are encountered in tracing out epidemic cholera. So far as we at present know, cholera appears to be an "infectious disease," not indeed in the manner the ordinary term infection indicates, as illustrated by small-pox or scarlet fever, but it may be defined as a disease caused by the reception from without of a specific infective material, into previously healthy bodies, under some special influence, possibly of the atmosphere, and that this material so introduced acts as a poison.

We see in India that you cannot light up an epidemic in an uninvaded district, and that, though cases of cholera are constantly being carried by the train into countries free from the disease, it does not, therefore, become epidemic; in fact, that the epidemic progression is quite a separate matter.

Acknowledging, then, that we have much yet to learn of the cause of cholera, what advice are we in a position to give as the result of what we do know?

First, as to quarantine. Quarantine may be summed up as impracticable, useless, and vexatious. At the same time no precautions should be omitted at all ports to examine ships entering, and, in the event of cholera having been on board, the vessel should be disinfected, the sick removed to properly isolated hospitals, and the crew kept apart for at least ten days subsequent to the appearance of the last case.

The provision of properly equipped cholera wards as near as possible to infected localities is, of course, most necessary; but more important, again, should be provision for evacuating infected houses and localities.

Here our Indian experience teaches the immense importance of at once evacuating all infected buildings; and this is, to my mind, an even more important step than removing those who have been attacked to hospital.

My arrangements as regards the troops in London are briefly these. In each barrack a large tent is stored, and, should a case of cholera occur, no matter at what hour, the barrack-room is to be vacated, and the patient removed to the tent.

If any further cases occur, the troops from that barrack will at

once go out into camp and remain under canvas till the epidemic ceases.

Of course such a proceeding would not be possible with a large civil population, but, as far as practicable, evacuation of infected buildings should be adopted.

For fumigation, I consider the simple plan of closing all apertures and burning sulphur freely to be the best and cheapest.

As a disinfectant of dejecta, and to use in sewers, closets, latrines, &c., the crude sulphate of iron in powder is about the simplest and most valuable.

The use of dangerous poisons, such as corrosive sublimate (as lately advocated), by inexperienced persons is much to be deprecated, and would probably cause unpleasant results from careless handling.

As regards the treatment of the disease, I need say little, but will merely remark that, so far as drugs are concerned, the only time they can possibly be of any value is during the premonitory diarrhœa.

I have no hesitation in saying, that a very large proportion of cases that would, without treatment, pass on to cholera, may be checked during the premonitory stage if taken in time.

The great danger of this premonitory diarrhœa is its usually painless nature, and persons suffering from it frequently disregard it till too late.

If cases detected in the early stage are at once placed in the recumbent position and given a full dose of opium combined with an acid astringent, many of them may be checked and will not pass into the algide condition.

Here I may remark that purgatives, especially saline purgatives, should never be taken during cholera epidemics, and also that the treatment of cholera by castor oil, as so highly advocated, is dangerous in the extreme. Should the disease pass on to the condition of true Asiatic cholera, I would point out how utterly useless, if not actually injurious, are all drugs given internally.

When a person is suffering from cholera in the algide stage all the symptoms are caused by the fact that the serum of the blood is draining away through the intestines, and that the patient practically bleeds to death.

In this condition of what possible value can drugs or stimulants given internally be?

Not only are they of no value, but, if not got rid of by purging or vomiting and reaction sets in, they may, by being absorbed, cause the death of the patient. When, therefore, a case of cholera has fully developed, no drugs should be given by the mouth. External frictions, heat to the surface and extremities, and hypodermic injections may be of benefit, but by the mouth nothing should be given but ice to suck or soda water to quench the intolerable thirst. Then, should happily reaction set in, the patient is in the best possible condition for recovery, and the secondary fever and suppression of urine may be treated on common-sense lines.

As you are aware, the injection of saline fluids into the circulation has been frequently tried, but generally with small permanent benefit; the reason of this I believe is the destruction that has been caused to the red corpuscles by the deprivation of serum and the want of oxygen, which reduces the blood of a cholera patient to a dark tarry consistence.

It occurred to me some time ago that it might be possible to save life in the algide stage of cholera by substituting the blood of an animal, whose corpuscles nearest correspond to those of human blood, for the tarry unoxygenated fluid that is unable on mechanical grounds to circulate through the lungs and capillary vessels of a cholera patient.

I am told that of domestic animals the goat nearest approaches these conditions, and my idea, crude no doubt, is to perform direct transfusion from the animal to the patient, using the heart of the animal as the *vis a tergo*.

Briefly, by means of an elastic tube and two glass nozzles, I would propose to connect the carotid of the animal with a vein in the arm of the patient. At the same time I would open a vein in the other arm of the man, and even one in each leg, to allow of the exit of the unoxygenated blood.

The details of such an operation would be very simple, and if the animal were prepared in another room, and the tube passed through an aperture in a screen, the patient need know nothing of it.

Such an experiment as this would, I submit, be perfectly justifiable in cases that were evidently hopeless and *in extremis*, and if any benefit was apparent it would be an encouragement to try it in an earlier stage.

No doubt some of those present here to-night will express their opinion on the possibility of saving life by such means, and should, unhappily, epidemic cholera appear in England next year, we may see direct transfusion such as I have proposed at all events attempted.

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AMONG THE of the Author

TROOPS IN THE UNITED KINGDOM,

AND

MEN OF THE ROYAL NAVY ON THE HOME STATION,

FROM THEIR INTRODUCTION IN 1864 TO THEIR ULTIMATE REPEAL IN 1884.

By ROBERT LAWSON, LL.D.,

INSPECTOR-GENERAL OF HOSPITALS.

9, ADELPHI TERRACE, STRAND, LONDON, W.C.

READ BEFORE THE ROYAL STATISTICAL SOCIETY, JANUARY 20, 1891.

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ROYAL STATISTICAL SOCIETY:

AN OUTLINE OF ITS OBJECTS.

THE *Royal Statistical Society* was founded, in pursuance of a recommendation of the British Association for the Advancement of Science, on the 15th of March, 1834; its object being, the careful collection, arrangement, discussion and publication, of facts bearing on and illustrating the complex relations of modern society in its social, economical, and political aspects,—especially facts which can be stated numerically and arranged in tables;—and also, to form a Statistical Library as rapidly as its funds would permit.

The Society from its inception has steadily progressed. It now possesses a valuable Library of more than 27,000 volumes and a Reading Room; Ordinary Meetings are held monthly from November to June, which are well attended, and cultivate among its Fellows an active spirit of investigation: the Papers read before the Society are, with an abstract of the discussions thereon, published in its *Journal*, which now consists of fifty-three annual volumes, and forms of itself a valuable library of reference.

The Society has originated and statistically conducted many special inquiries on subjects of economic or social interest, of which the results have been published in the *Journal*, or issued separately.

To enable the Society to extend its sphere of useful activity, and accomplish in a yet greater degree the various ends indicated, an increase in its numbers and revenue is desirable. With the desired increase in the number of Fellows, the Society will be enabled to publish standard works on Economic Science and Statistics, especially such as are out of print or scarce, and also greatly extend its collection of Foreign works. Such a well-arranged Library for reference, as would result, does not at present exist in England, and is obviously a great *desideratum*.

The Society is cosmopolitan, and consists of Fellows and Honorary Fellows, forming together a body, at the present time, of over *one thousand one hundred* Members.

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From the JOURNAL OF THE ROYAL STATISTICAL SOCIETY, MARCH, 1891.

The OPERATION *of the* CONTAGIOUS DISEASES ACTS *among the* TROOPS *in the* UNITED KINGDOM, *and* MEN *of the* ROYAL NAVY *on the* HOME STATION, *from their* INTRODUCTION *in* 1864 *to their* ULTIMATE REPEAL *in* 1884.

By ROBERT LAWSON, LL.D., *Inspector-General of Hospitals.*

[Read before the Royal Statistical Society, 20th January, 1891. The President, F. J. MOUAT, M.D., F.R.C.S., LL.D., in the Chair.]

THE great prevalence of venereal affections among the troops serving in the United Kingdom, and the men of the Royal Navy on the Home Station, from 1860 to 1863, led to the adoption of measures to reduce the frequency of that class of diseases, by subjecting the unfortunate females, who were the chief sources of its diffusion, to medical treatment while in a state capable of communicating it to healthy persons. The first Act, passed in 1864, merely provided for the treatment of such persons as applied voluntarily to have the advantage of it, or who were specially reported to a magistrate, and, while undergoing this, they were at liberty to leave the hospital whether cured or not. The Act of 1864 was amended in 1866, and this again in 1869, the additions being calculated to render them more efficient in their operation. This state of things went on with little alteration until 1882, when personal examination was stopped, and in 1884 the Acts were repealed. The records of disease of this nature, both among the troops, and the crews of H.M. ships at the stations where the Acts were in force, and at other points, are available to show its progress under the different conditions in which these men lived, and the whole may be regarded as a most interesting experiment on public health, in which we have not only the marked improvement under the employment of measures favourable to that end, but relapse to its former state on their abrogation. Our President is desirous that an authentic relation of these facts should appear in the *Journal* of the Royal Statistical Society, and has invited me to undertake its preparation, I having arranged the army statistics bearing on it for Dr. Sloggett, Inspector-General of Hospitals, R.N., who was Superintendent of the Lock Hospitals under the Acts at the time,

and conducted their case before the Parliamentary Committee which sat from 1879 to 1881 to investigate their working.

Before proceeding to the proper subject of this paper, it is necessary to indicate the forms of disease which came under the operation of the Acts; the different manner in which separate bodies of men, at the same place and at the same time, were affected by these diseases; and a very remarkable fluctuation, of an epidemic nature, extending over several years in succession, which is quite as great as that of measles, and the area it occupies very extensive.

Primary venereal affections present themselves as sores, or increased discharges of a more or less inflammatory nature from the urinary passages. The sores are frequently followed by a constitutional affection called secondary syphilis, and, of late years, a further transition of the constitutional complaint has been recognised which is named tertiary syphilis. The discharges from the urinary passages are followed occasionally by rheumatism, and more frequently by local inflammation, which may cause much trouble, but they do not affect the system in the injurious manner that syphilis does.

Primary venereal sores are far most commonly met with on the genital organs, but they may be produced on any part of the body, either intentionally by inoculation from an existing sore, or take place unintentionally by a portion of the surface discharge from a sore in one person coming into contact with a raw surface in another. The primary sores have long been known to be of two descriptions, viz., those that are followed by the constitutional disease, and hence designated "infective sores," and those which do not lead to this, and for this reason called "non-"infecting," or "simple sores." It was found at an early period that sores which left much thickening and induration around their site, and hence named hard sores, were frequently followed by constitutional symptoms, and this idea gave rise to the opinion that hard sores were the true infecting sores, and those which healed without induration were devoid of such troublesome consequences. Mr. Lane, of the London Lock Hospital, and Mr. Macnamara, the medical officer of the Dublin Lock Hospital, stated in their evidence before the Committee that, in their experience, the constitutional affection did not follow the indurated sore exclusively, and that in most cases it was impossible to say whether any given sore would eventuate in the constitutional affection, but neither of them was able to give a numerical statement of the relative frequency in which each of these sources occurred. Regimental medical officers, who formerly remained in the same corps for many years, and had the same men under

observation, and who were interested in the investigation, had thus an opportunity of connecting the secondary disease with the particular form of sore which it followed, and among such the general belief was that the constitutional disease frequently followed soft sores. The following striking instance occurred under my own observation in the west of Ireland. The depôt companies of the 47th Regiment, with an average strength of 254 for the year, under my charge, marched into Castlebar on 20th and 21st July, 1842, in a healthy condition. From this date to 24th November 90 men were admitted with primary venereal sores; from 24th November to 16th March, 1843, when the depôt left for Boyle, fresh admissions had almost ceased; and after arrival at Boyle there were very few admissions of primary sores, and these of a mild description. From 20th May, 1842, to 1st July, 1843, there had been 27 cases of hard sores treated and 49 cases of secondary syphilis, so that, admitting every hard sore eventuated in the constitutional affection, there were still 22 other instances following sores in which the induration was not observed. Indeed, it was expressly mentioned in the notes made at the time that excoriated sores were more frequently followed by the constitutional disease than other forms. Practically, in short, the matter comes to this—that it cannot be shown, with certainty, that the constitutional affection will follow a given sore in any particular instance until the general system shows unmistakeable signs that it is so affected.

During the investigation of the Select Committee objection was taken to syphilitic sores and simple sores being included together, under the term "primary venereal sores," in the returns sent in by the Army Medical Department, as being an unscientific arrangement, and calculated to involve the question in greater obscurity. This is not so, however, for, as has been shown in the last paragraph, it cannot be indicated with certainty that the constitution will become affected, in any particular case, until unequivocal manifestations of such infection make their appearance, any attempt to separate the two forms of sores must be altogether arbitrary, and the results so obtained can afford a very untrustworthy basis for statistical inquiry. In some instances hard sores fail to produce the constitutional affection, and even when that does arise, it may be very slight, and escape notice; but with a possible reduction in numbers from these causes, the frequency of the secondary disease is the only satisfactory test of the prevalence of true syphilis, and the estimated amount from the arrangement of the primary sores may be much in error. In Table I at the end, the returns of admissions among Dragoon Guards and Dragoons in the United Kingdom for primary syphilis, simple sores, and secondary disease,

are given for the periods 1830-37, 1837-47, and 1860-64. Similar returns are added for the last two periods for the Foot Guards and the infantry. From these it appears that the ratios per 1,000 of admissions from primary syphilis, simple sores, and secondary disease, were as under:—

Periods.	Dragoon Guards and Dragoons.			Foot Guards.			Infantry of Line.		
	Syphilis, Primitive.	Simple Sores.	Secondary Syphilis.	Syphilis, Primitive.	Simple Sores.	Secondary Syphilis.	Syphilis, Primitive.	Simple Sores.	Secondary Syphilis.
1830-37	31·7	48·1	7·6	No return available					
'37–46	25·7	53·7	8·6	118·7	22·0	13·3	61·5	133·7	20·9
'60–64	118·8	0·6	45·7	153·7	0·3	33·5	106·8	0·3	32·0

Here, in the first period, the primary syphilis returned by the cavalry was moderate in number, and the simple sores were about a half greater; the constitutional syphilis was 7·6 per 1,000, which was equal to 1 in 4·2 of the primary syphilitic sores, or, taking those and the simple sores together, as primary venereal sores, to 1 in 10·5. In 1837-46 the cavalry had rather less primary syphilis, but the simple sores were increased in number; the ratio for secondary syphilis was 8·6 per 1,000, being 1 to 3 on the primary syphilis, and 1 in 9·2 of the syphilitic and simple cases combined. The infantry had twice as many primary syphilis cases as the cavalry, and the simple sores were again more than twice the number of the syphilitic; the secondary cases were 20·9 in the 1,000, and were equal to 1 to 2·9 of the syphilitic, or to 1 in 9·6 of these and the simple cases combined, corresponding very closely with the same proportions in the cavalry. In the Guards the distribution of the respective forms was very different: the admissions for primary syphilis were practically twice as numerous as among the infantry, while those for simple sores were one-sixth as numerous only; the cases of secondary disease were 13·3 per 1,000, being 1 in 8·8 of those returned as primary syphilis, or 1 in 9·6 cases of other forms taken as primary venereal sores, showing that considerably more than twice the number of non-infecting sores had been classed as primary syphilis in the Foot Guards than in the cavalry or infantry of the line during the same period. From 1860 to 1864 there was a very remarkable increase of admissions for primary syphilis, as well as of secondary disease, in all three descriptions of force, while those for "simple sores" had dwindled to a small fraction; in the cavalry, the admissions for the secondary disease, 45·7 per 1,000, were in the ratio of 1 to 2·6 cases of primary; in the infantry the secondary cases were 32·0, or 1 in 3·4 of the

primary; and in the Foot Guards 33·5, equal to 1 in 4·6; the Foot Guards in each of the two periods including a greater number of simple venereal sores, under the head of primary syphilis, than either the cavalry or infantry of the line, and, even in the latter, two cases out of every three returned as primary syphilis seem really to be simple venereal sores. It was for these reasons that the Army Medical Department included all primary sores under the single group of "primary venereal ulcers," which involved no hypothesis, and avoided the obvious error of the arbitrary division ordinarily made. In 1885 the College of Physicians, in the latest edition of their "Nomenclature of Diseases," have separated the simple sores from the primary syphilitic, and have placed the former among the affections of the generative organs. In compliance with this the same change has been made in the Army Medical Returns, but a continuance of the practice, without the necessary precautions, will only serve to substitute an arbitrary conclusion for a more trustworthy result, and thus seriously impede the advance of our knowledge of this important disease.

The extent to which bodies of men, even at the same station, at the same time, become affected, though apparently equally exposed to the same chances of infection, varies to a degree that could hardly have been anticipated. On the recommendation of the late Mr. Acton, that there should be a lavatory in every barrack, where men might have an opportunity of washing after return to their quarters, an experimental one was erected in the east infantry block at Aldershot, in 1868, and I received instructions to report on the results. The portion of the permanent barracks, at Aldershot, set apart for the artillery and infantry, consists of four separate blocks of buildings, in a line extending from east to west, facing the town, and within a quarter of a mile of it. The artillery barrack is on the east, and the east infantry block, the centre, and west blocks follow in succession. The artillery barrack was occupied during the period of observation by two batteries of Field Artillery, numbering 280 men; the infantry blocks had each a battalion averaging 630 men; they are designated here A, B, and C, passing from east to west. As the night lavatory was erected in the east infantry block, it was obviously necessary to keep the returns of disease for each of these corps separate as a check on A; and this continued from 26th September, 1868, to 30th July, 1869, a period of forty-four weeks, except in the case of A, which left the station in the 30th week. There were at the same time three infantry battalions of similar strength in the North Camp (wooden huts), two miles from the town, indicated here as D, E, F. Of these D was forty-four weeks under observation, E thirty-four weeks, and F thirty

weeks. All the regiments had returned from foreign service in the early half of 1867, B from the Cape of Good Hope, the other five from India. The admissions for primary venereal sores and gonorrhœa in each of these corps, reduced to the ratio per 1,000, for one year, gives the following results :—

Artillery.		A.		B.		C.		D.		E.		F.	
Primary Sores.	Gonorrhœa.	Primary Sores.	Gonorrhœa.	Primary Sores.	Gonorrhœa.	Primary Sores.	Gonorrhœa.	Primary Sores.	Gonorrhœa.	Primary Sores.	Gonorrhœa.	Primary Sores.	Gonorrhœa.
141·1	120·4	84·0	101·2	42·5	110·6	124·4	134·7	114·5	69·4	58·9	56·6	22·9	56·9

So far as I could ascertain, the men of A did not make much use of the night lavatory; those of B in the next block had the lowest admission rate for primary sores of any of those in the permanent barracks, though they had no regimental arrangements for night ablution; while those of C, in which there was a room beside the guard room, in which appliances for this purpose were available, and to which all prisoners in the guard room, and men returning to barracks after tattoo, were sent before going to their rooms, had nearly the highest admission rate for primary sores, and far the highest rate for gonorrhœa of any of those in the table. In the North Camp, D had a high rate for primary sores; E had one little more than half as high, and in F the rate was 22·9 per 1,000 only, or one-fifth only that of D. Here there was a regimental arrangement for night ablution carried on in E, to which the surgeon of the regiment attributed the low admission rate from primary sores, but as in the permanent barracks, F, the next corps to E, had no night lavatory, yet had the lowest admission rate by far of all those referred to. The prevalence of gonorrhœa in the North Camp was little more than half that in the permanent barracks. The amount of gonorrhœa in both situations shows the intercourse was pretty general, and the fluctuation in the primary sores is evidence not that facilities for ablution were useless, but rather that in B, E, and F it was had recourse to immediately after exposure to infection, when it was much more likely to prove efficient.

Another important inference is to be drawn from the numbers in this table, viz., that no great weight, as regards the incidence of the disease on the country, can be attached to the sickness of small bodies of men taken by themselves. Many small detachments, well spread over a considerable area, may afford a pretty correct view as to its state of diffusion, but it is always desirable, and the larger the numbers are the more satisfactory and trustworthy they become.

When the records of syphilis from year to year are available

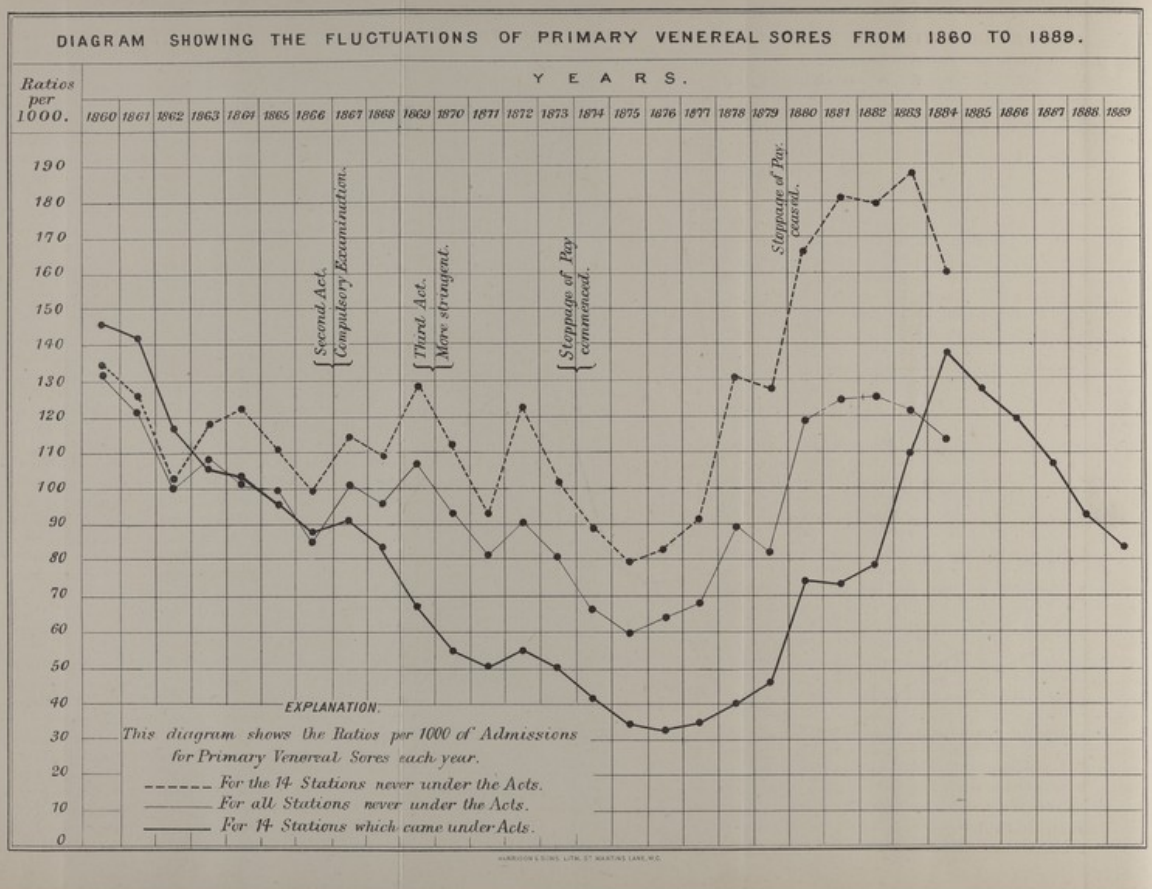
in such a form as admits of precise calculation, it is found they fluctuate very considerably like other epidemic diseases. Thus in Table II, which shows the admissions for primary venereal sores and gonorrhœa among the Dragoon Guards and Dragoons in the United Kingdom, annually, from 1830 to 1837, and those of the same force, and of the Foot Guards (chiefly quartered in London) from 1837 to 1847, with their millesimal ratios throughout, among the Dragoon Guards and Dragoons the mean ratio of primary venereal sores for the seventeen years was 79·5 per 1,000; it was 72 per 1,000 in 1830, 96 in 1831, 80 in 1832, 95 in 1833; after which it went down to 63 and 62 in 1836-38. The ratio rose again to 82 in 1839-40, and fell to 61 the following year, from which it rose to 108 in 1843-44, declining to 79 again in 1845-46. In the Foot Guards the mean rate for the ten years was 140·8; in 1837-38 the ratio was 107 only, rising to 143 the following year, and it fell back to 126 in 1839-40; it then rose to 153 in 1841-42, and to 217 in 1843-44, falling to 135 the following year, and to 102 in 1846-47. Similar fluctuations occurred in gonorrhœa, but in different years, and not quite so pronounced. From 1847 there are no detailed returns of the diseases among the troops in the United Kingdom until 1859. In 1860 the ratio per 1,000 of admissions for primary venereal sores among the troops at the whole of the home stations was 140, and from this date there was a continuous fall, though with frequent minor fluctuations, till 1875, when the ratio was 46. A rise then commenced, and the ratio went up to 125 in 1884; since which it had fallen to 83·5 in 1889. The causes which led to these results will now be explained.

When arrangements came to be made for carrying out the details of hospital treatment under the Act at different points, fourteen of the largest stations were selected, which were known subsequently as the "stations which came under the Acts," and fourteen others, all of those remaining at which an average strength of 500 or upwards was quartered annually, were chosen to compare with them, which were named "the fourteen stations never under the "Acts;" these groups respectively embraced :—

14 Stations which came under Act.	14 Stations never under Act.
Devonport and Plymouth	Isle of Wight
Portsmouth	London
Chatham and Sheerness	Warley
Woolwich	Hounslow
Aldershot	Pembroke Dock
Windsor	Sheffield
Shornclife	Manchester
Colchester	Preston
Winchester	Edinburgh
Dover	Fermoy
Canterbury	Limerick
Maidstone	Athlone
Cork	Dublin
Curragh	Belfast

Subsequently, when it was found that other stations never under the Acts had a considerable number of men distributed amongst them, they were added to the fourteen, and designated, "all the "stations never under the Acts." The object of these arrangements was to show the varying incidence of the disease concerned over the country, from year to year, at points where its progress was not interfered with by the operation of the Acts, so that it might be eliminated at the stations under them, leaving the changes due to the Acts apparent. Taking the returns for all stations "never "under the Acts" give considerably lower ratios of sickness, and less boldness of curve than when compared to the "fourteen "stations under them," as was anticipated; but from 1860-84 every fluctuation which appears in the curves for the fourteen stations, except two slight ones for 1864 and 1882, is found in that for all the stations never under the Acts. The accompanying diagram gives the curves for the fourteen stations "never under the Acts" uppermost, that for *all* the stations "never under them" in the middle, and that for the "fourteen stations which came under "them" lowermost.

The Acts commonly described as the C.D. Acts are those of 1864, 1866, and 1869; these may be considered as coming into force in each instance on 1st January of the following year; and the diagram shows how the progress of the primary sores in each of the groups was affected thereby. The Act of 1864 provided in substance that on information being laid before a Justice of the Peace by a Police Superintendent or Inspector, or a medical practitioner, showing that he had reason to believe a woman was a common prostitute, and infected with venereal disease, and that she had been within the limits of certain districts within a specified time for purposes of prostitution, the magistrate could order her to be taken to a certified hospital for examination. Provision was also made for voluntary submission to examination on the part of the woman, and on the certificate of a medical officer that the woman was diseased, the Justice could issue an order for her detention in hospital for a period not exceeding three months. Penalties were also imposed on persons aiding and abetting, which need not be specified here. By the Act of 1866 the Admiralty, or Secretary of State for War, were authorised to provide hospitals for the treatment of the contagious diseases. Periodical examination of prostitutes once a fortnight was ordered, and the period a woman might be retained under treatment was extended to six months if found necessary. The order for examination was to be in force for twelve months only, but could be renewed by the magistrate on reason shown that the female had rendered herself subject to its repetition; and, on the other hand, any woman deeming herself unjustly treated might



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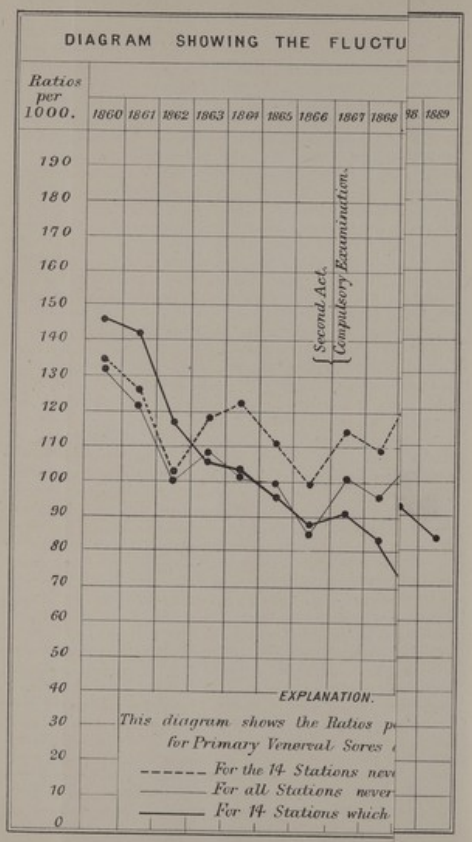

apply to a magistrate to hear the case, and if he were satisfied she had ceased to be a common prostitute, or if, with his approval, she entered into a recognisance for her good behaviour during three months, he could order her to be released therefrom. A woman on discharge from hospital well, after any period of treatment, was no longer subject to the order of periodical examination, unless under a fresh decision of a magistrate. By the Act of 1869 it was provided that if the examining surgeon had reasonable grounds for believing a woman was affected with a contagious disease, but found she was not in a condition that he could examine her properly, she might be detained in a certified hospital for five days to enable this to be done. It was also enacted that, if at the expiring of six months' treatment a female was not cured of her disease, she might be detained for another three months for this purpose. Voluntary submission by a woman, in writing, was also declared to have the same effect as a magistrate's order subjecting her to examination.

The limits of many of the "fourteen stations which came "under the Acts" included, for the purposes of the Acts, localities geographically outside them. Thus, for instance, Plymouth and Devonport include, amongst other places, Dartmouth. The Acts applied not merely to common prostitutes residing within the limits of the subjected districts, but also to common prostitutes who, being resident within ten miles of such limits, or, having no settled place of abode, have, within fourteen days, been either within these limits for the purposes of prostitution, or been outside those limits for the purposes of prostitution in company of men resident within those limits. The hospital accommodation was provided gradually, and with the necessary organisation came fully into operation at all the stations in the beginning of 1870. In the end of 1873 an order was issued by Lord Cardwell, then Minister of War, stopping the pay of soldiers in hospital, labouring under primary sores or gonorrhœa, during their period of treatment. It was pointed out at the time by the Medical Department that this would tend to much concealment of disease, and have no effect in restraining the number affected; but, nevertheless, it continued in force until the end of 1879. The personal inspection was suspended in 1882, and in 1885 the division of military stations into those under the Acts and not under them ceased.

In Table III the strength and numbers admitted for primary sores, secondary syphilis, and gonorrhœa, annually, with the ratios per 1,000, are given for each of the three classes of stations, from 1860 to 1884, and a smaller Table, IIIB, is added, giving the corresponding numbers for the whole force at home from 1885 to 1889. In Table III the years have been grouped so as to correspond with the changes introduced from time to time, and

bring out their effects more distinctly. In the accompanying diagram, which gives the ratio per 1,000 of admissions for primary sores at the groups of stations in the successive years, these features are strongly marked. Thus in 1860, at the fourteen stations which came under the Acts, the ratio was 146; at "all the stations never under them" the ratio was 131; and at the "fourteen unsubjected stations" it was 134. From these points all fell, so that in 1862 they stood at 117, 99, and 103 respectively. In 1863 the admissions at the "fourteen "unsubjected stations" rose to 117, while those at the "fourteen "subjected" were 107, and at the whole unsubjected, 108; and from this year the "fourteen unsubjected stations" continued much above the ratios for all the unsubjected stations in the diagram. The compulsory examination began to take effect in 1867, and though there was an increase of the incidence of the disease on the country, as indicated by rises in the ratio of 17 per 1,000 in both the "fourteen" and "whole unsubjected districts," that at the fourteen stations under the Acts was 4 per 1,000 only, and from this year the ratios at the fourteen subjected stations were always much under those in the whole until 1884, the last year of the comparison. In 1868 there was a fall of the ratios at all these classes of stations of from 5 to 8, followed in 1869 by a rise of 19 in 1,000 at the "fourteen unsubjected stations," of 11 at "all the subjected," but a fall of 17 at the fourteen subjected. In 1871 the incidence of the disease on the country seemed at the lowest, being 93 for the fourteen unsubjected stations, 81 for all the unsubjected, and 51 only for the fourteen subjected. There was a considerable rise in 1872, followed by a subsidence to nearly the same points in 1873 as in 1871. The stoppage of pay showed its effects in 1874 by a fall at each class of stations, and which was continued in 1875, and still traceable up to 1877, after which the advance of another epidemic wave caused a rise at the "fourteen "unsubjected stations" of 40 per 1,000; at "all the unsubjected" of 20; while at the fourteen subjected it was 5 only. In 1879 there was a slight reduction of the ratio at both classes of unsubjected stations, but a rise of about the same amount at the fourteen subjected; but in 1880, with the cessation of stoppage of pay, there was a general rise amounting to 39 at the fourteen unsubjected stations, to 37 on the whole unsubjected, and to 27 at the fourteen subjected stations; a portion of this was due, no doubt, to an increasing incidence of the disease over the country, but a large portion also to the removal of the inducement to conceal primary forms of the disease by stoppage of pay. In May, 1883, the compulsory examination of women was abolished, and the last impediment to the increase of the disease at the fourteen subjected stations having been removed, the ratio of admissions at these

increased 32 per 1,000, against a fall of 2 at all the unsubjected stations, and a moderate rise of 9 at the fourteen unsubjected; and in 1884 there was a further rise of 28 at the subjected stations, against a fall of 8 at the whole of the unsubjected stations, and of 28 at the fourteen unsubjected. This extraordinary rise in the ratio of primary sores at the subjected stations, placed them in 1884 at 138 per 1,000, midway between those at the two sets of unsubjected stations, and 13 above the general mean for all the troops on the home station last year. It differed little from what they were in 1860, and following as it immediately did on the removal of the last restriction on its propagation, there can be no doubt of its cause. The returns for the army do not give the distribution of the troops into subjected and unsubjected stations after 1884. The strength and numbers which came under treatment for the same forms of disease from 1885, on the home stations, have been consolidated, and are placed in the diagram in continuation of the curve for the subjected stations; they indicate a reasonably rapid diminution in the incidence of the disease in the country, which among the troops had fallen to 83·5 per 1,000; the details are given in Table III B at the end; that this reduced incidence of the disease on the country is real, is manifest from the Registrar-General's Returns, which show a striking diminution of deaths from syphilis among the civil population, at the same time, three-fourths of which is among children under one year of age.

The general course of the contagious diseases at the three classes of stations specified above, has been detailed in Table III, and the curve for each has been represented in the diagram, but now a more exact estimate may be made by using the sums for the periods into which the table is divided, each of which embraces the operation of one or more of the factors specified above as having influenced their frequency. The first period, 1860-63, the four years before the Act of 1864 was introduced, shows the prevalence of the three forms of disease in each class of stations, when subject to the influences in operation at these during the period. During the second period, 1864-69, the Acts were being gradually introduced, as hospital accommodation and other necessary arrangements were completed at the several stations comprised in the group, and hence was altogether a transitional one, showing nothing further than that the restrictive measures adopted had already produced a marked reduction of disease, and may therefore be passed over. The third period, 1870-73, the Acts were in force for the whole time, under their fullest development, at all the fourteen stations which came under them, with one or two exceptions of single stations in January and February, 1870, and the results show their full influence in limiting the extension of

these diseases; but as there had been a considerable reduction of them at the other two groups, indicating their diminished incidence over the country, this must have acted at the fourteen subjected stations as well, and has to be subtracted from the results there, leaving the portion really caused by the repressive measures under the Acts. Thus, taking the ratios per 1,000 from Table III, the admissions were:—

Periods.	At 14 Stations under Acts.			At all Stations never under Acts.			At 14 Stations never under Acts.		
	Primary Sores.	Secondary Syphilis.	Gonorrhœa.	Primary Sores.	Secondary Syphilis.	Gonorrhœa.	Primary Sores.	Secondary Syphilis.	Gonorrhœa.
1860-73, no Act in force	129·8	39·9	134·6	116·3	30·5	116·1	120·6	31·6	112·1
1870-73, Acts in force at fourteen stations	52·5	20·2	100·3	86·0	27·4	95·0	107·9	31·8	71·6
Difference between 1860-63 and 1870-73	77·3	19·7	34·3	30·3	3·1	21·1	12·7	+ ·2	40·5
Percentage of fall or rise	−60	−49	−25	−26	−10	−18	−10	+$\frac{1}{17}$	−36

Here, at the stations under the Acts, the fall in primary sores from 1860-63 to 1870-73 was 60 per cent.; at all the unsubjected stations the fall was 26 per cent., and, taking this from 60, 34 remains as due to the repressive action of the Acts. Taking the fourteen stations never under the Acts, where the intensity of the disease was greater than the mean over the whole country, and not very different from what it was in the fourteen under the Acts, the fall in the period under consideration was 10 per cent. only; and this, taken from 60, would leave 50 per cent. as the reduction due to the Acts; and it is probable it really lay between 34 and 50, or about 44. Proceeding similarly with secondary syphilis, the fall for the same period under the Acts was 49 per cent.; at all the stations never under them it was 10 per cent. only, leaving 39 as occurring under the Acts. At the fourteen stations never under them there was a small fractional rise, too small to be taken into consideration. With gonorrhœa the fall under the Acts was 25 per cent.; at all the unsubjected stations it was 18, leaving an excess of 7 under the Acts; while at the fourteen unsubjected stations it was 36, or 11 more even than under the Acts.

The effect of stopping the pay of soldiers under treatment in hospital, with primary sores or gonorrhœa, comes next for consideration. The warrant was signed in October 1873, and cancelled on 17th November, 1879, and practically was in force from 1874 to 1879, inclusive. Comparing the facts for this period with those for 1860-63, as already done for 1870-73, the

results will show the difference between them and those for 1870-73 as already obtained:—

Periods.	At 14 Stations under Acts.			At all Stations never under Acts.			At 14 Stations never under Acts.		
	Primary Sores.	Secondary Syphilis.	Gonorrhœa.	Primary Sores.	Secondary Syphilis.	Gonorrhœa.	Primary Sores.	Secondary Syphilis.	Gonorrhœa.
1860-63, no Act in force	129·8	39·9	134·6	116·3	30·5	116·1	120·6	31·6	112·1
1874-79, stoppage of pay in hospital	38·7	23·0	67·6	71·5	31·0	72·9	97·4	38·8	63·3
Difference between 1860-63 and 1874-79	91·1	16·9	67·0	44·8	+·5	43·2	23·2	+72	48·8
Percentage of fall or rise	−70	−42	−50	−38	+1	−37	−19	+23	−44
Increased percentage fall under stoppage of pay	+10	+ 7	−25	+12	+11	+19	+ 9	+23	+ 8

Here the increased fall after stoppage of pay came into force was 10, 12, and 9 per cent. for primary sores, in the three classes of stations respectively. In secondary syphilis the additional decline under the Acts was 7 per cent.; on the other hand, at all the stations never under them there was an increase of 11 per cent., and at fourteen never under them of 23 per cent. For gonorrhœa there were 25 per cent. fewer treated under the stoppage of pay at the stations under the Acts; at all the stations never under them they were 19 per cent. fewer; and at the fourteen stations never under them 8 per cent. fewer.

In the next period, 1880-82, whilst compulsory examination remained in force (this was stopped in May, 1883), the following changes occurred:—

Periods.	At 14 Stations under Acts.			At all Stations never under Acts.			At 14 Stations never under Acts		
	Primary Sores.	Secondary Syphilis.	Gonorrhœa.	Primary Sores.	Secondary Syphilis.	Gonorrhœa.	Primary Sores.	Secondary Syphilis.	Gonorrhœa.
1860-63, no Act in force	129·8	39·9	134·6	116·3	30·5	116·1	120·6	31·6	112·1
1880-82, stoppage of pay terminated	75·6	26·6	99·0	123·0	32·5	110·4	175·9	38·9	128·4
Difference between 1860-63 and 1880-82	54·2	13·3	35·6	+6·7	+2·0	5·7	+55·3	+7·3	+16·3
Percentage of rise and fall	42	33	26	+6	+7	5	+23	+23	+15

While the strong epidemic influence, in operation during this period, raised admissions at all the stations never under the Acts as high as they were in 1860-63, and at the fourteen stations never under them much higher, the repressive action of the compulsory examination at the subjected stations, though it could not prevent an increase of the low ratios previously found at them, still retained them for the three years at nearly the same elevation, and much below the ratios found in the other two groups.

The period 1883-84 only now remains to be considered. As already mentioned, the personal examination was suspended in May, 1883, and for the remainder there was little to prevent the disease, at the fourteen stations which had previously been under the Acts, assuming the frequency it had presented before 1863, save that the various hospitals remained open for the treatment of such females as chose to avail themselves of them. The results were as follow:—

Periods.	At 14 Stations under Acts.			At all Stations never under Acts.			At 14 Stations never under Acts.		
	Primary Sores.	Secondary Syphilis.	Gonorrhœa.	Primary Sores.	Secondary Syphilis.	Gonorrhœa.	Primary Sores.	Secondary Syphilis.	Gonorrhœa.
1860-63, Acts not in force	129·8	39·9	134·6	116·3	30·5	116·1	120·6	31·6	112·1
1883-84, Acts gradually terminating	123·9	25·4	100·1	118·3	32·7	109·4	174·0	46·8	135·1
Difference between 1860-63 and 1883-84	5·9	14·5	34·5	+ 2·0	+ 2·2	+ 3·7	+ 53·4	+ 15·1	+ 23·0
Percentage of difference	4	36	26	+ 2	+ 7	+ 3	+ 44	+ 48	+ 21

The following facts will enable the beneficial assistance derived from the hospitals after May, 1883, to be estimated approximately. The admissions of females into these in the three years 1880-82 differed very little, and their means were:—

	Primary Sores.	Secondary Syphilis.	Gonorrhœa.
Mean admissions, 1880-82	994	676	1,899
Admissions in 1883, including those before May	710	502	845
Admissions in 1884	288	375	291

Under these circumstances the primary sores among the troops rose to within 4 per cent. of their number in 1860-63, though the

secondary syphilis remained 36 per cent. below the former rate, and gonorrhœa 26 per cent. below it. In this last period the admissions at the stations never under the Acts, taking them as a whole, resulted in the same frequency, practically, as they had presented in 1860-63. But, separating the fourteen stations never under the Acts, the admissions for primary sores at them were 44 per cent. higher than they were in 1860-63; those for secondary syphilis, 48 per cent. more frequent; and those for gonorrhœa, 21 per cent. The enormous numbers who came under treatment for primary sores at some of the stations since 1880 deserve notice.[1] Thus the ratio per 1,000 of admissions for primary venereal sores was:—

In 1880, at Belfast..... 273, and above 200 at another three
" '81, at Sheffield .... 279, "
" '82, at Dublin..... 304, and above 200 at another two
" '83, " ..... 265, London and Manchester showing same ratio
" '84, " ..... 260, and two other places above 200

The separation of the stations into three groups has not been continued since 1884, and the diseases among the troops are all brought into one general return. These are given from 1885 to 1889 in Table III B. These show the ratio per 1,000 of admissions for the three forms of disease to have been in 1885, as compared with 1860:—

	Primary Sores.	Secondary Syphilis.	Gonorrhœa.
In 1860. Ratio per 1,000 of admissions	140	36	133
In 1885. Ratio per 1,000 of admissions	127	27	121

which, as they are for single years only, approach nearer than might scarcely have been anticipated. What is remarkable, also, is that, in both instances, there should have been a considerable fall in the following four years, and that in each the amount of this has not been very different. Thus the ratios per 1,000 were:—

	1860 to 1864.			1885 to 1889.		
	Primary Sores.	Secondary Syphilis.	Gonorrhœa.	Primary Sores.	Secondary Syphilis.	Gonorrhœa.
	140	34	133	127	27	121
	101	37	110	84	36	93
	39	+ 3	23	43	+ 9	28
A percentage of	− 28	+ 9	− 17	− 34	+ 33	− 23

As the Act of 1864 was promulgated late in that year, and could have had no sensible influence on the admissions, the changes indicated by these figures are deserving of special notice.

In Table IV will be found an abstract of the numbers under treatment in hospital, daily, among the troops in the United Kingdom, for primary sores, and secondary syphilis, at the fourteen stations under the Acts, and at all those never under them, arranged for the same periods as in Table III, and their ratios per 1,000. From this it is seen that the daily sick in—

	Fourteen Subjected Stations		All Stations never under Acts.	
	Primary Sores.	Secondary Syphilis.	Primary Sores.	Secondary Syphilis.
In 1860-63	9·27	2·95	8·11	2·61
„ '70-73	4·34	1·62	7·07	2·09
Showing reductions of	4·93 53 per cent.	1·33 45 per cent.	1·04 13 per cent.	0·52 20 per cent.

The operation of stoppage of pay, between 1874 and 1879, led to the further reduction of the admission for primary sores to—

2·87 1·83 4·79 2·21

though with some increase of secondaries to a slight extent in both groups; the explanation of which is that the stoppage of pay was imposed on men affected with the primary affections, and did not extend to those under treatment for the secondary disease. The numbers under treatment daily for secondary syphilis, at the two groups of stations, since 1880, are not given separately, but those for primary sores are available to 1884. These show a very large increase at the fourteen unsubjected stations in 1880-82, with a still further one in 1883-84; while at the stations under the Acts in the former period, during the continuance of the personal examination there was a much smaller rise; but in the latter, when hospital treatment was open to voluntary applicants alone the ratio was nearly doubled. These remarks confirm the conclusions arrived at from the discussion of the admissions under the varying conditions the men were subjected to during the different periods embraced in this paper.

During the sittings of the Select Committee on the C.D. Acts in the House of Commons, the question of the relative frequency of infecting and simple sores arose several times; this can be ascertained only by finding how many cases of constitutional disease follow the primary sores, observed among a large number of persons under observation for a lengthened period; thus

it was found that from 1861 to 1872, inclusive, the admissions for primary sores among the troops in the United Kingdom, were 73,238, and those for secondary syphilis 24,742, or 1 case of secondary in 2·95 primary cases. Subsequent returns, embracing some men omitted in those just referred to, raised the admissions to 90,915 and 27,807, which gives 1 case of secondary per 3·27 primary sores; but two sources of uncertainty present themselves here, viz., in how many instances have the constitutional affection been obviated by the treatment of the primary affection, and how far does the relative frequency of the infecting and non-infecting sores vary at the same place from year to year, or every few years. It is well known that the diagnosis of the constitutional forms of syphilis has been much improved of late years, and it may be, partly at least, that the explanation of the very low ratios of secondary disease mentioned above was due to the non-recognition of their slighter forms, or to their being attributed to another cause. Be that as it may, however, within the last five years, when there has been no obvious interference with the progress of the primary and constitutional forms of the disease, the ratio of the latter to the former has varied a good deal more than it should have done were the relative frequency of the infecting sores not materially altered. Table IIIB affords a good example of this; in that it may be seen that in 1885, with an admission rate of 127·4 per 1,000 for primary sores, that for secondary syphilis was 26·8 only; in 1887 these were respectively 107·5 and 42·6, and in 1889 85·5 and 35·7: the secondaries increasing very rapidly, while the primaries decreased, leading to the conclusion that the decrease was in the non-infecting sores.

Gonorrhœa has been but little commented on during the course of this investigation; but in general terms it may be stated that, though not responding so readily to the preventive aid of the Acts, it nevertheless ultimately was materially reduced under their operation.

The influence of the Acts on the prevalence of the different forms of venereal affections in the Royal Navy may now be considered. In the "Statistical Report on the Health of the Navy "for 1881," there is a table detailing the strength, and admissions, for primary venereal sores, and secondary syphilis, and gonorrhœa, year by year, from 1860 to 1881, in the various ships at the ports on the home station where the Acts were in force, and at those which were never under them. I have added the results for 1882, from the report of that year, to this table, so as to complete the period to that for the Army (Table III) already given.

The ports referred to are as under :—

Those which came under the Acts.	Those never under the Acts.
Dartmouth	Hull
Plymouth	Liverpool
Portsmouth	Kingston (Dublin)
Southampton	Greenock
Queenstown	Leith

The force was very unequally distributed between these groups, 87 per cent. of it being at places under the Acts, and 13 only at those never under them. The points of contact with the unprotected population being so few, and the numbers at them so limited, much greater irregularity must be looked for than was found in the army returns under such different conditions.

The Naval returns included primary venereal sores and secondary syphilis under the same heading from 1860 to 1865 inclusive, afterwards they were shown separately. It had been the practice in the Navy not to enter slight cases of gonorrhœa on the sick list, until the discussions on the Act arose, and attention was drawn to the subject, when instructions were issued for all to be included; this seems to have taken place about 1870. Table V in the Appendix embodies the details for the twenty-three years 1860-82, arranged in a similar manner to Table III for the Army, but the conditions just mentioned will show that the analysis of the results cannot be expected to be so close as was found in the Army. To proceed on the same plan, however, the period 1860-63, before any restrictive measures were in force, may be compared with that of 1870-73, when they were in full operation; 1864-69 being a transition period, may be omitted, as was done with the army. The following shows the relative frequency of primary sores and secondary syphilis taken together, and gonorrhœa, in the force under the Acts, and not under them, in the two periods :—

Period.	Under Acts.		Not under Acts.	
	Syphilis, Primary and Secondary.	Gonorrhœa.	Syphilis, Primary and Secondary.	Gonorrhœa.
1860-63, no Act in force	74·9	26·5	70·2	29·5
'70-73, Acts in full operation	45·6	62·0	106·8	50·4
Difference between 1860-63 and 1870-73	− 29·3	+ 35·5	+ 36·6	+ 20·9
Percentage of fall or rise	− 39	+ 134	+ 52	+ 71

Had the increase of 52 per cent. of the syphilitic disease at stations never under the Acts been due to greater epidemic incidence, the improvement under them would have amounted to

39 + 52, or 91 per cent. But, as shown by the Army returns, there was a sensible decrease of epidemic influence over the country in the latter period; and, in face of this, it is probable that the large increase of 52 per cent. was due to some of those irregularities presented by small numbers. All that can be proved by this comparison then is, that where the restrictive measures were in operation a material reduction of disease took place. As to gonorrhœa, the remarks made above obviate further comment.

In the next period, 1874-79, where the stoppage of pay deranged the admission rates in the Army, there was no such interference with those in the Navy. The results from Table V are as below :—

Period.	Under Acts.		Not under Acts.	
	Syphilis, Primary and Secondary.	Gonorrhœa.	Syphilis, Primary and Secondary.	Gonorrhœa.
1860-63, no Act in operation	74·9	26·5	70·2	29·5
'74-79, Acts in full operation	36·7	62·4	88·8	50·3
Difference between 1860-63 and 1874-79	− 38·2	+ 35·9	+ 18·6	+ 20·8
Percentage decrease or increase	− 52	+ 135	+ 26	+ 70

Here the percentage of reductions in the syphilis has increased from 39 in 1870-73 to 52 at the protected stations, but it has fallen from 32 at the former date to 26 at the latter, at those not under the Act, corresponding with what took place among the troops in duration, though not so closely in quantity.

In the years 1880-82 the following were the results :—

Period.	Under Acts.		Not under Acts.	
	Syphilis, Primary and Secondary.	Gonorrhœa.	Syphilis, Primary and Secondary.	Gonorrhœa.
1860-63, no Act in operation	74·9	26·5	70·2	29·5
'80-82, compulsory examination still in force	53·4	75·4	148·9	69·6
Difference between 1860-63 and 1880-82	21·5	48·9	78·7	40·1
Percentage decrease or increase	− 29	+ 185	+ 112	+ 136

The decrease at the protected ports in 1880-82 as shown here was still 29 per cent. of that between 1860-63, notwithstanding the much greater prevalence of syphilis over the country at large, as is obvious from the military experience as well as that of the Navy, in the general Tables III and V for the respective services.

The naval returns did not give the force at the protected stations and at those never under the Acts separately after 1882, but the strength and admission for the whole force at home last

year are given in Table Vb in the Appendix. From this it appears syphilis reached its highest point in 1884, the same year as in the army, though the ratios in the latter were much higher than in the former, being for primary sores 124·0 per 1,000, and for secondary syphilis 30·2, while for the navy they were 83·2 and 26·9 only. Subsequent to 1884 the disease diminished considerably though irregularly, but contrasting remarkably in these respects with the large and more regular fall in the Army.

Syphilitic affections are considerably more frequent among the troops than among the seamen at the protected stations, than would have been expected. Thus the admissions per 1,000 for primary venereal sores, secondary syphilis, and gonorrhœa, were at these stations for the undermentioned periods :—

Periods.	In Army.			In Navy.		
	Primary Sores.	Secondary Syphilis.	Gonorrhœa.	Primary Sores.	Secondary Syphilis.	Gonorrhœa.
1870–73.....	52·5	20·3	100·3	32·6	13·0	62·0
'74–79.....	38·7	23·0	67·6	26·9	9·8	62·4
'80–82.....	75·6	26·6	99·0	38·7	14·7	75·4

This immunity may be due, in part at least, to the seamen living on board ship a large portion of their time, and so less exposed to sources of infection than soldiers, who are always on shore, and possibly, to some extent, to their employing ablution earlier after such exposure than is customary among soldiers. Under any circumstances it is worthy of note.

The progress of syphilis among the civil population is a matter of much interest, but authentic information upon it is very limited. The returns of the registrar-general give the deaths from this form of disease, but the general impression seems to be that these are frequently attributed to some other disease, and that the record is therefore very imperfect. Be this as it may, there is, at present, no other source of information suitable as a basis for statistical investigation save the records preserved in his annual reports. Table VI in the Appendix gives the population, with the deaths from syphilis (in both sexes and at all ages) among them, taken from these, for every year from 1860 to 1889, from which it appears 56,551 persons died of this disease, 41,828 of whom were children under one year of age; of the remainder, 3,955 were between 1 and 5 years of age, and 10,768 above 5 years, being respectively very nearly 74·7 and 19 per cent. of the whole. As the deaths among young children constitute so large a portion of the mortality from syphilis, a separate column has been added to the table, giving the births each year, with the deaths of infants

under 1 year, with their ratios per 1,000, which show the fluctuations from year to year more plainly than the ratios per million adopted for the whole population.

Forty to fifty years ago the diagnosis of constitutional syphilis was by no means so well understood as it has since become; and during the period of transition the returns show traces of this in gradually increasing ratios per 1,000, without any intermediate falls. Thus in the second part of Table VI the deaths among children under 1 year give a ratio of 1·12 in 1860, then rise gradually to 1866, when it amounted to 1·57. In 1867 the ratio was 1·62 per 1,000, and from this year until 1889 it fluctuated between that and 1·99, there having been no less than four occasions when it fell below 1·70, with intermediate waves of varying amounts. The mean ratio for the whole thirty years is 1·69 per 1,000, but if the years up to 1866 inclusive be omitted, there remain 19,710,458 births, among which 34,989 deaths from syphilis occurred within the year, or 1·78 per 1,000, which represents the mean state, when confined to its normal limits, more correctly. During these years the ratio was constantly fluctuating, having been under 1·78 on twelve occasions, and at or above it on eleven. The great wave which caused the Military and Naval returns to increase so rapidly, and which culminated in these in 1883 and 1884, is also well marked here, and the abrupt fall to 1888 and 1889 equally so.

Table VII gives the distribution of the deaths from syphilis among the civil population of the different divisions of the Registrar-General, which have been arranged so as to throw the whole country into five continuous groups, the metropolis forming one of them, the period being for the six quinquenniads from 1860 to 1889. The first of these quinquenniads, being a transition one, may be passed over here as affording no secure basis for generalisation. The second, 1865-69, embraces the first introduction of the Contagious Diseases Acts, and with those that follow enables the influence of these Acts on the frequency of deaths from syphilis to be traced. The deaths per million living in each of these groups in the respective quinquenniads were as under :—

Periods.	England and Wales.	Districts.				
		I.	II and V.	III, IV, and VI.	VII and XI.	VIII, IX, and X.
1865–69	80	144	68	67	44	85
'70–74	80	127	62	72	49	88
'75–79	85	128	60	77	58	97
'80–84	84	127	55	75	56	96
'85–89	73	112	55	61	51	83

It is apparent from these numbers the beneficial action of the Contagious Diseases Acts had not been confined to the troops and seamen, but had reduced the mortality from syphilis among the civil population in the districts where they came into operation, to a material extent since 1870. Ten of the twelve protected stations in England are in the counties south of the Thames and Bristol Channel, constituting the II and V divisions of the Registrar-General; one station, Woolwich, is in the I or metropolitan division, and one, Colchester, in the IV division. Taking the quinquenniads 1865-69, 1870-74, and 1875-79, the mortality at all ages from syphilis in the II and V divisions was 68 per million living in the first period, declining to 62 in the second, and to 60 in the third, a reduction of 12 per cent. In the III, IV, and VI divisions, extending from the east coast to the Welsh border, immediately north of the II and V, the mortality from syphilis in 1865-69 was 67 per million, almost the same as in the two southern divisions, but instead of falling in the next quinquenniad it rose to 72, and to 77 in the following one, a rise of 15 per cent. In the next group to the north comprising the VII and XI divisions, the deaths from syphilis in 1865-69 were 44 per million, rising to 49 in the following quinquenniad, and to 58 in 1875-79, a rise of 32 per cent. In the remainder of England to the north the deaths rose from 85 in 1865-69, to 88 in the succeeding period, and to 97 in 1875-79, an increase of 14 per cent. London presented the only exception to the general rise; this, with the neighbouring county comprised in the I division, had a mortality of 144 per million from syphilis in 1865-69; this fell to 127, or 12 per cent., in 1870-75, and virtually remained at the same rate. These facts point clearly to the influence of the Contagious Diseases Acts having diminished materially the mortality from syphilis, not only in the immediate localities where they were enforced, but to a large distance around them, while in London there had been a smaller reduction, and in the rest of the country a very marked increase. In the quinquenniad 1880-84 there were indications of a commencing change which went on to the great decrease observed in the country generally in 1885-89, and in every group of divisions as well. The fall in 1880-84 was much accelerated in the II and V divisions, where the compulsory examination was continued until May, 1883.

APPENDIX.

TABLE I.—*Aggregate Strength, with the Admissions for Primary Syphilis, Simple Venereal Sores, and Secondary Syphilis, among the Dragoon Guards and Dragoons, the Foot Guards, and Infantry of the Line, Serving at Home, with their Ratios per 1,000, for the undermentioned Periods.*

Periods.	Dragoon Guards and Dragoons.						
	Strength.	Admissions.			Ratios per 1,000.		
		Primary Syphilis.	Simple Sores.	Secondary Syphilis.	Primary Syphilis.	Simple Sores.	Secondary Syphilis.
1830–37	44,611	1,415	2,144	339	31·7	48·1	7·6
'37–46	54,374	1,396	2,920	467	25·7	53·7	8·6
'60–64	46,130	5,482	26	2,108	118·8	0·6	45·7

Periods.	Foot Guards.						
	Strength.	Admissions.			Ratios per 1,000.		
		Primary Syphilis.	Simple Sores.	Secondary Syphilis.	Primary Syphilis.	Simple Sores.	Secondary Syphilis.
1830–37	—		No return available				
'37–46	40,170	4,769	883	536	118·7	22·0	13·3
'60–64	24,229	3,699	30	811	153·7	0·3	33·5

Periods.	Infantry of Line.						
	Strength.	Admissions.			Ratios per 1,000.		
		Primary Syphilis.	Simple Sores.	Secondary Syphilis.	Primary Syphilis.	Simple Sores.	Secondary Syphilis.
1830–37	—		No return available				
'37–46	100,103	6,157	13,380	2,092	61·5	133·7	20·9
'60–64	126,534	13,497	36	4,048	106·8	0·3	32·0

TABLE II.—*Return of Primary Venereal Sores, and Gonorrhœa, among Dragoon Guards and Dragoons in United Kingdom.**

Years.	Strength.	Admissions to Hospital for		Ratios per 1,000.	
		Primary Venereal Sores.	Gonorrhœa.	Primary Sores.	Gonorrhœa.
1830	6,402	458	383	72	60
'31	6,018	579	374	96	62
'32	6,408	512	343	80	54
'33	6,379	607	363	95	57
'34	6,261	504	494	81	47
'35	5,902	442	289	75	49
'36–37	7,241	457	403	63	56
'37–38	5,506	342	377	62	69
'38–39	5,060	373	392	74	77
'39–40	5,267	432	392	82	74
'40–41	5,330	326	323	61	61
'41–42	5,309	371	350	70	66
'42–43	4,995	391	348	78	70
'43–44	5,235	577	327	108	61
'44–45	6,225	578	474	93	76
'45–46	5,864	466	392	79	67
'46–47	5,483	460	350	84	64
Sums	98,985	7,875	6,174	—	—
Means	5,823	463	363	79·5	62·3

* "Statistical Reports on the Sickness, Mortality, and Invaliding among the "Troops in the United Kingdom, the Mediterranean, and British America from "1830 to 1837," p. 25, and from 1837 to 1847, p. 58.

TABLE II—*Contd. Return of Primary Venereal Sores, and Gonorrhœa, among Foot Guards in United Kingdom.**

Years.	Strength.	Admissions to Hospital for		Ratios per 1,000.	
		Primary Venereal Sores.	Gonorrhœa.	Primary Sores.	Gonorrhœa.
1830	No return for these years				
'31					
'32					
'33					
'34					
'35					
'36–37					
'37–38	4,502	481	265	107	59
'38–39	3,010	431	119	143	40
'39–40	3,234	408	307	126	95
'40–41	3,246	434	226	134	70
'41–42	3,180	488	203	153	64
'42–43	3,227	486	247	151	77
'43–44	4,879	1,060	222	217	45
'44–45	4,996	674	183	135	37
'45–46	4,931	690	183	140	37
'46–47	4,915	500	243	102	49
Sums	40,120	5,652	2,198	—	—
Means	4,012	565	220	140·8	54·8

* "Statistical Reports on the Sickness, Mortality, and Invaliding among the "Troops in the United Kingdom, the Mediterranean, and British America from "1837 to 1847," p. 60.

TABLE III.—*Annual Strength and Admissions for Primary Venereal Sores, Secondary Syphilis, and Gonorrhœa, among the Troops in the United Kingdom, together with the Ratios per 1,000 of Strength.**

Periods.	Stations which came under Contagious Diseases Acts.						All Stations never under Acts.					
	Strength.	Admissions for			Ratio per 1,000.			Strength.	Admissions for			Ratio per 1,000.		
		Primary Sores.	Secondary Syphilis.	Gonorrhœa.	Primary Sores.	Secondary Syphilis.	Gonorrhœa.		Primary Sores.	Secondary Syphilis.	Gonorrhœa.	Primary Sores.	Secondary Syphilis.	Gonorrhœa.
1860	37,479	8,405	2,157	7,366	146	38	139	40,224	5,291	1,160	4,958	131	29	124
'61	31,328	7,267	2,077	7,133	142	40	139	37,627	4,577	1,103	4,063	122	29	108
'62	45,322	5,314	1,874	6,281	117	41	139	32,851	3,264	949	3,925	99	29	120
'63	43,419	4,653	1,774	5,202	107	41	120	32,526	3,521	1,150	3,638	108	35	112
Sums and ratios	197,548	25,639	7,882	26,584	129·8	39·9	134·6	143,228	16,653	4,362	16,624	116·3	30·5	116·1
1864	40,694	4,135	1,631	4,803	102	40	118	32,558	3,297	1,087	3,252	101	33	100
'65	43,078	4,077	1,344	4,937	95	31	115	29,921	2,956	931	3,373	99	31	113
'66	39,476	3,444	1,138	4,573	87	29	116	30,816	2,594	806	2,993	84	26	97
'67	39,911	3,640	1,259	5,274	91	32	132	33,509	3,367	932	3,946	101	28	118
'68	42,595	3,533	1,354	5,685	83	32	133	35,666	3,370	1,230	4,061	95	34	114
'69	42,017	2,765	1,091	4,468	66	24	106	31,747	3,366	954	3,431	106	30	108
Sums and ratios	247,771	21,594	7,817	29,738	87·1	31·5	120·0	194,217	18,950	5,940	21,056	97·6	30·6	108·4
1870	41,580	2,268	996	4,081	55	24	98	33,734	3,134	937	3,195	93	28	95
'71	54,006	2,763	932	6,254	51	17	116	38,571	3,122	1,035	3,969	81	27	103
'72	50,794	2,752	1,045	5,280	54	20	104	41,424	3,736	1,178	4,013	90	28	97
'73	48,039	2,420	969	3,946	50	20	82	40,918	3,307	1,096	3,508	81	27	86
Sums and ratios	194,509	10,203	3,942	19,561	52·5	20·2	100·3	154,647	13,299	4,246	14,685	86·0	27·4	95·0
1874	48,136	2,039	1,074	2,968	42	22	62	38,701	2,555	1,052	2,596	66	27	67
'75	48,006	1,717	1,185	2,825	35	24	58	39,541	2,374	1,352	2,488	59	34	63
'76	48,620	1,622	1,121	3,302	33	23	68	38,073	2,412	1,217	2,642	64	32	69
'77	52,422	1,809	1,060	3,585	35	20	68	39,721	2,690	1,131	3,376	68	28	85
'78	55,813	2,235	1,222	4,352	40	22	78	45,316	3,970	1,469	3,144	88	32	69
'79	42,646	2,005	1,136	2,939	47	27	69	38,054	3,108	1,205	3,218	82	32	84
Sums and ratios	295,643	11,427	6,798	19,971	38·7	23·0	67·6	239,406	17,109	7,426	17,464	71·5	31·0	72·9
1880	44,026	3,280	1,331	4,387	74	30	100	39,869	4,756	1,225	4,543	119	31	114
'81	39,558	2,920	1,067	3,821	74	27	97	45,184	5,673	1,536	4,840	125	34	107
'82	41,783	3,275	940	4,199	78	22	100	45,064	5,582	1,473	4,990	124	33	110
Sums and ratios	125,367	9,475	3,338	12,407	75·6	26·6	99·0	130,117	16,011	4,234	14,373	123·1	32·6	110·5
1883	38,089	4,172	961	3,588	110	25	99	43,588	5,339	1,369	4,785	122	31	110
'84	37,859	5,235	970	3,818	138	26	101	45,276	5,175	1,538	4,944	114	34	109
Sums and ratios	75,948	9,407	1,931	7,606	123·9	25·4	100·1	88,864	10,514	2,907	9,729	118·3	32·7	109·4
Total and ratios	1,136,786	87,745	31,708	115,507	77·2	27·9	101·7	950,479	92,534	29,115	93,931	97·4	30·6	98·8

Periods.	Fourteen Stations never under Acts.						Periods.
	Strength.	Admissions for			Ratio per 1,000.		
		Primary Sores.	Secondary Syphilis.	Gonorrhœa.	Primary Sores.	Secondary Syphilis.	Gonorrhœa.
1860	22,900	3,058	459	2,671	134	20	117
'61	22,893	2,888	747	2,322	126	33	101
'62	19,781	2,031	691	2,437	103	35	123
'63	20,119	2,357	805	2,177	117	40	108
Sums and ratios	85,693	10,334	2,704	9,607	120·6	31·6	112·1
1864	19,987	2,455	729	2,025	123	37	101
'65	19,482	2,156	586	2,355	111	30	121
'66	19,835	1,945	503	1,985	98	25	100
'67	20,589	2,372	540	2,670	115	26	130
'68	19,486	177	683	2,236	109	35	115
'69	17,739	2,273	622	1,428	128	35	81
Sums and ratios	117,118	13,331	3,663	12,699	133·9	31·3	108·4
1870	17,852	2,022	555	1,367	113	31	76
'71	19,951	1,865	592	1,383	93	30	69
'72	19,950	2,457	684	1,445	123	34	72
'73	19,801	2,025	632	1,367	102	32	69
Sums and ratios	77,554	8,369	2,463	5,551	107·9	31·8	71·6
1874	18,879	1,661	644	1,043	88	34	55
'75	19,573	1,552	827	996	79	42	51
'76	18,790	1,554	745	834	82	39	44
'77	19,076	1,730	693	1,295	91	36	68
'78	20,749	2,723	874	1,401	131	42	68
'79	18,058	1,943	691	1,719	127	38	95
Sums and ratios	115,125	11,209	4,473	7,288	97·4	38·8	63·3
1880	18,054	3,010	668	2,305	166	37	127
'81	19,643	3,559	804	2,403	181	41	123
'82	19,449	3,481	739	2,618	179	38	135
Sums and ratios	57,146	10,050	2,211	7,326	175·9	38·9	128·4
1883	18,274	3,441	810	2,443	188	44	134
'84	18,635	2,980	916	2,542	160	49	137
Sums and ratios	36,909	6,421	1,726	4,985	174·0	46·8	135·1
Total and ratios	489,535	59,774	17,240	47,456	122·0	35·2	96·9

*. The annual details in this table are taken from a return from the Army Medical Department giving the admissions into the female hospitals, from

*Syphilis, and Gonorrhœa, among the Troops in the United Kingdom, together with the Ratios per 1,000 of Strength.**

to House of Commons, dated 31st July, 1885, signed T. Crawford, D.G., and with another War Office, ordered to be printed 6th August, 1885.

TABLE III B.—*The Strength, and Admissions for Primary Venereal Sores, Secondary Syphilis, and Gonorrhœa, among the whole Troops in United Kingdom, from* 1885 *to* 1889 *inclusive.*

Year.	Strength.	Primary Sores.	Secondary Syphilis.	Gonorrhœa.	Ratios per 1,000.		
					Primary Sores.	Secondary Syphilis.	Gonorrhœa.
1885	87,105	11,095	2,336	10,561	127·4	26·8	121·2
'86	92,601	11,002	3,097	10,632	118·8	33·5	144·8
'87	101,114	10,862	4,311	10,417	107·5	42·6	103·0
'88	101,695	9,479	4,095	9,268	93·2	40·3	91·1
'89	100,790	8,414	3,601	9,362	83·5	35·7	92·9
Sums and means	483,305	50,852	17,440	50,240	104·8	36·1	104·9

TABLE IV.—*Numbers under Treatment in Hospital, Daily, among the Troops in the United Kingdom, for Primary Venereal Sores, and Secondary Syphilis, at the Fourteen Stations which came under the Acts, and at all the Stations never under them, with their Ratios per* 1,000 *of Mean Strength.*

Periods.	Fourteen Stations under Acts.				All Stations never under Acts.			
	Under Treatment Daily.		Ratios per 1,000.		Under Treatment Daily.		Ratios per 1,000.	
	Primary Sores.	Secondary Syphilis.	Primary Sores.	Secondary Syphilis.	Primary Sores.	Secondary Syphilis.	Primary Sores.	Secondary Syphilis.
1860–63	1,834	582	9·27	2·95	1,161	374	8·11	2·61
'64–69	1,632	581	6·59	2·35	1,416	449	7·29	2·31
'70–73	845	316	4·34	1·62	1,093	323	7·07	2·09
'74–79	848	542	2·87	1·83	1,148	528	4·79	2·21
'80–82	742	—	5·91	—	738*	—	12·93	—
'83–84	800	—	10·50	—	558*	—	14·98	—

* These two numbers are those for the fourteen stations never under the Acts, and have to be divided by the strength for the periods in the third division of Table III instead of the second, as the heading to this table would indicate. The numbers remaining under treatment for secondary syphilis are not given in the Army Medical reports for the stations under the Acts, and never under them from 1880.

The above table is condensed from No. 2 in Appendix to "Report from the "Select Committee on Contagious Diseases Acts, 1881," p. 446, Parliamentary Paper.

TABLE V.—ROYAL NAVY. *Showing the Strength, and the Admissions for Primary Venereal Sores, Secondary Syphilis, and Gonorrhœa, at the Stations which came under the Acts, and at those never under them, from* 1860 *to* 1882, *with their Ratios per* 1,000 *of Strength.*

Periods.	Stations which came under Acts.						
	Strength.	Admissions for			Ratios per 1,000.		
		Primary Sores.	Secondary Syphilis.	Gonorrhœa.	Primary Sores.	Secondary Syphilis.	Gonorrhœa.
1860	7,560	481		150	63·6		19·8
'61	9,195	613		241	66·7		26·2
'62	9,345	795		288	85·1		30·8
'63	10,210	830		285	81·3		27·9
Sums and ratios	36,310	2,719		964	74·9		26·5
1864	9,880	1,055		196	106·8		19·8
'65	10,140	840		253	82·8		25·0
'66	10,945	510	171	159	46·6	15·6	14·5
'67	10,300	338	104	154	32·8	10·1	15·0
'68	10,445	322	154	281	30·8	14·7	26·9
'69	9,980	311	124	329	31·2	12·4	33·0
Sums and ratios	61,690	1,481	553	1,372	63·7		22·2
		1,895					
1870	9,690	314	95	534	32·4	9·8	55·1
'71	11,260	313	135	630	27·8	12·0	56·0
'72	11,475	413	160	832	36·0	13·9	72·5
'73	11,315	388	177	716	34·3	15·6	63·3
Sums and ratios	43,740	1,428	567	2,712	32·6	13·0	62·0
1874	11,155	337	129	709	32·2	11·6	63·6
'75	10,660	251	98	639	23·5	9·2	59·1
'76	10,615	255	83	653	24·0	7·8	61·5
'77	11,280	291	112	619	25·8	9·9	54·1
'78	11,000	264	83	673	24·0	7·5	61·2
'79	10,950	366	137	801	33·4	12·5	73·2
Sums and ratios	65,660	1,764	642	4,094	26·9	9·8	62·4
1880	11,510	411	134	830	35·7	11·6	72·1
'81	11,535	442	155	804	38·3	13·4	69·7
'82	9,845	421	194	846	42·8	19·7	85·9
	32,890	1,274	483	2,480	38·7	14·7	75·4
		4,614			81·9*		
Totals and ratios	240,290	5,947	2,245	11,622	32·3*	12·2	48·4

* These ratios are obtained by dividing 4,614, the sum of the primary and secondary cases under the Acts for 1860-65, by 56,330, the strength for these years, and 5,947 and 2,245, the numbers of these cases respectively for 1866-82, by 183,960, the strength for that period.

TABLE V *Contd.*—ROYAL NAVY. *Showing the Strength, and Admissions for Primary Venereal Sores, Secondary Syphilis, and Gonorrhœa.*

Periods.	Stations never under Acts.						
	Strength.	Admissions for			Ratios per 1,000.		
		Primary Sores.	Secondary Syphilis.	Gonorrhœa.	Primary Sores.	Secondary Syphilis.	Gonorrhœa.
1860	1,705	100		43	58·7		25·2
'61	1,590	115		49	72·3		30·8
'62	1,660	89		39	53·6		23·5
'63	1,725	165		66	95·7		38·3
Sums and ratios	6,680	469		197	70·2		29·5
1864	1,525	170		39	111·5		25·6
'65	1,555	139		42	89·4		27·0
'66	1,435	74	25	26	51·6	17·3	18·1
'67	1,770	99	44	63	55·9	24·9	35·6
'68	1,630	91	39	50	55·8	23·9	30·7
'69	1,750	110	31	78	62·9	17·7	44·6
		309					
Sums and ratios	9,665	374	139	298	85·0		30·8
1870	1,605	110	70	82	68·5	43·6	51·1
'71	1,650	124	67	71	75·2	40·6	43·0
'72	1,765	127	77	115	72·0	43·6	65·2
'73	1,925	122	45	82	63·4	23·4	42·6
Sums and ratios	6,945	483	259	350	69·5	37·3	50·4
1874	1,790	117	26	76	65·4	14·5	42·4
'75	1,845	135	25	126	73·2	13·5	68·3
'76	1,880	123	31	71	65·4	16·5	37·8
'77	1,895	114	20	101	60·2	10·5	53·3
'78	695	82	10	28	118·0	14·4	40·3
'79	1,015	106	21	57	104·1	20·7	56·2
Sums and ratios	9,120	677	133	459	74·2	14·6	50·3
1880	1,045	142	28	74	135·9	26·8	70·8
'81	990	104	39	65	105·0	39·9	65·6
'82	940	96	34	68	102·1	36·2	72·3
	2,975	342	101	207	115·0	33·9	69·6
		778			79·7*		
Totals and ratios	35,385	1,876	632	1,511	73·2*	24·7*	42·7

* Similarly at the stations never under the Acts, 778, the sum of the primary and secondary cases from 1860 to 1865, on a strength of 9,760, gives their conjoined ratio 79·7, and 1,876 and 632, on a strength of 25,625, from 1865 to 1882, give the ratios 73·2 and 24·7 respectively. From "Statistical Report on Health of the Navy, 1881-82."

TABLE VI.—ROYAL NAVY. *Showing the Mean Strength and Admissions for Primary Venereal Sores, Secondary Syphilis, and Gonorrhœa, in the Force on the Home Station from* 1883 *to* 1889 *inclusive, with their Ratios per* 1,000.

Years.	Strength.	Admissions for			Ratios per 1,000.		
		Primary Sores.	Secondary Syphilis.	Gonorrhœa.	Primary Sores.	Secondary Syphilis.	Gonorrhœa.
1883	22,200	1,585	442	1,968	71·4	19·9	88·6
'84	18,570	1,545	499	1,613	83·2	26·9	86·9
'85	23,100	1,637	563	1,883	70·9	24·4	81·5
'86	21,800	1,512	449	1,691	69·4	20·6	77·6
'87	23,700	1,827	512	1,873	77·1	21·6	79·0
'88	24,000	1,515	558	1,824	63·1	23·3	76·0
'89	24,730	1,769	583	2,138	71·5	23·6	86·5
Sums and ratios	158,100	11,390	3,606	13,040	72·0	22·8	82·5

TABLE VI.—CIVIL POPULATION. *Deaths from Syphilis among the Civil Population in England and Wales (both Sexes and all Ages), with the Ratios per* 1,000,000 *Living; also the Deaths from Syphilis among Children (both Sexes) under* 1 *Year of Age, with their Ratios per* 1,000 *on the Births.*

Years.	Population—all Ages.			Children under 1 Year.		
	Population. [000's omitted.]	Deaths from Syphilis.	Ratios per 1,000.	Births.	Deaths from Syphilis.	Ratios per 1,000.
1860	19,903,	1,067	54	684,048	767	1·12
'61	20,119,	1,177	59	696,406	798	1·15
'62	20,371,	1,245	61	712,684	867	1·22
'63	20,626,	1,386	68	727,417	983	1·35
'64	20,884,	1,550	75	740,275	1,089	1·45
'65	21,145,	1,647	79	748,069	1,155	1·54
'66	21,410,	1,662	79	753,870	1,180	1·57
'67	21,678,	1,698	80	768,349	1,241	1·62
'68	21,949,	1,886	88	786,858	1,364	1·73
'69	22,223,	1,859	85	773,381	1,361	1·76
'70	22,501,	1,858	84	792,787	1,422	1·79
'71	22,789,	1,742	77	797,428	1,317	1·65
'72	23,096,	1,831	80	825,907	1,410	1·71
'73	23,409,	1,843	80	829,738	1,376	1·66
'74	23,725,	1,997	85	854,956	1,484	1·74
'75	24,045,	2,134	90	850,607	1,554	1·83
'76	24,370,	2,134	89	887,968	1,580	1·78
'77	24,700,	2,074	86	888,200	1,550	1·75
'78	25,033,	2,182	88	891,906	1,647	1·85
'79	25,371,	2,039	81	880,389	1,493	1·69
'80	25,714,	2,162	84	881,643	1,589	1·80
'81	26,062,	2,097	80	883,642	1,540	1·74
'82	26,414,	2,227	84	889,014	1,666	1·87
'83	26,771,	2,313	84	890,722	1,773	1·99
'84	27,132,	2,280	84	906,750	1,733	1·91
'85	27,409,	2,196	80	894,270	1,652	1·85
'86	27,871,	2,231	80	903,760	1,701	1·88
'87	28,247,	2,064	73	886,331	1,584	1·80
'88	28,629,	1,927	67	879,868	1,452	1·65
'89	29,016,	2,053	71	865,944	1,500	1·73
Sums and ratios	722,610	56,551	78	24,773,217	41,828	1·69

Population, births, and deaths, from registrar-general's returns.

TABLE VII.—CIVIL POPULATION. *Showing the Mean Population, and Deaths from Syphilis (both Sexes and all Ages) in Civil Life, in England and Wales in the Successive Quinquenniads from* 1860 *to* 1889, *with their Ratios in* 1,000,000 *Living; also their Distribution in the Groups of the Registrar-General's Division, specified in Tables for the corresponding Periods.*

[The population for the middle year of each quinquenniad has been taken as the mean for the period, and 000's are omitted.]

Periods.	Middle Year of each Period.	England and Wales.			I Division.			II and V Divisions.		
		Population. [000's omitted.]	Deaths.	Ratios per 1,000,000.	Population [000's omitted.]	Deaths.	Ratios per 1,000,000.	Population [000's omitted.]	Deaths.	Ratios per 1,000,000.
1860–64	1862	20,371,	1,285	63	2,857,	317	111	3,727,	221	59
'65–69	'67	21,678,	1,750	80	3,078,	442	144	3,907,	268	68
'70–74	'72	23,096,	1,854	80	3,319,	423	127	4,084,	252	62
'75–79	'77	24,700,	2,111	85	3,595,	462	128	4,231,	255	60
'80–84	'82	26,416,	2,216	84	3,893,	495	127	4,385,	242	55
'85–89	'87	28,247,	2,094	74	4,215,	472	112	4,546,	250	55

Periods.	Middle Year of each Period.	III, IV, and VI Divisions.			VII and XI Divisions.			VIII, IX, and X Divisions.		
		Population. [000's omitted.]	Deaths.	Ratios per 1,000,000.	Population [000's omitted.]	Deaths.	Ratios per 1,000,000.	Population [000's omitted.]	Deaths.	Ratios per 1,000,000.
1860–64	1862	4,936,	241	49	2,629,	94	36	6,230,	411	66
'65–69	'67	5,186,	347	67	2,741,	119	44	6,766,	575	85
'70–74	'72	5,452,	394	72	2,874,	141	49	7,364,	644	88
'75–79	'77	5,742,	445	77	3,064,	177	58	8,062,	780	97
'80–84	'82	6,048,	453	75	3,267,	184	56	8,791,	841	96
'85–89	'87	6,376,	387	61	3,447,	179	51	9,632,	804	83

Note.—Details compiled and computed from data in registrar-general's returns.

DISCUSSION ON INSPECTOR-GENERAL LAWSON'S PAPER.

DR. NEVINS said that the diagram which Dr. Lawson had so admirably drawn excited his envy. His own diagram was rough in comparison, but it would be found that their figures, practically speaking, were the same. He himself began with 1860, because then the annual reports of the army were first published regularly, and the amount of disease was so great that a commission was appointed by Lord Herbert, Secretary for War, which investigated the matter with the greatest care, and made recommendations with respect to sanitary arrangements of barracks and healthy occupations for the men, such as libraries, and so on, cricket and football, &c., to improve their condition. These recommendations began to

be put in force as rapidly as the votes of the House of Commons would permit, and circumstances allowed. It was important to mention, that in 1860 the army was divided for sanitary purposes in the reports into camps, seaports, manufacturing towns, &c., as the conditions varied so much that the sanitary conditions of different sets of stations were likely to be different, and accordingly the army was divided into large camps, large seaports, and large dockyards; while London was put by itself, because there was nothing to compare with it. Dublin also was put by itself, and the large manufacturing towns were put by themselves, and also the battalion depôts —and the remainder of the less strongly characterised places, in which the rest of the army was distributed, were thrown together as "remaining stations." In these large camps, large seaports, and large dockyards the improvements recommended by Lord Herbert's Commission were pushed forward as rapidly as possible. When he (Dr. Nevins) was giving his evidence before the Select Committee of the House of Commons, he took out for every station for every year the whole work that had been done, and laid the result before the committee. Before the Act of 1866 important improvements, suggested by Lord Herbert's recommendations, had been carried out in thirty-five instances in the large camps, seaports, and dockyards, but in London and Dublin, and the fourteen subsequently non-subjected stations, only twenty important improvements were carried out. Coincident with those improvements an enormous fall in disease took place, which he represented by the black line in his diagram. The fall amounted to 28 per cent. in the large camps; to 33 per cent. in the seaports, and to 29 per cent. in the dockyards. In the large manufacturing towns the fall amounted to only 21 per cent., while London was worse than at the beginning, and Dublin was the worst of all on the average of the whole periods. The average annual fall in the stations afterwards put under the Acts amounted to 6·7 per cent. He had not mentioned the Act of 1864, because it was only in operation in four stations in all, and in these only for a short time, and there were no periodical examinations or compulsory detention in hospitals. The improvements recommended by Lord Herbert's Commission still continued to be carried out, and at a more rapid rate than before, for after the Act was passed there were forty-eight important improvements carried out in the camps, dockyards, and so on, but only twenty-three in the fourteen non-subjected stations. The whole of the camps, which had already improved 28 per cent., were then "selected" to be put under the Acts; the whole of the seaports, which had already improved 33 per cent., and two out of the three great dockyards, which had already improved 29 per cent., and five minor stations, which had shown no particular character previously, were also placed under the Acts for comparison with fourteen stations not under them. London, which had already fallen off, was taken, and Dublin, which was the worst of all; four of the largest manufacturing towns were also taken, and one dockyard and seven minor stations from the "remaining" numbers which had no particular character among them, and then the fourteen stations which had been so improved, by Lord Herbert's

suggestions, were put forward as a fair comparison with the wretched seat of London, Dublin, and the large manufacturing towns, where vice and crime always seem to gravitate, and which had been left with only twenty-three instead of thirty-five of Lord Herbert's important improvements. Furthermore, in order to prevent disease being brought into the stations under the Acts by the men belonging to the fourteen stations under them, an army regulation was issued, though without any warrant from the Acts themselves, that the men coming into these subjected stations were to be examined to see whether they had disease before they were allowed to join their comrades, and if diseased were at once sent to hospital; but in the stations that were not under the Acts there was no such examination, and the men were allowed to bring in any amount of disease that they had contracted during their furlough. The first women they consorted with could go and spread it, and then the thing worked its vicious round. The question was asked before the Select Committee of the House of Commons, "why is this not applied to all the stations?" and the answer was, that a great experiment was going on, and every precaution must be taken to prevent its failing. These conditions continued for six years, and in the diagram Dr. Nevins showed Lord Herbert's improvements still going on, indicated by the black line, and he had indicated the additional influence of the Acts by red lines. The disease continued to fall, and naturally so, but instead of 6·7 per cent. yearly, it fell only 6·3 per cent. annually for the next six years; then it appeared that the army authorities were dissatisfied, and Lord Cardwell issued an order that all men suffering from primary disease should have their pay stopped. When that order came into force he (Dr. Nevins) had added a third line in his diagram, to indicate it in order to show the deterrent influence of stoppage of pay. Of course that prevented the men reporting themselves to the army doctors when they only had trifling cases, and they went to druggists instead. Then disease apparently fell in four years from 54 to 33 per 1,000, but then, in spite of the Acts and of punishment, it began to rise for three years, and it rose until the warrant was withdrawn. But it would be seen from the diagram that by 1879 the disease had risen to very nearly the same height as before concealment first took place in 1873. Then when concealment was put an end to a very large and rapid rise took place. The previous rise had been for three years in existence, and it continued for three years more, at the end of which time (1882) the disease was 78 per 1,000. There had been an improvement of only 9 per 1,000 among the men in the subjected stations during the whole sixteen years of the Acts. Then in the middle of 1883 the Acts were suspended, that was to say, the periodical examinations and the compulsory detention in hospital were put a stop to, and then there was a sudden rush of disease from 78 to 110 per 1,000, which excited great alarm in the House of Commons, and among the medical profession and the public. Questions were asked in the House of Commons over and over again, and Lord Hartington, who was the Secretary for War, answered that there were so many causes operating at the same

time, that it was impossible to say to which of them the increase was due, but he especially mentioned the great amount of disease that the troops were bringing from Egypt. Those troops came back in 1883 and 1884 to England, and they brought back with them a large amount of disease. Was it then to the suspension of the Acts or to this imported disease that this great increase of disease in the home army was due? The fact was that in Gibraltar also, where the Acts were still in full force, the disease rose by above 90 per cent., and in Malta also, which had always been held out as the *beau ideal* of a protected place, the disease also increased by 76 per cent., while in the home army the increase was only 41 per cent. The fact was that the troops which were left at these places communicated their disease on the way, and the remainder brought the increase of disease with them into the home army. At the end of 1884 we start fair with an entire absence of Acts, and what was found to be the result? There was immediately a fall of disease, which continued without interruption till 1888. He had written to Mr. Stanhope and asked for the returns for 1889, but had not been able to obtain them, but it would be seen from Dr. Lawson's diagram that the fall still continued in 1889 without interruption, so that five years without the Acts showed that the disease had fallen from 138 to 82, or at the rate of above 8 per cent. yearly—a larger fall than at any previous period. He submitted, from these figures, that the application of the Acts, at first, did not increase the rate of improvement, and certainly did not prevent the increase of disease afterwards. He had taken his figures from the returns that were moved for, and granted by the House of Commons to Mr. Cavendish Bentinck, but they were limited to the fourteen stations under the Acts.

Dr. Lawson said that he took his figures from a return published by the House of Commons in June, 1885.

Dr. Nevins said that Mr. Cavendish Bentinck moved in 1888 and 1889 for returns of the amount of gonorrhœa and primary syphilis in the fourteen stations under the Acts, and it was from these more recent returns he had taken his figures.

Dr. Lawson said that was quite true.

Dr. Nevins pointed out that his table showed what the composition of those two sets of "selected" stations was, and how far they were capable of being compared one with another; but in 1875 the army report for the first time began to publish the amount of disease in other stations besides the fourteen selected ones not under the Acts. The home troops were distributed in about 130 stations. In addition to the fourteen "selected," there were about 100 more to which the Acts had never been applied, containing about 25,000 troops, which were distributed among these 100 stations throughout the whole country. In 1885 Mr. Stansfeld moved for a return of the amount of disease in these 100 previously discarded non-subjected districts. In one of the diagrams exhibited they would see that on the average of the whole period of the Acts the fourteen stations under them had a ratio of 80 per 1,000, but the 100 rejected stations, containing above half the non-subjected troops, had only 74 per 1,000: while

the fourteen non-subjected stations "selected" for comparison had a ratio of 136. But no one could wonder that London, Dublin, and the large manufacturing towns had an enormous amount of disease. The fact was that if London, Dublin, and the large manufacturing towns were left out, the stations not under the Acts would show a very small amount of disease. Thus it would be seen that more than half of the army not under the Acts had had a smaller amount of disease than the fourteen stations that had been under the Acts for sixteen years.

Secondary disease had never in the army reports been divided into stations under the Acts and the stations not under the Acts. It was impossible to trace the origin of secondary disease to its actual source, as it does not appear until weeks or months after the original primary, so that Dr. Balfour, whose death they all lamented, said that it was no use having returns of secondary disease except for the whole army. In 1866 secondary disease had fallen to 24 per 1,000, at which date the Act was put in force, and in 1883, when the suspension of the Acts took place, the ratios for the whole sixteen years showed that the average over the whole period during which the Acts had been in force was higher by ·076 than when the Acts were passed. There was a sudden and entirely exceptional rise in 1887, followed by a fall the next year, and he was utterly unable to explain it. He had tried all manner of theories, but without success. Between 1884 and 1888 the amount of fall in primary sores was in Chatham 32 per cent., and yet secondary syphilis rose 86 per cent. Primary sores fell in Woolwich 38 per cent., but the secondary sores rose 41 per cent., and similar discrepancies existed throughout nearly all the subjected stations. He had no theory to account for such remarkable discrepancies, and could merely place the following table before the Society. Possibly Dr. Lawson might be able to suggest some explanation.

Discrepancies between Primary and Secondary Disease in the Fourteen Subjected Stations between 1884 *and* 1888, *the Acts being absent the whole time.*

Chatham	fell in primary	32	per cent.,	yet secondary	rose	86	per cent.
Woolwich	,,	38	,,	,,		41	,,
Aldershot	,,	47	,,	,,		53	,,
Colchester	,,	33	,,	,,		65	,,
Canterbury	,,	29	,,	,,		230	,,
Curragh	,,	62	,,	,,		9	,,
Plymouth	rose ,, only	1·5	,,	,,		95	,,
Portsmouth	,, ,,	23	,,	,,		195	,,
Windsor	,, ,, ,,	55	,,	,,		118	,,
Shorncliffe	,, ,,	6·6	,,	,,		66	,,
Dover	fell ,,	26	,,	,,	fell only	4	,,
Winchester	,, ,,	42	,,	and ,,	,,	39	,,
Cork	,, ,,	27	,,	,, ,,	,,	20	,,
Maidstone fell totally. It had not a single case in 1888				,, ,,	,,	82	,,

Mr. Ernest Walford said that, not being a medical man, he had some diffidence in making any remarks, but Dr. Lawson had mentioned that from 1884, according to the Registrar-General's returns, there had been a decided falling off in syphilitic diseases in the country generally. He concluded that the Registrar-General's returns would show it in the form of deaths. Of course deaths from syphilis, either acquired by the individual or inherited, must have been acquired some years previously. For instance, a man who died in 1890 of syphilis must have caught the disease several years previously. Therefore, did not the falling off in the Registrar-General's return point to a decrease in primary syphilis during some years previous to 1884, and was it not an argument in favour of the Acts?

Dr. Fox said that, as a medical man, he felt some considerable amount of interest in this question, and on other grounds still more. There appeared to be some rather curious discrepancies, and yet both sides seemed to be in some degree substantiated by statistics. Some of the conclusions were not easy to understand. He himself had not gathered how it was explained that in Dr. Lawson's table there was that remarkable fall at the end after what appeared to him to be the improvement owing to this suspension of the Acts. Of course it was impossible not to feel that this was rather a moral than a statistical question, and that there were other ways of abating the evil which perhaps might be more successful than those that have been adopted—in the neglect of which such measures became requisite and must always be; and, although it was probably made out that the suspension of the Acts had done some good in a humanitarian point of view, some might regret the mere treating of soldiers or women as creatures as tending to degrade.

Mr. Bourne said they were all indebted to Dr. Lawson for the elaborate tables he had prepared, and also to Dr. Nevins, who had taken a different view of the question. He thought they might satisfactorily conclude one thing, viz., that the case in favour of the Acts had not been made out. Other causes might have been in operation at the same time as the Acts were in force, and it was not fair to compare all the results as due to the existence of the Acts. He gathered that the remarkable rise shown on the diagram was very much accounted for by the return of the troops from Egypt infected with disease. He felt assured that the whole question was still in a state of great ambiguity and uncertainty, but nothing whatever had been made out to justify the re-imposition of Acts which were repugnant to the feelings of the people as Englishmen, moralists, and Christians, and they were therefore emboldened to rely on moral and spiritual influences to effect the good they desired.

Mr. Shillitoe said that he could speak with some authority with regard to the present state of these diseases, he having been connected with the Lock Hospital for the last twenty-eight years.

During the last five or six years he had noticed a great increase in the severer forms of the disease, particularly amongst the women. Indurated sores are now much more frequently met with than formerly. One effect of the removal of the Contagious Diseases Acts is that the hospital authorities have now no power to keep the women in hospital until they are fit to be discharged. Women often come into the hospital, get partially relieved of the more painful symptoms, and then, regardless of the fact of their being in a highly infectious condition, insist upon going out; sometimes a batch of women, all of whom are more or less diseased, will agree to leave the hospital simultaneously, and however diseased they may be, they cannot be prevented. The effect of this is seen in the general increase of the disease throughout the country.

Sir Rawson W. Rawson thought it right to mention his experience of the operation of the Acts in Barbados. In 1869 or 1870 the Acts were brought into operation there, to the very great benefit of the community, the military, and the women themselves. It was his duty to keep a close watch upon the operation of the Acts, and occasionally to visit the hospitals, and he certainly thought it right to bear his testimony to the advantageous operation of the Acts there from 1870 to 1875.

Mr. J. B. Martin said he must apologise for intruding in the discussion, as this was a subject on which he had no knowledge or authority whatever, but as a statistician he wished to make one remark on the tables submitted to them. They could see the fall to which Dr. Nevins had called attention, from 148 to 67, during the six years when Lord Herbert's recommendations were in force; that was at an average of 6·7 per cent. per annum. During the next cycle there was the continued operation of Lord Herbert's recommendations, assisted by the operation of the Contagious Diseases Acts, and Dr. Nevins had pointed out that the fall was 6·3 as against 6·7; that was a very small difference. It seemed to him that in such a case one might reasonably expect that the fall would be more and more difficult to maintain in its ratio, that, except by the introduction of some new force, the fall would tend to diminish year by year. A third cycle was indicated by the violet line, when the motive of concealment came into play. From that point there was a rise to the period when the Act was abolished. The result of the observations to be deduced from these tables seemed to him to be that it was a great advantage that they had opposite views stated from a purely statistical standpoint, so as to enable the meeting to sift accurately the facts and phenomena which were brought under its observation.

Dr. Lawson said it had been his lot to hear a great deal of the evidence on both sides of the question, and almost every word of Dr. Nevins's statements had come before him previously; on most occasions he had, he believed, refuted them, at all events to his belief satisfactorily, though apparently not so to Dr. Nevins.

Dr. Nevins had compared London, Dublin, and large manufacturing towns with places where there was no manufacturing. He maintained that that in this case was an error which no man of statistical knowledge would support. He had been frequently asked if he compared Manchester and Shorncliffe, but his answer was "no." In the group of stations never under the Act he compared Manchester at one period with Manchester at another, and similarly in the group under the Act, Shorncliffe with Shorncliffe. Dr. Nevins had attributed the amelioration after the introduction of the Acts, not to the Acts, but to measures of sanitation, &c., that were introduced after 1860; but to his own knowledge numbers of those things had been introduced twenty years before. Then Dr. Nevins was altogether wrong in supposing that those improvements were introduced at the camps chiefly or principally. Had the reduction of venereal affections from 1866 to 1873 been due to the sanitary measures then introduced at stations under the Acts, these same measures being continued and improved should have prevented their rise again subsequent to 1877; but they failed altogether to do it, and Dr. Nevins affords us no explanation why. A great deal had been said about the people who came home from Egypt in 1883 introducing the disease, but there was a very marked increase at home in 1879 and 1880, and what was the cause of that?

The President in closing the discussion intimated his intention to take no active part in the proceedings, beyond stating that in his opinion Inspector-General Lawson had fully proved his contention, and that he regarded the repeal of the Contagious Diseases Acts as disastrous in its consequences, particularly in India. He considered that it was the duty of the State to maintain its sea and land force in a condition of efficiency for the work it has to perform, without reference to any of the side issues raised in the discussion, and concluded with moving a cordial vote of thanks to Dr. Lawson for his able and conclusive statement. This was carried unanimously.

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ROYAL STATISTICAL SOCIETY.

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OF THE SOCIETY.

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	Period.
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The Right Hon. the Lord Overstone	1851–53
The Right Hon. the Earl Fitzwilliam, K.G., F.R.S.	1853–55
The Right Hon. the Earl of Harrowby, K.G., D.C.L. ..	1855–57
The Right Hon. the Lord Stanley, M.P. ..... (now Earl of Derby.)	1857–59
The Right Hon. the Lord John Russell, M.P., F.R.S. .. (afterwards Earl Russell.)	1859–61
The Right Hon. Sir J. S. Pakington, Bart., M.P., G.C.B. (afterwards Lord Hampton.)	1861–63
Colonel W. H. Sykes, M.P., D.C.L.	1863–65
The Right Hon. the Lord Houghton, D.C.L., F.R.S. ..	1865–67
The Right Hon. W. E. Gladstone, M.P., D.C.L.	1867–69
W. Newmarch, Esq., F.R.S., Corr. Mem. Inst. of France	1869–71
William Farr, Esq., M.D., C.B., D.C.L., F.R.S.	1871–73
William A. Guy, Esq., M.B., F.R.S.	1873–75
James Heywood, Esq., M.A., F.R.S., F.G.S.	1875–77
The Right Hon. George Shaw Lefevre, M.P.	1877–79
Thomas Brassey, Esq., M.P. ..... (now the Right Hon. Lord Brassey.)	1879–80
The Right Hon. Sir James Caird, K.C.B., F.R.S.	1880–82
Robert Giffen, Esq., LL.D.	1882–84
Sir Rawson W. Rawson, K.C.M.G. C.B.	1884–86
The Right Hon. George J. Goschen, M.P., F.R.S.	1886–88
T. Graham Balfour, Esq., M.D., F.R.S.	1888–90

EXPERIENCES

IN RELATION TO

CHOLERA IN INDIA.

(FROM 1842 TO 1879.)

BY

SURGEON-GENERAL C. A. GORDON, M.D., C.B.,

Honorary Physician to Her Majesty the Queen, etc., and Vice-President of the Epidemiological Society.

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(*Read: January 17th*, 1896.)

Syllabus.

Introductory.—The plan in accordance with which the following remarks have been arranged is this: In the first place, to consider the phenomena of cholera presented

in the individual subject of that malady; in the second, those of an epidemic as a whole; in the third, some points relating to the incidence of particular outbreaks in regiments or other considerable bodies of British troops in India; in the fourth, some measures intended to be precautionary against its occurrence; and lastly, the therapeutic method which seemed most appropriate in dealing with individual cases. But with due consideration for time at our disposal, it becomes necessary to limit the number of points selected for comment, and also that the comments on each be brief, and in a sense fragmentary. The period to which the remarks refer is that from the beginning of 1842 to the end of 1879.

1. *Symptoms or Phenomena.*—Familiar as they are to those of us who have had considerable length of service in India, they are now recapitulated, with the objective view of enabling us the more definitely to realise the precise conditions with which we are about to deal.

Those which are characteristic of cholera are the following: Profuse vomiting and purging, the evacuations like rice water, painful spasms affecting the abdominal muscles and those of the extremities; suppression of urine nearly or altogether complete; the aspect of the patient once seen can never be mistaken, though difficult to describe in words; the sunken bloodshot eye, surrounded by a bluish zone; contracted features, the expression that of despair; restlessness of body; carelessness as to desire for life; intense thirst, the desire being for cold drinks to quench what is expressed by the sufferer as "burning heat" within, while to the hand the surface feels clammy and cold, the tongue and breath also cold. The voice has the distinctive "hollow" tone, little above a whisper, as characteristic in its way as are the indications enumerated; the fingers are corrugated, the entire surface livid, the pulse, at first rapid and small, becomes imperceptible, vomiting and alvine evacuations cease, the limbs are unmoved, vitality rapidly ebbs, and the patient appears literally to fall asleep in death.

The asphyxiated form of the malady was comparatively rarely met with during the period to which these notes refer.

2. *Sporadic Cholera.*—The characters so enumerated distinguish cholera, whether occurring in isolated cases or as an epidemic. On many occasions the former is preliminary to the latter. In 1861, it was so at various stations in Northern India, notably in respect to the 88th

Regiment at Moradabad, and the 42nd at Agra. In 1874, a similar circumstance was recorded. In that year isolated or sporadic cases occurred as nearly as possible simultaneously at stations far apart, namely, Fort William, Lucknow, Thyetmyo, Poonah, Dinapore, and Ferozepore. Whereas in Northern India such cases have their seasonal and irregularly periodic occurrence, in the Gangetic delta they happen at all periods of the year, generally in the absence of apparent cause, but on occasions after errors in respect to food or beverages, and at times as result of saline drastic or depressant medicines. Nor is the occurrence of idiopathic sporadic cases on all occasions followed by an epidemic outbreak, though for the most part it is so.

3. *Epidemic Cholera.*—The simultaneous occurrence of cholera epidemics at places in India far apart from each other has been often noticed and recorded. During the prevalence of a particular epidemic, the degree of its severity has varied at different places within its general area; in 1861 it raged with peculiar intensity at Gwalior, Agra, and Mecan Meer, while in Rohilcund it was comparatively mild in type. Neither is the severity of successive epidemics in the same locality alike, although all apparent physical conditions remain unaltered. Thus, in 1841, the district to the west of Cawnpore was very severely affected; whereas in 1842 the type in the same locality was mild. In 1875, certain villages in Central India that had suffered severely on a recent previous occasion remained exempt, while others within the same area were affected; yet, in 1876, those that had then escaped were affected. In Northern India the epidemic of 1852 was comparatively mild; that of 1876 comparatively severe within the same area.

As in the case of yellow fever in the West Indies, so with cholera in India: the occurrence of epidemics is periodic, the apparent conditions of particular localities affected remaining unaltered meanwhile. The duration of intervals between such epidemics extends on certain occasions to several years, and in this sense is more or less defined.

The incidence of particular epidemics is variable; the disease not unfrequently attacks soldiers of the same regiment and spares those of another, or all those located at the same stations, the circumstances and conditions of all being apparently identical. It has on occasions left soldiers exempt, while it attacked their wives and children; in others it has affected the men, leaving their wives and

children exempt—as happened notably in the epidemic of 1867. The occupants of a particular barrack-room may suffer, while those in adjoining apartments escape, as happened in Fort St. George, Madras, in 1870.

4. *Age.*—Statistics relating to the year 1872 record that of 118 children who died by the epidemic in that period only one was under four months of age; that the disease was comparatively rare during the two first years of life; but that the ratio of mortality to attacks was greatest in those of from two to three years old. According to a series of statistics extending over five years,* all ages suffer alike, from that of twenty to thirty and upwards—that constituting the period of a soldier's active life in India. Statistics relating to the intermediate ages are unavailable.

5. *Sex.*—According to general statistics the rate of attack among soldiers in India is 17.40 per 1000 strength; of deaths 7, as against 15.80 and 5 respectively among soldiers' wives. In the epidemic of 1869 the ratio of attacks to strength was 25.7; 26.1 among their wives and children; but, unfortunately, particulars are wanting with respect to the incidence of the malady in each of the two classes so included. On some occasions, so severe has been its rate of incidence among women in India, that there are observers who believe that in the mass their liability to attack is proportionally greater than that of men. But, as shown above, the results of observations relating to this point differed among themselves, and in different epidemics.

6. *Development of Epidemics.*—In 1845, epidemic cholera suddenly occurred in the month of June at Cawnpore; it raged with intense violence during four days, and then ceased with equal suddenness as it had appeared. In 1846, at Kurrachee and some other places, the epidemic outbreak was preceded by cases of diarrhœa and of sporadic cholera. In 1861, the epidemic which prevailed in northern India presented various modes of development in different places. In some it appeared suddenly; in others it was preceded, during variable periods, by diarrhœa and malaise. In some instances, isolated cases of cholera occurred in different parts of a cantonment distant from each other. On occasions, the malady, after prevailing violently for a few days, relaxed in intensity only to recur with increased virulence. In certain instances, communication with infected localities could be traced. In others simultaneous outbreaks occurred at places far apart, and in the absence of seemingly possible communication between persons, or with other infected places.

* Recorded in *Hygiene of Cholera*, p. 57.

In 1867, cholera appeared simultaneously at Hurdwar and Bijnore, separated from each other by the river Ganges; also at various places far apart, the intervening districts remaining unaffected. In 1869, the epidemic suddenly appeared in Rajpootana, occurring simultaneously at places 300 miles apart. In 1871, the epidemic suddenly and with great intensity occurred in the 18th Hussars at Secunderabad, affecting that regiment alone among the large force there stationed. In 1876, it affected the portions of the Chittagong district that had been inundated by the cyclone of that year.

7. *Diffusion of Cholera.*—On various occasions, notably in 1871, cholera has been restricted within definite limits, notwithstanding that free communication took place between the district affected and those around it. On the other hand, instances are numerous in India, as elsewhere, of an epidemic spreading far and wide; others, in which an epidemic of one period having affected a locality to which a previous outbreak had been restricted, has on the second occasion spread beyond the limits of that district. An occurrence of this kind was recorded in relation to the cholera outbreak of 1827, as compared with those of 1826 and 1825, namely, seventeen years prior to the earliest date properly included in these remarks, but noteworthy with reference to the present analysis.

In the year 1842, cholera prevailed in Lower Bengal, but did not extend northward beyond Cawnpore. [Here the circumstance may be noted parenthetically that, in 1817, the disease in epidemic form extended to Jessore from without, it having, in the first instance, occurred among the troops engaged in military operations in Bundelkhund.] In 1843, it prevailed with great intensity at Agra. During the period from 1840 to 1843, both inclusive, an epidemic current extended gradually down along the course of the Irawaddy to Rangoon, and thence to Moulmein. In 1844, a current of epidemic progressed from the Punjab south-eastward to Delhi, Bengal proper being free except as regards a few localities. In 1845, it extended south-east to Jhelum, Loodianah, Umballah and Meerut, from Peshawur; south-west to Hyderabad, Scinde. In 1846, it prevailed all over the Bombay Presidency; in 1848, at Dacca, Calcutta, Dinapore and Cawnpore, but did not

GEOGRAPHICAL POSITIONS OF PLACES NAMED.

STATIONS.	LAT. N.		LONG. E.	
	Deg.	Min.	Deg.	Min.
Agra	27	10	78	5
Allahabad	24	47	81	11
Almorah	29	35	79	41
Bijnore	29	22	78	10
Bellary	15	8	76	57
Bhaugulpore	24	32	86	21
Bombay	18	55	75	53
Calcutta	22	34	83	23
Cawnpore	26	28	80	23
Chittagong	22	21	91	52
Comorin, Cape	8	4	77	35
Cuddeypah	14	0	78	0
Curnool	14	54	77	46
Deccan	23	43	90	26
Darjeeling	27	2	88	18
Delhi	28	33	77	16
Dinapore	25	38	85	5
Ferozepore	30	56	74	38
Ganjam	19	22	85	2
Ghooty	15	6	77	41
Gondak	27	7	82	0
Gwalior	26	13	78	12
Hasarabagh	23	59	85	24
Hurdwar	29	57	78	12
Hyderabad, Scinde ...	25	23	68	24
Jhelum	32	55	73	46
Jounpore	25	41	82	43
Jubbulpore	23	11	79	59
Kurrachee	24	51	67	4
Lahore	31	34	74	21
Loodianah	30	55	75	53
Lucknow	26	51	80	58
Madras	13	4	80	17
Meean Meer	31	30	74	25
Meerut	29	0	77	45
Mooltan	30	11	71	28
Moulmein	12	35	97	58
Moradabad	28	49	78	49
Monghyr	25	22	86	30
Nursingpore	22	56	79	14
Nynee Tal	29	22	79	29
Poonah	17	54	73	24
Poonee	19	48	85	51
Rangoon	16	55	76	25
Rohilcund (see Moradabad) ...	28	49	78	49
Salem	11	39	78	11
Saugor	23	49	78	43
Secunderabad	17	26	78	33
Shahjehanpore	26	50	83	53
Simla	31	6	77	11
Thyet Myo	17	35	96	32
Umballah	30	21	76	52
William, Fort, Calcutta ...	22	34	83	23

extend northward beyond Agra. In 1849, Behar and Central India suffered, the epidemic reaching Bombay from

the eastward. In 1851, in the south-western parts of Bengal, in the Madras and Bombay Presidencies, and along the western coast. In 1852, over the North-Western Provinces and Punjab, extending to the mountain stations of Almorah and Simla. In 1853, in Dacca and Assam, extending to, but not beyond, Cawnpore. In 1854, in Bengal proper, and in that province only. In 1856, simultaneously at several places around Agra, extending thence to Gwalior in the south, and to Nynee Tal in the north. In 1857, with great violence among the troops besieging Delhi, more especially in the 75th regiment.* In 1859, in Lower Bengal, and to, but not beyond, Cawnpore in that direction; also at Bombay, and along the western coast from Kurrachee to Cape Comorin. In 1860, in Bengal, Oude, and Bombay; also in Assam, and thence to Darjeeling. On the same occasion it prevailed with great intensity at Agra.

In 1861, the great epidemic of that year in one region extended along the Grand Trunk Road. It thence branched off, passed over several villages, and attacked others more distant. In some portions of a district it prevailed with great virulence; in others, with less intensity; and villages occasionally escaped attack in the absence of apparent conditions to account for the circumstance. In Rajpootana the epidemic suddenly appeared in the Bhurtpore district; thence it spread in a north-west direction; it also extended south-west to a particular point, where it suddenly ceased. It did not attack the British troops in the Fort of Lahore until three weeks after it had become prevalent among those at Meean Mear, nor could any communication be traced as having taken place between those in the two localities. In Northern India generally, that particular epidemic seemed to be diffused independently of all discoverable conditions.

Official reports with reference to that epidemic in northern India record that it crossed and moved directly contrary to currents of rivers and of wind; that when the wind blew in directions favourable to the course of aerial miasmata, the epidemic did not appear to advance with any particular velocity.

In 1863, cholera prevailed along the valley of the Ganges, extending to Hazarabagh on the one hand, to

* The 75th had been rapidly brought from the hill station of Kussowlie to take its part in actions against the mutinous Sepoys. Other regiments, whose service had been long and continuous at stations in the plains, either escaped cholera, or suffered to a comparatively small extent during the campaign of the Mutiny.

Oude on the other. It prevailed in Bombay also, having been conveyed, as believed, by pilgrims. In 1864, all over Bengal, central and western India, including Bombay. In 1865, along the Malabar coast, in Mysore and Bellary, in Bombay and Scinde. In 1866, in the west of India, Punjab, Cashmere, and Afghanistan; also in Bengal proper. In 1867 it continued to prevail in the Punjab, Cashmere, and Afghanistan. In 1869, in Central India. In 1874-5 the epidemic was unusually diffused over India, the mortality greater in the latter than in the former year.

8. *In Relation to Rivers.*—River deltas in which cholera is endemic, and occasionally epidemic, differ among themselves in respect to geology, the nature and quantity of impurities deposited, the range of temperature and extent of rainfall along their courses; as, for example, those of the Brahmaputra, Ganges, Godavery, Cauvery, Nerbudda, and Indus; so in respect to the course of those rivers and of their respective tributaries. Yet, according to statistics, of 152 outbreaks of cholera in the Madras Presidency, 106 have occurred in places adjoining rivers.

In 1842, and subsequently, troops ascending the Ganges in country boats were suddenly attacked while the boats were moored for the night at particular places, the disease not persisting on their proceeding therefrom. Of such localities, one was near Bhaugulpore, a second near Monghyr, and a third opposite Dinapore. On occasions cholera prevailed along both sides of a river; thus, in 1861 it affected the natives on both sides of the Jumna, near Allahabad; in 1876, on both sides of the rivers in the Narsingpore district of the Central Provinces.

In some instances, the progress of an epidemic has been downwards along a river course; as, for example, in 1842, when cholera so followed the flow of the Irawady from the north; in 1845, from Peshawur, an epidemic current descended by the valley of the Indus, and so reached Kurrachee. In other instances, the progress of an epidemic has been upwards, as against the current of a river; thus, in 1862, cholera having occurred at Taku, extended thence upwards against the Peiho, and so reached Peking. A river has acted as if it were a barrier against the further progress of an epidemic; in 1862, in Rajputana, the course of cholera seemed to be so turned by the rivers Bunass and Chumbul.

9. *Potable Water and Cholera.*—The principle was generally accepted, and acted upon, that a connection existed between the use of contaminated water and the occurrence

of cholera, whether in individuals or communities. But observations made over extensive tracts of country, comprising numerous military stations, presented differences among themselves in respect to the degree to which that connection has existed, or existing has been traced. For example, in 1861, at Calcutta, of nineteen persons who drank water subsequently ascertained to have been contaminated by recent cholera dejecta, five became affected with that disease within three days, while fourteen remained unaffected.

In 1867, cholera spread in several gaols in Bengal, the drinking water of which was declared free from contamination; the epidemic appeared in places where, although the natives drank contaminated water, they had drank the same water continuously during the preceding twenty-three years, but remained the while exempt from the disease. At Peshawur, in 1869, the native troops used water contaminated with fæcal matter, and escaped; the 104th Regiment obtained its supply from a well declared pure, yet the soldiers belonging to it suffered severely. In 1871, at Secunderabad, cholera became epidemic in the 18th Hussars; while it was so, the soldiers were using the same water supply they had previously employed without evil result. During the prevalence of the epidemic in that regiment, other troops used the same water supply, yet remained unaffected by the disease. In 1872, a similar circumstance occurred at the same station; of various bodies of troops using the same water supply, some suffered from cholera, some did not. Other instances could be given did space permit.

Throughout the long period referred to in these notes, various methods have been applied to potable water with the assigned object of counteracting contamination by choleraic poison. The subject has been much dwelt upon by both army and civil medical officers in India, and by commissions, international and others, the general results being that they doubt if boiling, or filtration, or both combined, are sufficient to counteract contamination with that "poison".

Various methods of purifying water for barrack use have been used in India; among them the native plan by means of *strychnos potatorum*, lime, sand and gravel, charcoal and sand, magnetic oxide of iron and sand, filtration by means of double casks, according to the method of Dr. Lind and others.

10. *In Relation to "Poison" and "Germs".*—In India,

during the period now referred to, chemical and microscopical investigations relative to cholera were actively conducted, more especially in the concluding decade of it. So far the results of those investigations were declared to be negative in respect to the former; while with reference to the latter they were expressed after this manner: No special fungus has been detected in choleraic matters which had not also appeared in other media; there is no specific germ to be found in the atmosphere of localities where cholera prevails that can be connected with the production of cholera. The nature of the generating principle of cholera has evaded all investigation; it is only known by its effects; the presence of a cholera poison has been assumed; the disease is only known to us as a phenomenon; there is not a jot of evidence to prove that there is a causative entity which gives rise to the phenomena—such was the conclusion arrived as a result of observation and inquiry up to the end of the year 1879.*

11. *Relation to Atmospheric Conditions.*—In 1843, at Agra, the month of June was characterised by unusually severe thunderstorms and heavy rains; in July cholera of virulent type occurred in the 39th Foot, and continued onwards through the greater part of August. In 1845, at Umballa, the seasonal rains suddenly ceased, the sky became clear, the sun bright: simultaneously with the change cholera occurred. In the same year, at Madras, the epidemic of cholera was attended by a hot land wind by day, with heavy rainfall in the evening. In 1846, at Kurrachee, the violent epidemic in the 78th Regiment was attended by a moist and stagnant state of the atmosphere. In 1848, during the prevalence of a similar epidemic in the upper provinces of Bengal, there was a seasonal deficiency of rain. In 1854 the epidemic was attended by low barometric pressure and temperature, with rain and constant movement of the atmosphere. Similar differences characterised subsequent years.

12. *In Relation to Prevailing Winds and Storms.*—In 1849 cholera reached Bombay from the eastward, the south-west monsoon at the time prevailing in full force. The epidemic of 1856 appeared to be unaffected by the

* *Germs.*—Their presence bears the same causative relation to cholera as infusoria and other minute organisms which exist in myriads in the muddy waters around and beyond Saugor Island bear to the storm wave which, under the influence of the cyclone, sweeps over and devastates huge tracts of Lower Bengal; or which the motes that similarly exist in the clear still atmosphere bear to the destructive hurricane.

direction of the prevailing wind. In July, 1860, at Ganjam, cholera advanced against the south-west monsoon. In 1865, in Bengal, it advanced against the same monsoon. In 1869-70 it traversed the Madras Presidency in opposition to the prevailing wind. In 1873, at Thyet Myo, the 45th Regiment was severely affected at the same time that the occupants of the native town and gaol, both situated to windward, were exempt; as were also the Royal Artillery and their followers, all of whom were situated to leeward of the 45th. In 1869 epidemic cholera in the gaol at Jounpore suddenly ceased on the occurrence at that place of a storm in the month of August. In 1871, at Secunderabad, the occurrence of a dust storm heralded the disappearance of the epidemic from the 18th Hussars. But in 1845, at Meerut, cholera of very virulent type attacked the 10th Foot immediately after the occurrence of a hurricane, an officer, and the wife of an officer, being its two first victims. In 1846 a similar occurrence happened to the 88th Regiment at Kurrachee. In 1861 at Meerut; in 1867, at Meerut, Peshawur, and Hurdwar. But in 1872 instances occurred in which the outbreak of cholera was neither preceded by atmospheric storms nor other perturbation.

13. *In Relation to Season.*—In 1842, cholera occurred in Bengal in April, and continued throughout the remainder of the year. In 1843, at Agra, in July and August. In 1844, at Peshawur, in November. In 1849, at Bombay, in August. In 1850, at Bombay and in Central India, during the rainy season (June, July and part of August). In 1852, at Almorah, Dehra, Umballah, in May to July; Moradabad, in September. In 1853, in the eastern parts of India, through the winter or cold season. In 1855, at Dinapore, in May; and at no other station throughout that year. In 1861, at Meean Meer, the intensely severe outbreak made its first appearance on 2nd August. In 1863, at Madras and lower part of the Gangetic tract in the early months of the year. Bombay, Agra, Hazarabagh, and Gondah in July; Central Provinces in October and November. In 1864, Central and Western India, in March. In 1867, in the Punjab, in May. In 1869-70, at Thyet Myo, among British infantry in the hot weather (May and June) of each year; Royal Artillery, in the rainy season (July and August), the Indian troops and native Burmese escaping on both occasions. In 1871, at Secunderabad, it appeared on 25th May. In 1872, at Meean Meer, on 31st July. In 1873, as in 1869-70, among the British infantry during

the hot weather; Royal Artillery during the rains. In 1875-6, in the Central Provinces, during the rains (July and August). The sudden occurrence of one or more deaths in the European inhabitants of Calcutta in February, or early days of March, is painfully familiar to residents in that Presidency capital.

14. *In Relation to Natives and Foreigners.*—In 1843, at Agra, the 39th Regiment, and white soldiers of the East India Company's Artillery were severely affected, while the native troops in their immediate vicinity were so in a very slight degree. In 1848, at Dinapore, cholera raged in the 80th Regiment, but in a mild form among the Sepoys and in the native bazaar. In 1853, at the same station and in the surrounding district, it affected the British troops more severely than those of native regiments. In 1861, at Meean Meer, the first person attacked was a native, but the epidemic fell entirely upon the white troops, the Sepoys and the native population remaining almost completely exempt. In 1867, at Shahjehanpore, the British troops suffered severely, so did the native population, but the Sepoys only in a slight degree. In 1871, at Secunderabad, the 18th Hussars suffered; so did a few native residents; the epidemic spared all the other troops, British and native; but having ceased in the Hussars, it attacked the native general population. In 1872, at Lucknow, the British troops suffered, the Sepoys and their native followers remaining exempt. Various other illustrative instances could be given did time and space permit.

15. *In Relation to Certain Other Diseases.*—In 1853, epidemic cholera in Calcutta was followed by the prevalence of a form of fever to which the name of "typhoid" was then given. In 1861, on the other hand, when cholera prevailed at Delhi, the more usual endemic diseases were below their average. In 1869, at Madras, cholera was preceded by "an unhealthy wave"; wounds and ulcers manifested an unusual tendency to become gangrenous. In 1877, cholera and diarrhœa prevailed together in the Wynaad.

In 1844, at Ghazepore, the 29th Regiment suffered severely from fever, the attacks attended by a degree of prostration similar to the collapse of cholera. In the same year, in The Buffs at Meerut, severe attacks of fever often lapsed into cholera. In 1856, at Peshawur, various cases of the severe form of fever prevailing speedily ran into collapse similar to that of cholera. In 1861, at Lahore, Umritsur, and Agra, cholera and intermittent fever

prevailed simultaneously. In 1869, they did so at Peshawur, Umritsir, and various other places. On the banks of the Ganges, however, there was no proportion between the intensity of a malarious epidemic and one of cholera; each attained its climax at a different season of the year from the other. Occasional instances have been observed in which the subject of cholera has presented the yellow tinge of the surface and the black vomit characteristic of yellow fever in the West Indies. Others are familiar, in which the cold stage of intermittent fever lapses into the collapse of cholera, and no less so with "secondary fever", to which the convalescent from cholera so frequently succumbs.

This aspect of the general subject is of sufficient importance to justify the addition of some further illustrative examples, namely: In 1869, at Ghooty, fevers and cholera prevailed simultaneously. In 1872, at Secunderabad, the first person of 18th Hussars attacked was a soldier affected with intermittent fever; in that year also, an epidemic of fever immediately succeeded one of cholera in the majority of military stations in the Bengal Presidency, more particularly at Allahabad, Meerut, Meean Meer; also at Peshawur and Mooltan.

Nor are observations to the same effect confined to the period to which this paper is properly limited; similar remarks are recorded in the years 1477 and 1575. Ancient Hindoo writers allude to similar occurrences in reference to the disease "Jiwar-antishar", believed to have been cholera. Even Hindoo mythology gives prominence to the existence of a similar empirical belief in relation to certain other diseases, personified respectively under the figures of "Oola Beeby"* and "Seetala".

16. *In Relation to Animal Life.*—In June, 1846, it was observed that for some days previous to the outbreak of cholera in the 86th Regiment at Kurrachee, carrion birds, usually numerous around barracks, disappeared; while the epidemic prevailed, some of the dead were buried on the sea-shore, the dearth of wood rendering it impracticable to provide coffins for them; their graves were left untouched by prowling animals (hyænas and jackals), by which such places had on previous occasions been attacked.

Concurrently with the epidemic in South Canara and Malabar in 1869, the coasts were strewn with dead fish.

* Called also "Mahamararee".

At Lucknow, in 1872, the horses of the 19th Hussars suffered from an affection precisely like cholera, then prevailing among the soldiers of that regiment. In 1875, at Delhi, while cholera was epidemic among the troops, seventy-five cats were reported to have died from an affection presenting all the characters of that disease. In the past history of cholera similar examples are somewhat abundantly recorded. [In relation to plant-life, results of observations made in India are not available. Those made elsewhere are on record, showing in some instances the coincidence of blights in cereals with outbreaks of cholera.*]

17. *Whether Contagious and Infectious.*—During the period to which these notes refer, different opinions prevailed among medical officers in regard to contagion and infection, according to the ordinary significance of those expressions: the opinions in question being the outcome of individual experience. Thus, in 1843 and 1844, while cholera prevailed severely in the Buffs at Allahabad, soldiers affected were placed promiscuously in wards, nor did an instance occur in which occupants of adjoining beds were seized by the malady. In 1848, during the outbreak among British troops at Cawnpore, no medical officer or hospital attendant became affected. In 1861, at Meean Meer, the mortality among the soldier orderlies employed in hospitals was great, but medical officers and native attendants altogether escaped. In 1865, during the epidemic in the Madras Presidency, a large proportion of medical officers and of hospital attendants succumbed. In 1875, of sixty-seven hospitals in India in which cholera sick were treated, no attendant was attacked in fifty-nine.

18. *In Relation to Troops in Motion.*—During the same period the occurrence of cholera in bodies of troops on the line of march was so frequent as to point to the act of travelling being itself a predisposing cause of the malady. This liability was recorded to be greater in the Madras Presidency than elsewhere in India; and in that Presidency, most of all in the districts of Bellary, Cuddapah, and Kurnool, the ratio of mortality greater among large bodies than in small. On occasions the attack has occurred while meeting and in contact with bodies of pilgrims; on some it has clung to troops so situated; in others it has ceased on their emerging from the masses of pilgrims. On the one hand, under such circumstances troops affected have

* *Hygiene of Cholera*, p. 167.

been the means of conveying the epidemic to the civil population; in others, the epidemic has extended from the civil population to them.

19. *In Relation to Conservancy.*—During the period under review, the general result of experience confirmed the belief that insanitary conditions of places or persons favour the occurrence of cholera in them; that wherever sanitation was neglected, there cholera, having originated or been introduced, became concentrated and intensified. But experience pointed to the conclusion that insanitary conditions are not, under all circumstances, and by themselves alone, the originating cause of cholera. For example: in 1856 the ravages by the disease were very great at Meerut, a station noted for the excellence of its sanitation; while at Saharunpore, a peculiarly dirty city, few persons suffered. In 1861, at Allahabad, the Wellington Barracks, situated in the worst locality, were exempt; while those situated in more favourable localities were affected. In that year the 52nd Regiment, occupying barracks sanitary in themselves and in situation (in the King's Mews), suffered severely, while the crowded and dirty city of Lucknow was exempt. In 1867, at Lucknow, Meean Meer, and Morar, occupants of localities close to filth pits, and otherwise objectionable, escaped, while those in more "sanitary" positions were affected.

20. *Quarantine by Land.*—Experience showed that in Indian cantonments the strict application of quarantine was impossible. In the Punjab, the people concerned declared that they preferred the cholera to the restrictions implied in that measure. In 1869, it was declared to have failed at the stations to which it was applied. In 1872, some of those in which no quarantine was observed escaped; at others to which it was applied cholera raged violently; for example, at Roorkee strict quarantine was observed, yet cholera occurred there for the first time during seventeen years. In 1875, while cholera was at a distance of forty miles from Salem, Madras Presidency, quarantine was applied in the direction of the point affected, but the epidemic suddenly occurred in that town.

21. *Encamping Troops.*—According to official records, the method of removing troops into camp, and of changing camp grounds during cholera epidemics, was adopted with good results at Madras so long ago as 1774; in the West Indies, during the prevalence of yellow fever, from a still earlier date. Adverting to the period proper, embraced

in the present paper.* In 1843, at Agra, the 39th Regiment was moved from the infected barracks into camp at Rambagh; within a week after that move had been made, cholera ceased in the regiment. In 1848, the 1st European Fusiliers at Cawnpore, and 31st Regiment at Umballah, were moved into camp from infected barracks with the result that in both corps the disease ceased. In 1861, when cholera raged violently among British troops at Meean Meer, a portion of them were marched across the river Ravee and encamped at Shadera: the epidemic thereupon ceased in that particular portion, but continued to prevail among the soldiers left in cantonments. At Umritsur, on the same occasion, no case occurred among the men of the 94th Regiment after they had been moved into camp. At Meerut, with regard to the Royal Artillery and 8th Hussars, and at Agra, with the 42nd Regiment, the move into camp was similarly successful, although the rainy season prevailed at the time.

But not on all occasions was the movement of British troops into camp so successful. In 1845, cholera occurred in the 31st Regiment at Umballah. The effectives were sent into camp during the prevalence of the rains; their tents got blown down, the men, their clothes and bedding were rendered completely wet; during the succeeding night cholera occurred violently among them. In 1856, at Meean Meer, a body of European artillery were marched from infected cantonments to camp; cholera did not appear among them while encamped, but on their return to barracks, forty-eight hours thereafter, cholera attacked some of their number. In 1867, similar measures were adopted at various stations, at some successfully; at others the disease was not checked; while at a few, "evils took place little, if at all, less than cholera itself."

22. *Precautionary Measures.*—Throughout the period referred to in these notes, rules and regulations, the joint result of experience on the part of the higher medical, military and civil authorities in India, have been issued from time to time; whenever cholera threatened or actually attacked British troops, those regulations were most carefully carried out by regimental officers, military and medical, such additional details being supplemented as

* When in 1817 cholera attacked the forces under the Marquis of Hastings, operating between Saugor, Jubbulpore, and Munoola, Central India, the epidemic ceased on the force being moved to the high ground of Gwalior. On that occasion the epidemic seems to have extended from Benares, Allahabad, and Mirzapore.

became necessary by individual conditions. A resumé of such regulations is given in the volume on *The Hygiene of Cholera* already mentioned. In them stress is laid upon the necessity for the early administration of remedies, and full instructions given as to the means by which that measure is to be provided for.

The codes of rules thus alluded to have reference, respectively, to troops in transit by railway and on the march; in cantonments; to conservancy of camps; and to the management of soldiers' families during times of epidemics.

23. *Inoculation against Cholera.*—During the period under notice no case was recorded in which cholera was communicated to man by means of inoculation; that is, by punctures accidentally received while performing autopsies. The blood and evacuations had often been similarly brought in contact with a recent wound without producing evil results.

There is on record only one form of "inoculation" intended to be protective against cholera as having been adopted during that period. This happened between the years 1862 and 1864, at Calcutta, when, at the instigation of Dr. Honigberger, inoculation was performed, the material inoculated being a preparation of Quassia, generally believed to be the simple infusion of that wood. For the time being success was said to follow the process. Within a few months thereafter the subject had passed into oblivion.

24. *Treatment.*—The result of general experience was that only in the early stages of attack by cholera did success seem to reward medical treatment, except in comparatively rare instances; hence arrangements existed regimentally both in barracks and in hospital with that object. Of various methods used, the following epitome represents that which, personally, I was led to consider the most appropriate: namely, calomel, concentrated stimulants, including sulphuric æther, and ammonia, together with carminative tinctures in a suitable vehicle. Diluted medicinal hydrocyanic seemed on occasion to allay gastric spasms, and so enable the stomach to retain those remedies. Frictions to the limbs: *iced* water in small quantities (ice itself not obtainable in the earlier years of the period), warmth externally. The vital powers having shown signs of restoration, they were encouraged by means of continued dry warmth externally, and hot restoratives, medicinal and alimentary, within; these continued till convalescence was

established. Except in the very earliest stage of the malady, opium was omitted. Its use was considered to increase liability to secondary fever.

25. *Summary.*—A careful survey of the data so adduced seems to me to support the deductions therefrom as follows, namely:—

1. That the symptoms or phenomena in an individual case of cholera are definite and characteristic.

2. In certain instances sporadic cases of cholera have immediately preceded an epidemic of that malady; in others, no epidemic has followed.

3. In some instances the sphere of an epidemic was more or less definitely restricted; in others, there seemed to be no definite limit. Outbreaks have occurred simultaneously at places far apart. Their respective degree of incidence has varied.

4. The period of life presenting the greatest liability to attack by cholera would seem to be twenty years and upwards.

5. Varieties have been presented in different epidemic outbreaks in regard to the relative liability of the sexes to cholera.

6. In certain instances the outbreak of an epidemic has been sudden; in others gradual. In some it has quickly culminated and disappeared; in others more slowly, and persisted during longer periods. In another class of instances, an epidemic having moderated in prevalence or mortality has suddenly recurred with increased intensity.

7. The diffusion of epidemics has taken place in various directions, without apparent reference to lines of traffic, or to prevailing winds. The directions recorded include eastward, south, south-west, north, and west.

8. A large proportion of epidemic outbreaks have occurred in places adjoining rivers. In some instances the progress of an epidemic has been downwards along the river course; in others, upwards against the current. The progress of an epidemic has been apparently stopped by the occurrence of a river in its line of progress.

9. Evidence differs in regard to the relation assigned to contaminated water in the causation of a cholera epidemic. Illustrative examples, *pro.* and *con.*, are given in the text.

10. The observations recorded on the subject of specific "germ" and "poison" in relation to cholera had negative results.

11. Atmospheric conditions during epidemics of cholera

have been various, except with the general existence of an increased hygrometric state.

12. Neither prevailing winds, nor the occurrence of storms such as prevail in India, have had apparent influence on the occurrence or cessation of cholera epidemics.

13. The months of the year during which cholera epidemics were most prevalent included those from March till November. In Bengal, during the earlier part of the year; towards the south-west during the later; in Western India, June, July and August.

14. On many of the instances recorded, British troops suffered more severely during particular epidemics than did the Sepoys or native populace.

15. Observations seem to confirm native belief in the existence of a connection between cholera and the maladies recorded in the text.

16. The occurrence of disease, and of certain unusual phenomena in various classes of the animal kingdom, have been observed during the prevalence of cholera in man. Observations on plants wanting.

17. Certain instances are given indicative of cholera being contagious in those enumerated; others are given which point to this property not being constant under all circumstances.

18. Troops on the line of march are shown to be in an especial degree liable to be attacked by epidemic cholera. They may become infected from the general population, or may be the means of communicating cholera to them.

19. Imperfect conservancy is shown to favour the occurrence of cholera; but instances are recorded in which troops occupying barracks in most "insanitary" positions suffered little, or altogether escaped, while those in more "sanitary" barracks suffered severely.

20. Quarantine has failed at stations in India to which it has been applied; it has at others proved impracticable.

21. The practice of moving troops affected with cholera into camp dates from the eighteenth century. In certain instances the measure has proved successful; in others not so. Minute instructions regarding this measure exist.

22. Minute rules relative to precautionary measures against cholera among troops have also been published.

23. Inoculation of various kinds had negative results.

24. A particular method of treatment, deemed to be relatively successful, is detailed in the text.

Conclusion.—The particulars now submitted have been selected from among such as came directly within my own

knowledge while serving in the capacity of a regimental surgeon in India, or were recorded in official documents which came under my cognisance as an administrative medical officer in that great Dependency. They are here related in the form of bare narrative, such conclusions being drawn therefrom as the data presented seem to justify and support. This being so, I would venture to express a hope that, notwithstanding the high antiquity of the period referred to, the remarks I have dared to formulate may be accepted as a contribution to the literature of what has heretofore proved to be the most extensively fatal and intractable scourge by which, during the greater part of the present century, British soldiers in India, together with their wives and children, have been from time to time afflicted.

A Lecture

ON

VACCINATION AGAINST CHOLERA.

Delivered in the Examination Hall of the Conjoint Board of the Royal Colleges of Physicians of London and Surgeons of England, December 18th, 1895.

BY

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THE PRINCIPLES OF PREVENTIVE INOCULATION.

BEFORE dealing with my work in India allow me to recapitulate here the chief circumstances connected with the problem of preventive inoculation. After experimental medicine had been inaugurated the efforts of bacteriologists remained for a long time concentrated on that classical form of infectious disease, splenic fever, in connection with which the fundamental laws of the new science have been elucidated. It was reserved to Dr. Koch to discover in the formation of spores the means by which the microbe of this disease, when outside the animal body, protected itself against the external world. Shortly after this it has been found that the spores not only preserved the life, but also all specific properties of the microbe, and that it is owing to this circumstance that the bacillus of anthrax is one of the most constant species of schizomycetes known. On the other hand, a great mutability of properties has been discovered in all microbial virus not possessing spores, or in which sporification is arrested for a certain period. On the bacillus of chicken cholera Pasteur observed for the first time the loss of virulence in a microbe of a high infectious power. Since then it has been found that the virus of every disease, although it remains constant in the nature of the affection it produces, varies without limit in virulence; that in one and the same specimen this property can be diminished or strengthened by special proceedings, and that in this we have the greatest part of the explanation of the variability of disease in individuals and communities.

This variation in virulence was familiar to all observers, and from time immemorial has been turned to advantage by the peoples of the East. It is known that the practice of inoculation against small-pox was originated from the observation that there are mild and severe epidemics of the disease, and that people affected in mild years remained immune in severe years. At the appearance of a non-fatal epidemic every one wished to get through the disease, and not only did not avoid infected people, but sought their presence and a close contact with them. A practice thus

arose in Asia to take artificially the infectious stuff from mild cases and to communicate it to healthy people. Unfortunately, very often in a resistent patient a mild semblance of disease conceals an infectious agent of unexpected virulence, and such virus, on being transferred to a less resistent subject, produces a terrible attack, not infrequently leading to a fatal epidemic in the community. In view of this dangerous character the religious laws of the Hindus, by special regulations, restrict the practice, and the Government from time to time find themselves under the necessity of instituting legal proceedings against those who apply the method. As soon as Jenner discovered an attenuated virus, and showed the method of keeping it in the desired strength by passage through the calf, the practice became immediately safe and certain, and the Eastern method has been abandoned in the whole civilised world.

In the case of small-pox, however, as in the case of rabies or syphilis, the disease is communicated from individual to individual, and the morbid virus is cultivated exclusively in the animal body, under conditions varying little in their character. The modifying influences become infinitely greater when a virus can grow in a saprophytic form and is exposed, in the interval between visiting animal bodies, to the vicissitudes of nourishment, oxidation, light, temperature, which are to be found in the external world. Even microbes, like that of anthrax or tetanus, provided with protective spores do not escape this law, and one finds in Nature their specimens presenting a very large scale of modifications; but there appears to be no limit to variability in infectious virus leading a saprophytic life and deprived of the sporulating faculty. The microbe of cholera is one of the most striking examples of this phenomenon.

Variability of the Cholera Microbe.

When the cholera bacillus was first discovered, eleven years ago, its properties were described with great precision, which helped in concentrating for a long time all studies on well-defined and carefully-chosen specimens. Little by little, as the field of investigation grew larger, a number of varieties have been found with characteristics differing so largely as to annihilate almost completely the original description. When we open the intestines of deceased cholera patients and investigate the microbes there, the adopted methods will bring to the surface vibrios in which the external form, instead of the characteristic comma or spirillum, will vary between a coccus and a straight thread; the number and disposition of the cilia, the secretion of acids, the form of growth in broth, will vary; instead of giving in gelatine a discrete and well-defined figure of liquefaction, the variation will extend from the complete loss of this property to a rapid dissolution of the whole of the medium; there will be varieties which grow luxuriantly in given media, and others which do not grow there at all; some will be phosphorescent in the dark, and others not; some will give the indol reaction, and others will be deprived of this property, and so on. The first thing to be done is carefully to select amongst these the most typical specimens, rejecting the others, and then we try their pathogenic power. We shall find such a divergence in strength that the extreme forms will not be believed to be of the cholera species. There will be commas deprived of any

virulence demonstrable on animals, and others which kill the most resistent species. Some will be fatal to a guinea-pig at a dose of $\frac{1}{1000}$ of a culture tube, and others harmless in doses 500 times stronger. The average comma dies out when introduced under the skin to an adult animal; others will spread in the system and give a fatal septicæmia. The ordinary comma will be without effect on birds; but several specimens have been isolated, and believed to be typical, which easily killed pigeons by hypodermic or intramuscular injection. I believe to be of great value the method worked out by Pfeiffer for comparing all such varieties with one selected as typical, and which he employed for the preparation of an antitoxic serum. This method will be found of efficient help in distinguishing specimens of the greatest affinity with the average cholera comma. But once such specimens are selected and their particular properties studied, they begin to change from the first day they are introduced into the laboratory, and no calculation based on these studies is possible. In a case quoted by M. Metchnikoff, the proportion of initial power of the microbe, and the strength it showed at a later trial, was of 75 to 1, the microbe having gradually sunk to $\frac{1}{75}$ of its initial virulence. If, for producing a certain infectious, or preventive, or curative effect, we had to use, in the first days, 1 c.cm. of this culture, later on a dose smaller than 75 c.cm. would be without effect, and the changes of the microbe would certainly continue still further.

The System followed in India.

In all operations on men done in India we used exclusively living cholera virus, for the reason that sterilised cultures or products of cultures, as a rule, produce an effect of a far shorter duration than living microbes. The symptoms in anticholera vaccination consist in localised swelling and pain in the side, at the seat of injection, and in an attack of fever. The pain is felt only on pressure, and its amount is such as to prevent a soldier from putting on his belt for a couple of days, and a coolie worker from doing work involving bending the body or stretching otherwise the interested tissues. But the intensity of the symptoms and their duration vary in direct proportion with the virulence of the cultures and the doses administered. On the other hand, in all forms of preventive treatment the amount of protection depends on the intensity of reaction produced in the subject. A small dose of a given virus, or else the same dose of a weakened virus, will produce less reaction and afford less protection; a higher dose of the same virus, or the same dose of a stronger virus, produces more reaction and affords a higher and, probably, more lasting protection.

In the first period of my work in India I adopted $\frac{1}{10}$ of a standard culture, of a given strength, as a dose for an adult person. The reduction of this dose by a small fraction is sufficient not to produce in the subject any noticeable reaction at all. Later on, after the first series of observations was collected, I was induced to apply a treatment by increased doses of a stronger vaccine. A series of experiments and observations, for which I am especially indebted to Dr. Arthur Powell in Cachár, have been instituted with this object. It has been

found that with the increase of the doses the amount of local pain, and especially that of general discomfort, was proportionately increasing, the fever was of a more severe type, and lasted longer, disabling the men for work for four, five, and more days. In Dr. Powell's mind there remained no room for doubt that with the increase of the doses the operation would become fatal to man. The limit of the doses adopted for the strength of the vaccines we used was between $\frac{1}{2}$ and $\frac{1}{4}$ of a culture.

From this it will be seen that it is a matter of vital importance, a *sine qua non*, in order not to exceed or fall below the intended reaction, to have a method of fixing the properties of this modifiable microbial virus, to keep it at the same degree of activity, and to know exactly the amount of power contained in a given dose.

The general method worked out for that purpose consists in finding out an animal susceptible to the given virus, and discovering the conditions in which the virus can be transplanted from animal to animal without interruption and without having recourse to artificial media. Jenner's method in its essential features remains intact, and our proceedings correspond exactly to the cultivation of vaccinia from calf to calf, or from vaccinated man to man. The particular difficulties which were connected with the diseases for which vaccines have been worked out, have been treated in the technical literature, and I believe there is no room for dealing with the matter in the present lecture. The terms virus and vaccine are still used in the same sense as they were used in regard to small-pox. The infectious substance from a subject who naturally fell ill from a disease—a small-pox patient, a rabid dog, a person affected by cholera—is a virus; the Eastern practice of inoculating small-pox virus against small-pox is variolisation. On the other hand, the substance cultivated under conditions intended to keep the morbid agent at a given and fixed state of virulence, permitting the use of it with safety and sure measurement, such as Jenner's calf lymph, or Pasteur's rabies emulsions, is a vaccine, and the application of such substances for preventive treatment is called—following the suggestion of Pasteur and in honour of Jenner who first used the term—vaccination.

The method which I worked out for the preparation of two cholera vaccines, one weakened and a second one strengthened, has been described in my previous lecture delivered in this hall three years ago.

It is the difference between vaccination and variolisation that distinguishes the method which I have applied in India from that tried in Spain by Dr. Jaime Ferran in 1885. Ferran's operations consisted in inoculating vibrios collected from cholera patients. The method employed in India consists in inoculating a vaccine worked out following the proceedings of Jenner and Pasteur.

The difference between the two operations is such that Jenner's method has survived criticism and the test of a century's daily application, and has been vastly generalised; the other method, imitating the inoculation of small-pox virus against small-pox, had to be abandoned on every occasion where attempts to apply it were made. At present there is not a single practice, in therapeutics or in preventive medicine, where the use of living virus taken directly from infectious persons, is allowed, whether on individual

subjects, or, still less, in application to whole populations. The attempts made by Toussaint, previously to Pasteur's operations, of inoculating anthrax virus against anthrax, died out without the slightest possibility of practical application. In the treatment against anthrax by Pasteur's method, an excessive attenuation of the first anthrax vaccine, which was permitted to fall below the desired amount of virulence, caused on some occasions serious accidents. The neglect to make strict distinction between vaccine and virus was responsible for a disaster which occurred in the inoculation of sheep against anthrax in the south of Russia. The missadventure led to a prolonged suspension of all anthrax inoculations in that country, and partly in Austria-Hungary, and Italy; but one shudders to think of any similar accident occurring, instead of a flock of sheep, in a regiment of men. The attempts at inoculating cholera virus against cholera by Ferran had to be stopped by the Spanish Government, and was disapproved by all commissions sent out to investigate these operations by the Governments of Spain, Great Britain, France, Russia, Belgium, a result which was used as one of the arguments, seven years later, by the Government Committee in Russia, in refusing to admit the trial of my method of protection against cholera. On the other hand, *vaccination* against rabies has been going on these ten years with a marvellous precision, and has been already applied to about 15,000 people in France alone; innumerable flocks of domestic animals are vaccinated yearly in different parts of the world, against anthrax and pig-measles. And now we come to record the results of upwards of 70,000 injections of living bacteria, performed on 42,179 people, without having to record a single instance of mishap or accident of any description produced by our vaccines.

Indian Experiences.

My actual work in India lasted twenty-nine months, between the beginning of April, 1893, and the end of July, 1895. During this period the anticholera vaccination has been applied to 29¼ British officers, 3,206 British soldiers, 6,629 native soldiers, 869 civil Europeans, 125 Eurasians, and 31,056 natives of India. The inoculated people belonged to 98 localities in the North-West Provinces and Oudh, in the Punjab, in Lower Bengal and Behar, in the Brahmaputra valley and in Lower Assam. No official pressure has been brought on the population, and only those have been vaccinated who could be induced to do so by free persuasion. In every locality efforts were made to apply the operation on parts of large bodies of people living together, under identical conditions, in order to compare their resistance in outbreaks of cholera with that of not-inoculated people belonging to the same unit of population. This object has been obtained in 64 British and native regiments, in 9 gaols, in 45 tea estates, in the fixed agricultural population of the villages parallel to Hardwár pilgrim road, in the *bustees* of Calcutta, in a certain number of boarding schools where the parents agreed to the inoculation of their children, in orphanages, etc. The vast majority of inoculated people lived thus under direct observation of the sanitary and medical authorities of India.

Cholera broke out in the inoculated localities from 1 to 459 days after the operation, and careful statistics of occurrences were immediately collected by the corresponding civil and

military and medical authorities, as well as by myself. The whole number of observations made, as they were at the time when I left India, may be grouped in three categories: (I) the first, containing unsuccessful results, or such in which no conclusion was possible; (II) the second, with results slightly favourable to the method; and (III) the third with results satisfactory.

I. To the first category belong observations made on a series of tea estates in Assam. The coolie workers on these plantations live in well-defined isolated bodies, distant from the villages, and not mixed with outside population. The inoculated individuals were scattered among the non-inoculated, and shared with them food, water supply, and all other conditions of life. In all instances belonging to this category the people had undergone only one part of the preventive treatment—namely, were inoculated with first attenuated anti-cholera vaccine given in maximal doses; the second inoculation, with the final vaccine, was applied after the cholera season had ceased. The disease occurred from one to six months after the first inoculation with the following results.

ADAM TILA.

657 non-vaccinated had no cases.
318 vaccinated had 2 cases (0.63 per cent.) with 1 death (0.31 per cent.).

KALACHERRA.

520 non-vaccinated had 4 cases (0.77 per ct.) with 3 deaths (0.58 per ct.)
211 vaccinated had 1 case (0.47 per ct.) with 1 death (0.47 per ct.)

CHABGOLA.

1,007 non-vaccinated had 3 cases (0.30 per cent.) with 1 death (0.10 per cent).
291 vaccinated had no cases.

PALLARSUND.

1,170 non-vaccinated had 2 cases (0.17 per cent.) with 2 deaths (0.17 per ct.).
431 vaccinated had no cases.

LUNGLA.

2,050 non-vaccinated had 3 cases (0.15 per cent.) with 3 deaths (0.15 per ct.).
421 inoculated had no cases.

BURNIE-BRAES, LOORACHERRA, KALAINCHERRA, AND SANDHURA.

Number of non-vaccinated not stated; had 11 cases with 5 deaths
677 vaccinated had no cases.

II. To the second category, with results slightly favourable, belong (*a*) two observations made on people inoculated with maximal doses of the first vaccine only, cholera occurring a short time after the inoculation, and (*b*) two observations on people inoculated with weak doses of both vaccines, cholera occurring thirteen to fifteen months after vaccination had been applied.

(*a*) The 2nd Battalion Manchester Regiment at Dinapore 2 to 6 days after injection of first vaccine only:
729 non-inoculated had 6 cases (0.82 per cent.) with 3 deaths (0.41 per cent.).
193 inoculated, no cases.

Degrubber Tea Estate, 3½ months after inoculation of first vaccine only:
228 non-inoculated had 2 cases (0.88 per cent.) with 1 death (0.44 per cent.).
287 inoculated, no cases.

(*b*) The British troops in Cawnpore, 13 months after inoculation with small doses of both vaccines:
797 non-inoculated had 19 cases (2.38 per cent.) with 13 deaths (1.63 per cent.).
75 inoculated, no cases.

The East Lancashire Regiment in Lucknow, 14 to 15 months after inoculation with small doses of both vaccines:
640 non-vaccinated had 120 cases (18.75 p. ct.) with 79 deaths (12.37 p. ct.)
133 vaccinated had 18 cases (13.53 p. ct.) with 13 deaths (9.77 p. ct.)

III. To the third category, with results satisfactory, belong (*a*) observations on maximal doses of first (mild) vaccine made on the Karkurie and Kalain Tea Estates, one to three months after inoculation; (*b*) observations on small doses of both vaccines, made on the prisoners of the Gaya Gaol inoculated during an epidemic; (*c*) observations on middle doses of one and of both vaccines in the *bustees* in Calcutta, collected during a period of 459 days, and finally, (*d*) the observation made quite lately on the Kassia Hill coolies, from the survey party of the Assam-Burmah Railway.

(*a*) Karkurie Tea Estate, 2 to 3 months after inoculation with strong doses of first vaccine only:
263 non-inoculated had 5 cases (2.46 per cent.) with 2 deaths (0.98 per cent.).
709 inoculated had 1 doubtful case (0.24 per cent.) with 1 death (0.24 per cent.).

Kalain Tea Estate, 1 to 3 months after inoculation with strong doses of first vaccine only:
1,375 non-inoculated had 23 cases (1.67 per cent.) with 11 deaths (0.8 per cent.).
661 inoculated had 2 cases (0.29 per cent.) with 1 death (0.15 per cent.).

(*b*) In the Gaya Gaol the inoculations were for the first time applied in a prevalent epidemic, and very weak doses of relatively weak vaccines have been used. The gaol contained over 400 inmates. After 6 cases with 5 deaths had occurred, a half of the prisoners, including aged and young people, women, children, patients from the hospital, and people affected with premonitory diarrhœa, was inoculated; the other half, of an exactly similar composition, was left uninoculated. The result was a gradual disappearance of cases and deaths among the inoculated, the difference in susceptibility having gradually increased during the period of 10 days necessary for the two vaccines to produce their full effect.

During the first period of 5 days necessary for the 1st inoculation:
209 non-vaccinated had 7 cases (3.35 per ct.) with 5 deaths (2.38 per ct.)
212 vaccinated had 5 cases (2.36 per ct.) with 4 deaths (1.89 per ct.)

During the second period of 5 days necessary for the 2nd inoculation:
197 non-vaccinated had 9 cases (4.57 per ct.) with 4 deaths (2.03 per ct.)
206 vaccinated had 3 cases (1.46 per ct.) with 1 death (0.48 per ct.)

During the last 4 days of the epidemic:
192 non-vaccinated had 3 cases (1.56 per cent.) with 1 death (0.52 per cent.).
201 vaccinated had no cases.

The total results are as follows:
The non-vaccinated half had (3.90 p.c.) of cases with (4.95 p.c.) of deaths.
The vaccinated half had (2.86 p.c.) of cases with (2.41 p.c.) of deaths.

The treated prisoners showed a reduction of 2.56 times of cases, and of 2.05 times of deaths. I wish to call your attention to the fact that the inoculations had been applied in this instance not before the epidemic, but a week after it had actually broken out, in order to arrest it, and to cure, so to say, the community from the disease. The reduction of deaths by one half will therefore justify the application of the method in all similar conditions, there being up to now no other method known in medicine by which such an effect could be obtained. We shall see directly an instance of the same kind when far higher results have been obtained by an application of stronger doses.

(*c*) In the *bustees* situated round the tanks in Calcutta, where cholera exists in a permanent state, the disease occurred in 36 houses with inoculated people. In each of these houses there was one part of the family inoculated and another not. The observations were continued for 459 days, with the following results:

During the first period of 5 days subsequent to the inoculation with first vaccine cholera occurred in 8 houses:
75 non-inoculated had 5 cases (6.66 per cent.), with 3 deaths (4 per cent.
52 inoculated had 3 cases (5.77 per cent.), with 3 deaths (5.77 per cent).
During the second period of 5 days subsequent to the second inoculation cholera occurred in 2 houses:
8 non-inoculated had 2 cases (25 per cent.), with 2 deaths (25 per cent.).
17 inoculated, no cases.
After the 10 days necessary for the preventive treatment had expired, and up to the 459th day, the disease visited 20 houses, with the following results:
263 non-inoculated had 38 cases (14.45 per cent.), with 34 deaths (12.93 per cent.)
127 inoculated had 1 case (0.75 per cent.), with 1 death (0.75 per cent), in a child that had not been brought up for the second inoculation.

Thus, after the expiration of the first 10 days, the inoculated members of the affected houses had 17.24 times fewer deaths and 19.27 times fewer cases than the non-inoculated inhabitants of the same houses, and this proportion was maintained up to the 459th day after vaccination.

(d) The last observation comes from the Brahmaputra valley, where Surgeon-Captain Hare, of the Indian Medical Service, my co-worker during the last eight months of my stay in India, is continuing now the work of inoculation for the Assam Government. Dr. Hare's full account of this observation has not yet reached me, but from a communication of the Health Officer of Calcutta, and from the Indian papers, it appears that 350 Khassia Hill coolies had been collected for the survey party of the Assam-Burmah Railway and put under the escort of a detachment of Goorkhas, when cholera broke out amongst them. The largest part of the coolies immediately submitted to the preventive inoculation, the rest remained uninoculated. The result was that among the not inoculated minority there were 34 cases, with 30 deaths; whereas the inoculated had 4 fatal cases. In this instance, also, the inoculation appears to be applied not as a preventive but as a curative for an existing epidemic, and the result, if the information is complete, has been the reduction of the mortality of more than seven times.

Summary.

The following seems to be a summary of the results observed up to now:

1. In all those instances where cholera has made a large number of victims, that is to say, where it had spread sufficiently to make it probable that the whole population, inoculated and uninoculated, were equally exposed to the infection, in all those places the results appeared invariably favourable to inoculation.

2. The treatment applied after an epidemic actually breaks out tends to reduce the mortality even during the time which is claimed for producing the full effect of the operation. In the Gaya Gaol, where weak doses of a relatively weak vaccine had been applied, this reduction was to half of the number of deaths; in the coolies of the Assam-Burmah survey party, where, as far as I can gather from my preliminary information, strong doses have been applied, the number of deaths was reduced to one-seventh. This fact would justify the application of the method independently of the question as to the exact length of time during which the effect of this vaccination lasts.

3. In Lucknow, where the experiment was made on small doses of weak vaccines, a difference in cases and deaths was still noticeable in favour of the inoculated fourteen to fifteen months after vaccination, in an epidemic of exceptional virulence. This makes it probable that a protective effect could be obtained even for long periods of time if stronger doses of a stronger vaccine are used.

4. The best results seem to be obtained from application of middle doses of both anticholera vaccines, the second one being kept at the highest degree of virulence obtainable.

5. The most prolonged observations on the effect of such middle doses were made in Calcutta, where the mortality from the 11th up to the 459th day after vaccination was, among the inoculated, 17.24 times smaller, and the number of cases 19.27 times smaller than among the not inoculated.

Results of Anticholera Inoculation.

The evidence accumulated up to now is decidedly in favour of the anticholera vaccination, and my own conviction in the matter is more and more strengthened. The special responsibility, however, which lies on me in this subject forces me to point out that the number of observations is not yet very large, and that it is most desirable that the results obtained should be further confirmed by new and more ample information. At the same time, you will find it, I hope, pardonable on my part if, before finishing the review of the results, I cite the opinion expressed on the subject by the scientist who himself accomplished the first and the most difficult part of the cholera problem, and whose discovery was the starting point of the whole of the modern researches on cholera.

When recapitulating with Professor Koch the data of my report to the Government of India, I said that, in my idea, the results tend to prove the efficacy of the method, but that I feel necessary to do all in my power in order to confirm them by new observations, I was most happy to learn that, for Professor Koch, the demonstration was already complete; that he believes the protective power of the method to be established finally by the observations collected in India up to now; that further perfections and simplifications may be possible, but that the main question at issue, the chief part of the problem, is solved by the facts recorded in the above report. Professor Koch gave his kind permission to quote these decisive conclusions in this Hall and to use the very terms I used, and he added that, in his conviction, the chief struggle against cholera must certainly take place on the banks of the Ganges, in the home of the disease; that this struggle is to be effected by preventive inoculation, and that he sees in the application of this method the way in which, by gradually restricting the area of the extension of the disease, it shall be brought to such a limit when it will become possible to control its prevalence by simple measures of a sanitary police.

Programme for Next Operations.

Allow me now to consider the question whether the new facts brought to light during my absence in India ought to be incorporated into my method of anticholera vaccination. The treatment by antitoxic serum, which by now may be considered as having proved a decided success in diphtheria, could not, unfortunately, be substituted for a preventive vaccination, its effect being rapidly worn out by the system. According to the observations made up to now, neither the

antidiphtheritic nor an anticholera serum could be used for protecting a population against an epidemic lasting more than a few days, not to speak of an endemic prevalence of the disease. The question stands otherwise as regards the possibility of treatment in individuals actually affected with cholera. Although in this particular disease we have against us the great rapidity with which the symptoms take hold of the system, the antitoxic serum has accomplished in other instances such excellent results that there is every possibility of its being beneficial in the case of cholera also. I intend, therefore, on my return to India, to give, in connection with the physicians of the country and with the help of Professor Pfeiffer from Berlin—who most kindly put at my disposal all his experience in the matter, as well as a supply of a very active antitoxic serum—an extensive trial to this method.

In case a simple application of the antitoxin serum proves to be insufficient to stop the rapid course of the symptoms, I intend to combine it with intravenous saline injections and to prolong in this way the period left for treatment. And if in this case also the attempt should fail, I shall try to utilise the new therapeutic for accelerating the effect of my vaccines in a manner which I will characterise in a few words. We have seen up to now that in the places where anticholera vaccination has been applied in a prevalent epidemic, the total number of deaths was reduced from two to seven times in comparison with the deaths in the non-inoculated, but the effect of the treatment was *nil* in the first four or five days after the first inoculation. There is the possibility that, by injecting a mixture of my vaccines with a powerful antitoxic serum, the mortality may be reduced also in the first days after the treatment, the serum arresting the disease for the time necessary for the vaccines to produce their full effect. The admixture of antitoxic serum with the vaccines may mitigate the vaccinal reaction, as has been suggested to me by Professor Wright from Netley, and this reduction of reaction may possibly reduce the amount of active protection conferred by the vaccines. A series of experiments have therefore been undertaken in the Netley bacteriological laboratory in order to investigate this important question.

Mr. Chairman and Gentlemen,—On the day when I came back from my expedition to India, I found my former chief, M. Pasteur, lying on his bed of death. Whatever might have been his appreciation of the work done in India, there can be only one desire on my part, that all the honour for the results which may possibly come out of my efforts, should be referred to him, to his sacred memory.

To the Government of India, the gentlemen of the Indian and Army Medical Staff in India, to Professor Hankin in Agra, Dr. Powell, and especially to Dr. Simpson, the eminent health officer of Calcutta, I address my hearty expressions of gratitude for the assistance they have given me in carrying out my work. I beg these gentlemen, if my present words are destined to reach them, to accept this public acknowledgment that without their most efficient help I would have never been able, with all my individual powers, to accomplish in India the smallest part of the work which has been done.

I also beg the Chairman and the organisers of the present meeting to accept my best thanks for having given me this opportunity of making the present communication.

With the Authors Compts

CONTRIBUTIONS

TO THE

EXPERIMENTAL PATHOLOGY OF SPIRILLUM FEVER.

BY

H. VANDYKE CARTER, M.D.,
BOMBAY.

(COMMUNICATED BY DR. JAMES ANDREW.)

Read February 6th, 1880.

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(Received December 20th, 1879—Read February 4th, 1880.)

No. 1. THE COMMUNICABILITY FROM MAN TO A QUADRUMANOUS ANIMAL.

INTRODUCTION.

THE object of inquiry was the elucidation of the pathology of spirillum fever (relapsing fever) by means of comparative experiments, which might afford fresh facilities, furnish new suggestions, or illustrate by analogy, and this object has been partly accomplished.

Attempts to reproduce the fever in pigeons, rabbits, and dogs failed here in 1877; in 1879 they were successful as regards one of the Quadrumana, and this animal—the *Macacus radiatus* of systematic authors—has been alone made use of, from its being readily procurable in

Bombay, whither it is brought from the adjoining hills and woods. The specimens employed were all young and small (average weight 3 lbs. avoird.), fresh and in good health, and commonly males. They were kept in one large room and regularly fed; though tied apart, they were not so continuously isolated as to preclude the possibility of occasional contact.

The material employed to test the infective nature of the fever was commonly the blood, and occasionally the saliva; no antiseptic precautions were taken in collecting the blood, or during the defibrination usually practised prior to inoculation. Injections were made with the ordinary hypodermic syringe, not deeply, but into the subcutaneous connective tissue, the point of a lancet being also occasionally used; the site was near the groin, and the quantities (approximate) such as are named in the table appended. The method of inoculation did not seem to materially affect the issue.

The subjects furnishing the first and most frequently used material were native patients in the Goculdas Tejpal Hospital, Bombay; cases unselected and of ordinary character.

Attention was directed chiefly to alterations in the bodily temperature of the monkey, as ascertained by clinical thermometers placed in the axilla at two- or three-hour intervals throughout the whole day, and to changes in the blood which were to be found upon microscopic examination of specimens taken simultaneously from the digits. The temperatures were verified by myself, and both fresh and dried specimens of blood repeatedly scrutinised, whenever it appeared desirable. All notes were preserved, and the facts are stated without reserve.

The dates of experiment range from the close of February to the middle of August, 1879; their number and kind are shown in the index attached.

Dr. Henry Cook, Principal of Grant Medical College, Bombay, was good enough to verify the results of

Experiment 10, which is a sample of the rest. The infected condition of the monkey's blood in my first essay was promptly recognised by Prof. Cohn, to whom a specimen was forwarded, and Dr. Koch has successfully repeated similar inoculations in Europe (*vide* the 'Deutsche Medicinische Wochenschrift,' Berlin, No. 16, dated April 19th, 1879, and No. 25, dated June 21st).

A third object, viz. to learn, if possible, the mode and place of origin of the blood spirillum, has as yet been only partially attained, but enough appears, at some inevitable sacrifice of life, to warrant the inference that this parasite grows abundantly in the spleen and liver, and probably in the vascular endothelium and white blood-cells. A large collection of parts preserved in absolute alcohol still awaits attention.

Finally, cultivation-experiments were made with specimens of the blood used in inoculation, and a note on this subject is appended. The parasitic organism may be induced to grow and expand into an open network of exceeding beauty, the spiral contour of the threads being preserved throughout. Further information on this topic may be hereafter offered to the notice of the Royal Medical and Chirurgical Society, the present details being submitted with an acknowledgment of the many imperfections inevitable to a first essay in a new and highly complicated subject.

The experiments will be described first, and then commented on. Temperature charts and specimens of infected blood accompany this paper.

PART I.—DESCRIPTION OF EXPERIMENTS.

A. Series 1.—*Positive results.*

(For appended Charts see p. 120.)

Inoculation from the Human Subject.

Invasion attack.

First Experiment.—N. P., a stout young man, an extra hand on duty for the previous ten days in a medical ward containing several "fever" cases, was suddenly seized with the disease, which in him exhibited its typical features of first and second attack, with an apyretic interval. On the fourth morning of the invasion, temp. 103°, the blood plasma was noted as being rather turbid; it contained some, but not many, spirilla, and otherwise was not abnormal in aspect. (Chart appended.)

Nos. 2 and 3.—Two healthy monkeys brought from the woods only a few hours before, and consequently quite wild, had each about fifteen minims of defibrinated blood injected into the thigh. Temperature at the time as high as 104·4°, on account of their violent struggling on being handled; blood seemingly normal. Next morning the temperature had fallen to 99°—100°. Twenty-six hours after inoculation one of the animals (marked W. B.) was killed to furnish specimens of the viscera at the stage of incubation. The other (marked G. P.) was allowed to live, and forty-eight hours after injection, temp. 102·2°, a few active spirilla were seen in its blood, which otherwise appeared normal. The animal was not at all distressed, and the temperature did not rise for the next twenty-three hours, when at 8 a.m. a smart febrile paroxysm came on; at 1 p.m. the temperature was 105·4°, and at 4 p.m. 103·6°; in the evening at 8 it was 102·6°, and next morning at 8 it was 101°, after which there was a rise again towards night, and two days afterwards another exacerbation, also a third four days subsequently. Thence forward, for the remaining five days of detention, the temperature

was tolerably uniform. (Chart appended.) On the morning of the day when the brief paroxysm of "fever" occurred, the blood plasma was rather clouded, contained much small protoplasm, and a very few delicate spirilla were detected on careful scrutiny; at 2 p.m., or about the acme of fever, not a single parasite was to be seen, and at 4.30 the blood plasma was clear, with very little protoplasm, no specks, and not a trace of movement. On all subsequent examinations of the blood the same negative results were arrived at, even when the temperature had risen or was rising, so that there was no evidence of a "relapse" in this case; the brief paroxysms subsequent to the specific attack were probably mere rebounds of temperature, such as are seen in other animals and in man. The monkey showed no marked signs of illness at any time; the specific pyrexia was very brief, and it will be noticed that the parasite had disappeared at its acme. The chart of W. B. is added in interrupted lines on the first and second days.

Second experiment.—H. S., an aged female mendicant, paraplegic, two months after admission into hospital was attacked with relapsing fever acquired by contagion; the invasion lasting seven days, the apyretic interval ten days, and the relapse four days. (Chart appended.) The attack was pronounced and uncomplicated. On the fourth evening of invasion the blood plasma was clear, there was seen active protoplasm, no specks, and red corpuscles normal; there were several active spirilla of the usual aspect.

2. W. T., a healthy monkey, had ten minims of this blood (defibrinated) injected into the thigh; temp. 102·2°. It was kept apart, and subjected to examination every three hours on each of the following days. The temperature was rather high, but normal in course on the second day, depressed on the third and fourth, and on the fifth there was a brief paroxysm of fever; subsequently, for fifteen days, the temperature was low and level or normal. In the night of the third day, or fifty-four hours after inocu-

lation, the blood first showed the spirillum, which for twenty-seven hours longer was associated with a temperature rather below the mean natural, and the animal was lively. The specific pyrexia was sudden, brief, and moderate (max. temp. 104·6°), and was not attended with much obvious distress. The blood parasite was never abundant and did not seemingly increase with the fever, being sparsely found at its acme, and disappearing within five hours afterwards; it was never again detected. The chart is appended. The sign plus-minus at 11 a.m. of fifth day indicates that in the fresh blood no spirillum was seen, and that after treatment with acetic acid some were detected. This double method was followed throughout, but its results were particularly noticeable on this date.

Third experiment.—I—, a Mussulman sailor, shipwrecked and destitute in Bombay, who had been in contact outside with other sick men (one was in hospital at this time with spirillum fever), showed on admission all the characteristic symptoms of a first attack, which was followed by a marked relapse, and a second briefer recurrence. (Chart appended.) Two days before the first deep fall the blood-plasma was clear, fibrillation distinct and close-set; there was granular protoplasm and very many active spirilla, so that the material for infection seemed well-suited.

2. B. 3, a fresh monkey with normal blood, had five minims of the above (defibrinated) injected into the thigh; temp. 104·4°. A normal rise, slightly exaggerated, occurred next day, then a decline, and on the fourth day a very mild febrile paroxysm (max. temp. 103·6°), which was the sole representative of the specific attack, thence forward the temperature did not vary beyond normal limits, except on the tenth day when it rose somewhat (no blood parasite visible), and the observations were discontinued on the twelfth. The blood was scrutinised regularly four times a day. Fifty-four hours after inoculation some appearances only of the spirillum were seen, which continued for eighteen hours longer, when

during the febrile attack a single organism was detected in the fresh blood, and after treatment with acetic acid a few more; subsequently none were to be found. The chart is appended.

Remarks on the above series. In all three experiments healthy animals were inoculated with blood decidedly contaminated (once even remarkably so), and taken during the first and most pronounced attack of relapsing fever in man; yet the induced pyrexia was singularly mild, especially when least expected, namely, in the third experiment. In every instance there was a slight rise following inoculation, a depression with the advent of preliminary infection, and fever so mild and brief that it might have been overlooked. Rebounds of temperature are indicated; they are more fully shown in the longer original charts, which it did not seem necessary to reproduce throughout. The paucity of the spirillum in conjunction with very mild pyrexia is worthy of special notice.

Inoculation at First Relapse of Man.

Fourth experiment.—H. T., æt. 22, a low caste Hindoo belonging to the scavenging community (frequently affected with severe relapsing fever), showed, after a prompt crisis, a quick rebound, and two days after (eleventh day of illness) high fever set in which never left him till his death on the eighteenth day; there was lobar pneumonia on the right side three or four days at least before the end. Blood was taken by cupping on the fourteenth day (temp. 105°), and displayed a rather clouded plasma, much protoplasm, few white cells or specks, and red corpuscles mostly shrivelled, coagulation partial, and no twitching movements indicative of spirilla; but subsequently a very few organisms were detected in a stained preparation of this blood. The man was very ill of fever, seemingly idiopathic and not specific, as the local complication had not manifested itself, and the

blood showed no parasite until specially treated, upon this presumedly first day of relapse.

2. W. P. 2, a healthy monkey, several days in custody, had five minims of defibrinated blood as above, injected in each thigh. For three entire days the normal course of temperature was maintained only at lower and decreasing level, and the animal seemed to be weakened. On the fifth evening (temp. 101·2°) spirilla were detected in the blood, and the temperature fell in the night to 99·6°; it then rose next night to 102·8°, and on the seventh day fever was decided (temp. 104·4°) and the parasite abounded; a sudden fall and very sharp rebound took place in the after part of the day (spirilla absent). This was the end of the specific attack, and the temperature remained low for three days; on the fourth there was a brief rise (temp. 103·4°, and nothing peculiar seen in the blood just after) with a quasi-normal temperature (no spirilla) for ten days longer. The acute isolated paroxysm at the close of specific pyrexia was unusual in these animals; it occurs sometimes in man. W. P. 2 showed the usual signs of illness during its short attack, and subsequent recovery was prompt; the advent of infection was here unusually deferred, even after allowing for long intervals of observation, and this may be connected with the state of his blood at inoculation from H. T.

Fifth experiment.—B. M., an adult negro of stalwart build, was admitted towards the close of invasion attack, and after an apyretic interval of five days went through a well-defined relapse; there was no subsequent recurrence. The chart is appended. On the second evening of the relapse some blood was drawn, which presented the following characters:—Plasma clouded, fibrillation indistinct, few white cells, a little protoplasm, chiefly small, spirilla several and active.

2. R. T, a fresh, healthy monkey, had three or four minims of partially defibrinated blood injected beneath the skin of the thigh, it was then kept apart with a companion not subjected to operation. No prominent

symptoms were noticed until five day after inoculation, when the animal appeared depressed, refused food, and was hot and shivering; temp. 105·8°. The blood was then examined by gas-light; it set quickly, plasma clouded and so full of active spirilla that the whole field of view appeared in incessant motion. Next morning the fever had remitted (temp. 102·8°), and the monkey though distressed took a little food; at noon temp. 103·4°, with renewed prostration, as indicated by the lowered head and folded limbs, hiccup, rejection of all food and drink, and a sleeplessness in marked contrast with the frequent dozings of its companion; the hair was rough and staring, yet not wet. Upon examination, the blood-plasma appeared tolerably clear, fibrillation coarse and open, white cells and protoplasm scanty, a few specks; the red corpuscles were in constant movement owing to the abundance of active spirilla. At 2 p.m. the temperature had risen to 104·8°, at 4 p.m. it was 103·8°, and at 6 p.m. 102·4°; at 9 p.m. it had fallen to 100·2°, and this probably represented the crisis which thus took place some twenty-seven hours after observed initiation of high fever. At 4 p.m. the blood was found to have regained its normal aspect; plasma clear, fibrillation distinct, white cells not numerous, red corpuscles piled and quiescent; there was some granular protoplasm, and a few minute specks and filaments of indeterminate character. With cessation of fever the monkey rallied, moved languidly, and began to eat; its appetite, indeed, was ravenous; it slept. There was no rebound of temperature, and for ten days no sign of relapse; convalescence was prompt, four ounces in weight being gained in six days; examination of blood on the second, fourth, and fifth days after fever negative. The chart in this case is withheld, being imperfect, as no night observations were made.

The companion monkey did not become infected, although in close alliance throughout; its chain caused some chafing, which doubtless induced the transient feverishness occasionally noticed; blood repeatedly examined with

negative results. In the course of these experiments similar accidents to these little animals were not unusual.

The above was my first essay, date February 26th, 1879, specimens of the infected blood were forwarded to Professor F. Cohn, and their character verified.

Sixth experiment.—I. S. B., a lad of 14, whose father had relapsing fever, was not admitted until the first apyretic interval, but in a specimen of dried blood taken from him at their home I found the parasite in abundance. His relapse was much shorter than his father's, and though the blood spirillum was at first very plentiful, his illness seemed to be of the mildest. On the morning of the second day (temp. 102·6°) the liquor sanguinis was clouded and contained some large protoplasmic bodies, and there were numerous active organisms to be seen. Ten minims of the defibrinated blood were injected hypodermically in each of the following monkeys at 10 a.m. 10th July.

2. Chain, a fresh animal brought to hospital the previous night, small and wild, had normal temperature and blood. The temperature took a normal course and was rather below the mean for the first three days, it then declined and rose into a mild paroxysm prior to the onset of high fever on the fifth day; the blood was examined only twice daily, and forty-eight hours after inoculation a few active spirilla were found in the very clear plasma; next day there were more, and at last the blood was filled with the parasite. The animal was then ill, though still active, and it was killed for pathological inquiry. In this case high fever was preceded by a minor or quasi-abortive rise.

3. Rope, a similar subject and similarly treated, showed healthy blood and a temperature which, pursuing a normal course, was somewhat more pronounced than usual, until the advent of the blood parasite, forty-eight hours after inoculation. Death was then inflicted for the purpose of research at this commencement of specific infection. All charts are appended.

The concordance of date upon which the spirillum was

first seen in both these animals, supplies evidence of uniform conditions and effects to the exclusion of accidents, such as a possible contagion; and since in the other two instances, in which more than one animal was simultaneously submitted to inoculation, a similar concordance was noted, I feel justified in relying upon the majority, at least, of my essays, which were always made in like manner.

Seventh experiment.—B. L., a destitute immigrant labourer, exhibited in hospital, after the close of the invasion, a first and second relapse with subsequent minor perturbations of temperature, all fairly characteristic of famine fever. The chart is appended. On the third day of the first relapse (temp. 103·4°) the state of the blood was as follows:—Plasma clouded, fibrillation indistinct, white cells few, some large protoplasmic masses, no free granules, red corpuscles heaped; there were several active spirilla to be seen. At noon (temp. 104°) two drachms of blood were abstracted and defibrinated.

2. Y. T., monkey, healthy, had twenty minims of the mixed serum and corpuscles injected into the thigh; temp. 101·2°. Next day the temperature rose a little as usual, and on the third day it had subsided. At 10 a.m. it was rising again (102·8°), and the animal's blood was then (forty-six hours after inoculation) found to contain a few active spirilla; plasma rather clouded, but fibrillation seen; white cells few, some large protoplasm, no moving specks, the red corpuscles piled. The monkey looked a little drowsy, though not sick; it was now killed in order to furnish specimens of the viscera at this early stage of infection. (Chart appended.) Y. T. had previously been inoculated with dried spirillar blood, and had remained unaffected.

Eighth experiment.—F. J., æt. 28, ship labourer and immigrant, after a most pronounced first crisis in hospital, and somewhat prolonged first interval, underwent a relapse, striking from its intermittent character. On the evening of the third day, during a mild mid-paroxysm,

the temperature was 100·4° and the blood plasma was clouded, white cells very few, no moving granules, red corpuscles piled, and amongst them indications of two or three spirilla which, with the Albrecht process, were seen to be slender, though not seemingly immature. The man was not suffering much. (Chart appended.)

2. B. 1, a large monkey, rather thin and weak from the effects of a late experiment with sputum, but not now feverish, had ten minims of the above-named blood (defibrinated) injected into the thigh. Its condition as to the temperature and blood was then ascertained at three-hour intervals for the next six days. The spirillum made its appearance fifty hours after inoculation (temp. 100·6°), and was found for forty-eight hours longer, though sparingly, until high fever set in, when the parasite became abundant, and individual examples seemed to be dividing about the middle. The temperature was normal on the second day, higher than usual in the morning of the third, and with advent of the visible infection, declined considerably on the fourth and fifth days (min. 99·4° on last morning), rising at the end to 102·4°, prior to the abrupt onset of pyrexia on the sixth day (temp. 105·4°), when death was inflicted for the purpose of ascertaining the state of the venous blood of different organs. The animal showed hardly any signs of illness till the last day, when it became languid and opened its mouth frequently. (Temperature chart appended.)

Ninth experiment.—S. B., father of the lad in experiment No. 6, after a slowly declining first crisis, and tolerably level first interval, had a well-marked relapse, at 2 p.m. of the third day of which (temp. 102·5°) blood was drawn, and the serum allowed to separate; it contained some red discs and several spirilla, some being extended and quiescent, and others in active movement.

2. W. T 3, a healthy monkey, had ten minims of this blood-serum injected into the thigh at 5.30 p.m., June 24th; temp. 102·4°. The temperature declined at midnight to 101·4°, and then rose steadily next day until 2

p.m., when it reached the maximum of 106·8°, which was also the acme of a brief paroxysm of specific fever. It declined even more rapidly than it rose, to 100·4° at midnight of this second day. A slight rebound followed, and thenceforward for twelve days a tolerably level, though low and slightly irregular, course was preserved. Here infection was very prompt, the blood spirillum being found sixteen hours after injection, and possibly being present at an earlier period, as the temperature was already 104° on first employment of the microscope after inoculation; it was then abundant. Three hours after the climax of the acute isolated paroxysm (temp. 105·7°) the parasite had quite disappeared from the blood. None but the briefest preliminary infection could have occurred in this remarkable instance, fever setting in so soon as twelve hours after inoculation. The sharpness and brevity of the attack, and its prompt decline, with absence of decided rebound, are other striking features of the case.

The experience was unusual and even unexpected, since the man, S. B., was suffering considerably, and his blood might be supposed to be highly infective. However, I should observe that blood-serum was the vehicle used (whence possibly the rapid infection of the monkey), and that in the two hours and a half after the blood was drawn and had set, some of the spirilla had ceased to be active, whence possibly the milder infection, as manifested by brief duration of pyrexia. This was the only instance known of fever coming on so soon as twelve or fourteen hours after inoculation, and it must be viewed apart from all the rest.

Tenth experiment.—R. Y., a low caste Hindoo, one of others attacked outside, was admitted into hospital just after the invasion, his chart shows only the relapse, and is appended. The symptoms were marked, but the state of the blood was at no time characteristic as usual, owing to opacity of the plasma, and sparseness of the parasite. On the fourth evening of the relapse (temp. 105·4°) the spirilla were so obscurely indicated by a rare twitching of the red

corpuscles, that their existence might easily have been overlooked; but on treatment with acetic acid, their presence in small numbers was fully established. The other characters of the blood were as follows:—Plasma clouded, fibrillation slow and not distinct, much protoplasm, large and small, many small rounded bodies or specks (quiescent), white cells numerous, some large granule cells, red corpuscles in small piles, and often shrivelled. The patient was affected with asthma and bronchitis.

2. W. T., a healthy monkey, had about fifteen minims of defibrinated blood injected subcutaneously in the thigh (temp. 102°); it remained well to all appearances for three and a half days, when fever was noticed at my morning visit, temp. 104·2°; aspect depressed and shrunken. Blood plasma clear, very few specks, white cells not numerous, protoplasmic masses rare, red corpuscles piled and heaped; "there are vast numbers of very active spirilla, which seem to be rather larger than in man." In the afternoon at 3 the animal became worse, its head hung so low that only the radiating scalp was visible, and its general aspect resembled that of R. T. in the fifth experiment (No 2). At this time Dr. Cook saw the blood and became assured of the validity of the observation. At 11 p.m., temp. 103·8°, still crowds of spirilla, and next morning also; no abdominal tenderness evinced, and spleen not felt; at 2 p.m. of the second day of fever the animal was killed with chloroform, in order to furnish specimens of the viscera during pyrexia; blood defibrinated after death showed abundance of active spirilla, so that the vapour of chloroform does not act as an immediate poison on these organisms. The temperature chart of this early experiment is not complete; it shows a maximum of 106·8 in the evening of the first day, a decline to 103·4 next morning, and an interrupted rise on the second day to 106°, when death was inflicted; the temperature was below the normal prior to fever setting in suddenly.

Eleventh experiment.— The first relapse of the man

furnishing the material for experiment 3 was very pronounced, and on the fourth day (5 p.m.) the blood exhibited the following characters:—Plasma tolerably clear, fibrillation distinct, some large granular protoplasmic bodies, no specks, there were swarms of spirilla, fully formed and active, and besides some long wavy beaded filaments were seen, which possibly were immature forms.

2. W. T. 2, a monkey with normal blood, had five minims of the above (defibrinated) injected into the right thigh at 6 p.m., its temperature was 102°, falling in the night to 100° and rising next afternoon to 102·4°; then sinking on the third morning to 99°, it rose abruptly to 105°, again declined, and on the fourth day of experiment ascended at about noon to 105·2°, when the animal was killed. Here was a distinct paroxysm preliminary to what was probably the main attack, and the same event is occasionally seen in man. (The chart is appended.) Blood: at the first examination, fifteen hours after inoculation, a few spirilla were detected in the otherwise unchanged fluid, they appeared to be slender, but were active; thenceforward, during the brief non-febrile period, and as well the isolated paroxysm, to the end, the parasite was invariably present, being at last very abundant. The animal did not show unequivocal signs of distress at any time previous to the last day, and even then its general state was not marked by much apparent malaise; had its life been prolonged, possibly with high fever the usual symptoms would have supervened, yet this circumstance is noteworthy (it has been seen also in children attacked with relapsing fever), as indicating that with even pronounced blood-infection the system is not necessarily overcome. Another striking feature was the rapidity of induced contamination with blood taken during the relapse, as compared with the delayed and mild results of inoculation with that taken during the invasion attack as shown in Experiment 3. I should mention that W. T. 2 had five weeks before undergone an earlier attack of induced spirillum fever (described in

Experiment 2), and upon recovery had been returned to the bazar, whence it was again brought on the day of the present proceeding (April 26th).

Inoculation at Second Relapse.

Twelfth experiment.—R. M., a stout but scorbutic young negro of the same family as B. M., in Experiment No. 5, was admitted after the end of the first attack, and underwent a second and third in hospital. On both these occasions the blood parasite was so sparse that its presence might easily have been overlooked in ordinary examination. The second relapse consisted of an isolated paroxysm of less than one day's duration, but terminating in a fall of 10·6°. At the acme of this brief attack (temp. 104·6°) the blood exhibited the following characters:—Thin, devoid of fibrine, brownish in hue, but brightening on exposure, plasma clouded, little white matter, red corpuscles shrivelled and dispersed, a single spirillum after long search was detected. The patient suffered very little at the time. (His chart is appended.)

2. B. B., a healthy monkey with normal blood, had eight minims of the above (defibrinated) injected hypodermically into the right thigh at noon, 29th March; temp. 101·4°. For three days the blood presented no obvious change and the temperature did not vary beyond normal limits. Early on the 2nd of April, the fifth day of experiment, or under ninety-four hours after inoculation, the animal seemed well, though being kept alone it cried out occasionally; temp. 101·8; blood plasma clear, fibrillation not distinct, very little protoplasm, and no peculiarity except the presence of several active spirilla. The temperature now declined to 99·8 at midnight, and on the next day to 98·6 at 6 a.m.; but at 8 a.m. it began to rise and at 8 p.m. it was 105·6; it remained at 104·5 during the whole of the following day, and the animal was evidently ill. Early on the 5th the temperature declined to 100°, and

subsequently took a quasi-normal course. The spirilla were few at first (1 to 4 in the field), and with the accession of fever their number increased (6 to 12), till at last they swarmed in the plasma; at 10 p.m. of the 4th April there were many of full size (temp. 104°), but at 2 a.m. of the 5th (temp. 100°) not one was to be found. Unpromising as this experiment seemed, its results were comparable with those of No. 5, and I have no doubt that had the same early scrutiny been practised then, a similar ante-febrile blood infection would have been detected.

B. B. quickly recovered, and it was kept under notice, and daily examined for eleven days in order to ascertain the likelihood of a relapse; the result was negative. Yet on the twelfth day after fall I found that the spirillum had reappeared (temp. 102·8°), and this was the beginning of a second attack, which had a preliminary infection period of at least thirty-six hours, and culminated in a smart febrile paroxysm (temp. 105·2°), of twenty-seven hours' duration, the parasite, at first sparing, was then abundant; there was hardly any constitutional disturbance, and return to the normal state was prompt, and maintained for the next thirteen days. I am unable to assign the cause or character of this fresh attack, seemingly it was spontaneous, and the probability of contagion remote, yet with other contrary experience I cannot view the event as a true relapse, unless it be that repetitions of fever by auto-inoculation are, in the monkey, subject to irregularities not perceptible in the human subject. Contagion was not proved amongst these animals when it might have been looked for, but it had possibly occurred in this case. (Two charts are appended.)

Inoculation at Stage of Incubation.

Thirteenth experiment.—S. B. (*vide* Experiment 9) had a somewhat prolonged first interval, and on the ninth day, or two days before the relapse (temp. 98°, and health

fair), his blood was described as clear, white cells few, protoplasmic bodies small, red discs normal; after treatment with acetic acid only a few specks and short rods were noticeable as possibly unusual ingredients.

2. R. T. 2, monkey, had ten minims of the above (defibrinated) hypodermically injected into the thigh; it remained unaffected to all appearance for fully ten days, the temperature being level, except on the seventh day, when a brief rise to 103·4° took place; the blood was unchanged. After so long an interval this experiment was regarded as a failure, and another injection was about to be made, when I found in the blood (temp. 102·6) several active spirilla, and the animal appeared sluggish, though not ill. About twenty hours afterwards a brief febrile paroxysm occurred, which lasted six hours and ended abruptly. The parasite was detected prior to and at the acme (temp. 105·4°), and had disappeared three hours afterwards. The monkey was ailing for the time, but soon and permanently rallied.

Respecting this irregular example, I have to observe that four other monkeys were inoculated on successive days of the same apyretic interval. R. T. being the third in this series, and in all the rest the result was negative; further, it would be quite extraordinary if so long a period as ten days' incubation were conceivable in these animals, and I am therefore inclined to suppose that in the present instance R. T. 2 had acquired the fever it displayed by means of contagion from W. T. 2., (*vide* 11th Experiment), although I had given orders for the latter to be kept apart; were this so the incubation period would be reduced to five days, and the anomaly would be accounted for. Observation has led me to infer that, like men, these quadrumana differ individually in their susceptibility to infection, and though direct attempts were made to test contagion amongst them ineffectually, I think it probably took place in the present instance, and in the 12th and 17th Experiments as the *vera causa* of the second attacks then noticed. This opinion is inferential only, and in the

appended table I have felt bound to give the figures actually found.

Inoculation from the Monkey.

Stage of High Fever.

Fourteenth experiment.—W. T. (*vide* Experiment 10). On the first day of observed pyrexia (temp. 104·2° at 11 a.m.), and general symptoms of illness manifest, the state of the blood was as follows:—Plasma clear, fibrillation slow, white cells and protoplasm scanty, a very few moving specks, and red corpuscles piled and heaped; there are vast numbers of most active spirilla, which appear to be rather larger than those of human blood.

2. R. T., monkey, in fair condition, though rather thin in consequence of an earlier attack (*vide* Experiment No. 5), this day, March 16th, being the twelfth after the fall, and no sign of relapse being manifested during the interval, a minute quantity of blood was taken by puncture from the thigh of W. T., as above, and inoculated with the same lancet in the thigh of R. T., the clot, not larger than a pin's head, being introduced beneath the skin; no bleeding ensued. The animal remained well, and its temperature was tolerably uniform until midday of March 20th, or four complete days after inoculation, when an abrupt rise took place; the attack thus initiated lasted sixty-six hours, and was continuous; the maximum temperature of 106·4° was noted about midway, the decline occurred at 6 a.m. of the 23rd, with a prompt descent to 100·6°. The general symptoms of the fever were the same as seen on other occasions, and the monkey was killed at the fall in pursuit of further inquiry. (Chart appended.)

This early example of communicated fever was unmistakably clear, and it is noteworthy as proving that no protection against reinfection is afforded by even a recently foregoing attack; it also shows that no predisposition to a recurrence, as estimated by comparative

length of incubation period, can be said to result from such previous attack; and, lastly, it demonstrates that a very small quantity of blood, or hardly more than the amount of lymph commonly employed in vaccination, will suffice, when introduced beneath the skin, to convey a pronounced spirillar infection.

Fifteenth experiment.—W. T. (*vide* Experiment 10), on the second day of observed fever, or upwards of thirty-two hours after its initiation, the defibrinated blood, obtained after death by chloroform, was found to contain abundance of active spirilla, which were seemingly unaffected by the inhaled narcotic, and it was therefore employed for further testing the communicability of spirillum fever at first remove from man.

Three monkeys had each a few minims of blood *minus* fibrin subcutaneously injected in the same manner and hour; of these two were fresh acquisitions from the bazar, and the third (C. below) was the companion of R. T. (*vide* Experiment 5), which, although in closest propinquity to that fever-stricken animal, had never shown any sign of contagion. The results are briefly described below, and the fever charts are appended entire, with the exception of the first two days, when night observations were not complete.

2. N. W. T. (also termed "biter" from its viciousness). The temperature rose beyond the mean for a few hours, and then became nearly normal; on the third day it rose again simultaneously with that of the two other animals, and rather higher, being at 11 p.m. 106°, and the monkey still very wild; the blood contained many spirilla. Next day the temperature subsided a little, being 103·8° at 11 a.m.; the animal now seemed ill; its blood was highly contaminated, and death was inflicted when there was every prospect of the attack continuing as in its neighbours.

3. R., the other fresh monkey, showed but little variation of temperature for forty-six hours, when fever came on rather gradually but decidedly (104·2° in the first

evening, and 106·2° on the next); then, after a morning abatement, again rising (third day), and so again (fourth day), when the crisis took place (fifth morning) in a decline to 101·4° at noon. Apparently this ended the specific febrile attack, which had thus lasted for about ninety-four hours or four complete days; and now began a sharp and prolonged rebound, the temperature at 4 p.m. having suddenly risen to 107·2°, and this exacerbation persisted throughout the next day (at 4 p.m. temp. 106·2°); but on the third the body heat declined at first slowly, then rapidly, until the animal died at 4 p.m. The blood was repeatedly examined throughout the entire illness, and found to contain numbers of the parasite on the first day and second, and even at the considerable decline on the morning of the fourth day (temp. 102·2°), when it swarmed with clusters of spirilla. On the true fall occurring next day at noon, not a trace of the growths was to be seen even with the $\frac{1}{16}$ in. immersion lens, or indeed any abnormal appearance. The secondary pyrexia, or rebound, was also marked throughout by an absence of the spirillum, and so its real character was made manifest. At the beginning of its illness the monkey was very quiet, and sweating of the palms was noted; next day, though fever was high, it sat up and took food in the morning, but at noon it joined the other two, and all huddled together, being evidently very sick. On the third day both survivors presented the characteristic aspect, drooping, pallid, and shrunken, refusing rice, nibbling only at fruit, and drinking water, though not with eagerness. At the fall the symptoms were mitigated, but with the renewed pyrexia, shiverings and depression were noted, and finally prostration, semi-consciousness, rapid breathing, and lowering of temperature till death. An autopsy was made and the parts preserved. I may here observe there was found no localised inflammation sufficient to account for the fatal termination, unless some extreme redness of the small intestine be regarded as inflammatory; the

animal seemed to die of fever as human subjects occasionally do.

4. C., a monkey, some time under observation, and affected with an accidental sore, but never the subject of experiment, showed a high temperature shortly after inoculation, which had subsided next day. On the third the temperature again rose, but somewhat more gradually than in the other two animals, declining in the morning, to ascend permanently at night to 106·2°. On the fifth day there was a morning decline and evening rise, and so on the sixth, when the acme of 106·8° was attained a few hours before the critical fall to 101·6° in the morning of the seventh or following day. Except at the beginning, the course of the pyrexia was similar to that in No. 3. The animal was lively on the second morning when the blood was found to be full of spirilla; soon after it became sick, and remained so till the fall. On the last day, at 5 p.m., the blood contained many active parasites; an hour later there were none, and at 8 p.m. the fever reached its turning point. I had intended to watch the case by minutes, but was called away to perform an amputation; sufficient was seen, however, to show how abruptly the blood parasite disappears at this period of febrile crisis, and the observation was even frequently confirmed in the wards of the hospital. A prompt and pronounced reaction of temperature followed the cessation of specific pyrexia, and it was prolonged for four days, slowly subsiding at the last, and the monkey then quickly became convalescent. The blood was free from visible contamination at this time, and no relapse followed during the eighteen days after crisis; the animal was closely watched.

The above experiment is decisive of the inoculability of spirillum fever, of the similarity of symptoms under similar conditions, of the greater severity of the fever induced by infection at first remove, *i.e.* from monkey to monkey after a prior infection from man; and, finally, of the similarity of the comparative phenomena to the human, with the

exception of the relapse, so-called, which was not seen in the lower animal surviving.

Sixteenth experiment.—From monkey No. 2 of the last experiment, the blood taken twenty-six hours after initiation of pyrexia was swarming with spirilla; it was allowed to stand for three hours and a half, and then had separated with considerable distinctness into clot and serum. The serum was found to contain many moving parasitic organisms and a few red discs unchanged, with no other visible particles; the clot was dark and firm.

2. B. T., No. 1 in the chart, had ten minims of the slightly-tinged serum injected beneath the skin of the thigh at 5.30 p.m. of 20th March; temp. 103°. The body heat rose the next day to somewhat above the normal mean, and still more on the third and fourth days, descending to the mean at 8 a.m. of the fifth day; it then rose promptly to 105·4°, and continued high on the following day; early on the seventh the critical fall took place, and very soon after a sudden and sharp rebound (temp. 107°); on the eighth day the temperature declined, at first moderately, and at last very quickly, the animal dying this night (the last entry, temp. 96·4°). The blood was examined at intervals, and the spirilla were found before fever set in, being then few and small; with rise of temperature they became numerous, the animal not seeming to suffer much. On the sixth day, with continuous fever, the parasites were fewer, seeming gradually to decline at first, then towards the end of the specific attack they were abundant and aggregated in clusters; at the fall on the seventh day all traces of them had disappeared; with the rebound of temperature the blood was found to be loaded with plasmic material only. The animal was very ill, as if overpowered by depression, the ears and extremities being cold, and the head and trunk very hot; no spots could be seen on the skin; it remained in this state, the body cooling, until its death. The stomach and small intestines were apparently much inflamed, and there were some hæmorrhagic spots.

3. O. T. Two bits of the above blood clot, not larger than a pin's head, were introduced beneath the skin of the left thigh; they had been slightly washed in a weak solution of sulphate of soda, and were not examined microscopically, it being supposed that a few spirilla would be still entangled in the fibrin meshes. The temperature maintained a quasi-normal course for two days, and on the morning of the fourth a few active spirilla were detected in the blood. Pronounced fever did not come on till the following day (temp. 105·6°), it was less next day, and on the seventh, when an exacerbation took place (spirillum present), which ended in the fall. After a few hours a sharp rebound set in, and at 4 p.m. of the eighth day the temperature was 106·8°. This renewed fever was a veritable relapse, resembling in form and duration, and exceeding in intensity, the preceding attack, but distinguished from it by the entire absence of spirillar blood-infection; at the close the animal was so exhausted that it died. At the autopsy I found some inflammation of the stomach and small intestines; there were some petechiæ on the heart.

Remarks.—The similarity of results in this experiment is manifest, even in particulars, and the series may also be compared with the last, their common feature being increased severity of infection with maintenance of all characteristics. The rebound, or secondary fever, or "relapse," properly so-called, was present in all these instances of inoculation at removes from man, and I infer that the infective property of the blood was increased at each successive remove. As both these last animals died, there seemed no occasion to pursue this subject by means of fractional inoculation, and my experience had not been such as to warrant confidence being placed in dates and changes of temperature as criteria of intensity of blood poisoning in this particular form. I note that although the infection in Experiment 16 was sufficiently intense to lead to death, yet the incubation-period of the fever was not shorter than the mean, nor was the specific temperature unusually high; and Experiment 20, and those made with saliva, show that other organic poisons operate differently to the spirillar. Here the varying state of the blood at different stages of the "fever," and probably idiosyncrasy of subject, are elements of calculation as yet not enough known. There could hardly be a more intense degree of blood-infection than was displayed in my experiments, and all the deaths occurred during secondary fever; perhaps some elucidation of the character of this last-named sequela might be elicited by the fractional method.

Seventeenth experiment.—W. B., in Experiment 1 (*vide* chart), had twenty-six hours previously to furnishing the infecting material used below, been injected with spirillar blood from a human subject, which was proved (in its comrade, G. P.) to be capable of conveying disease. In this material no sign of the parasite was detected; plasma rather clouded, fibrillation visible, white cells few, little protoplasm, specks few and quiescent, red discs piled and heaped.

2. E., a healthy animal with normal blood, had a few minims of the above defibrinated blood injected in the usual manner at noon, March 25th; it remained well till the 29th, the temperature being tolerably uniform in its daily oscillations, though rather higher than usual at maximum (103°). The blood was examined twice daily (excepting on the 28th), and at 10 a.m. of the 29th, or ninety-two hours after injection, it was found to contain a few active spirilla without being otherwise peculiar. Next day there occurred a smart febrile paroxysm (temp. 106·2°) of about eight hours' duration, and soon after its acme the blood was found to be free from the parasite, only some moving granules being detected; the temperature then declined to 101°. There seemed no reason to doubt that this brief attack was due to artificial infection, and hence the inference that the germs of specific pyrexia are not necessarily represented by the blood parasite.

Relapse.—E. continued well for six days, or about 150

hours, during which time the temperature oscillated between 100° and 103°, and whenever examined (once or twice daily) the blood was normal in aspect. In the afternoon of 6th April, one or two active spirilla were detected (temp. 103°), and again next day (temp. 102·2°). On the 8th, or thirty-six hours after their first advent, a smart febrile paroxysm took place (temp. 105°) which lasted ten or twelve hours; at its onset the parasites became numerous, and at its decline they had all disappeared. The animal looked pale and thin at this time; it was kept under observation for eleven days longer with negative results. (Charts appended.)

Remarks.—The interval between the first and second attacks of fever was longer than the first incubating period as nine to five, and this points to a character of relapsing fever in man; both attacks were alike in the preliminary non-febrile infection, and in the form and duration (nearly) of pyrexia, and this circumstance also seems in favour of their essential connection; the alternative view is that contagion was the cause of the second attack. Compare with Experiment 12, where the "relapse" came on nearly twice as late, thus showing a suspicious want of conformity which is of the rarest in man.

As regards the invasion-attack, this experiment corresponds to No. 13, in which also incubation-blood seemed to prove infective; both attacks were mild, and so far alike, yet there is a wide discrepancy in their dates of onset, which it is difficult to comprehend, except upon the supposition that the spirillum fever of the monkey is liable to hidden modifications hardly consistent (as it might appear) with the open manifestations in the human subject; here, too, the alternative view was that of incidental contagion.

Series 2. *Experiments furnishing negative results.*

The fact of communicability under certain conditions being established, I proceed to narrate some other experiments made in similar manner, which may assist in elucidating the nature of these conditions.

Failure of Spirillar blood to infect.

1. *Of man, at invasion attack* (*a*).

Eighteenth experiment.—K. G., a pauper immigrant, æt. 55, had a severe attack of spirillum fever, which was said to be the first and seemed to be much prolonged (fourteen to fifteen days); the end only was seen in hospital, and it was accomplished by slow descent extending over three days, during two of which the blood parasite was abundant. Immediately afterwards a sharp rebound took place, with head symptoms, and the patient died (cerebral hæmorrhage). His daughter was in hospital, and also died after her attack (thrombus in the femoral veins); the wife had had "fever" a short time before, and had recovered. There were no other members of this family. On the first day of decided decline (temp. 100·4°), the blood contained many spirilla, and a minute freshly clotted portion was used for inoculation. (Chart appended).

2. Y. T. 2, a monkey, with normal-looking blood, had the above fragment introduced beneath the skin of the thigh (temp. 102°). The same evening the temperature rose to 102·6°, when the blood was still normal (red discs somewhat irregular); four hours later the temperature rose to 105°, falling promptly to 101·8° next morning (blood healthy), and subsequently for eight days there was only such oscillation of body heat as might be referred to the presence of sores on the body, the blood remaining unchanged in aspect.

Here inoculation failed, though made after the same fashion as in the successful Experiment 16, No. 3; there is no reason to suppose that the brief rise after inoculation was of specific character, and upon consideration, I infer that when the spirilla, as a rare event, persist till near the end of the crisis, their presence does not necessarily imply infective quality of the blood. Under artificial cultivation, I found that at this time the parasites in the blood of K. G. (who was unusually ill) did not grow as other specimens had done, whence it is probable that these organisms do not themselves evolve the germs of future broods, except under certain conditions which do not pertain to the close of a febrile attack. Yet upon the hypothesis that early "broods" or "crops" of the parasite usually leave behind them, in the blood itself, the germs of a succeeding growth to be developed with the "relapse," it might be supposed that blood at or near the "fall" would be both infective and culturable; the contrary being the case, I infer that the "germs" are lodged (if not produced) outside the blood-current. Perhaps the conditions vary, for reproduction is not invariable.

At first Relapse (b).

Nineteenth experiment.—Blood taken on the third day, or the day after the successful attempt described under Experiment 5, from the man B. M., had the following characters:—Plasma not clear, a few white cells, some moving granular protoplasm, many specks, and several spirilla in active movement.

W. and B., two monkeys in good health, had the entire blood injected, namely, a few minims beneath the skin of one, and the same into or around the femoral vein of the other; no local or general ill effects followed, both animals continuing unaffected for eight days. Special notice was taken on the fifth day, or the date of fever in the earlier experiment, and I conclude that the present attempt

was a failure. Why it should have been so is not manifest, for both animals were afterwards successfully inoculated, and the material employed did not appear to differ materially from that used the day before with signal results. I notice, however, that at the time the temperature of the man B. M. was at its highest (105·8°)—and it is probable that at high temperatures, whether mid or final, the parasite loses something of its dynamical activity—the man was sweating when the blood was abstracted; and upon examination of the latter by the acetic acid process, I did not find so many parasitic organisms as was anticipated. The alternative view would be that some fault or accident in either procedure or instrument had intervened to prevent infection; none was perceived.

Twentieth experiment.—The patient named in the successful experiment, No. 4, had, two days at least before his death, pronounced pneumonia (it seemed to be of pyæmic character from the post-mortem examination) in conjunction with spirillum fever; thirty-six hours before decease (temp. 104·6°), nothing definite of peculiar aspect was seen in the blood as ordinarily scrutinised, but I found upon treatment with acetic acid a very few spirilla, besides many small protoplasmic particles—infection, therefore, was possible.

2. R. T., a fresh, healthy monkey, had ten minims of the above, defibrinated, injected into the left thigh. The effect was high and continuous fever ending in death on the fifth day, and the blood never showed any signs of specific contamination; twelve hours after inoculation, the temperature rose and shortly attained 105·8°, it remitted on the third and fourth morning, and the animal died on the fifth, there being some local sero-purulent infiltration above the side of injection, and possibly septicæmia. Here, I suppose, there existed a poison in the patient's blood, which in the monkey over-powered the spirillar infection, checking its development and inducing a fatal toxæmia. A similar instance afterwards occurred (*vide* No. 24), and I do not regard either merely as exceptions

to the rule of spirillar reproduction; both were complicated cases and otherwise interesting as showing the antagonism of blood poisons.

Twenty-first and twenty-second experiments.—S. B. (*vide* No. 9) displayed the relapse ten days after complete fall; as usual, it began abruptly, and blood was taken morning and evening of the day of onset.

1. The morning temperature was 97·4°, pulse 84, the patient convalescent, the fresh blood was noted as containing clusters of white cells, very little protoplasm, but numerous active granules, and by the acetic acid process a few small yet distinct spirilla were also detected.

2. G. T., a healthy and excitable monkey, with normal blood, had ten minims of the above injected after defibrination; for five or six days afterwards the temperature showed marked daily paroxysms with occasional high range (as 104·4° on the sixth afternoon), and yet the blood, examined twice daily, furnished no evidence of spirillar infection. The animal itself continued well. Observations were made until the fifteenth day, with like negative results, and it must be supposed that the parasitic organisms were too few or too immature to induce specific fever, supposing that they represent the infecting agent, the daily perturbations of temperature may be attributed to the excitability of the monkey.

3. The man's relapse set in at 4.30 p.m., and at 5.30 the temperature was 102°, pulse 100, the blood then showed a few spirilla, with small protoplasm and some granules; ten minims, defibrinated, were injected.

4. F., a fairly healthy monkey, but so restless that the chain it was bound with, caused, by chafing, a large ulcer round the waist, and feverishness in consequence. The chart shows this mild pyrexia to be continuous, and as the blood was carefully examined daily with negative results (only protoplasm and white cells abounding) I conclude that there was an entire absence of specific infection in this experiment also. Possibly the local irritation may have rendered the animal's system unfit, or the injected

parasites were too few or immature; two days later the blood of this patient proved to be promptly infective in another monkey (*Vide* No. 9).

2. *Failure with Spirillar Blood of the Monkey.*

During Fever.

The animal, No. 2 in Experiment 6, furnished blood-serum containing many active spirilla at the time of its decease.

Twenty-third experiment.—Four minims were injected beneath the skin of Y. T. 2, a monkey previously the subject of ineffectual trial and troubled with sores. The usual observations were made for eight days continuously, and I became assured that no infection took place. Soon after, Y. T. 2 lost health and died with nervous symptoms. It was probably an unhealthy animal, and seemed to be insusceptible to this particular fever.

During Preliminary Infection.

Twenty-fourth experiment.—Blood taken from B. B. twenty-four hours after the relapse was noted, temp. 102°, and several small but active spirilla being present (*vide* Experiment 12), was introduced on the point of a lancet beneath the skin of B. 1. By oversight, next day B. 1 was injected with human saliva from a fever patient (first interval), and immediately high pyrexia set in which was not of the spirillar character. This experiment, therefore, was a complicated one, and it shows only that one kind of blood contamination is capable of overcoming or preventing another. (*Vide* also No. 20.)

Twenty-fifth experiment.—From R. T. 2 (*vide* No. 13), whilst the temperature, though rising, was still not in excess of the normal, a minute quantity of blood containing several active spirilla was taken, and on the point of a lancet introduced beneath the skin of the thigh of B. B.

This animal had been previously the subject of experiment, but was now in very good health. No result of marked or specific character followed during the next eight days, and why this was so did not appear; perhaps there was some defect in the manipulation, or the blood of R. T. may have been in a peculiar condition, for brief and high fever came on in six hours, and then the spirilla disappeared.

During the Earlier Incubation Period.

Twenty-sixth experiment. — Twenty-four hours after inoculation of the animal mentioned in No. 3, and whilst the temperature and blood were seemingly normal, two half-drops of blood were taken, and on the point of a lancet introduced beneath the skin of both thighs of B. 2, a healthy monkey, though troubled with sores on the body which made it fretful. The temperature rose on the next and succeeding two days, but was within normal limits for the following six; and the blood regularly examined never showed any sign of spirillar infection. Here inoculation with blood at early incubation stage failed to act, whilst in Experiment 17 it seemed to be efficient.

This essay forms a transition to another negative series of attempts I next proceed briefly to narrate.

B. Series 3.—*Experiments with Non-spirillar Blood, with Dried Spirillar Blood, and with Saliva.*

To test further the validity of the instances of successful inoculation, I employed, in the common method, and upon similar subjects, the blood taken at the "fall" or crisis of the spirillar attack, also at dates preceding the expected "relapse," and, finally, during the secondary fever or "rebound" which sometimes follows specific pyrexia.

Seeing that a spirillar organism similar to that detected in the blood is to be found in the saliva or fluids of the mouth, I also made use of this sputum as material for

injection, taken from both febrile and non-febrile subjects.

Lastly, blood that had been dessicated was employed in other experiments, with a view of ascertaining whether or not the blood containing spirilla or their germs (supposed) was infective after being dried up.

Blood at "Fall."—Man.

Twenty-seventh experiment.—S. B. (*vide* No. 9), at the close of first attack, presented characteristic symptoms with a critical fall so prolonged as to resemble decline by "lysis." Near the end the morning blood (temp. 101·6°) contained many active spirilla, whilst that of the evening (temp. 98·8°) was absolutely free from the parasite, and served for the following operation.

2. R. T. 3, a new and healthy monkey with normal blood, had ten minims of the above, defibrinated, hypodermically injected in the thigh; next day the temperature rose to 104·2°, and declined to 99·8° on the following morning; afterwards it was tolerably level, subsiding slightly for the nine days of observation; the animal appeared to be unaffected. The blood was carefully examined, and the result was negative. The rise of temperature on the second day was attributable to irritability of the subject, which for a few hours once escaped custody altogether.

Monkey.

Twenty-eighth experiment.—R. T. had a well-defined attack of spirillum fever (*vide* No. 14) terminating with a prompt fall (temp. 100·6°), three hours after which it was killed and furnished blood at this time with clouded plasma, partial fibrillation, few white cells, little protoplasm, large red discs normal and no movements.

2. Chain 2, a fresh restive animal, had twenty minims of the above, defibrinated, injected into the thigh (temp. 102·6°), blood normal. The temperature rose in the night

but speedily subsided, and thence maintained a uniform course till the seventh day, when there occurred a brief febrile paroxysm; afterwards it was level till the sixteenth day. The blood was repeatedly examined with negative results; the exacerbation noted seemed clearly attributable to irritation of the chain, ending in an ulcer, and it was neither attended nor preceded by specific changes in the blood.

So far as they go, these two experiments are decisive as regards the non-infecting properties of the blood taken at or immediately after the crisis of an attack of spirillum fever.

Blood at "Rebound."—Monkey.

Twenty-ninth experiment.—B. T. 2, of trial No. 16, after a well-defined attack of specific fever, and at the fall a pause of three hours, had a sharp rebound of temperature from 102° to 106·6°; the animal was then very ill, and eventually it died. The state of the blood at the onset of this secondary fever was as follows:—Plasma clouded, fibrillation partial, much protoplasm, some large granule cells, several white cells, red discs heaped, shrunk, and blended, no spirilla.

2. W. T., a healthy animal with normal blood was inoculated in both thighs with the dark, thin blood of B. T. 2, as above; temp. 102·4°, rising towards the close of the second day but subsiding on the third and fourth, and again rising on the fifth and sixth. The blood was repeatedly examined and always with negative results, and the experiment shows the non-infecting character of blood taken after the specific fever, when even more pronounced secondary fever occurs. I consider, also, that the nature of this rebound is indicated by the present trial, in so far as its relationship to septicæmia or other special blood contamination is concerned, for the effect of injection was here nil. W. T. was subsequently inoculated with success (*vide* No. 2).

Blood during the Apyretic interval, prior to expected Relapse.—Man.

Thirtieth and thirty-first experiments.—A., a man, admitted with high fever (specific), which, according to his account, was a first attack, displayed the usual level apyretic stage following the crisis, and on the third day his temperature was 98·4°, and his blood free from any signs of the parasite.

Ten minims after defibrination were injected into the thigh of a monkey (Chain 2, of No. 28), temp. 102°; next day there was a rise, on the third none, and on the fourth a smart paroxysm (temp. 104·8°); afterwards the temperature continued to be level for ten days. The blood was frequently examined and nothing abnormal was detected in it, excepting on the morning of the fourth day, just before the paroxysm above alluded to, when small curved filaments were seen, which at the time I regarded as resembling imperfect spirilla; from subsequent experience, I should not lay any stress upon such appearances, unless in the same specimen undoubted parasitic organisms were also to be found.

On the sixth morning after the fall, the temperature of A. was 97·4°, and blood only rather clouded.

A second fresh monkey (B. 1, of No. 24), with normal blood and temperature 101·4°, was injected similarly to the first; slight exacerbations of temperature followed on the first, second, and fourth days, and on the eighth the observations were closed, all having been negative in results, including the frequent scrutinies of the blood.

The man himself had no relapse, nor did his blood display any marked changes at the dates when the second attack usually supervenes.

Thirty-second, thirty-third, and thirty-fourth experiments.—The patient named in No. 9 had quite rallied after the invasion attack, and showed a level (temp. 97° to 98°), and somewhat prolonged first apyretic interval. In anticipation of the relapse, I abstracted and used for

inoculation blood drawn on the seventh, eighth, ninth, and tenth days after the main fall and disappearance of the parasite. The same process was followed on each occasion, the morning blood being taken, promptly defibrinated, and about ten minims injected subcutaneously into the thigh of a healthy monkey. The four animals were then kept apart, the temperature every three hours taken and recorded, and their blood scrutinised twice daily for ten days.

The result was in every instance negative, the temperature charts showing nothing peculiar and the blood being unchanged. That there was no want of susceptibility in three of the animals is apparent from two of them being afterwards successfully inoculated, and the third is that case described in Experiment 13, where contagion probably occurred; the fourth monkey, however, seemed to be impervious to infection (*vide* Y. T. 2., in No. 23).

This series is continuous with that narrated under Nos. 21 and 22, which was concerned with the onset of the relapse, and furnished similarly negative results, whilst No. 9 shows successful inoculation with blood taken during the recurrent attack. I consider Experiments 30, 31, 32, 33, and 34, prove that the non-spirillar blood of the apyretic interval in man is incapable of conveying infection.

c. Series 4.—*Experiments with Dried Blood.*

At the late period in the epidemic at which my inquiries began, the supply of infecting material from hospital patients was only intermittent, and as the source from animals was necessarily of brief duration, I had early to consider if spirillar blood might not display its characteristic property in the dried as well as in the fresh state. Several specimens of blood proved by experiment to be infective, were accordingly dessicated with care in thin layers, either simply under cover at temperature of the air (about 80° F.), or over sulphuric acid, or over caustic lime, and some of these attempts at preservation were so far successful that the dried blood was found by the

microscope to show, when moistened with distilled water, the parasitic organisms hardly altered in aspect, and but little intermixed with new growths. This material suspended in water was freely used, and I also added in two instances some acetic acid with a view of better liberating the spirilla or their germs from the albuminous substance in which they were embedded. These essays to conserve the blood intact without the aid of antiseptics (the use of which seemed undesirable) have all failed; they form the Series No. 35 to 42 inclusive.

Thirty-fifth experiment.—Blood taken at the crisis of a well-marked first attack in a man, dried in vacuo, and hermetically sealed was, after an interval of eight months, inoculated in B. T. monkey, about a grain's weight being used; the result was negative.

Thirty-sixth experiment.—Blood taken on third day of first relapse, dried under cover, and kept for five days only, was inoculated in C. monkey. The temperature rose for the first three days, and then became normal; there was no visible change in the blood of the animal. The same material produced no effect in two men who had small quantities placed under the skin. In both the above instances the monkeys readily acquired the fever upon inoculation with fresh blood.

Thirty-seventh experiment.—The blood of W. T. monkey, known to be highly infective, was dried over sulphuric acid, and two months afterwards employed on B. B. When moistened with water some bacteria were found, but the spirilla were numerous, and on the addition of acetic acid appeared to be unchanged. The softened fragment and drop of fluid were introduced beneath the skin of the thigh, the temperature was taken, and blood examined with care for twelve days in succession, and there was no sign of illness or spirillar contamination.

Thirty-eighth and thirty-ninth experiments.—The blood of man (first relapse) and of a monkey, known by experiment to be infective, was dried without undergoing any apparent change, and nearly two months afterwards

inoculated in two monkeys, which never showed any evidence of being affected thereby. In the man's blood no trace of the spirillum was detected after desiccation, but that of the monkey showed them distinctly. Bacteria were present in a dried condition, and these produced no effect on inoculation.

Fortieth and forty-first experiments.—The same materials were moistened with acetic acid, and so rendered soft and translucent; they were then used for inoculation in two fresh monkeys, and still without result.

These failures contrast with the success so readily obtained with the preserved blood of animals affected with the so-called splenic fever; and they serve to show that the Spirochæte possesses more delicate physiological properties than the Bacillus.

D. Series 5.—*Inoculations with Saliva.*

The following experiments display a notable contrast with the results of the previous successful inoculations:

Forty-second experiment.—About the same time as the blood was employed of the patient No. 1, I made use of his saliva for injection. High fever being present the fluids of the mouth were scanty, the saliva had a milky aspect and gave a whitish sediment; it contained large epithelial scales, much granular matter, and many active bacterioid forms, including the spirillum. As contrasted with the parasite in the blood, this of the saliva was larger or thicker and more sluggish, never twisting or lashing into knots and rings, and never clustering together; perhaps the more tenacious medium was concerned here. I observe that the Spirochæte proper of Ehrenberg, as I found it in tank water, is much larger than either of the above, and always preserves its spiral contour in movements, however active; whereas the organisms in man straighten out in their contortions and display the screw-like form only when nearly or quite quiescent.

About twenty minims of the above fluid were hypodermically injected in the thighs of two fresh and healthy monkeys.

2. B. (temp. 102·6°). Next day the animal was ailing and the temperature had risen to 104·5°, remitting but slightly; on the third day of the fever it remained high (105·4°) and nearly continuous, and death took place early on the fourth. The blood was quite free from specific contamination throughout the attack. At first, coagulation was slow, and small protoplasmic masses were seen; towards the end there were large granular protoplasmic masses, with plasma clear in the morning and faintly granular in the evening, with little protoplasm and few white cells, red discs shrunk and blending; no moving particles of any kind were detected.

The animal was evidently poisoned by the saliva injected, yet it did not present the same aspect as seen in spirillum fever. There was inability to sit up and the head did not droop low, but was leaned against the wall; attempts to eat were shown, which were ineffectual through debility, as it seemed, and finally, there were signs of paralysis on the left side of the body. After death, meningeal hæmorrhage was found over the right hemisphere of the brain, and there was no inflammation of the small intestines, such as I found in the body of a monkey dying on the same day of spirillum fever.

3. S. Temp. 101·2°, rising next day to 104·6°; the fever being continuous it was 104·8° on the third day, and 105·4° on the fourth. Slightly remitting, it rose to 105·6° on the fifth day, and further remitting, attained the same elevation on the sixth; on the seventh day there was a complete intermission, with an evening paroxysm (105·6°); on the eighth a remission at first, and then an intermission (temp. 101·6°), followed by exacerbation on the ninth (105·8°); again a decline and rise, but now not so high (temp. 104°), and the animal sank early on the eleventh day of experiment. At first the blood resembled that of B., then it became clear and showed small clumps of protoplasm, the red discs being unchanged; on the fourth day there was

nothing peculiar visible, white cells were few, and so next day; on the sixth sloughing of the nates on the right side had began, yet the blood was not altered in aspect; in the intervals of pyretic abatement the monkey rallied a little, but gradually became exhausted by repetition of fever and extension of the local necrosis. At the autopsy no striking lesion was apparent.

This animal also died from the effects of the inoculation, but more indirectly; probably plugging of the vessels had occurred in both animals. Any influence which the spirilla in the saliva may be supposed likely to exert when introduced into the blood was clearly overcome by other toxic agents, of which more than one was doubtless present in the very composite sputum.

Forty-third experiment.—A patient, who had a severe attack of relapsing fever (*vide* No. 3) on the second day of the first interval, was rallying from the "fall" after invasion, and furnished saliva which contained epithelium, bacteria forms, granules, and *débris*, but no spirillum was seen. A small quantity was injected in the usual manner.

2. B. 1, a healthy monkey, temp. 101·8°. After twelve hours, fever set in, which was high (105·6°) and of intermitting character for the first three days, and then became continuous at equal elevation for six days. On the tenth day there was a decline, followed by a sharp rebound (temp. 106°), after which the temperature slowly declined to a sub-normal level in the course of four or five days more. The blood had a dark hue; it was regularly inspected throughout this prolonged attack, and never showed any signs of the spirillum or other forms of bacteria, even after treatment with acetic acid; its characters varied only within quasi-normal limits. The animal suffered considerably, and at first the most. It became prostrate on the second day and lied down, refusing food, the body hot, and the limbs cold, and the left arm seemingly powerless. When the paroxysms ceased and pyrexia became continuous, the monkey seemed to rally, sitting up and looking about; it grew thinner and weaker, however, and did not attempt to eat. Presently, and before fever had ceased, improvement began, and at last convalescence was prompt; the rebound did not appear to entail additional suffering; the palsy of the left arm was persistent.

By the only mishap which occurred in my experiments this animal had been injected with spirillar blood the day before inoculation with the saliva. I do not think the prior injection had any considerable influence upon the results noted, which were similar in character to those of the preceding experiment, No. 42. B. 1 was shortly afterwards again inoculated with spirillar blood, and the successful result is described under Experiment 8.

Forty-fourth experiment.—The saliva of a perfectly healthy man contained epithelial scales, micrococci, bacteria, vibrios, and granular matter; spirilla were not detected in the fresh state, but after treatment with acetic acid, wavy filaments were seen, which had all the aspects of them. Ten minims of this fluid were injected in the usual manner and place.

2. B. B., a monkey in healthy condition, though a few weeks before the subject of spirillum fever, showed on the day following some inflammation of the thigh, and a small abscess at the site of injection three days later. There was no fever (maximum temperature on fourth day, 103·2°), or only a slight exaggeration of the normal daily cycle, with a tendency to decline below the mean, and the blood was unchanged on the first four days; convalescence was complete.

The above experiments indicate the presence of a toxic agent in saliva which is not the spirillar, and should the latter exist, it seems to be overcome by the former, whatever its nature. Healthy saliva is irritant, and during and after the spirillum fever this quality is greatly intensified, so that even death may ensue from the inoculation of febrile sputum. Germs of the mouth-parasite are not developed within the blood of an animal susceptible of direct contamination from the blood of another infected animal.

CHARTS

Illustrating Dr. V. Carter's Inoculation Experiments.

SERIES 1.—*Relapsing Fever* (spirillum fever) *in Man.*

(In Diagrams I to IV.)

The temperatures are axillary and shown in the usual manner.

The state of the blood is indicated by the signs + and −, signifying respectively the presence and the absence of the spirillum at the time of examination.

By the sign ± is meant the apparent absence of the parasite in fresh blood, and its subsequent detection after drying of the specimen and treatment with acetic acid.

N.B.—These charts will also serve to show the identity of the fever as seen in Bombay, with its European forms.

SERIES 2.—*Artificially induced Fever in the Monkey.*

(In Diagrams V to VIII.)

The temperatures are axillary, and are given for every three hours of the day.

The state of the blood is shown by the signs + and −, which respectively signify the presence and the absence of the spirillum at the time of examination.

The sign ± means spirillum not seen in fresh blood, but seen after drying and the application of strong acetic acid (Albrecht's process).

? Indicates appearances not wholly affirmative.

N.B.—The dotted line immediately above that of 101° F., represents the mean normal temperature, viz. 101·3° F.

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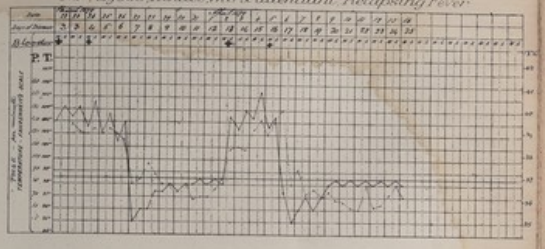
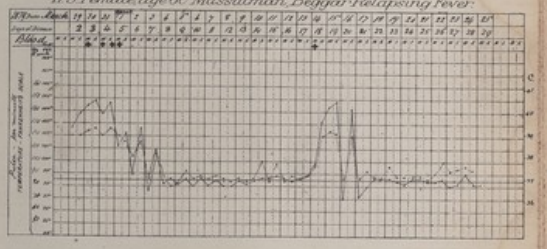
Diagram I–VIII p. 120

Diagram I. Series 1. Experiment 1.
NP, age 28, Hindoo Ward attendant. Relapsing Fever.



Experiment 2.
H.S. Female, age 60, Mussulman, Beggar. Relapsing Fever.



Experiments 3, 11, 43.
E.S. age 27, Mussulman, Coal Trimmer. Relapsing Fever.

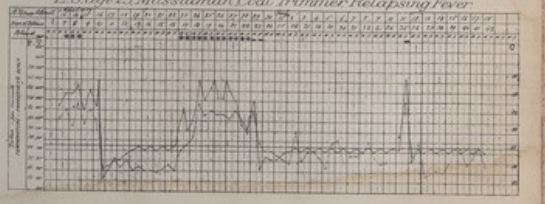


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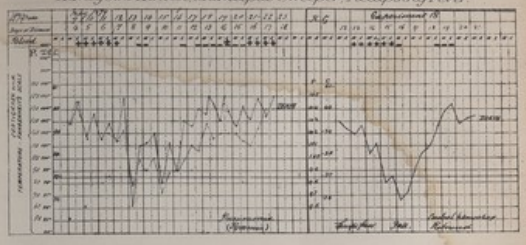
Diagram II. Series 1. Experiments 4. 20.
H.T. age 22 Hindoo Municipal Sweeper: Relapsing Fever.



Experiments 5, 19.
B. M. age 30, Mussulman, Ship Labourer: Relapsing Fever.

Experiment 6.
I.S.B. age 14, Mussulman, Coolie Labourer: Relapsing Fever.

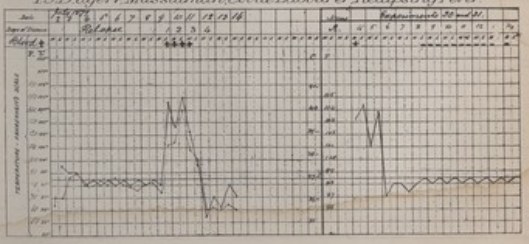
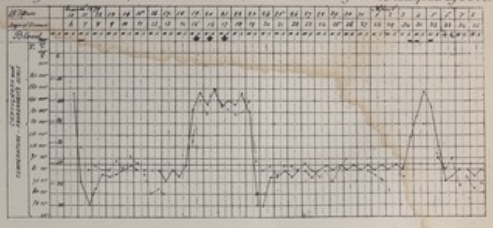
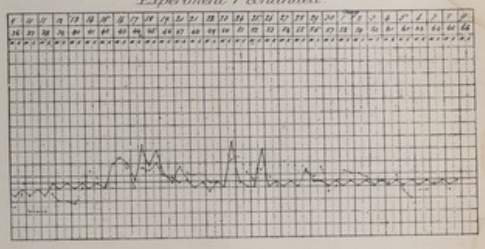


Diagram III. Series 1. Experiment 7.
B.L. age 34 Hindee, Coolie Labourer. Famine Immigrant. Relapsing Fever.



Experiment 7 continued.



Experiment 8.
F.J. age 28, Mussulman, Ship Labourer; Relapsing Fever.

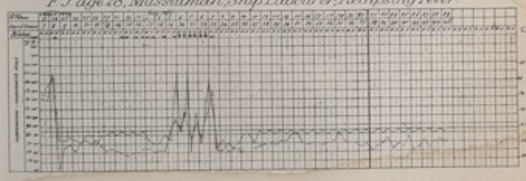
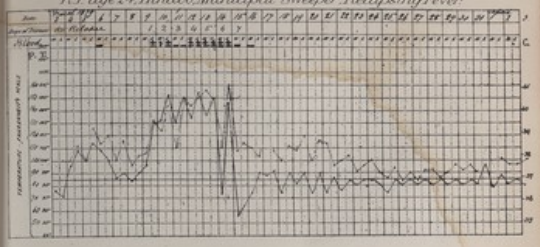
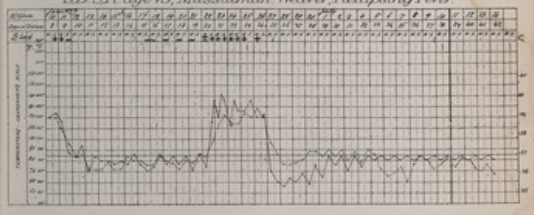


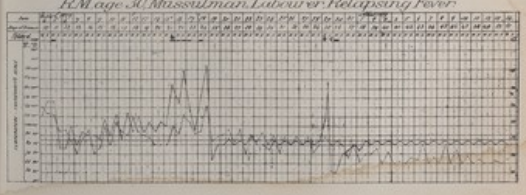
Diagram IV. Series I. Experiment. 10.
R.Y. age 24. Hindoo. Municipal. Sweeper. Relapsing Fever.



Experiments 9, 13, 21, 22, 27, 32, 33, 34.
S.B. S.R. age 45, Mussulman. Weaver. Relapsing Fever.



Experiment. 12.
R.M. age 30. Mussulman. Labourer. Relapsing Fever.



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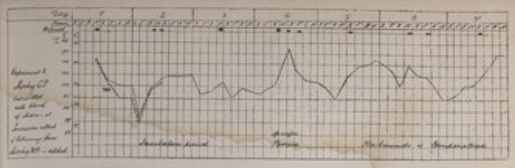

Experiment. 3, 7, 11, Monkey, B 3, YT. & WT 2.

Experiment. 6, Monkey, 1, Chain.

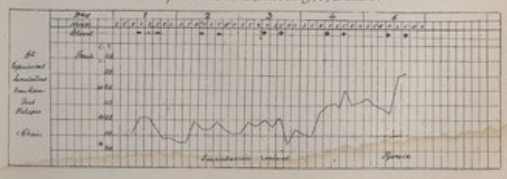

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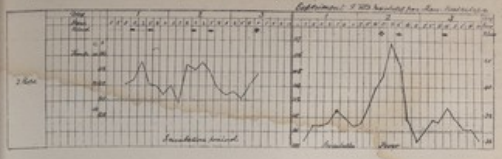
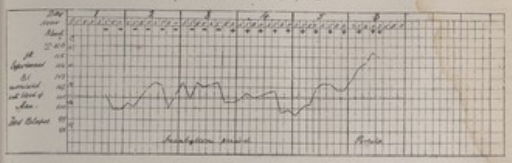
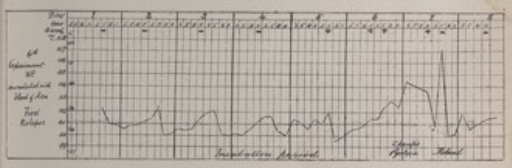
Diagram VI. Series 2. Experiment 2, Rope, 9 WT. 3

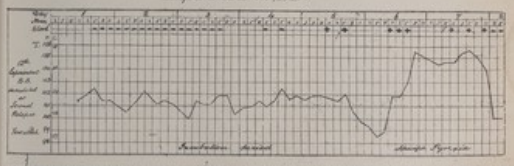


Experiment 8, B14, WP.





Experiment 12, BB.



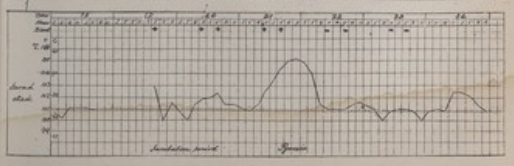


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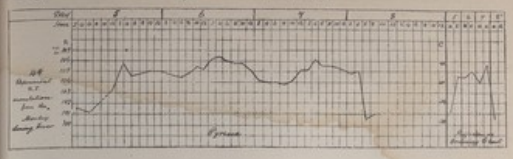
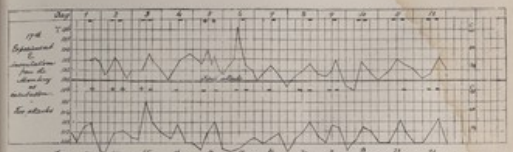
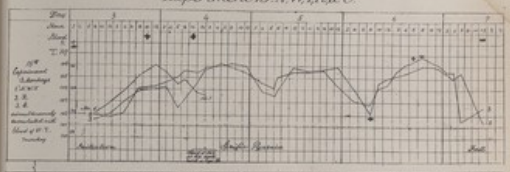
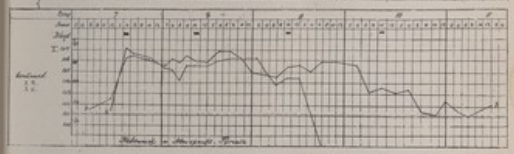
Diagram VII. Series 2. Experiment 14, R.T. 17.E.



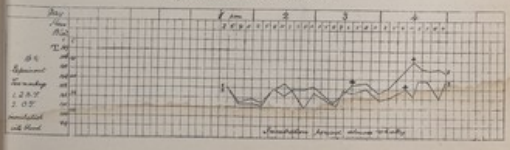


Experiment 15. N.W.T.R.& C.



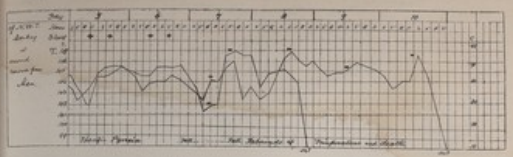


Experiment 16. B.T. & O.T.

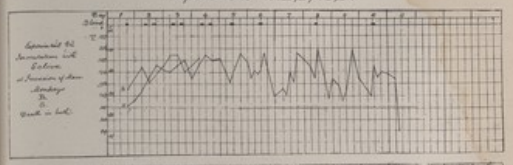


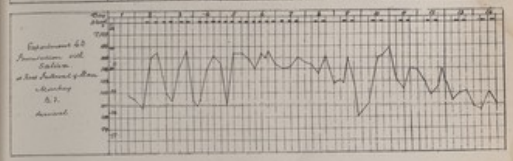
Mintern Bros lith.

Diagram VIII. Series 2. Experiment 16, continued.



Experiment 42. B.S, 43 B1





Appendix. Monkey 1 & 2.

INDEX TO EXPERIMENTS.

PART II.—COMMENTARY.

The above forty-four experiments were made with material derived from man (in thirty-one instances) and from the monkey (in thirteen), upon fifty-one of the lower animals. Serious attempts upon the human subject become unnecessary in the light afforded by my comparative data, for I presume there is no doubt that the blood of an individual suffering from relapsing fever is capable of communicating the same disease to an unaffected subject, just as it does to the healthy quadrumana, and also to these animals amongst themselves.

The chief group embraces the essays made with blood containing the spirillum. Of these there were twenty-one inoculations from man with six failures (*i.e.* 1 to 3·5), and ten from the monkey with three failures (*i.e.* 1 to 3·3), or more properly nine with two; the total is thirty-one with nine failures. Even thus crudely stated, the preponderance of successful inoculations is so decided as to render it certain that the spirillum fever is even readily communicated from man to the lower animals, and between the latter themselves; and this being so, the exceptions to the rule claim special notice, not only from their intrinsic interest, but from that bearing upon a series of complementary experiments, which were made with a view of testing the positive results. The significance of this further series of nineteen essays giving negative results, would be much modified were it established that infective material was commonly or even frequently inoperative, and I will, therefore, at once point out the circumstances under which the somewhat unlooked-for failures occurred, with the inferences that may hence be drawn.

A. *Negative Series.*

Remarks on the second series, Nos. 18 to 25 inclusive.—Whilst under most conditions spirillar blood is capable of conveying infection, the following states seem unfavorable to this result:—A period prior to the onset of fever (No. 25), or at the very beginning of high fever (Nos. 21, 22, 23), when I may here observe the parasite will not grow readily under artificial cultivation; again, at the acme of attack with high temperatures (No. 19), or at the very end (No. 18), when also cultivation fails. The present series shows, too, that when pyæmia is present in conjunction with spirillar infection, the blood conveys not the latter, but a contamination possibly like the former (No. 20), and, finally, if a second poison (*e.g.* of saliva) be injected immediately after the spirillar, it overcomes or annuls the latter (No. 24). Upon review, therefore, these anomalous instances appear not inexplicable, and, further, they become highly suggestive.

Remarks on some other discrepancies.—Experiment 17 showed that blood at early or non-spirillar incubation stage may convey infection, whilst No. 26 displayed only negative results in a similar trial. There is also to note the discordance of Experiment 13 with Nos. 32, 33, and 34, for as they stand these data show that the blood of man and animal, during the ante-febrile stage, may or may not convey infection. When all the evidence is summed up, however, the balance is decidedly against the likelihood of the non-febrile incubative period being an infective one; and of the two instances to the contrary just named, in one (No. 13) there seemed an inferential probability of contagion, and in the other (No. 17) the monkey appeared unusually susceptible, for it presented a "relapse," and this, at least, may have been incidental. I would further remark that the advent of the spirillum during the pre febrile stage being intermittent, it seems

possible that an incubation experiment may succeed at one hour and not at another during this period.

Remarks on contagion as a disturbing influence in these experiments.—The possibility of an affected animal communicating its disease to another by means of contact was early recognised, and I made some trials to test this with negative results. Contagion was never actually proved, in so far that no animal not operated on ever showed the specific fever; possibly the hairy integument was a protection more or less complete, yet bearing in mind the case in man, I do not deny that amongst the lower animals contagion may have occurred in spite of some measures taken to prevent it, and it is not impossible that the anomalous instances of Nos. 9 (quasi-immediate infection), 13 (infection at first interval), 12, and 17 (relapses), may owe their peculiar features to that agency; for this reason, which is only inferential, they will not be insisted on in the final summary. In the great majority of successful inoculations there was so much concordance in time, that I do not hesitate to exclude the influence of contagion. Whether or not the monkey could acquire the fever by simple contact with human patients is not known; none of the persons handling the sick animals were attacked.

Remarks on the negative Series 3 *and* 4.—In Series 3 are nine experiments with non-spirillar blood, showing no ill effects, namely, one with blood at period of incubation (No. 26), two with blood at or just after the "fall" (Nos. 27 and 28), one with blood of "rebound" (No. 29); also two with blood of man in "first interval" when no relapse occurred (Nos. 30 and 31), and three with human blood in "first interval with relapse" following (Nos. 32 33, and 34). Upon consideration I am disposed to consider these instances as valid evidence, that in the absence of the blood-parasite inoculations fail; and I add that under the test of artificial cultivation the same non-spirillar blood never evolved the specific parasite.

The negative effect of inoculation with dried blood

taken during fever or at the fall, I am disposed to consider as fully settled; and some other means than desiccation is needed to preserve intact the contagious property of infected blood. This bears on the *rôle* of fomites.

As regards Series 5, it seems equally obvious that the spirillum in the sputum does not, upon injection of the saliva entire, induce the specific fever; whether or not it would do so in an isolated state cannot well be known. The different effects of febrile and non-febrile saliva, though structurally alike in abundance of bacteria, &c., is worthy of notice.

In bringing these preliminary remarks to a close, I will only observe that the discordant results elicited in my inquiries produced some surprise until it was considered that the propagation of infective diseases in man is by no means uniform, invariable, or comprehensible as regards exceptions to the rule. These experiments show that (like ordinary typhus) the spirillum fever is not conveyed at all stages or upon all occasions, and they point to some of the exceptional conditions, which I need not recapitulate. Supposing that the contagious element is represented by the spirillum, I find grounds for believing that the parasite is not equally active at all periods of the fever, and not at all so during the ante-febrile state; the discrepancies, indeed, in my experiments are marked enough to render it doubtful if the spirillum itself does represent the contagium proper, and not rather some other agency which at certain periods is associated with it. Such doubt seems warranted so far as regards the earlier scanty proportion of the parasite, its dynamical properties at high temperatures or immediately preceding its total disappearance at the "crisis," and lastly, when associated with some other blood poisons (also possibly parasitic).

Additional inferences might be drawn from the above negative series as regards, for instance, the condition of the animals operated on, which will be suggested by the experiments themselves, and there are, besides, several important points not even alluded to; but I claim for my

work no more completeness than commonly attends a first essay, especially as regards negations which are difficult of proof, and the following series is, perhaps, the more satisfactory.

2. *Positive Series.*

The data I have to offer concern the changes of temperature and state of the blood consequent upon spirillar infection artificially induced; a few remarks upon the post-mortem appearances at different periods of infection are added, and some collateral evidence derived from culture-trials.

Memorandum on the normal temperature of the monkey.—It is necessary to be aware that these small creatures have a greater body-heat than man. The axillary temperature of four healthy animals was taken in the usual manner, and under common conditions, at three-hour intervals during from two to five days; total observations 97; mean temperature of air 80° Fahr. The data obtained were at least as uniform as have been stated for man, and are summed up as follows:

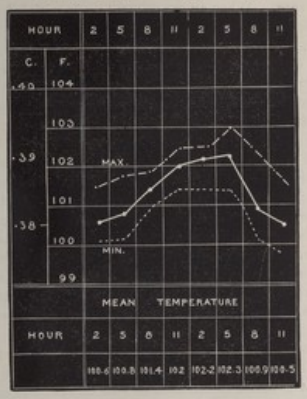
Daily mean temperature . . .	101·35° F.
Mean daily range	100·4° to 102·3°
Maximum	103°
Minimum	100°

The daily mean temperature is nearly the temperature at the hours of 7 a.m. and 7 p.m.; the maximum was found at 5—6 p.m., the minimum at 10—11 p.m.

Course: the lowest temperature occurs about midnight (100·5°); a gradual rise takes place after 2 a.m., continuing till the afternoon, when (5 p.m.) the highest point is reached (102·3°); then follows the evening depression, which proceeds more rapidly than the morning rise.

As compared with man the mean temperature is nearly 3° higher; the range of 1·9° is about the same, and the course followed throughout the day is very similar. The

Normal Temperature of Monkey.



mean daily temperature of healthy natives, taken in the usual manner, I find to vary in range, and oftenest to be rather below that of Englishmen at home.

Normal variations.—The data show these to be not very considerable. They consist in tendencies to a narrower range, to a slight rise soon after midnight, and to an elevation preliminary to the common mean maximum near the hour of sunset.

Incidental variations.—A temporary exacerbation follows restiveness or excessive muscular exertion; and the presence of sores due to biting, with chafing of the band or chain holding the animal, also leads to perturbations of temperature. In cool and damp weather the body heat declines, especially at night.

Some quasi-normal temperatures.—Without entering

into details, I would here allude to my records of abortive experiments. When an experiment made with infecting or non-infecting material fails to produce an effect on the monkey, the temperature retains nearly or mostly its normal characters, and the same is true for the period immediately following an ordinary spirillar attack. This statement is not, however, exhaustive; for although I found that desiccated blood and the blood during the incubation period, at "fall," "rebound" and at date of expected relapse of man, did not induce decided constitutional disturbance, as measured by the bodily heat, yet some perturbations of temperature may ensue, and it has still to be positively determined that these do not represent the mildest or quasi-abortive developments of the blood spirillum. In my observations even at three-hour intervals some minute or very brief blood changes, really specific, may have been overlooked which would correspond to these temperature perturbations when there was no other apparent influence at work; and it would be highly significant, if the spirillar infection, in whatever degree, was established under any of the conditions named above. The chief obstacle to advance in this direction is the want of definite knowledge regarding the development of the spirillum itself, by which to interpret such blood changes as are not seldom seen; and I have many times reluctantly recorded a negative observation owing to this ignorance.

General conditions of experiments.—70 per cent. of my essays, including the first and last that were made, proved successful; and I am of opinion that, with the precautions above intimated as necessary, a much larger proportion of successes might be obtained. In the seventeen trials noted below, twenty-two monkeys were employed, and I find that when two or three were used in a single experiment the result was sufficiently alike, as regards both time and degree, to exclude the idea of contagion as an intervening influence; and as regards the occasions when the same animal was at successive intervals subjected to

repeated inoculations, I had no reason to conclude that the earlier essay materially influenced the later ones. The prime source of infection was the blood of human patients at first, second, or third attack of relapsing fever of ordinary type; subsequently blood inoculations were made from one animal to another.

The induced fever in the monkey can here be compared only in part with its human prototype; yet I am able to say that there was throughout a degree of concordance in general symptoms of oppressive character, which clearly indicated that the "fever" was virtually the same. Post-mortem appearances correspond in the main.

1. *Observations on the Pyrexia.*

Its general features.—The attack in the monkey being initial is to be compared with the first or invasion attack of man, which in him has a strikingly uniform duration, course, and intensity, and in three fourths of cases is followed by a relapse. In the lower animal there is much more variety of form, the date of onset also varies, and a relapse is so rare (viz. at most as one in eight) and so irregular, as to appear altogether incidental or possibly wanting. No such foretelling of events is practicable here as is feasible in the human subject.

These results were not anticipated, and upon reflection I observe, as regards the monkey, that the spirillar infection being new to the species a greater range of susceptibility was likely; besides, the inoculated material was not always the same in character or amount; it may have become modified in transmission, and it was implanted in an artificial manner in healthy subjects.

The human subject, on the other hand, seems to have become uniformly susceptible to attack, is infected in a "natural," possibly uniform, manner, or at certain stages only of the fever; commonly, too, the frame is at the time predisposed by a departure from the normal state.

It is the same thing to say that the contagium itself may have become modified in its passage through the human system; its specific characters may even be due to gradual evolution within the same sphere.

According to my observations the relapse is an acquisition in man, and not an essential part of the fever.

Particular Features of the Pyrexia.

Incubation-period.—This is commonly regarded as a breeding time, ending in maturity of the pyrogenic agency, and reckoned as lasting from infection to fever, general symptoms being seldom well defined until towards its close, when the prodromata appear. My experiments serve to illustrate the varied duration and form, and probable nature of this period, especially as regards the nearer pre-febrile stage corresponding in date to the premonitory symptoms.

I should here remark that, correctly speaking, the relapsing fever of man is a composite affection embracing a series of distinct attacks, and therefore cannot, except in a very restricted sense, be classed as one of the "continued" fevers. The corresponding affection in the monkey, on the other hand, comprises but a single febrile event, which is probably the fundamental, as it is the simpler, manifestation of spirillar pyrexia.

Judging from analogy, the several apyretic intervals of the recurring variety should be regarded as incubation-periods belonging to the attack which they precede, and the accuracy of this view is confirmed by the fact that the specific blood-contamination invariably commences one or two days (at least) before the onset of fever in man and animal, that is to say, towards the close of the apyretic incubation-period; whilst it is never prolonged beyond the pyrexial attack, but promptly and wholly ceases with it. Particular scrutiny is needed to detect the spirillum during the incipient apyretic infection of

man, and in him data are necessarily wanting for the first incubation-period, or that preceding the invasion-attack; but in the lower animal this preliminary blood-infection, besides beginning earlier, is more readily detected during the first and sole incubation-stage here witnessed, and thus, by experiment, the whole series of observations is rendered complete.

Each of the non-febrile periods in question thus becomes divisible into an earlier incubation-stage proper, and a later stage of apyretic infection, during which there is present the same visible blood-contamination as characterises the pyrexial condition, the only difference being that, with the onset of fever, the parasite becomes more abundant. I was not able to correlate in the monkey any premonitory symptoms beyond occasional languor and impaired appetite with the preliminary infection stage, nor have I yet in man observed further concurrence; future inquiry may show such other coincidences as might reasonably be anticipated.

The following details of temperature are available from thirteen selected experiments:

Non-spirillar stage.—After incidental excitement has passed off there occurs but slight perturbation of body heat, the tendency in prolonged instances being to a decline, connected with effacement of normal daily range. The mean duration was 60 hours, which is probably in excess of the actual, but such wide variation is apparent (viz. from 15 to 96 hours), that it becomes evident there were conditions differently influencing each group of experiments; these might be concerned with the quantity of injected material (though hardly likely so), or with the stage of fever, or state of the blood inoculated, and of this the number and activity of the spirillum may not be a complete measure. In general, this stage was twice or thrice as long as the succeeding one.

Stage of spirillar infection.—The ascertained mean temperature at first appearance of the parasite was 102°, or so completely within normal limits as to show conclu-

sively that the mere presence of the spirillum does not entail high fever; subsequently the body heat even declines from ·3° to ·9° below the normal mean of corresponding hours at day-rise especially, and if this stage be prolonged the temperature may sink to 98·6°, or below the normal minimum. I have verified this course in the human subject. The mean temperature immediately prior to the estimated hour of febrile onset was 101·6°, or hardly above the normal mean; once it was 99·8° and once 103°, when fever came on more gradually than usual. The charts show a quasi-normal course, with depressions rather pronounced.

Duration.—This varied from 15 to 50 hours, but the average was near enough the mean of 26 hours to permit this stage being regarded as frequently a well-defined one.

By combining the above two stages the entire incubation-period is obtained; its mean duration was about 90 hours, range from 30 to 126, average rather over the mean, or nearer 4 days than 3. It varies, in general, with the intensity of ensuing fever; thus, five severe cases had a mean total incubation of 64 hours (range 53 to 84), and four mild cases a mean of 86 (range 66 to 118), these differences being determined chiefly by the length of the second or spirillar stage.

The elements of calculation are submitted in the table appended, from which Experiments 9 and 13 may be eliminated, 17 may be exceptional, and 14 is ill-defined. Most of the data being necessarily approximate, the needed corrections would be an abbreviation of the first with corresponding lengthening of the second stage; estimate of fever was arbitrarily fixed at first observation after rise above mean normal. After correction the second, third, and fourth columns of the table would be still unharmonious, and upon the strength of two experiments more precise than usual (viz. Nos. 2 and 8), a natural variation of the incubation-period, as yet obscurely understood, must be admitted, however unlikely

this at first sight would appear; upon arrangement of each series a fair average commonly appears, with rarer extremes in either direction, and more cannot now be be advanced. I would only add that these remarks are in accordance with clinical experience.

REMARKS ON THE ANNEXED TABLE.

(Page 56.)

The figures in the second to sixth columns are hours; the blank spaces in the second to eighth columns are due to observations cut short or incomplete. The first thirteen experiments were made with the blood of man, the last four with blood of the monkey. The figures in the second column are overstated where the blood examinations were made at long intervals, those in the third column being equally understated. In the fifth column fever is reckoned to begin with rise to and decline until normal upper limits (102·3°); comparison with the charts may be made. The fourth column is the sum of the second and third, and the sixth column the sum of the third and fifth.

Incubation-period.—Assuming my data to be free from fallacy, the length of this period is seen to be not only varied in particular instances, but inharmoniously so with regard to current ideas of infection; thus, the three mild attacks after inoculation of human invasion-blood had a mean incubation-period of seventy-five hours, and equally so the two severe and fatal ones of comparative infection at second remove from man (No. 16). This fact seems conclusive of the little significance of incubation-periods as respects the spirillum fever. Nos. 6, 7, 8, and 10 conform in pre-spirillar and apyretic infection, and 11 in the latter only. The longer delay of visible infection in No. 4 (1 Rel.), 12 (2 Rel.), 17 (Incubation), and still more in No. 13, and the two relapses 17 and 12, are not susceptible of collation; if the latter were the result of contagion, the interval in question remains undetermined. No. 9 is wholly exceptional in the other direction.

Fever: Man.—The invasion series Nos. 1, 2, and 3 are concordant, and almost equally brief attacks occurred after inoculation with incubation-blood (Nos. 13 and 17, with relapse). No. 9 had also a brief attack. The sharp rebound of No. 4 is not reckoned above. No. 12 (second relapse) stands alone; the period of spirillar infection (sixth column) was nearly alike in first and second attacks. *Monkey.*—This series is tolerably concordant, and offers a great contrast to the corresponding invasion-series of man, the mean duration of fever being as 72 to 7—a prominent fact.

Table of Conditions and Successful Experiments.

No. of experiment.	Pre-artificial incubation.	Specific incubation.	Total incubative period.	Duration of pyrexia.	Total specific infection.	Max. temp. noted.	Character of attack.	Date of inoculation.	Nature, quantity, and quality of material inoculated.
1	48	23	71	8	31	105·4	Mild	4th day of invasion	Defibrinated blood, minims xx. Spirilla several.
2	54	37	91	8	45	104·6	Do.	Do.	do. x.
3	54	18	72	6	24	103·6	Do.	8th day of invasion	Do. v. Spirilla numerous.
4	96	24	120	37	61	104·4	Do.	1st day, 1 relapse	do. v. Spirilla very few.
5	48	50	? 120	? 30		105·8	Marked	2nd ,, do.	do. iv. Spirilla several.
6	48	98				105·2	—	2nd ,, do.	do. x. Spirilla many.
7	48	—	—	—	—	—	—	2nd ,, do.	Do.
8	46	—	—	—	—	—	—	3rd ,, do.	do. x. Spirilla several.
9	48	—	—	—	—	—	—	3rd ,, do.	do. xx. Spirilla few.
10	?	—	—	—	—	105·8	Mild	3rd ,, do.	do. xv. Spirilla many.
11	15	48	63	15	?	106·8	—	4th ,, do.	Serum of blood do. x. Spirilla few.
12	94	50	144	42	62	106·6	Marked	4th ,, do.	Defibrinated blood do. xx. Spirilla numerous.
13	264	36	300	37	61	105·2	Mild	11 day, 2 relapse	Do. do. v. Spirilla few.
14	240	26	266	6	32	105·6	Marked	1st day, 1 interval	Do. do. viij. —
15	—	—	96	66	66	105·4	Mild	9th day, 1 interval	Defibrinated blood, minims x. No Spirillum seen.
16	—	—	53	—	80	106	Severe	1st day of attack	Whole blood, a quarter of a drop. Spirilla many.
	—	—	57	—	86	106·2	Do.	2nd day of attack	Defibrinated blood, a few minims. Many spirilla.
	65	24	89	62	86	106·8	Do.	Do.	Do. do.
	48	12	60	67	79	105·6	Do.	Do.	Do. do.
17	92	24	116	8	32	106·8	Do.	Do.	Blood-clot, the size of a pin's head. Spirilla unknown.
	150	36	186	12	48	106·2	Mild	Do.	Blood-serum, minims iij. Spirilla many.
	—					105	Do.	1st, day, incubation Relapse	Defibrinated blood, a few minims. No spirillum seen.

Stage of manifested Fever.

Beginning.—Fever sets in from 1½ to 5 days (at most) after inoculation, the mean period being 75 to 80 hours, after excluding an exceptional instance. The hour is commonly near noon or somewhat later, but there is no rule, and it may be at night or early morning; since the majority of inoculations were practised at 5 p.m., no relationship of time here appears. A high temperature is attained on the first day, and generally within a very few hours (3 to 6), it may possibly be earlier, and is sometimes later (8 to 12 hours); this abrupt beginning of high fever is also a character of the attacks in man. The mean temperature at observed initiation was 104·8° for a morning rise, and 105° for an evening rise, both figures being doubtless within the actual, yet sufficient to show how decided is the onset of fever. As the normal temperature of the monkey is higher than that of man by 3°, the absolute initial rise is not so great as in him, yet the upward limit being nearly the same on this first day it is observable that the spirillar pyrexia again displays its special character.

Course.—As to duration, the induced fever is briefer than that of man, never lasting longer than 3½ days (86 hours), in the mean barely 2 days (43 hours), and at the shortest only 6 hours. Such very varied duration has no counterpart in the first attack of man, but it accords with the varying length of "relapses" in the human subject; so that the single comparative attack may be said to represent almost all known degrees of fever. Proportionately to its bulk of body the lower animal suffers more than equally, and so does the human infant, hence the hypothesis of a limited *materies morbi insitæ* has no application here. One half the attacks might be called mild, the fever lasting not more than 24—30 hours; the

rest were pronounced, lasting twice or thrice as long, and being sometimes fatal in the rebound. The form and degree of pyrexia may be stated as follows:—Fever is paroxysmal in the briefer attacks, and remittent, or even continuous, in the severer. Five mild instances had a total mean duration of 16 hours, and the form of an isolated paroxysm, declining somewhat more slowly than it rose, and more deeply than its starting-point; the temperature attained was in the mean 104·7°, at maximum 105·8°, and at minimum no more than 103·7°, or not more than 1½° above the normal level. A rebound was rare, yet prominent once (*vide* Experiment 4). In two pronounced attacks, lasting 24—48 hours, the fever was practically continuous, with a depression at early morning hours more or less marked; the second wave was rather less prominent (105·2°) than the first (105·6°). Five severe attacks lasted from 62 to 86 hours, or in the mean rather over three days; in all, the fever was continuous when viewed at short periods, but when projected from the daily maxima and minima its remittent character was very apparent; high pyrexia was rarely sustained for 24 hours together, and the single instance showing this had a low initial temperature at starting, the animal dying (*vide* Experiment 15); the remissions generally took place in the early morning, and varied from 1° to 3° or 4°. A daily cyclical range was so apparent that it may be confidently looked for in fever lasting two days or longer, and according to the duration will be the number of daily exacerbations and remissions. The mean temperature of these epochs was the following:—First or initial rise 105·5°, first remission 103·1°, second rise 105·8°, decline 103·8°, third and final rise 105·9°, and fall (crisis) 101·7°; there is a visible tendency to gradual augmentation of pyrexia till the acme (maximum temperature 106·6°) immediately prior to crisis of attack. The mid-febrile remissions amounted in the mean to 2·3° (first) and 2·1° (second), or about one half the final fall.

All these severe attacks were succeeded by a sharp

rebound or secondary fever, during which three animals died, and a fourth would probably have succumbed had it been allowed to live as long. Excepting in absolute briefer duration, these comparative phenomena agree with human experiences, and as the contemporary blood-infection is the same, I conclude that the specific pyrexia of man was actually reproduced in the lower animal.

Crisis.—This was always well-defined, yet not so extremely pronounced, or commonly quite so abrupt as in the human prototype. Profuse sweating or incipient collapse were not noticed, and in the milder cases recovery was prompt. The main fall was usually recorded at the 5 a.m. observations; the absolute decline varied from 2·8° to 6·6°, mean about 4° Fahr., the mimimum temperature noted at this time was hardly below that sometimes recorded in healthy animals (100° Fahr.), whereas in man it may be 2° or 3° lower than normal minimum, and this difference may be referable to the greater constitutional robustness of the *ferœ*.

Relationship of Pyrexia to Incubation-Period.

No invariable rule was here manifested, only it may be said that whilst for all degrees of fever the earlier non-spirillar stage had a mean duration of near 60 hours, that of apyretic infection had a mean of 26°; divergencies as regards the intensity of ensuing pyrexia were more variable than the conditions of experiment, which was hardly to be anticipated, and I regard the absence of an appreciable regularity of sequence in this respect, an incubation-period of almost identical length preceding, in individual instances, both mild and severe attacks, as indicative of some intrinsic difference of the contagium which is not displayed until fever sets in. The following note bears upon this topic.

Comparative Severity of Fever in the Monkey.

A mild or severe attack in the human subject does not necessarily entail a corresponding one in the lower animal, but inoculation from a monkey infected directly or at one remove, especially from man, always produced a severe attack; and hence it appears that the human virus becomes intensified in passing through the monkey. The following tabular statement of results of seventeen inoculations, more or less completely followed out, illustrates this point; the data are means only, and those of Experiments 9, 13, 14, and 17, have been excluded as being least certain or precise.

Events.	Inoc. from man. Mild attacks.	Inoc. from monkey. Severe attacks.
Spirillar infection appears at latest after .	56·4 hours	56 hours
Spirillar infection lasts, at least . .	28·5 „	18 „
Total incubation period	90·7 „	62·5 „
High fever lasts	22·5 „	74 „
Total spirillar manifestation . . .	42·6 „	82·5 „
Deaths known	0 : 12	3 : 5

N.B.—Though derived from common data, these figures may seem not to tally with others previously given, but there is no real discordance.

Somewhat parallel with this striking augmentation of infective properties by repetition (if it be nothing more), is that indicated by the experiments made with human blood at successive pyrexial stages of relapsing fever; thus, infection at "invasion" (Nos. 1 to 3), resulted in the mildest form of attack. whilst the "first relapse" supplied more active material (No. 5), and the barely visibly contaminated blood at "second relapse" (No. 12), was also highly effective. Similar results might be looked for in human experience, and if the successive attacks of

"recurrent typhus" have anything of a cumulative character, or together be comparable with the longer sole attack of ordinary typhus, it might be remembered that the infective powers of the latter fever are greatest at, if not limited to, its terminal stage; nor is the instance a singular one of a contagium slowly gathering in force.

Rebound of Temperature or Secondary Fever.

This is the commoner sort of "relapse" met with, and the phenomenon is a striking one. After mild specific attacks it assumes the form of a smart but brief reaction, and is promptly recovered from; after the severer attacks it is commonly contemporary with local inflammation (see the note on autopsies), and may lead to death. The blood is always free from spirillar contamination here, as in the human subject. Rebounds set in either immediately after the crisis or in the course of a few hours, the milder lasting six hours, the complicated from one and a half to three and a half days, or as long as the prior specific fever. According to their duration, the pyrexia is wholly paroxysmal, or it is sustained and of remittent type, with a tendency to become continued; the onset is prompt and so is the final decline. The temperature attained equals or more commonly exceeds by about 1° Fahr. that of the specific attack, and the highest recorded in my series, viz. 107·2° occurred at the beginning of secondary fever (see the chart of Experiment No. 15); all the maxima were over 106°; the remissions varied from 1° to 3·4°. At the decline, body-heat did not descend below normal limits, except in the three fatal cases, when it probably sank till death.

Secondary fever followed all the severer specific attacks seen throughout, and of four instances only one survived after serious illness; its occurrence after milder attacks

was irregular. Experiment No. 4 is a good example. I need only add that this event furnishes evidence of a similarity, descending even to incidental characters, between the human and comparative attacks of spirillum fever.

Relapses.—The only two known instances have been described in Experiments 13 and 17; they resembled in all features ordinary mild attacks and occurred six and twelve days after the primary event. The extreme range in man was 5 and 12 days in an infinitely larger series than the present, and the average interval was practically invariable, hence my hesitation to insist upon this limited and irregular comparative experience. The absence of a relapse would be no argument against the identity of the spirillum fever of the monkey with the relapsing fever of man, for in the human subject second attacks are wanting in one fourth of cases, or even oftener, and still the invasion preserves its usual characters. I am not aware that relapses were overlooked in these experiments.

The Post-mortem appearances in Spirillum-Fever.

Twelve autopsies were made of nine animals killed at various stages, and in three dying of fever. During the incubation-period (three cases) commonly no striking change was noticed, but once deep congestion of the mucous membrane of the stomach, with minute petechiæ, about the middle of the viscus; liver and spleen congested. In five deaths during fever, vascularity of the stomach about the middle, with small petechiæ, and vascularity of the duodenum and the lower end of the ileum, with congestion of liver and spleen. In one animal bled to death the liver was almost translucent and the spleen small, flabby, and pale, which shows how little the solid parts were altered. Twice, however, there was pulmonary apoplexy; the brain,

heart, and kidneys were not notably changed. In one death at "full," the viscera showed nothing peculiar. In the three animals dying during secondary fever the liver was congested and once enlarged; the spleen large and congested; kidneys healthy-looking; the mucous membrane of the stomach was once unchanged in aspect, and twice inflamed (being once of a deep maroon colour) about the middle. In two animals dying on the third day of rebound the small intestines were inflamed throughout, beginning abruptly at the pylorus and ending at the ileo-cæcal valve, there being hæmorrhagic spots also. In one animal dying a little later, this mucous membrane was very vascular and the intestinal walls were very thin; the large intestine was comparatively unchanged, the rectum only being rather vascular. Petechiæ were seen twice on the lungs and on the heart in these three cases; the brain was pallid only. These data form part of the evidence showing the identity of the "fever" in the man and animal.

After death from poisoning by saliva (two cases) inflammation of the stomach and extravasation into the arachnoidal sac were once noted.

Portions of the above viscera are preserved, and may show minute textural changes (possibly in the blood-vessels), elucidating the essential seat of morbid lesion better than coarser appearances; at present, I have detected no peculiar changes except within the blood.

Microscopic Observations on the Blood.

From a very large number of data I am able to state that there obtains the closest correspondence in aspect between the blood of the monkey and of man at all stages of the spirillum fever, including that of apyretic infection; nor has any discordance come to light. Respecting the less peculiar constituents, various forms of protoplasm deserve

mention from their possible connection with development of the spirillum; but as such "clumps" and "filaments" may be independent, attention will here be limited to the parasite alone.

I regard it as manifest that this organism is identical in both species, and its comparative prevalence in time is also alike. Thus, on first detection in the early non-febrile stage its numbers are sparse (*e.g.* one or two in field of view), and being only rather commoner in the monkey; it then has a fully-formed aspect and would seem to be introduced into the blood *ab extra*; no change occurs until the onset of fever. The spirillum may, indeed, somewhat diminish in numbers, and even temporarily disappear at this time, but with, or even before the rise of temperature, it rapidly augments (*e.g.* six to twelve in the field), and hence sometimes I have been able to predict the advent of fever. During the course of pronounced pyrexia the parasite positively swarms in the monkey's blood (appearing almost as numerous as the red discs); it is little less abundant with remissions of temperature, but it promptly and wholly disappears at a period, sometimes computable by minutes, immediately prior to initiation of the critical fall of temperature, vanishing at the *perturbatio critica* when this phenomenon occurs. The intermittent appearance of the spirillum during high fever, and its continuance at a complete intermission of temperature or during the fall by "lysis," are exceptional phenomena hitherto seen only in man; and the inevitable inference from my comparative studies is wholly in favour of there being the closest relationship between abounding spirillar infection and pronounced pyrexia. The evidence of interrupted parasitic growth, or accession by "crops" or "broods," has not been so manifest here as in the longer attacks of man.

The great variety of form assumed by the more active spirillum in the freshest possible blood does not seem to be remembered, and the ordinary delineation of a straight spiral filament pertains rather to a more quiescent state

supervening some time after withdrawal from the body; in quickly abstracted blood I found the organism in incessant movement, presenting the shape of curved and twisted filaments, and of loops, knots, and rings, such as were never assumed by the spirilla and spirochæte of tank-water, which I also submitted to scrutiny for comparison. These last preserve their rigid spiral contour in all their movements, and do not unfold, as it were. On the other hand, I have seen the Bacillus (subtilis ?) of similar water part with its straight or wavy outline, and take on a twisted, spiral form, which evidenced nearly as much flexibility and extensibility or contraction as is shown by the blood parasite, and my impression is that the latter organism might be defined anew.

The spirillum of the saliva has been alluded to already in Experiment 42.

For thorough scrutiny of the blood it is necessary to employ the Albrecht process, with or without subsequent staining; and simple dyeing of the blood elements with anilin violet will also be found very useful. By either of these means a multiplication of the spirillum by mid-fission may be seen in most specimens of infected blood, and oftenest, I think, when the parasite is increasing. Often, too, the presence of immature and possibly growing organisms is thus made apparent, the primitive granules and short curved filaments having a diameter somewhat larger than that of the perfect parasite. A dotted or even partially beaded condition of the latter may sometimes be noted, which seems indicative of a mode of growth. The same processes applied to the venous bloods issuing from the spleen, liver, lungs, kidney, &c., during the height of fever, reveal a striking aspect of the plasmic contents, which I can only interpret as significant of active spirillar development; the splenic venous blood is especially rich in endothelial and white-cell forms containing the germs (?) and incipient spiral filaments; this subject is still under inquiry. I should add that there are some fallacious appearances pertaining to blood protoplasm, and (in Bom-

bay, at least) to minute incidental fungus growth which require discrimination.

As to the mode of disappearance of the spirillum at the close of fever, this organism has been found in preserved specimens of blood to quickly melt away leaving no immediate trace behind; sometimes the amœboid masses common in the plasma seemed to involve and remove the quiescent filaments. That the destruction of the parasite, now or previously, is an active process was shown by the fact that in specimens of infected blood kept for several hours the spirillum had been preserved in activity outside the body, whilst it had altogether disappeared from blood drawn afresh within the same period, having evidently been destroyed by some natural process not operating outside the living frame. It was not clear that this process pertained only to a high temperature.

The activity and life of the spirillum are independent of the life of its host; in the living subject this organism is to be seen only in active movement, and thus its detection is rendered comparatively easy. Its movements may persist for many hours after decease of man or monkey (*e.g.* 24 or 36,), and their cessation is not a sign of its own death, for they cease before the filament begins to grow under the influence of artificial culture.

Reserving other details, I will only add here that the parasite of spirillum fever may be readily induced to multiply and grow into a delicate mycelioid network, which in favorable conditions is very luxuriant and striking. Sometimes spores seemed to arise from this fructification, but I was never able to see the production of a second generation of free spiral organisms.

On the connection between the results of Inoculation and of Artificial Cultivation of the Blood.

There exists a certain accord between the experimental series above described and another carried out about the

same time and with the same or similar material, in which attempts were made to induce growth or reproduction of the spirillum outside the body, and the results are worthy of brief mention here, even if it be not admitted that the blood parasite is the "cause" of fever.

Thus, in eight essays at culture I found the spirillum is never developed in blood not containing it at the beginning of experiment, and this is in accordance with the negative results of inoculation practised with similar material. It would, therefore, appear that the germs of the parasite are not habitually present in the blood.

Again, in eighteen cultivation experiments made with visibly infected blood, some (eight) failed whilst others (ten) succeeded, just as is the case with inoculation experiments which are only partially successful. The failures were two of incubation-blood, one of invasion-blood at "acme," one of invasion-blood at "fall," both specimens taken from the same patient as in Experiment 18, which was also unsuccessful at the last of these dates; three failures were of blood at first day of "relapse," which is in accordance with Experiments 21 and 22, and the blood employed was the same as in No. 22; one was of relapse-blood at fall, which also accords; and, in short, these negative data agree throughout, nor are there discrepancies. It therefore appears that growth of the parasite within the blood is, at least, not usual at certain stages of the fever. The successes were six, viz. four of invasion-blood of man from second to seventh day inclusive, and two of monkey's blood at first and second day of high fever, both series agreeing with positive inoculations. Since success in culture implies the growth and increase of spirilla in the medium employed, its relationship with successful inoculation becomes obvious; and the inference favours the view of the blood parasite being essentially connected with the production of pyrexia.

Conclusions.

1. "Relapsing fever" is readily transmissible from man to a quadrumanous animal, and from one of these animals to another, by inoculation of the blood, and it then commonly assumes the form of a single febrile event of highly varied intensity, type, and duration. So far as evidence goes the "relapse" is much more incidental in the monkey than in man. The conditions of infection are multiple.

2. In the comparative attack the incubation-period is characterised towards its close by a non-febrile spirillar infection of the blood, and the same fact has been verified for the first apyretic interval of man. It therefore appears that all incubation-periods are divisible into two stages of a prior non-specific and a later specific character respectively. The duration of these periods, or even of their stages, bears no fixed proportion to the intensity of ensuing febrile phenomena.

3. The relationship of spirillar blood-infection to pyrexia cannot hence be regarded as an immediate one, yet, in the monkey, fever was an invariable sequel to infection, beginning and being conterminous with, and in degree generally corresponding to, augmentation of the parasite in the blood. In milder degrees of infection, however, it is conceivable that the terminal development of pyrexia may be wanting, and hence the spirillum disease would become essentially definable as a *mycosis sanguinis prope cum febre*.

4. Nothing definite has been elicited respecting contemporary pyrogenetic agencies of a specific character, other than the spirilla. Such there may be, yet the tendency of my comparative observations was towards the inference that exceptions to the relationship indicated are explicable upon idiosyncrasy of subject or other complication, the non-specific causes of "fever" being numerous.

APPENDIX.

Successful Inoculation with Blood of Monkey at Incubation-period.

M. No. 1, new animal, had five minims of defibrinated blood taken from a woman, æt. 35, at last day (a.m.) of a characteristic invasion-attack of relapsing fever (temp. 104·8° F.), injected hypodermically in the thigh; material employed contained a great number of active and quiescent spirilla; blood and temperature of the monkey normal.

On the second day at 4 a.m., or 16 hours after injection, the parasite was found in the animal's blood (temp. 99·2°), and for 48 hours longer there was no fever; then a brief intermittent attack ensued, marked, as usual, with increased visible contamination of the blood, and ending with abrupt fall and concurrent disappearance of the spirillum (*vide* Chart, Diagram VIII).

M. No. 2, a female, freshly brought from the bazaar, had hypodermically injected in the thigh ten minims of entire blood drawn from the ear of No. 1 about mid-period of non-febrile, specific incubation-stage (*vide* Chart, Diagram VIII). At this time very few spirilla were to be seen in the blood employed for inoculation, even on testing with the acetic acid process. For two days (possibly less) there was no change in No. 2, but on the fourth day, or 64 hours after experiment (temp. 101·2°), a single organism was detected in its blood, and thenceforward others for 48 hours longer, still without fever, when a brief febrile paroxysm occurred, which terminated the attack.

There were no peculiarities in the state of the blood, temperature, or general symptoms of this case, which seems to show conclusively the possibility of infection during the incubation-stage of fever, due precautions having been taken to avoid error from incidental contagion.

Previously negative results are therefore qualified by this positive issue, and the significance of the spirillar state is, perhaps, increased thereby.

BOMBAY; *December*, 1879.

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NOTES ON THE

ORGANIZATION AND WORKING

OF THE

INDIAN FIELD HOSPI
IN WAR

BY

BRIGADE SURGEON LT.-COL. G. J. H. EVATT, M.D.

Medical Staff.

"I have an idea that the better soldier you make the Doctor, the better Military Doctor he will make."—*Surgeon Major-Gen.* SIR WM. MACKINNON, *Director-General, Army Medical Dept. Evidence before Camperdown Committee*, 1889. *Question No.* 2281.

"The highest professional attainments are comparatively of little avail where there is neglect of systematic arrangements for hospital administration."—*Lt. Gen.* SIR REDVERS BULLER, K.C.B., K.C.M.G., V.C. *Evidence before Camperdown Commission*, 1889. *Question No.* 1523.

CALCUTTA:
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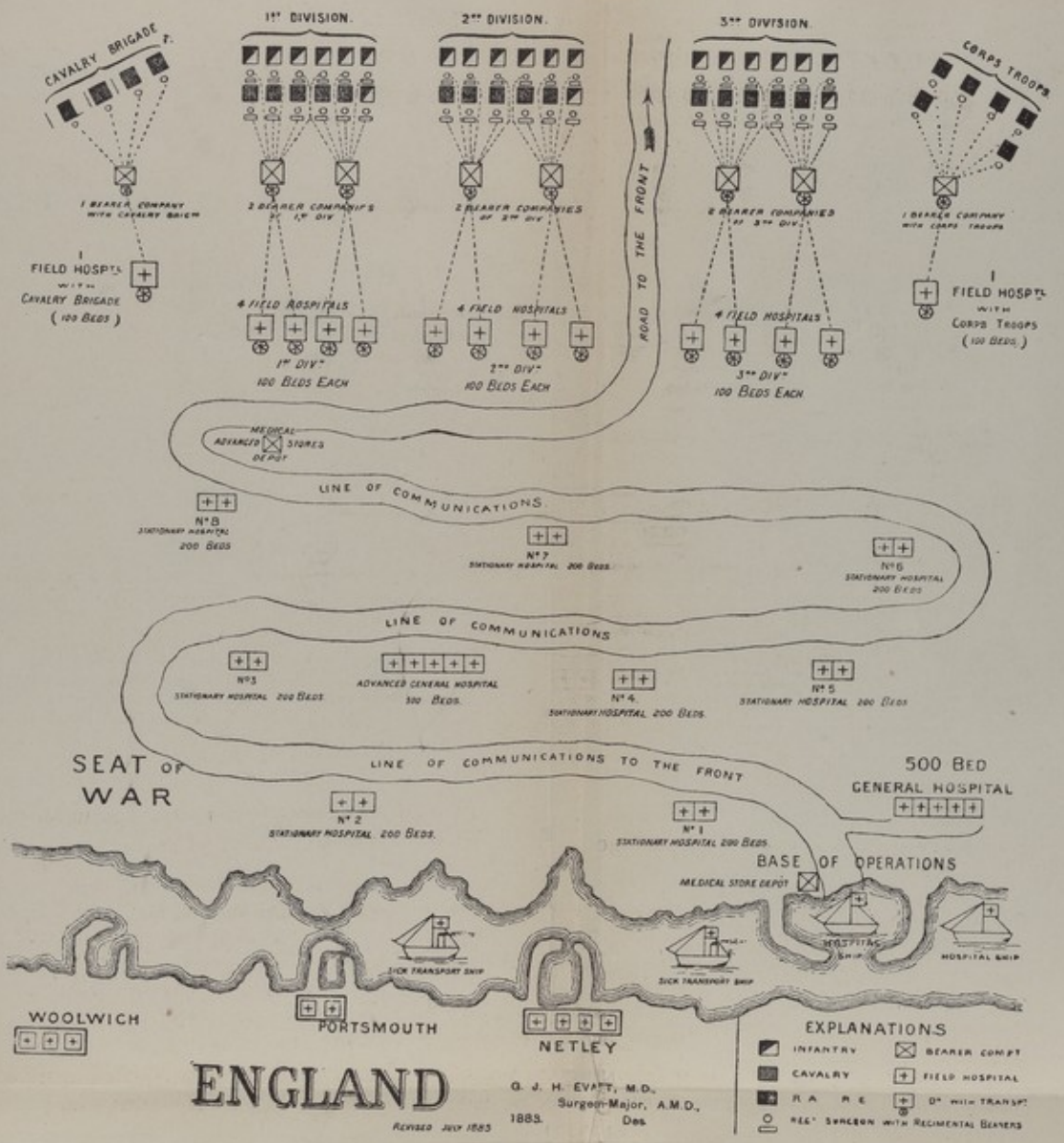
1892

PLAN OF THE MEDICAL ARRANGEMENT OF A MODERN ARMY CORPS IN THE FIELD.



This Diagram shows the various Divisions of an Army Corps in the field, and the medical arrangements in sequence from the front of the Army in the field to Netley Hospital in England, as follows :—

1*st.* Medical Officer with Battalion with Regimental Ambulance Men.
2*nd.* Divisional Bearer Companies of the Medical Staff Corps.
3*rd.* Movable Field Hospitals.
4*th.* Stationary Hospitals on the Line of Communications.
5*th.* The Base Hospital.
6*th.* Hospital Ships carrying wounded to England.
7*th.* Netley, Woolwich, Portsmouth.

Through each of these various units, all of which are officered and manned by the Medical Corps, the wounded soldier must pass in war time.

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1892.

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DEDICATION.

TO

SURGEON-COLONEL E. C. MARKEY, C.B., M.S.

AND

BGD.-SURGN. LT.-COL. G. C. GRIBBON, M.B., M.S.

I DEDICATE THESE PAGES IN MEMORY OF THE DAYS WHEN WE THREE SERVED TOGETHER IN THE 1ST AND 2ND BATTALIONS OF THE KING'S OWN BORDERERS AS THE LAST REGIMENTAL MEDICAL OFFICERS OF THAT REGIMENT UNDER THE REGIMENTAL SYSTEM, ABOLISHED MARCH 1ST, 1873.

TWENTY years have passed by since that day in 1873 when the warrant was issued that separated us from the battalions of that grand old Regiment to which both of you gave such devoted service, and in which I, as a junior officer, learned by your perfect examples so much of the duties of a Regimental Medical Officer.

When I remember the feelings of absolute love for, and complete identification with, that historic Regiment with which all three of us were inspired, and the absorbing *esprit de corps* which animated all our connection with it, who can doubt the blow which we all received when, in March 1873, in a moment, and with not a word of warning, we were turned out of its happy internal social life into the arid deserts of an unorganised Department.

When I bear in mind the self-sacrifice, the skill, and the deep sympathy with your brother-officers and men which characterised your long years of work in those battalions, is it any wonder that the feeling of loss was as deeply

felt by our old comrades as it was by you both and by myself?

Years have gone by since then, years of constant warfare under trying conditions, and we each of us now feel that sad though the separation was, and almost heartless as was its method of execution, it was and has been entirely for the best and absolutely essential for the Regiment, for ourselves as Medical Officers, and for the Army.

Lulled in the pleasant regimental social life we remained hopelessly unready for war, untrained in the completest way for field service, it was as certain that if war came disaster to the wounded and sick would follow as surely as in 1854 on the Alma hillside, or in the Crimean winter, or in the long corridors of Scutari soldiers died who should have most certainly have lived. A fuller professional life as to the treatment of disease, a stronger standpoint for the all-important sanitary care of the soldier's life, and the potentiality of perfect success in war have all resulted from the seemingly bitter wrench of 1873.

Thus out of apparent ill, and much personal suffering, good, and the hope of further good, has largely come.

But that further good, so largely needed, so earnestly hoped for, and for which each of us, and every officer of the Medical Service daily waits, can only come when a statesman rises with sufficient grip of the facts to see that on that day in March 1873, when in deference to the demands of modern war it became necessary to give autonomy to the Medical Service, and to gather in its scattered elements into a body organised for better work in peace and success in war, we should have been made into a Royal Corps, as completely organised as the Royal Corps from which we were so suddenly torn.

Removed from a Regiment where the regimental Commanding Officer was the responsible head of the battalion

hospital, where the Adjutant was a helping executive officer, where the battalion Quartermaster was the supply officer and store-keeper, and where soldiers of the battalion furnished the needful ambulance and administrative help for working that regimental hospital, we all of us feel that when the demands of modern war necessitated the autonomy of the Medical Service and the gathering in of its scattered regimental units into a self-governing and responsible body, we should have been given from our own body a medical Colonel to replace the Colonel we had lost, a medical Adjutant to replace the Adjutant whose help was no longer available, a Quartermaster to do for us all the work the battalion Quartermaster did, and a Corps of trained men under our own orders and linked to us by a common title, a common dress, and a joint tradition to do the frightfully heavy work needed from the Medical Service in war—coming as we did from Royal Corps.

We claimed then to be made a Royal Corps, clearly defined military rank, perfect equality within the army and the organisation of our field units of Field Hospitals and Bearer Companies in peace for war, and a status and an organisation as complete as, and identical with, that given to the Royal Engineers, or any other technical Corps of the army.

Had this been done in 1873 what bitter social suffering might have been averted, what misery in one's daily life might have been fully avoided, and what a heavy strain in war might have been largely minimised? Serving as either of us three have done in warfare in Malayan jungles, up the desolate Bolan Pass, and on the freezing Quetta table-lands, on the march to Kabul from Kandahar, and from Kabul to Kandahar, up the narrow defiles of the Khyber, in the rugged Passes of Jugdulluck and the Afghan mountains, in the Soudan, whether on the Nile or by the Suakim shore,

or in the Chin-Lushai country, have we not hoped and prayed that better days might come, and that good organisation in peace and a defined status in the army might save us from preventible sufferings in war.

We have hoped in vain, and we will continue so to waste our wishes and our energies until a statesman arises with a clear and open mind, free from narrow tradition and able to appreciate facts as they stand ; and he will give us that absolute justice which is all we claim.

No words can ever record our sufferings in those past twenty years in peace and in war; and the hopelessness and despair of the Medical Service is the result of inconsiderate rule and unjust conditions.

We still hope almost against hope that a juster future will come, and we appeal only for enquiry, absolutely convinced as we are of the equity of our demands.

I have endeavoured in the following pages to record some experiences gathered in the most bitter trials, in five separate campaigns, and I know that both of you can largely supplement, and will in a very large degree support, all that I have said.

I dedicate these pages to you both, once my brother-officers on the narrow regimental basis of 1873, but to-day my brother-officers in that Medical Corps which suffered and suffers so much in its painful evolution, but which, despite the opposition of prejudice, class-feeling, ignorance, and old world tradition, is forging its way ahead to the position and the efficiency which we never cease to claim for it.

The *comradeship*, the devotion to duty, the *esprit de corps*, the absolute cohesion for good and ill of officer and man in peace and war, the rise and fall together in good or evil days, which was the bond of internal life in the King's Own Borderers, we are to-day building up in our own devoted Medical Corps—and all we pray for is as equal

a status, as honoured a name, and as absolutely just consideration and treatment as is accorded to our old Regiment and its gallant officers and men.

On so just a foundation we may succeed : on anything less our life must be socially unhappy in peace, and certain of failure in war.

I dedicate these pages to you both in pleasant memory of the past and in firm hopes of justice in the future.

1892. G. J. H. E.

CHAPTER I.

Introductory.

The one great aim of all the changes which have taken place in the Army Medical Service since the abolition of the regimental system in 1873, has been to strive to make that service more ready for its work in war. During the long peace that intervened between Waterloo and the Alma, the medical service was a purely regimental organization. That is to say, it had no autonomy, no independence, no system whatever of field organization, but was sub-divided and attached to battalions in the same way that regimental bands belong to battalions.

Living in comfortable messes, listening to pleasant bands, enervated by medical duties often trivial in character, working in petty regimental hospitals with little or no sick, the medical officers became weakened in self-confidence, and when the time of real war came as in the Crimea, the sub-divided edifice came crashing to the ground.

So long as peace exists, and settled order reigns, and war is unheard of, this regimental sub-division does its work fairly. The battalion Colonel commands the hospital, the Adjutant issues any needful orders, the Quartermaster attends to supplies and the physician prescribes for the sick. He has no executive functions; everything is done for him, and he is kept free from all anxieties. If any disaster or break-down occurs, he is not responsible; he blames someone else. This happy life flows merrily on in the piping times of peace, and it develops a physician with a charming bedside manner, but with methods and character absolutely

untrained and unfitted for executive functions in war. The sick are hungry, he blames the Quartermaster ; the patients are drunken, he blames the Commanding Officer ; orders fail to reach the Hospital Staff, he blames the Adjutant ; but never for any neglect, or break-down, or breach of discipline does he blame the Doctor. Carry on this system for a generation, and you have ready to hand all the elements of collapse in war, and the *chaos* of Scutari is being organized by utterly defective training in peace.

Now go into the field and go in front of the enemy. The very first volley—the bursting of the first shell—smashes up all the peace routine and all the non-responsibility theories of the practically civilian doctor of the regimental days.

My battalion goes into action, and when the day is done, I find 30 men killed and 80 wounded in my battalion alone. The next battalion has suffered more heavily. I find it has 45 killed, and 98 wounded. I and my aids do our best to dress the battalion wounded, and two of us are kept busy in giving these few wounded the roughest, hastiest, simplest bandaging on the field and within the bullet range. The wounded strew the field. I can give them no food and perform no special operations or dressings, as their number far exceeds the resources of the small regimental medicine pannier. But while I stand on the field and see my shattered comrades, the men I grew up with in my battalion, lying wounded and dying around me, I hear the regimental bugles sounding for the advance of my battalion, and word is passed round that the enemy are retiring, and pursuit is urgent and is to be begun at once.

What am I to do ; am I to let the battalion go on without medical aid, or am I to forsake my wounded friends and follow the Corps ? Nay, but if I do wait behind with them, what can I do for them ! I want to get food for them, but I have no Quartermaster ; he is gone on with the battalion.

I want transport, but every available carriage has been pushed forward with the pursuing force. I want my Commanding Officer's advice, he is hurrying forward miles to the front. I want the Adjutant to see if he will issue orders ; he is away with his battalion. I want orderlies to attend on the wounded. Every man has pushed to the front, and I stand alone on the battle-field, and my comrades are dying around me, and what can I do—I would fain help them, but I cannot ; I have no means at my disposal, and the wounded die uncared for.

All this comes of not thinking out in peace what war means ; you must have behind the battalion a new corps, another organization, an independent body organized like any other corps in peace for war.

This corps trained and drilled and disciplined takes over the wounded men on the field, carries them to a central collecting place, operates on them, dresses them, feeds them and transports them to the Field Hospital behind the fighting line, whence, if severely wounded, this corps takes them, march by march from Field Hospital to Field Hospital along the communications to the base of operations, where if they recover they return to the front, or, if severely hit, they are embarked for England on hospital ship manned by the Doctor's corps.

The very same rule applies to the sick soldier. He must be removed from the front ; he must be sent to the rear ; he must be cared for *en route*, and he must be sent to England if hopelessly ill.

All this service then of the sick and wounded from the battle-field in front to England, thousands of miles away, has to be done by a corps, the Medical Corps, working on a disciplined, ordered, regular, and military basis, and it is or should be a corps in the army like any other corps ; the same training, the same drill, the same gradation of rank, command and authority are all needed to make that purely military

machine go, and the more the scheme of medical organization in war is studied, the more it will be found that it needs exactly the same routine and the same methods of work as any other corps. The medical men working it must put aside their previous position and their previous stand-point of fault-finding and of taking no responsibility. Their old Commanding Officer is gone away long marches to the front, then let them develop their own Commanding Officer; their Adjutant is riding with the column 50 miles away, let them develop their own Adjutant; the Regimental Quartermaster is toiling after the battalion far away, and food for the sick there is none, let them develop also their own Quartermaster and draw their own supplies. Orderlies to care for the sick, there are none; for all are in the ranks in front, then develop in peace, the needed men and the essential corps, dress it like its Officers, give it and them a distinctive title, bind it and its Officers together with the bonds of comradeship and discipline. Train it and them in peace for the risks, the danger, and the frightful strain of war, and when the day of trial comes, it will not fail the Nation and the Army. *Esprit de corps*, self-sacrifice, devotion to duty, discipline, are all as possible and as needed in the Medical Corps as in the other. Treat it as unjustly as you please, call it by any defective title, minimize its importance, separate its Officers and men, isolate it from the army it serves, withdraw from it that share of equal rank and justice and rewards which England meant for all her fighting sons; nevertheless they are soldiers still, they are serving their mother-land as well and with equal self-sacrifice as the soldier; and the more you recognize this fact, the more devoted will be their service in the day of battle. From these crude beginnings of the Doctor, his wounded comrade and the orderly carrying out the Doctor's orders, develop all the organized ambulance aid, all the Bearer Companies, the numerous Field

Hospitals, the long weary line of communications Hospitals, the care of the mass of wounded and sick in the General Hospital at the base, the organized Hospital ship carrying the wounded safely to the dear land at home. From this comes Netley's miles of corridors of wounded men; from this come the Herbert Hospital's palatial wards, and all the help, the aid, the comfort given by the nation to the soldier who serves England in the fight. Developing under excessive difficulties, struggling daily with heavy and old-world prejudices, crushed out by the selfishness of narrow class-feelings, pressed upon by all the social pressure which tradition and its exclusiveness can muster, undermined at times by ignorance of the first principles of organization within its own body, unaided often by those in whose hands supreme authority lies, fearful of assuming, and definitely claiming, the name, the status, the methods of a military body, undrilled in the actual routine of war, often ignorant of its *matériel* and with a *personnel* thrown together without cohesion, nevertheless the Medical Corps is slowly working its way ahead to that efficiency which can only come to it when absolute justice and equality is its share, and when every private soldier of England is looked upon by all who have to do with him as a citizen of great value to the State; and who, when he falls wounded, is to be cared for by order of the nation. That day is coming, and let us hope rapidly, but it can only come when the Medical Service itself fully appreciates its rôle and remembers that, however attractive and charming may be the life of the Civil Physician, who enters the home of his patients and simply orders a treatment to be carried out by affectionate relatives, the duties and the lifework of the Soldier-Surgeon must be completely and entirely different. Not only must he order treatment, but he must see to his order being carried out in distant stations; not only must he prescribe drugs, but he

must see the drugs are there on the battle-field ; not only must he direct food to be given, but he must see that the food is forthcoming, even in the desert ; not only must he instruct the orderly, but he must see that the orderly obeys him as a soldier. All this differentiates him largely from the Civil Physician, working in peace, trained it may be in the same medical college. The lives of the two men are absolutely divergent, and the common title of Doctor given to each is wholly misleading in the case of the Military Officer. Not all the surgical knowledge of a Brodie or a Ferguson will take the convoy of 200 wounded soldiers from Kabul over the snowy Pass of Lataband for two hundred miles to Peshawar. Not all the medical science of a Jenner or a Watson will ensure that in the great Base Hospitals of war every one of the hundreds of patients is seen, and carefully attended to, cleansed, fed, and cared for on a hostile shore, and shipped for England in all the confusion and turmoil, and oftentimes the selfishness of the base of operations of an army in the field. My dear Civil Brother Physician it is true I was at the same school of medicine with you ; yes, but it never taught me to work in the Soudan square and see that others worked under me, until every man that fell was not only dressed but fed and cared for, and carried for miles off the field to a far away tent hospital. In the crowded war transport, in the Indian camp, in the frightful sights and scenes of a cholera epidemic in the Punjaub, in the torrid heats of Suakin deserts, or in the steaming tropical depths of Malayan forests I do other soldier's work for England, than you who serve her in a civil capacity at home, and I do it far away and alone, often unaided, and far from sympathetic help. Energy, courage, self-sacrifice, devotion to duty, a soldier's heart, discipline to the yielding up one's life under fire, all these are needed. Life with the soldier on the choking march in the burning

Soudan, in the drifting snow and freezing winds of Cabul tablelands, the burning tents in the wide bare Indian plain, all these things shared with the soldier separate me far from you with whom I learned the physician's art. It is true I am a doctor in the civil sense and glory in the fact : but I am a soldier of England too, and for her and her people, I have given all the devotion and all the self-sacrifice she demands of her soldier-sons, and although every man in the army denied me the title of soldier—from the chief at the head to the last recruit that joined yesterday—I reply you are wrong, and you are wrong because you do not know and you do not understand, and I appeal from the army in its prejudice to England and its people to do justice between us, and to say if she denies me the title I have so justly, and I hope so devotedly, earned in her cause. For the army does not belong to the army but to the nation that lies behind it.

It seems necessary to speak thus, because while many in the Medical Service hesitate to claim, and the Military Service objects to yield, the definite status of soldier to the Medical Corps in the field, war efficiency can never come. One feels that if the English nation once fully understood the responsibilities and the duties and the work of the Soldier-Surgeon, she would in her wisdom at once grant all that justice demanded, and all that the claims of efficiency needed to help on good work in war.

For it can never be forgotten that it is England—the Nation—that loses most in any friction and disagreement of the contending elements in her army. What she wants is success in war, and the due care of her fighting children, and if that success is interfered with, as often it surely is, and that the due care of her torn and wounded sons is defective because integral parts of the army may be at issue : she may well cry, "*A curse on both your houses,*" and herself end or mend the matter.

While success in modern war consists in rapid movements, swift marches, thorough pursuit of a broken foe and an army mobile and capable of being thrown in any direction against the enemy, the sick and wounded cannot be cared for by their own battalion arrangements. They must fall into other hands, or they impede to an intolerable degree the mobility of the troops, and in fact ensure defeat.

Those other hands to whom they fall are to-day the Medical Corps, which in every modern army is gaining a more or less complete military autonomy.

If that Corps is to be efficient, it must be organized and drilled in peace for war. The definition of rank must be complete to ensure its own internal obedience, and the social equality of its officers with other army officers. Uniform, internal organization, a fixed routine of work on a military basis, are all needed to successfully carry out a purely military duty of gathering in, caring for, transporting and embarking the wounded of the army over hundreds of miles of hostile country. Hence, you must give your Doctors a military status, and a military organization if they are to be responsible ; and if not, the logical method is to replace them if you can by pure soldiers, and then see how the machine works.

But the work is so technical, so involved in every movement with weak and failing human lives, that only technically trained men can order and govern a technical corps doing technical work. It is unfortunately true, that a part of the army refuses to acknowledge any status or any military position for the Army Surgeon. If they attempt to drill in peace for war, it is a matter of ridicule, and class jealousy may be carried to an extreme extent, paralysing in a great degree the efficiency of the military machine and doing absolute injury to the nation's interests.

Military Surgeons who are so only in name, and whose

true position is in a brougham in Western London, can join in with this military prejudice or ignorance. They can loudly state that they only are really doctors, that is to say, Civil Physicians healing the sick, and they fight against all drills, all fixed routine, all active and rigid discipline which trains for the field, and they can in fact largely handicap the struggle of the Medical Corps towards war efficiency. They desire to stand well in with the ignorant prejudices of inexperienced or biassed or class-ridden men, and develop a passive resistance to any lines of active medical progress.

All this while, perhaps, pleasant for them in peace, is failure to the nation's army in war, and the very soldier who stopped progress by prejudice in peace may die uncared for in war, purely as the result of his opposition to medical progress. It is then for the nation to cut the gordian knot, to solve the problem, and to clearly lay down the rights, the duties, and the responsibilities of each section of her fighting machine, and see these rules obeyed.

To my mind the crying need of the English Medical Corps is a purely military organization as in the Royal Engineer Corps.

All the war units of Bearer Companies and Field Hospitals should exist in peace, be as well drilled and trained in its war routine as is a battery of Artillery, and we could then go to war with some certainty of success ; whereas to-day when Field Hospitals are merely paper organizations and, Bearer Companies mere expressions in a book, absolute risk of failure stares us in the face in any real campaign.

Our medical mobilization is so defective, so unreal, so much a thing of paragraphs in a code, completely divorced from practical experiences and peace trials, that one looks forward with absolute dread to its being put to the test in the hurry and confusion of imminent war. The great outcome of the new system of field medical arrangements was the Field Hospital,

that is to say, the unit which takes over the care of the wounded men of the Brigade and the Division on the battle-field.

A more important unit bearing on the comforts of the wounded private soldier does not exist, yet we never see one in peace ; they are detailed on paper only. It is the joke of the Medical Corps in India that no one knows what such a hospital is like, for none know how to pack it up, or pitch it, or strike it, or how to make it work with an army in the field. The medicines are in a depôt far away. The tents are in a distant arsenal, the transport is non-existent so far as the Medical Corps is concerned. The *personnel* in India is a fortuitous concourse of atoms gathered in in a hurry from the four winds of heaven, ignorant, untrained, undisciplined followers of the meanest physique and woefully hungry-looking.

With these wretched materials, with no training, no drill, no settled order of work, the curse of the column, always late, always in the way, one is pushed into the field to deal with the life of the dearly obtained, and with difficulty recruited, private soldier of England. Can anything be so painful, and yet, whom are we to blame !

Some narrow-minded soldiers hinder and oppose our drill in peace, push us out of the army circle, forbid us to be soldiers, put every difficulty in the way of our being efficient in a military *sense*, fight about our rank till life is made bitter as gall ; but we seem to have a fearful vengeance in the end, for this hospital is in the way of all his active movements in war, is always late in moving off, stops his passage in narrow defiles, and effectually handicaps the army. Nay more, if this soldier falls on the field, he has no resource but to fall back on the same hospital, this shaky organization which his prejudice has kept inefficient in peace, and which now with the irony of fate becomes his death-place on the battle-field.

In this trying state of things, this terrible organized inefficiency, in this frequent friction between the officers of both

sides, it is the nation as represented by the private soldier in the ranks that comes to grief in the matter. For the sick officer there are soldier-servants, money, and many aids to conquer his discomfort, but the private soldier is the real sufferer in this lamentable working at cross-purposes, and the question is how long is this to go on, and is there none to appeal to to secure efficiency ?

So late as 1890 one could see here, in India Field Hospitals working, or attempting to work in the field. No words can express their inefficiency—their feebleness, the powerlessness for work, the unreadiness in any emergency, the paralysis of working-power they showed. Cursed by the column for their straggling, their lateness in falling in, their cumbersomeness, their always-in-the-wayedness—what would have happened to them if there had been a European enemy or any real fighting !

But it is not fair to blame the Doctors ; they are not gods, nor miracle workers ; they are men, like other men, and they cannot in a few weeks give cohesion and form and discipline to the frightfully discordant and hopelessly inefficient elements given them as *personnel*.

We want above all things, training in peace for war—to be joined to our men by a common title, that we may rise with them as they rise, and fall with them when they fall. We want Field Hospitals in every garrison, worked by the garrison Doctors and kept ready for use in the field, and practised at all field-days.

It seems dreadful to hear Medical Officers talk openly of failure and break-down, and make a joke of what in the end means death to the wounded soldier ; yet no one seems to listen, and between soldiers who don't care and Doctors who have given up caring, and even hoping, where are the elements of progress ?

The answer is in the nation's heart and in the Parliament of England, and in the common humanity and good sense

of the people. Things cannot go on as they are, and the only remedy is the pure militarization of the Medical Corps, exactly on the lines of the Royal Engineers, and its training in full in peace for its work in war.

No drill book, no clear routine for guidance, no definite code of internal rules exist as regards the Indian Field Hospital internal working, and it is as an endeavour to codify my personal experiences in the field that I have put together these paragraphs to strive, if possible, to help those Officers whom fate has fore-ordained to undergo that heavy labour, *viz.*, the command of an Indian Field Hospital in an active and severe campaign. War experiences in Malacca, two years of constant campaigning in Afghanistan, the dreary marches up and down the Cabul-Peshawar Road, service in lonely camps outside Suakin, and more recently my experiences in an petty Indian border campaign have all in their turn acted upon me and driven into my brain certain lessons gained by experience, and these I offer—in the absence of anything better—to my comrades of the Medical Corps. If it helps them in any way in their killing labours, it may tend perchance to save the life of that man who suffers most by our inefficiency, *viz.*, the much sought-after, and with difficulty obtained, private soldier of the English army whose Field Hospital in India is a paper organization, stored in an arsenal, and which we never see till the day of battle. The mistakes I have made are chronicled here for others; the systems I found useful are recorded to be copied or avoided as may seem best to the Officer dealing with like conditions. It is only by building up by personal experiences that one day efficiency may come.

In an important chapter I have dealt with the Bearer Company work in front of the enemy, a duty still very weakly organized in the Indian Army, and needing careful study to see if it is really fitted for war work.

THE FIELD HOSPITAL OF THE INDIAN ARMY—ITS ORGANIZATION AND WORKING.

CHAPTER II.

Size of Hospital and Complement of Beds.

An Indian Field Hospital is organized for 100 beds. This implies a *personnel*, including patients, of nearly 300 persons, and is to my mind too large for a working field unit in India.

I would prefer 50 beds as a more useful size and more easily *mobilized* from one station or district.

My idea is that it should be possible to have at all times ready for field service a 50-bed Field Hospital or more in all the larger district head-quarter stations in India. To mobilize such hospitals would not be great trouble, and it would not greatly interfere with the working of the local Station Hospital from which the staff of the 50-bed Field Hospital came.

I propose this method, because it seems to me to be essential that we localize our hospitals in peace and mobilize them in one place complete in *personnel* and *matériel*. According to this arrangement a 50-bed Field Hospital would be mobilized, say, at Meerut from the Meerut staff and subordinates, and under the orders of the Meerut Principal Medical Officer, and he should be responsible for it in every way.

When complete in every detail, it would be entrained for the place at which its division was mobilized; but should always look back to Meerut as its depôt and head-quarters, draw its needed reliefs from Meerut, send its sick attendants and orderlies back there, from the front

and return there after the war was over, to be demobilized, and its staff to return to duty in the Meerut district from whence it came, and its equipment to the Meerut local stores. This system would enable very perfect arrangements to be made locally, to have everything ready for rapid mobilization, and every quarter or every six months, official lists would be published of the *personnel* of the Meerut Field Hospital; it could at times be regularly paraded and drilled, and Officers, Warrant Officers, and men would know that they would go on field service together as a unit. With any reserve system such localization is essential. Every district head-quarters could mobilize at once one or two or three of such 50-bed Field Hospitals, and the moment one was completed and sent off arrangements could be made to begin mobilizing a reserve one ready for emergencies. A 50-bed hospital would fit in very well to an Infantry Brigade; and as 50 beds of a Field Hospital is the usual hospital unit at posts on the line of communications, the proposed 50-bed hospital would suit very well there.

A 100-bed Indian Field Hospital is very unwieldy to move—can rarely be all together, in one camp, the personal influence of its chief, can rarely extend over such a scattered unit, and accounts, returns and pay questions are complicated by its size. A 50-bed hospital, if complete and filled with patients, has a *personnel* of not less than 150 persons, and can be made a very handy unit in our border or Afghan wars. The great point, however, is that a 50-bed Field Hospital can at any time be mobilized out of a large head-quarter Station Hospital in India, without in any way paralyzing its working, but a 100-bed hospital takes away a large number of the staff at once, and is a certain wrench on the institution from whence it comes. As General non-mobile Hospitals are also built up by 50-bed units,

it would be possible to send such 50-bed segments complete from one station to the place where the 500-bed General Hospital was forming.

I cannot but think that our present system of scattered mobilization, which brings together Officers, Warrant Officers and men from scattered stations all over India, is tedious, liable to break down, impossible to work with any army reserve system, and is far too centralized, throwing the whole weight of rapid mobilization on the office of the Principal Medical Officer of the Army at Simla, and letting the P. M.O.s of districts be quite free. The very reverse is what would suit better. Leave Simla free from all detail questions, and force the local Officers in the districts to be fully responsible for the mobilization work, giving them general rules as to mobilization procedure, and holding them responsible in every way.

The only function of the central authorities on the declaration of war would be to telegraph the word "mobilize." This should set the machinery of the districts in motion without further delay, and leave Simla free to deal with newer and more urgent matters that cannot be foreseen or arranged for. For limited expeditions, where only a few Field Hospitals were needed, the districts should be on a roster, and if the Peshawar district gave a Field Hospital to a campaign in 1891, then Rawal Pindi should give one in 1892, and so on throughout the Presidency. Such a 50-bed Field Hospital breaking up into two divisions of 25 beds each—and these again dividing into four sections of 12, 12, 13 and 13 beds each, would be a very handy unit. It is essential to be able to sub-divide the 25-bed section into at least half that size to meet the constant demands made upon the medical department in the field to provide hospital aid for small detachments of a couple of companies. In our border wars this is highly essential. There is no difficulty in laying

down such sub-sections; the only real hindrance is the want of suitable establishments of attendants, &c.

With 50-bed Field Hospitals coming from separate stations or districts it would be perfectly easy to group them together in any larger form, say, for 150 or 200 or more patients; but the *personnel* and *matériel* would belong to the 50-bed groups, and these groups would be like companies in a battalion or batteries in an Artillery Division. The central authorities should post a Medical Commanding Officer of senior rank to control the grouped 50-bed units, and an Adjutant should be also posted, leaving the 50-bed unit staff to do its own interior work, and, if needed, to march away to any place complete with its own *matériel* and staff. Such a Field Hospital column could be mobilized to any needed strength, but would divide and separate without trouble to the Officer in charge of it.

I would suggest, then, 50-bed Field Hospitals, capable of dividing into four groups, and capable of being concentrated with other like units to any strength.

Present System of Mobilization.—At present Medical Officers are detailed for Field Hospitals from Army Headquarters, and Officers may be collected from stations as distant as Calcutta and Rawal Pindi for the same Field Hospital.

Warrant Officers are similarly collected from stations as far apart as Attock and Lucknow; and, as a result, there is no cohesion and no defined method of work at first in a Field Hospital, that is to say, at the beginning of a campaign, leading to intense confusion and trouble, and utter risk of break-down.

Pack Store Sergeants and Writers are also thus mobilized.

The hospital native sick attendants are also gathered together from all quarters in driblets, and amongst them

there is little or no cohesion, and the comradeship and friendliness that could exist in definitely organized district units is absent, nor is it possible to know who are good men, nor who bad, until trouble and confusion occurs.

The Purveyor's establishment, now called Hospital Storekeeper's establishment, is now similarly gathered together from all quarters, but it is not a good system, and I strongly recommend and advise defined district localization and mobilization with peace practice, and frequent drills as a unit.

A Field Hospital going to war from a certain station and calling itsef No. 1 Meerut Field Hospital—or No. 2 Lucknow Field Hospital—has about it a certain definiteness, and its career can be watched and its doings noted far better that any hospital with a mere number and a *personnel* gathered together from every corner of a presidency. The same remarks apply in a lesser degree to hospital equipment. This equipment is now stored at a few central commissariat depôts, where it is not seen by Executive Medical Officers or by Medical Subordinates, and they know little or nothing about its character. What is wanted is a great decentralization of Field Hospital equipment. Every large garrison should have its own Field Hospital equipment stored in that garrison and in custody of the Senior Medical Officer of the Station Hospital through his Senior Apothecary, acting as Quarter-master. The medical stores, tents, ordnance stores, military works stores and commissariat equipment should all be packed and stored away in a house or store-room specially built in the ground of the Station Hospital. The Medical Officer mobilizing a Field Hospital should take it over from the Senior Medical Officer of the Station Hospital, and on return give it into store again at the same place. This would occupy little space, and be of much advantage. In mobilization every

hour is of importance, and with this system of decentralization much time would be saved. All the staff of every kind should come from the district of the Principal Medical Officer directing the mobilization, so that they might know each other, and have trust and confidence in each other.

The only thing that should need to come from outside might be the animal transport, but even this could be arranged for locally in many places.

When a Medical Officer now begins to mobilize, he has to gather his medical stores from a distant depôt, his ordnance stores from a far away arsenal, and his other equipment often from distant sources. All this means delay, and delays are fatal now-a-days in any campaign; the best place to begin to mobilize a Field Hospital is in the grounds of a Station Hospital, and there open in a tent a Field Hospital Office. Let the attendants, as they join, have their tents pitched, and let a regular hospital camp be started. This familiarizes every one with the camp idea, and keeps them together from the first.

The Medical Officer on arrival reports himself to the P. M. O. of the district, then gets permission to use the grounds of the Station Hospital, and there hoists his red cross flag and begins mobilizing work. He should pitch an office tent and fix an office hour, and he will be kept hard at work for days in getting his Field Hospital ready.

It will take not less than ten days to mobilize a Field Hospital even if everything is ready, and extra days must be allowed if the equipment is distant.

A rough outline of the mobilization work might be as follows :—

A Ten Days' Mobilization Scheme for Field Hospitals.

1*st Day.*—Arrive. Report to P. M. O. Arrange with

S. M. O. Station Hospital to use its grounds to mobilize in and pitch camp, and open office.

2*nd Day.*—Warn Ordnance, Commissariat and Military Works Department by letter, of place where stores are being collected.

Take over staff as they arrive. Explain outline of sysem of mobilization to staff. Apply for Hospital Guard 1. N. C. O., 6 men, and 1 bugler.

3*rd Day.*—Draw tents from Ordnance. Apply to Transport Department to hand over *doolie* bearers, and with servants pitch camp or portion thereof. Post guard.

4*th Day.*—Receive over medical stores and check all boxes by list. Practice establishment at tent-pitching, folding and striking. Have parade for Field Hospital, and drill them at this work morning and evening.

5*th Day.*—Take over transport, including *doolie* bearers and muleteers. Have medical inspection of them. Parade morning and evening. Evening parade for loading drill on camels or mules. Inspect ponies of medical subordinates, also saddlery and horse equipment.

6*th Day.*—Draw Military Works equipment. Parade morning and evening. Pay Documents of staff to be verified and examined. March out in afternoon with transport loaded as for the field. Warn Chief Staff Officer of the size of hospital camp in the field. Warn for daily guards, also for daily fatigue parties on the march. Warn for space needed in camp for hospitals—50 yards front for 50 beds—and 150 yards depth, add ten yards frontage for every ten beds—say, 100 beds. 80 to 100 yards frontage—depth the same throughout.

7*th Day.*—Inspect kits and equipment of Officers, Warrant Officers and men. Weigh all articles, and see that no excess is carried. Parade morning and evening. Drill at tent-pitching, striking and loading.

8th Day. — Drill morning and afternoon. Marching order parades. Every Officer and all subordinates in full Marching Order, kits loaded, and all ready for the field. March out six miles, and pitch camp, and return.

9th Day.—Inspection by District P. M. O., who should see everything from *personnel* to *matériel* and satisfy himself of its completeness and, perhaps, by General Officer.

10th Day.—Report to P. M. O. all ready and entrain in afternoon.

This outline of work must, of course, be varied under certain conditions, but it may serve as a rough guide to the character of the work needed. If time presses, link each two days into one day and so hasten matters.

Everything points to the absolute need of an early taking over of *personnel*, and the establishment of an office, as without the *personnel* no fatigues can be carried out, nor supplies nor stores drawn. The fatigue parties must come from the hospital *personnel*, hence the need of early drawing of that *personnel*.

CHAPTER III.

Personnel.

Having thus far dealt with the general question of mobilization, we now turn to the *personnel* and *matériel* mobilized, and may deal with both in order of importance, beginning with the Officers.

Mobilization of Officers and their Equipment.—When Medical Officers are mobilized for war, on arrival from their peace station they report themselves to the District P. M. O., who hands them over to their future C. O., the head of the Field Hospital, for duty.

It is necessary to enquire into several points concerning the Officers sent for duty. Thus, physique is of great

importance, and no Officer commanding a Field Hospital can ignore defects in his Officers on this head. Take for example, good eyesight. From need of good eyesight in a Doctor a Field Hospital may be awfully handicapped and be in everybody's way.

Everyone knows how in one of our heaviest campaigns the Officers in charge of two Field Hospitals were practically useless from bad eyesight. Inability to ride is also a great handicap; and it is to be remembered that the Aldershot training is often very meagre on this head. By practice at field-days in peace riding would be better.

Equipment.—The Dress Regulations of the Indian Army lay down the Field Service Dress—a capital dress when one remembers how defective the old army was in this matter. The khaki-covered helmet has no ornaments. The field service khaki cap should be of serge and not drill, as drill soon soils. The shade of khaki should be fixed by order and regulation for the medical service; it now varies very much owing to the scattered mobilization from distant stations. Spinner & Co., Bombay, supply Leehman and Gatty's Fast Dyed No. 1 Shade, and it is the average colour in use. Permanently dyed khaki should of course be used. Khaki should be loose and made to fit over warm European clothing. It never is so made, and the tight collar is the difficulty in my opinion. If the collar could be made loose and easy, all would be well. The sailor pattern open collar would suit well. A good tasteful design of this kind is much needed.

Bedford cord breeches with Elcho field boots are the common wear, but khaki serge putties and ankle boots are, in the end, the most serviceable. Poshteens of sheepskin are much used as great-coats in mountain warfare. A good one costs about Rs. 30 (thirty) on an average in the Peshawar Bazar. For winter campaigns poshteen boots of

sheepskin to wear over one's feet in bed are very useful and warm—the cost is nominal—and the weight very light. Cost, about 4 rupees per pair. They would suit the sick very well.

Canteens.—Insist on every Officer having a canteen. It is the order in the Queen's Regulations that Officer every is to have one, but the order is never enforced in peace, and great trouble results. Officers join you on the frontier with no means of cooking their food. Over and over again I have known this neglect occur. The canteens can be purchased at Bombay for Rs. 20 or so. Medical Officers are so constantly detached alone that to be without a canteen is a fatal omission. They should be shown at annual inspections in place.

Saddles.—It is essential that all Officers mounted in the field should *not* use hunting saddles. The new universal Staff pattern saddle for field service (hunting with panels) is essential. The plain hunting saddle carries nothing—gives sore backs—and is itself torn in pieces if any heavy article is fastened to it, and is in every way unsuitable. The panel saddle costs a little more—say (Rs. 80) eighty rupees; but it is absolutely essential, and ought to be a compulsory article of equipment for all Officers. Compulsion and inspection in peace for war is the only remedy in many of these equipment matters. Officers are so utterly careless at times, that only compulsory methods are of use. All Officers should purchase it on joining and have it always in their possession.

Horses.—Great laxity also exists about Officers' horses, and they are never inspected in peace. This also needs remedy. A horse of the type used by Officers of Mountain Batteries is the best class of animal for frontier campaigns. Spare horse-shoes and nails should not be forgotten, if trouble is to be saved. Every Officer should carry

a spare set. Intense difficulty exists in getting horses shod in the field.

Pocket-Cases.—A definite order is needed, making it compulsory to carry the pocket-case in a leather case on the Sam Browne belt in the centre of the belt behind. Officers and Warrant Officers should so carry it. The revolver always needs a khaki cord lanyard. Revolvers have been frequently lost for need of this cord. One need not refer to water-bottles and haversacks, both so much needed, and both often deficient.

Servants.—On the efficiency of one's personal servants health and fitness for work in war largely depend. A good cook is very important. Medical Officers are allowed one personal servant and one syce each. So far so good. But they are allowed half an extra servant and half a grass-cut. This is puzzling at first. It would be better to say, every Officer is allowed three servants including syce. This would make the Officer independent, and he could make his own arrangements for his own servants, in his own station. In the same way Officers are allowed half a pony between each Officer in addition to the ordinary baggage, allowance, but this is a difficult matter to carry out. With scattered mobilization and with no means of arranging between Officers from distant stations who is to provide the pony, it would be better to allow each Officer a pony to himself, but only give half the forage allowance as at present to each Officer. People soon learn how to eke out rations and forage in the field. With our scattered mobilization it is impossible for Officers to make arrangements to share any servant, or any pony, or any tent with any person. The individual should be made a complete and independent unit in himself; for one is so moved about in war that all joint arrangements fail. This applies in the most marked

manner to Medical Officers who are few number, constantly detached, very liable to fall sick, very difficult to replace—and they should be taken care of.

Medical Warrant Officers—Their Mobilization and Equipment.

Great care is needed in checking the equipment of Medical Warrant Officers. They often are deficient of important parts of their outfit. Great-coats and field equipments generally are often wanting, greatly injuring their efficiency on service.

This arises from want of definite kit or equipment inspections by their Commanding Officers while doing duty in Station Hospitals, and from defective inspection by P.M.O.'s

It is too late at the outbreak of a campaign to provide for deficiencies; only constant regular inspections in peace by Inspecting Officers will secure readiness. Warrant Officers have joined me in mountain campaigns without any great-coat whatever—this means pneumonia and death.

Pocket-cases are lent by the State to Apothecaries for each campaign. It would be better to issue these cases definitely to all such individuals and let them keep them in peace and in war. They should be carried on the Sam Browne belt in a leather case and worn in the centre of the back behind. Canteens are much needed for Warrant Officers. These officials only receive 40lb. allowance for kit—the same as a private soldier, and no allowance is given for cooking utensils, although a private soldier's pots are carried. They need about ten pounds extra for a canteen. These essential articles, of suitable small size, can be bought at Treacher's, Bombay, for about 15 rupees or so. A sealed pattern Warrant Officer's canteen is much needed for field

use, and it should be shown at all inspections like the remainder of their kit every year.

If they don't have regular canteens, there is the constant tendency to utilize the Field Hospital equipment utensils, and this causes trouble and inconvenience to the sick, and should never be allowed. It is of continual occurrence, and must be so until every official is provided with his own canteen.

Horses and Riding.—Of the riding of Warrant Officers I could write pages. They ride wretchedly, as a rule, and it is a fatal omission not insisting on this most needful accomplishment for these officials before promoting them to Assistant Apothecary rank. It handicaps their field efficiency most awfully, and is really an urgent matter that they be taught. A lazy, idle, Apothecary may urge his ignorance of riding as an excuse for not doing his duty on the march. They also need the grant of Government saddles, as they cannot afford to buy these articles themselves. A saddle like the Mountain Battery Sergeant-Major saddle is the type to be copied.

I would like to see these Warrant Officers mounted by the State, as the allowance they receive for up-keep of their ponies is very defective, and they rarely have funds to buy ponies. Given ponies and saddles by the State they would be doubly efficient.

They also need one personal servant each, instead of a half servant, as they are constantly likely to be detached, and servants cannot be divided, and if they are not fed they get sick, become useless, and retire to the base.

Pack-store Sergeants and European Writers, &c.—These men are obtained from regiments, and come to us untrained and ignorant of their special line of work.

It would be advisable to give these N.C.O.'s and men swords and revolvers instead of rifles; returning their rifles to their regiments.

The defaulter sheets of these N.-C.O.'s and men should pass over to the Medical Officer in charge of the hospital as the men pass under his definite command while attached to the hospital. They are rationed by the Medical Officer of the Field Hospital.

A Sergeant to act as Quarter-Master Sergeant, and to be in executive charge of the camp equipment is much needed. The care of the equipage, barrack, and ordnance stores needs a good man, and the laying out of the camp, the camp sanitation, and the pitching and striking of the camp, all need some responsible person for this duty. Such a Sergeant would be a real boon to any Field Hospital. For want of such men the technical staff is often overworked.

Hospital Storekeepers.—I regard these Storekeepers as the weakest element in our hospitals in the field. They are so unsoldierlike, so lax in discipline, and being Hindoo Baboos are so prejudiced about classes of work, that they are in many ways a weakness instead of a help, while employed entirely for the English soldiers' comfort; their caste prejudices interfere with the full discharge of their duties. They need uniforms, drill, and to be handed over in peace to the Medical Department and to be mobilized for war by the Medical Department and not by the Commissariat Department.

Mussulmans are the best men to have, the readiest and the strongest; the Hindoos are not so fit for our class of border wars at present. It is fatal to allow Hindoos with caste prejudices to be attached to a European soldiers' hospital. Although forbidden by regulation it constantly occurs, and in the field is very inconvenient in every way. I have, over and over again, had Storekeepers sent to me in the field who declined to touch or handle the soldiers' meat ration, that is to say, the food of the soldier for whose help they are employed.

If the Storekeepers came over to us, then all their staff would come over also, and all would belong to the Army Hospital Native Corps. This is the final and only solution of the present indefinite position of the hospital establishments in India. All Storekeeper's servants should have gone through a course of hospital service as ward orderlies, and having learned to care for the sick, be then promoted from that post into the Store Department of the hospital. This would prevent men with caste prejudices entering the Store Branch of the Medical Service. The six tindals and tent lascars now supplied to a Field Hospital should be withdrawn, and an equal number of ward orderlies sent in their stead who could do *khalassi* work, if needed, but who would also attend on the sick, if not needed otherwise. This would be a great help in the routine of the hospital which is now entirely undermanned. The tailors' work in a hospital is simple; they also should go through a course of hospital training, and should come from the Hospital Corps to be tailors. Simply, no man should be in or about a Field Hospital who will not in emergency aid the sick. This principle once laid down progress may come—but on no other basis.

Mussulman *dhobies* are not difficult to obtain—if they came to us, they would be a great help—if not, sweeper *dhobies* of the *mehtar* caste would do. The present Hindoo *dhobie* is a wretched creature in every way, physically very weak, and quite undisciplined, and they die off very easily in mountain wars. I think all these men should come from the A. H. N. C., and should go through a course of hospital training in the wards, and should be entirely under the Medical Department in peace as in war.

I would like to see the appointment of Storekeeper thrown open to men who had passed through the A. H. N. C., and who would give security for their honesty as the present

Storekeepers do. The moment it was known that such posts were open to the ward orderlies, better men would come to that duty, and it would greatly improve enlistments.

The Army Hospital Corps.—The time has arrived to deal fully and finally with the Army Hospital Native Corps. No words can exaggerate their absolute inefficiency, ignorance, feebleness, and utter slackness. After visiting eight or ten European armies, I have never seen in any army anything to approach them for hopeless uselessness: underfed, underpaid, undrilled, senile, rickety, tottering—a more utterly Falstaffian Corps does not exist in any army; and it is to these wretched men, the care of the valuable English soldier is committed in war time.

It is simply deplorable that such should be the case, and the commonest justice requires these to be better paid and more fully fed. Chronic hungriness seems to have enfeebled their physique, and they have not strength for any fatigue duty—not even to pitch a tent with any celerity.

Their pay-rate is so small that it only appeals to the refuse of the bazaars—a terrible gang of inefficients employed to care for the English soldier when wounded in a foreign land and far from English help.

They should be made sepoys and not left as followers as they now are. They should be drilled, armed and trained in full as sepoys—as well as being Hospital Corps men, just as the ward servants of the Native Regiments have been made ward orderlies, so should the ward servants of the A. H. N. C. Their present position is most unsatisfactory, and the Medical Officers have no confidence in them whatever.

The present ward sweepers should be made ward servants, and be also armed and drilled.

The cooks also should be taken from the ward orderly class, and be likely to revert there in case of neglect or indiscipline as cooks. This would abolish the cooks as a

separate class in the Corps; every man of which should know elementary cooking.

There is no reason why Mussulman watermen should not come from the ward orderly class, nor sweepers from the ward servant class. We should set the example to India to raise these depressed classes.

Excellent orderlies come from the *bheestie* or waterman class—and some of the very best sick attendants I have known were sweepers by caste—although not actually employed in sweepers' duties. They are without prejudice, and as ready for work as a European orderly. They are physically very strong, very willing, and get on well with the soldier.

The A. H. N. C. should be dressed in khaki cloth in winter and not in blue, and in khaki drill in summer. The red and blue *pugris* should be replaced by a more definite colour for the Medical Department—say, black and red or black and yellow.

Their pay needs to be raised to the sepoy standard, and cooks paid extra pay above that standard while doing cooks' work. At present they contain many aged and feeble men who are unfit for the field, and their pay is so small that they are weak from underfeeding.

The number of such men is quite insufficient in a Field Hospital. Five ward servants per section of 25 sick and wounded Europeans are quite insufficient. If the *khalassis* were taken from the A. H. N. C., this would give a slight improvement, but at least ten men per 25 bed sections are needed, not counting head ward servants, of which two per section are needed. The work cannot be done with less than this amount, and sooner or later it must be given. The conservancy sweeper should be replaced by a disciplined servant mobilized by the Medical Department. We should send only disciplined men into the field.

The Medical Department should do its own work and mobilize all its own *personnel* quite independently of any other department. To-day, we throw nearly all this work on the Commissariat Department.

Dandie Bearers or Kahars.—Without these men the Field Hospitals could not work. On their strength, discipline and training depend much of the efficiency of the machine. I regard them as inefficient and unpracticable for present field work in war on the mountains.

First comes the fact of the divided authority over them. This is fatal to any real discipline.

They belong to the Commissariat in peace and to the Medical Department in war; they stand between two stools and, certainly, serve both masters indifferently.

Although they form the Bearer Companies of the Medical Department, they are men of caste prejudices, will not nurse European sick, and are of no use to the Medical Service in an emergeney. In other countries, as in England, these men are a technical reserve from the Medical Department, but it is not so in India. In fact, when one sees the number of men in an Indian Field Hospital, one imagines there is a good working staff, but on enquiry it is found that such is not the case. Caste prejudices and enlistment by classes tend so to sub-divide the *personnel* that, in the end, the men who will nurse the sick are a mere nothing amongst the rest.

The Kahars are Hindoos who will not give a European a cup of tea nor a basin of soup. They are largely vegetable eaters and die of pneumonia in the Afghan winter unless carefully tended. They carry the sick mainly by use of their shoulders, and hence the *dandie* can only be utilized by specially trained men whose shoulders are hardened.

Their class of work is disappearing in civil life in India,

owing to the spread of railways and wheeled transport, and the whole question concerning them needs to be reconsidered in the light of existing conditions, and the character of our recent and future wars in trying climates, and in mountain countries very different from the plains of Oudh and the Grand Trunk Road.

I would fain take over the Kahars into the Army Hospital Native Corps, and enlist only men of good physique, who will go through a nursing course, and all that such a course implies in the way of caste prejudices.

The Kahars would then be the Bearer Companies of the A. H. N. C. and would be our own men in peace. I would build barracks for them near the larger Station Hospitals, and organize them by companies for field work.

I would abolish the *dandie* for the front line of the army and replace it by the field stretcher which can be carried by any man of good physique, while the *dandie* needs a special training and a special class on account of its dreadful pole.

By allowing four men to each stretcher at one time and two as reliefs, one could carry the wounded on a stretcher over long distances.

The *dandie* is also unportable, cannot be folded up or carried on a mule, and is in every way an encumbrance to the army. Let us get rid of it for all our non-Indian mountain campaigns, replacing it by a field stretcher with a hood and apron.

By utilizing the army reserve system we ought to be able to mobilize our own men locally and not have to fall back, as we constantly do, on the already overworked Commissariat Department.

Even if the whole body of Kahars was not given over to us, a Bearer Company of the same amount of men as is allowed for a Field Hospital, *viz.*, 126 bearers with mates,

should be kept constantly mobilized and under medical command at the head-quarters of every district, ready for war, and completely ready to absorb and to train any further levies raised for any campaign. This would leave a large number of *doolie* bearers still with the Commissariat Department, and they could work with *dandies* on the line of communications; while in the extreme front of the army with the fighting line would be the disciplined Bearer Companies of the A. H. N. C. definitely under the Medical Department.

This system would be a compromise and would, at any rate, be a vast improvement on the present defective system.

No words can exaggerate the trouble and difficulty of the present systems on any real campaign, say, like the Afghan War of 1878-80, a break-down in the transport of the wounded is certain to occur unless fully dealt with in peace beforehand.

European Nursing Orderlies.—With every 100-bed Field Hospital there should be 12 private soldiers posted as orderlies to nurse the sick. Twelve men would give three men per 25-bed section, and they would be a tower of strength to the hospital and greatly aid the medical staff in their work. They should come from a battalion not in the field, but belonging to the garrison army. They should join the hospital as they would any other unit, and come completely armed and equipped for the field. In many of our border wars, where only small numbers of troops are employed, a down-country battalion in an easy garrison could well spare a couple of dozen men: volunteers for the campaign. Such men would join the hospital on mobilization, act as nurses, fatigue men, escort on the march, and general helpers in the hospital work. For caring for the wounded they are absolutely essential, and it is absolutely impossible to care for the British wounded without them.

A very good corps could be made from Eurasians for this purpose.

The number of men so needed is inappreciable in its smallness, and yet it means life or death to dozens of wounded men who cannot be cared for by the native orderlies.

A dozen men, such as those in a 100 bed hospital would be a tower of strength to the hospital, and would earn their rations and their transport, over and over again, in the good work they would do. It is deplorable that we should be without this help.

CHAPTER IV.

Notes on Equipment of Field Hospitals.

The equipment of Field Hospitals is not during peace, in the custody of Executive Medical Officers who have to use it in war. In fact, they never see it in peace, and the Warrant Officers and men of the A. H. N. C. are equally ignorant about its character, contents and loading. This means confusion when war breaks out, and great wear and tear of the lives of the medical staff. Their Warrant Officers and men know nothing of the *matériel* to be handled, the Officers know nothing of the *personnel* who have to do the handling. Can anything be worse than this? Surely, the English soldier serving in our Indian wars deserves to have better attempts at hospitals than this provided for him.

Every Station Hospital in India should have its field mobile equipment stored in the hospital building ready for use, and in constant practice with it at drills and parades, at which they should appear as regularly as any other army unit. We now draw our equipment when a campaign is imminent from the—

(*a*) Medical Store Department;
(*b*) Ordnance Department;
(*c*) Commissariat Department; and
(*d*) Military Works Department.

Let us glance at the equipment by the above classes.

Medical and Surgical Equipment.—Five mules in every 25-bed section carry medical and surgical equipment—that is, four pairs of medical boxes and one pair of field panniers. The Field Hospital boxes have one great failing, *viz.*, they have to be tied on the mules or camels with loading ropes, and have no rings fixed on the boxes to hook on to the hooks on the transport saddles, as in mountain battery loads, and in all private mule trunks.

The trouble, delay and worry this causes is excessive. One cannot get out a dose of medicine nor a glass of brandy for a fainting man without undoing two ropes, which have to be specially knotted on the box, and are tedious in opening.

What are needed are iron rings fastened on the medicine or other boxes and made so as to fit on the hooks of the pack saddle. This would be a very cheap, but most useful alteration, and would greatly facilitate the loading and unloading of hospital equipment. In rapid moving much time is lost in ropeing up the equipment boxes, and on a dark night it is awfully tedious.

Drugs.—All useless drugs should be abolished and only the most active taken. To carry 7lbs. of cinchonidine is useless; calumba root is useless in the field. One pound chrysarobine is useless, oils of anise, cajeput and juniper are all in the way—increase the peppermint oil only. Tinct. cardamom is useless. Ditto, cinnamon. Very few drugs are needed, and all should be the very best and strongest; and all be compressed into tabloids like military cartridges.

In fact, certain diseases occur, and for these there should be ample drugs.

The diseases occurring in war are, as a rule—
Ague.
Typhoid and Remittent Fever.
Diarrhœa and Constipation.
Dysentery.
Pneumonia and Wounds.

If drugs to deal with these are supplied in abundance, then the other demands are not very serious, and need hardly be provided against. Every drug needed can be compressed by machinery into one-sixth of its bulk and be issued to the sick in tabloid form, so minimizing the risk of breakage and reducing compounding to a minimum. No loose drug should cross the frontier in any war. I took quinine to Cabul in 1879 in great glass bottles, as loosely filled as in a London chemist's shop.

In the surgical equipment a scissors to cut tin would be very useful, so as to make splints out of old tin boxes, &c.

Office Boxes Nos. 9 *and* 10.—These two boxes should be used for office equipment, and half the stationery, &c., carried in each, so that half-sections might take with them one box as an office load for correspondence and writing purposes when the sections subdivide, as they constantly must in our border wars.

No. 11 *Box.*—Cups, drinking, tin—five are quite insufficient. One per man would be better, and a better class of cup of enamel is now needed. Knives and forks are insufficient. One pair per man is needed; also one plate and bowl per man. Spoons, one per man is needed.

No. 12 *Box.*—Soap is in excess; omit 22lbs. at least, and let the Commissariat carry reserve of this article. Put in plates and bowls instead.

Nos. 13, 14, 15, 16 *Boxes.*—Omit port wine and replace by brandy. Brandy alone should be carried by Field Hospitals. Let port wine be kept for hospitals more in the

rear. In the front only the most powerful and easily carried stimulants are needed.

Lime Juice.—Reduce the quantity of lime juice to six bottles per section.

One cannot treat scurvy in the front of the army; if one had to do so, the quantity allowed (18 bottles) is insufficient. Six bottles might be taken for drinks for fever patients, but even these might be replaced by chemical salts equivalent to lime juice.

No. 16 *Box.*—Omit all compressed vegetables and fill up space left by essence of mutton. Compressed vegetables are rarely needed in a Field Hospital. Omit all sago; let its place be taken by compressed arrowroot in packets; arrowroot compresses beautifully into one-third its bulk. Omit barley and take an extra quantity of condensed milk, so much, and so constantly, needed.

This reduces the medical comforts in a Field Hospital to—

Brandy, lime juice, arrowroot, condensed milk, sugar, extract beef, and essence mutton.

Tea is very much needed; 20lbs. might be carried. It is a most useful and easily prepared stimulant. It is not now carried, and one has to depend daily on the Commissariat Department who may be, and often are, far in the rear. Tea also can be compressed. It is a most valuable stimulant on a dark freezing night when wounded, are lying about, and the Commissariat supplies are miles in the rear.

Its omission from the Field Hospital stores is a most serious defect.

Loads 19—22.—Blankets to be packed in strong leather or waterproof cloth valises, and not in *sulectahs*. *Sulectahs* soon wear out and let in the rain. Leather valises would be far more useful and lasting.

Loads 23—26.—Omit blankets—black double—25, weight about 220lbs. Supply instead mattress cases. Duck,

25, weight about 78lbs. These when filled with straw or *bhoosa*, are very comfortable, and can be washed easily if soiled, and would be of the greatest use in a hospital. They can nearly always be filled with grass or leaves, and are most useful in every way.

Loads 29, 30, 31, 32.—I would like to see these four loads reconstructed as follows:—Two pairs of mule *kadjawas* to be given to each section in lieu of one pair, as at present.

One pair of these to be wholly for the cooks and kitchen loads, and to contain nothing else but cooks' and kitchen equipment and materials, so that one could hold the cooks responsible for their loading and care on the march, and in camp and no one else.

The one other pair of *kadjawas* per section to contain—

Line gear, mussucks, washhand basins, fomenting-tin, poultice-tin, stool-pan, copper lamp—Orr's—lanterns, poultice tray, and all other articles of the existing loads not belonging to cooking work.

The cook-house load to be equally divided between the two *kadjawas*, so that if the section divides one *kadjawa* for the cooks can go with the half-section. The other pair of *kadjawas* to be likewise divided equally; so that one *kadjawa* can go with a detachment of the section. *A mincing machine is needed with each section.* Axes (felling) for cutting wood are much needed. Two per section needed for the cooks' use, and to be carried in their loads.

It would be an advantage to replace the present bamboo staffs of the small line-gear camp colours by iron rods. They would occupy less space and would need no iron shoeing at the end. The flag could be fastened on to a ring made at the top of the iron rod. The present bamboo camp colour flags easily break and are bulky to carry. The camp lines need to be increased by two more per section, each about 120 yards long.

Ordnance Equipment.—These are composed of—

Tents, lanterns, flags, picks and shovels.

The mountain service double fly-tent is not a convenient tent for sick, although a very good field tent. I find men do well in mountain campaigns in the 160lb G. S. tent. It is too thin for hot countries, but a double roof might be supplied for hospital use only. Every tent needs three small canvas *chaguls* to hold drinking water for the wounded. This is of paramount importance.

Tent-pegs.—All-tent pegs should be of iron in mountain campaigns; wood is useless, and may be burned as fuel by the men at times.

All our frontier on the west is completely devoid of wood.

Tent Mallets.—Wooden ones are quite useless. All should be of iron. A very good pattern is in use in the Transport Department for driving in line-gear pegs for transport animals. Such a pattern would suit well as a universal pattern for tents.

Lanterns. — All the present tent lanterns are quite useless; a much better type is needed. A good pattern should be made to fit into the tent buckets, and so be carried safely on the line of march. Candle-lanterns or kerosine lamps are what seems needed. This matter calls for urgent consideration. A square tent bucket with a lid would be very useful.

Flags.—Omit one "flagstaff Geneva cross complete" from each section — taking only one flagstaff, but two or three flags. The flagstaffs are heavy and cumbersome, but the flags are light and easily carried, and can often be hoisted by other extemporised means beside the regular flagstaffs. A *doolie* pole acts well.

The "directing flags—triangular Geneva cross"—have their present staffs too long. They should be cut in two and

jointed, and would then be more portable. At present they are greatly in the way for mule carriage, projecting beyond the load several feet, and catching in rocks and trees.

Picks and Shovels.—These essential articles are deficient in number. One *mamootie* and two picks and two shovels are needed for each section of a hospital. The picks and shovels to be of the light size and pattern issued to the battalions in the field for entrenching purposes.

Arm Racks. — An arm rack for mules to carry 12 rifles is needed for each section to carry the arms of the sick. A pattern is now issued to Infantry battalions.

Commissariat Department.—I have already referred to these in the preceding paragraph.

Packals.—Two pair of packals per section with mules extra to the complement are needed. The packal is of the most vital importance in our Afghan campaigns. Two empty pairs of packals should be carried in the *kadjawas* for use on arrival in camp, by utilizing some of the mules made free from their loads on arriving in camp. Nothing is more important than this.

Rope in abundance is needed in all Field Hospitals. Special camel loading ropes and special nets for carrying kits on camels are also absolutely essential. They are needed for attendants' kits, kahars' kits, patients' kits, and are of the very greatest help in every way in the field. They are drawn from the Commissariat Transport Department on requisition, and should be always with the hospital, and returned to the same Department at the end of the campaign.

Military Works Department.—I find that the folding chairs now issued break very easily.

Camp Stools.—Two per section would be better. They rarely, if ever, break.

The Tables are very good although heavy. Two together form an operation table.

The Field Commodes are very good.

Filters.—The filters seem good enough, although field filtering is rather a vague proceeding, so far as *my* experience goes.

A good watch or spring clock should be issued for each section, and a small gong of the Mountain Battery size is much needed. One per Field Hospital would suffice. If time is not carefully kept, the Field Hospital will be late in marching off with the column; a very common occurrence in field service.

Field Hospital Transport.—There are two kinds of animal transport used, as a rule, for Indian Field Hospitals, *viz.*, mules and camels. Wheeled carriage has, up to the present, been rarely used for this purpose.

Mule Transport.—This transport may be of two kinds, *viz.*, transport for equipment or transport for sick by riding mules.

Mules with transport saddles are supplied for the equipment, and with every three mules is one driver.

The mules do not give much trouble, but the deficiency in drivers in a hospital is very marked and causes great inconvenience.

With delicate loads like medicine panniers and medical comforts boxes, the proportion of drivers now allowed is quite insufficient, and the loss by the breaking away of mules is very troublesome and, at times, irremediable, when far from the base of supply. The Sapper Companies of the Indian Sappers and Miners have a very good system of classification for mules and muleteers.

They divide their technical equipment in three classes, first, second, and third. For the first class equipments one muleteer per mule is allowed; for the second class one muleteer per two mules is allowed; for the third class one muleteer per three mules is allowed. This classification would suit a Field Hospital excellently.

Thus the first eight loads carried on four mules each need a separate muleteer, as do also the medicine panniers. As these loads are constantly needed independently, and any injury to them would be most inconvenient to the sick, one muleteer per mule is advisable. The loads contain medicines in glass bottles.

Boxes Nos. 9, 10, 11, 12.—These loads might be placed in the second class, and one muleteer allowed for each pair of them.

Boxes Nos. 13, 14, 15, 16.—These should be first class loads with one muleteer each, being fragile medical comforts loads, which if lost or broken cannot be easily replaced. The breaking away of one mule may leave the hospital with no wine or brandy.

Packages Nos.—17, 28.—Third class arrangements would suit, but for 29—30, 31—32 it is advisable to have a muleteer for each load, as they are needed independently, and are very liable to cause disturbance if the mule is not led.

Tents and baggages would remain in the third class with one muleteer per three mules.

All hospital packal mules need one muleteer per mule, as they are so liable to be detached with small bodies of troops. Muleteers, though a hardy lot, are very dirty and disorderly in their habits. There is no reason why they should not be clean and disciplined. This can only be *achieved* by constant inspection by the S. M. Officer of the hospital. A Transport Sergeant is with each Field Hospital and he supervises the transport. His duties will be dealt with later on.

A Transport Agent is a kind of follower who devotes his energies to assisting the Transport Sergeant and supervising the *doolie* bearers.

Mules for Sick Men.—When ambulance tongas cannot be given or used, ponies or mules are supplied for the sick to

ride. These animals and their equipment need careful inspection.

Saddlery.—Bad bridles, bad stirrups and thoroughly bad saddles are often supplied. I have myself had to use water gear pads during a campaign to carry faint and exhausted men. It is wretched.

The saddle for a wounded man should be large and comfortable, and have a support behind to prevent the wounded man falling off. A bucket to hold the rifle is needed, and a hook on the saddle to hang on accoutrements is advisable.

One muleteer per animal is very essential, and he should march alongside his animal and lead it himself if the wounded man is at all weak, from loss of blood.

I have seen much discomfort and, indeed, risk of a severe accident from the defective number of muleteers allowed. That is to say, I have, over and over again, had the sick men thrown off their mules, flung to the ground, or run-away with, by having to mount untrained mules without muleteers and with no saddles, but simply pads of canvas. To a badly wounded or seriously ill soldier the injury done is excessive.

There is great room for a prize being offered for a good saddle suitable for one wounded man to ride in—on a mule or pony. A modification of a child's saddle for a pony is what is needed. It is pitiful to see men falling off their mules from bad saddles. This I have often seen and been helpless to remedy. The constant care of one's transport is very important, and it should be continually under the inspection of the Medical Commanding Officer of the hospital, and not left solely to the Transport Department. "Stables" should be done every morning by the S. M. O., and the Orderly Officer at his evening visit should also inspect the transport lines.

Camel Carriage.—When camel carriage is supplied for

equipment, four boxes or packages are placed on each animal, and at times a fifth is balanced on the top, the whole weighing about five maunds.

Great trouble and delay always attend the loading of Field Hospital equipment on camels, as the loads take time to load, and often fall off.

Whenever camel carriage is supplied for a hospital, a certain number of "obligatory mules" are needed, as supplied at all times to a battalion. This is very urgent.

Thus, all the medicine loads should be carried on mules.

The kitchen utensils should most certainly be on mules as in a regiment. At least, one mule load of medical comforts should be allowed, and tents for bad cases might also be so carried.

I have seen pitiful exposure of the wounded to rain and cold from want of tents being carried on mules, although in the same column mules were freely used by regiments for carriage of all their kit and tents. I desire to draw special attention to the need of *obligatory mules* in all Field Hospitals. The matter is of paramount importance. Whenever camel carriage is used, camel loading ropes should be drawn from the Transport Department, and also nets for carrying kits and small articles. These coarse nets are most useful and prevent the contents of a load slipping out on the road. They are supplied on requisition by the Transport Department.

If the camels are permanently detailed for the Field Hospital, tin numbers with F. H. and the consecutive number of the camel are useful things to have.

Packals are never carried on camels, but always on mules.

Camel Kadjawas.—I still think, that despite all the odium expended on the camel *kadjawa* as a means of sick transport, that we have not done enough to introduce a

comfortable and useful camel *kadjawa* for sick natives. If such an appliance could be invented, it would be of the greatest use, as it would carry the wounded man and his kit easily on one side of the camel, and one camel would thus evacuate two wounded men along the communications.

Up to the present time neither camel *cacolets* nor camel *kadjawas* are at all a success in the field, nor are mule *cacolets* nor litters much better.

Ambulance Tongas.—These ambulance carts are made to carry four men seated or two men lying down. They seem heavy for the load they are to bear. If two mules could be used in these carts instead of bullocks, it would greatly hasten the transit of sick along the communications, as they could cover two stages of a line of march instead of one, as bullocks do, and might thus carry men over twenty to twenty-five miles of road per day instead of about ten, as bullocks now do.

This would mean saving of forage and food supplies, and, I think, would be in the end a real economy by getting the sick rapidly to the base. Fixed racks for rifles exist in the carts, and the kits go under the seats.

CHAPTER V.

Guards, Escorts and Fatigue Parties.

Guards, Escorts and Fatigues.—A Field Hospital is entitled to a Guard from the troops with whom it is marching. It is also entitled to a fatigue party, and on nearly all occasions it needs an escort which, for convenience, may be composed of the men of the fatigue party.

Guards.—If a hospital is pitched, as it always should be, flanked on either side by the European troops for whose use it is intended, then the flanks of the hospital

need no sentries on them, but can be protected against stragglers and thieves by internal police from the ambulance bearers.

The front and rear of the hospital, therefore, alone need protection. To pitch a hospital in the rear of its Brigade is quite wrong. It needs a number of sentries, and is always liable to have its mules stolen. A Field Hospital should be always pitched between the regiment it is working with—patients in line with men—Officers in line with the Officers and transport with the transport. It works perfectly.

The Guard tent may be placed in the same line as the Quarter-Guard of battalions ; and if a Rear-Guard is posted, then the Guard tent should be aligned with the Regimental Rear-Guard tent. Sometimes it is advisable to bring the Quarter-Guard close up to the front of the hospital and, in fact, to pitch it on one side of the central road of the hospital camp.

In small camps a Guard of one N.-C. O. and six men and one bugler is sufficient. The six men furnish two sentries —one on the front of the camp and one on the rear.

If the camp has a wide front and consists of a full Field Hospital in open order, then a second sentry may be needed in the front or rear, as may be most exposed, and the Guard will need to be increased by three men. These sentries can, as a rule, be furnished by the Guard posted in the front of the hospital, but, if occasion require it, a Rear-Guard tent and Guard must be placed in the rear of the camp specially guarding the transport animals.

A bugler is always needed to mount with the Guard as there are as yet no buglers with the A. H. N. Corps—a distinct want on field service leading to great discomfort to the Medical Officers. The Guard should pitch their own tent, but should receive water from the hospital water

establishment. The Guard strike their tent themselves and the N.-C. O. of the Guard hands it over to the Senior Apothecary for loading in the morning when marching.

The following Standing Orders, in addition to any special orders, should be observed by the N.-C. O. commanding the Field Hospital Guard :—

1. The N.-C. O. on arriving at the hospital will report himself to the S. M. O. for orders.

2. The Commander of the Guard will be responsible for the pitching and striking of the Guard tent, and will have it struck at the "Rouse" and handed over to the senior Warrant Officer for loading.

3. The sentry on No. 1 post will warn the hospital authorities whenever the Brigade or Divisional Order bugle sounds.

4. If no bugler is present, the sentry will call the Warrant Officer on duty at the "Rouse" and the hospital cooks at such hour as may be ordered.

5. The bugler on duty will sound the following calls—the "Rouse," the "Fatigue" Bugle, the "Dressing" Bugle, the "Quarter" Bugle, and the "Fall-in," on every morning, when the hospital marches, at the times fixed by the Senior Medical Officer in Field Hospital Orders.

He will repeat all Brigade or Divisional bugle calls which may be sounded on the line of march or in camp.

He will sound "Retreat" and "First" and "Last Post," and such other calls for the internal service of the hospital as may be ordered by the S. M. O. of the hospital.

6. On the line of march the Guard will march with the sick or with the equipment, or baggage, as may be ordered by the S. M. O.

7. If the old Guard remains with the hospital on the line of march, it will also take part in the escort duty.

8. The N.-C. O. on arrival in camp, will receive over

for safe custody the arms and ammunition of the sick from the Pack-Store Sergeant for safe custody, and on the line of march will detail a soldier of the Guard for their special protection.

9. When relieved, the N.-C. O. of the old Guard will, before marching off his Guard, make a report to the S. M. O. that all is satisfactory or otherwise.

Fatigues and Escorts.—Quite apart from the Guard, which is detailed for 24 hours' duty, and which furnishes sentries for the hospital, is the fatigue party from the troops detailed to assist in the loading, pitching, striking, &c., of the hospital tents and equipment. These men, as well as the Guard, are obtained from the Officer Commanding the Force by letter, written by the S. M. O. of the hospital to the Staff Officer of the Force.

The fatigue party should be 25 men for a 50-bed hospital, or 50 men for one of 100 beds. They should arrive at the hospital half-an-hour after the "Rouse," and the N.-C. O. in charge should report to the S. M. O. or Officer on duty for orders. They should then pile arms, take off their belts and accoutrements, and assist in the loading and striking of the hospital tents. At the "Fall-in" of the hospital establishment they also fall-in, and, if not marching with the hospital as an escort return to their battalion after obtaining permission from the S. M. O.

On arrival at camp the same men again return from their battalion and unload the animals and help to pitch the hospital camp, and do not leave until dismissed by the S. M. O. It is far better, however, to utilize these men as an escort on the march, divided between the sick, the equipment, and the baggage of the Field Hospital.

The Hospital Guard should be applied for from the first day the hospital mobilizes, so as to act as a guard over the stores and equipment during their collection. A tent

should be pitched for them and their routine of duty assimilated, as far as possible, to that in the field, so as to accustom them to the field service customs of a hospital. It is well worth considering if a detachment of soldiers, sufficient to give the guards, escorts and orderlies, could not be posted to the hospital for the campaign. They could come from any battalion not in the field, and would be very useful.

CHAPTER VI.

Daily Routine of a Field Hospital in War.

When a hospital, after being fully mobilized, marches into the field, there should be a definite routine laid down for the guidance of all the Staff, and this routine should be regularly adhered to, as far as can be, under the changing conditions of field service.

There are two main lines for which routines are needed, *viz.*, the Marching Day Routine and the Halting Day Routine—according as the hospital halts or marches on certain days.

Let us first examine in detail the routine of an ordinary marching day.

Routine of a Marching Day.—Let us imagine that we are in a Brigade or Divisional Camp, and that orders have been issued on a certain afternoon that the "Rouse" will go at 5 A.M., and the column march at 6-30 A.M. next day.

This allows one and-a-half hour for preparing the Field Hospital for the march, and, in my experience, it is difficult to prepare the hospital in any less time.

It is absolutely essential to place on record the constant tendency of Field Hospitals to be late in marching off with their columns.

The fact is, it is a very difficult and trying matter to

move off a Field Hospital, and nothing but the most careful forethought and most definite sub-division of labour can possibly enable such an organization to move off with the same rapidity as ordinary marching battalions.

There are so many details to be thought of, and so many helpless elements to be cared for, that I consider it one of the most difficult and fatiguing duties in the army.

The "Rouse" sounds at 5 A.M. from the Brigade Headquarters, and is at once repeated by the Field Hospital bugler.

At once all should rise, and great care should be taken at the beginning of the march that Officers, Warrant Officers and men at once rise from their sleeping places.

The sentry at the Quarter-Guard of the hospital should call the cooks three-quarters or half-an-hour before the "Rouse" sounds, so that fires may be lighted and water boiled for the gun-fire tea. A cook may sleep with the Guard.

To ensure the readiness of the tea everything should be prepared on the previous night, and wood, water and the tea and sugar, all be seen as ready by the Senior Warrant Officer at his night visit of inspection at "Last Post."

Tea being thus ready after the "Rouse," it should not be issued to any of the hospital staff in their tents. They should drink it in the open air after dressing and vacating their tents.

To issue it in the tents causes great delay, and certain trouble in being ready to move off in time.

The sick should not receive any tea until they have moved out of their tents and formed up on the ground appointed for the parade of the hospital when loaded.

If the "Rouse" goes at 5 A.M. and the column marches 6-30 A.M., the hospital "Fatigue" bugle should sound at 5-30 A.M. This is the ordinary "Fatigue" bugle call of Infantry, with the "Medical" Staff call sounded before it.

Before the "Fatigue" bugle sound, that is, during the first half hour after the "Rouse," the Officers, Warrant Officers and hospital staff should rise, dress themselves, and the hospital attendants should make up their kits and pack them on the camels or mules assigned for these loads, and strike, fold up, and pack their tents.

If this routine is not followed when the bugle sounds for hospital "Fatigue," no one will appear, all the hospital staff will be engaged packing their own kits or idling about amongst those who are packing. It ought, therefore, to be a rigorously enforced rule, that half-an-hour after the "Rouse," all the men's kits and tents of the Hospital Corps and the kahars and the muleteers, should be packed and the men be free for other work.

"*Fatigue*" *Bugle at* 5-30.—When this bugle sounds, all the staff of every rank and class and grade should appear on the parade.

This rule is essential, and although it is not usual in other units for the Officers to appear so early in the marching preparations in moving off a hospital, it is very requisite, as the wounded must be seen and medicines ordered before the march begins.

The different sections of the hospital form up under their Warrant Officers, and all store-keepers, servants and kahars attached to sections form up with these sections.

Officers then join their sections, and the whole parade is reported present to the Senior Officer on the spot, or if only one Officer is present, the Senior Apothecary reports the parade as present to him.

All men of the Hospital *Corps* who are sick or ailing, should be fallen out and at once get medicine, or if needing carriage, that carriage should be arranged for for them. At the "Fatigue" bugle call the regimental fatigue party should also have arrived, and they should be told off to

the various groups of fatigue work with the hospital establishment proper. These fatigues are:—

1. Striking "sick" tents and loading them.
2. Packing sick men's kits and loading them.
3. Officers' tents striking and loading.
4. Warrant Officers' tents striking and loading.
5. Hospital store-keeper's stores loading.
6. Hospital medical equipment loading.

So far as my experience goes, it is advisable to tell off the European soldiers' fatigue party to the European "sick tents" as a duty. The moment the "Rouse" goes, the ward servants on duty should call all the wounded, and the Warrant Officer on duty should be responsible that this is done. All convalescent wounded should then rise and dress themselves and proceed to pack up their own kits in the *suleetahs* and nets for the camels or mules told off for their loads.

They should then move out of the tents and form up either in front of the hospital on the space where the Field Hospital would parade, or in the central road of the hospital camp if space allow.

At any rate, by the time the hospital "Fatigue" bugle goes *i.e.*, half-an-hour after the "Rouse," the convalescent patients should have left the tents, and only bad cases needing to be carried outside should remain in the tents.

Tea will be issued to the convalescent patients in their own tin pannicans while the fatigue parties are at work.

The moment the fatigues are sent to their special tasks, the first thing to do is to remove all the really bad cases either to their *dandies*, or stretchers, or tongas, or ambulance carts, taking care that their kits accompany them if in carts or tongas. The *dandies* should be at once carried to the place where the hospital will eventually be formed up and left there with the sick, who will be seen by their Medical Officer in this place.

If the hospital parades in column of sections outside the hospital, the markers should be posted—1st for the Hospital Corps; 2nd for the *dandies*; 3rd for the riding mules; 4th for the tongas; 5th for the mules with equipment, and 6th and last for the camels—allowing sufficient space for the length of each group. As various loads are ready, or various groups of patients are ready, they should move outside the hospital and form up on the marker as proposed.

If, however, the ground in front of the hospital is unsuitable for this column formation, then the Field Hospital should form up on the centre road of the hospital itself, in the same order as that laid down for the column of sections formation.

If in this formation, then the Field Hospital is simply called to "Attention" and marches straight out of the hospital camp, and so on to the Brigade rendezvous.

So far as I have seen, Field Hospitals have a constant tendency to be late in marching off. It arises at times from the deficient number of men for the loading work, but also very often from the want of the personal attention and personal supervision of the Medical Officers and their subordinates over competely ignorant and untrained attendants.

The time may come later on when Medical Officers can remain absent from the hospital fatigue until the final "Fall-in" goes.

That day certainly has as yet not arrived, and nothing can make up for the absence of the Officer. The hospitals are constantly late in marching off.

The European fatigue party having struck the "sick" tents and loaded them, and also loaded the kits of the wounded, these latter are given over by the Pack-Store Sergeant to three or four men of the guard or escort to be cared for on

the line of march. The tents on camels or mules join the mule or camel portion of the hospital column. The Writer sees the office tent struck and the office books loaded on the mules told off for the purpose. The European N.-C. O.'s and men of the hospital staff should always be up very early and be quite clear of their tents by the time the "Fatigue" bugle goes. The hospital Store-keeper and his men and a fatigue party, if needed, see to the loading of the hospital commissariat equipment.

The cooks load up the kitchen utensils, and if any tent has been used for cooking in, that also should be struck by them and loaded.

The watermen or *bheesties* start the moment the "Rouse" goes to the mule lines and draw the water mules and driver, and go and fill the packals for the march, and on return report the fact to the head ward servant of the hospital, and then fall in with their mules and packals with the *dandies* or with the riding mules as may be ordered.

The sweepers strike the latrine tents, and pack up all the utensils belonging to it in the *kadjawas* for the purpose.

The party told off for the camp colour party get ready their gear, line gear, picks, shovels and camp colors and form up on the parade ready to join the Advance Guard, or to march in the front of the hospital column according to orders.

In the absence of a Quartermaster-Sergeant the Pack-Store Sergeant lays out the camp; if so, he falls in the camp colour party, and after reporting all ready moves off, if necessary, with the Advanced Guard, in accordance to Division Orders.

The Transport Sergeant should be on the fatigue parade with great punctuality. He should allot all the animals the previous evening at evening parade, and tell off the

carriage for the kits of the native establishment with great care, so that they may be ready at the "Rouse" to be loaded by the hospital establishment before the fatigue duties of the hospital itself begin. The camels should therefore be brought close up to the hospital camp before nightfall the previous evening, so that they may be at once allotted to their loads.

All the camels for the carriage of tents, baggage of sick, equipment, should be brought on the parade at the "Fatigue" call and be at once placed near their future loads.

The Transport Sergeant should himself see to this, as otherwise great delay occurs.

The Transport Sergeant remains on the parade from the "Fatigue" call till the hospital marches off, superintending the loading and assisting in every way to the rapidity of the work.

The loading of camels is tedious and uncertain, hence time is needed for the work. But mules are rapidly loaded as the hooks on the saddles are ready for the loads to be hung on to.

The mules need not come up from their lines into the hospital enclosure proper until a quarter of an hour, or even later, after the "Fatigue" bugle sounds.

If everything is well organized, they need not come up until the "Dress" of the hospital is sounded, when they are at once loaded and sent on to the ground where the hospital parades before forming up to join the main column.

The riding mules also need not come until the "Dress" is sounded, when they at once move up to the spot where the convalescent sick are fallen-in in front of the hospital and the mules are allotted in regular order, so that the one muleteer, with his three mules, may be utilized in regular sequence.

Let us now glance at the time taken in this loading work: "Rouse" at 5 A.M.; "Fatigues" began at 5-30 A.M. and went on until 6 A.M. "Dress" then sounds, and all the fatigue parties replace their belts and unpile their arms and get ready for the "Fall-in" at 6-15.

The whole are then finally inspected, and move off at 6-20 to the place assigned for the Brigade or Divisional Assembly. The order of march of the hospital column will be by sections, each section in this order:

1. Hospital Corps in "Fours," followed by *dandies* with sick or empty.
2. Packal mules.
3. Mules or ponies ridden by sick and spare mules.
4. Tongas or ambulance carts.
5. Mules laden with equipment.
6. Camels always last.

The *dandies* should, as a rule, march two abreast, as also the riding and equipment mules, but much depends on the character of the track or path.

The camping ground, before leaving, should be well searched for any mislaid or missing articles, and the conservancy people should fill up the latrines and any filth pits that have been opened. Even sick men may be forgotten.

The total number of camel loads should be counted over to the hospital Store-keeper or Apothecary or Officer with the hospital baggage, as also to the Commander of the escort or guard, so that mistakes may not occur.

The Transport Sergeant should remain with the camel column of the hospital until it is well free of the camping ground and actually on the line of march. There is always a bad quarter of an hour, leaving camp.

He can then ride forward and report the fact to the Medical Officer Commanding the Hospital.

Too often one finds the Transport Sergeant spending all

his time with the mules—a very easy and unimportant work, but it is to be remembered that he is for transport and *supply* work and for the supervision of camels as well as mules.

It is advisable to examine the various roads leading out of camp on the previous evening and so choose a good path, and when the hospital column joins the Brigade Assembly, an Officer or Warrant Officer may be sent forward to report the fact to the Staff Officer or Commanding Officer of the column.

When the hospital thus marches off its camping ground to the Brigade parade, it marches at "Attention." That means that no smoking is allowed for either Officer or man. Silence is to be imperative. The Senior Officer rides in front and leads the column, and the other Officers at the heads of their sections, the Warrant Officer or Apothecary of each section being in the rear, and the Senior Apothecary in the rear of the hospital column. The European Writers and Sergeants march with the Army Hospital Corps in front, immediately in rear of the advanced portion of the Hospital Guard, beyond which they should not advance. The Transport Sergeant rides in rear of the baggage mules. The Purveyor marches with his stores, loaded on camels or mules.

Officers and Warrant Officers should not leave their positions while marching at "Attention," and the condition of "Attention" should exist marching in and out of camp, or when nearing or marching from a halting place—or before any order is given to the hospital as a whole. It is absolutely essential to enforce the marching of Officers with their sections or in their allotted places; if any laxity is allowed it becomes impossible to find one's Officers. On the word "March at Ease" more laxity is allowed. All Officers and Warrant Officers who draw allowances for a

horse should ride when at "Attention," and so be able to assist their Commanding Officer in maintaining order and regularity in the column and to aid in getting it out of camp.

The bad riding of Apothecaries is a standing joke, but it may at times be a very sad and serious joke if it means failure in duty.

If any difficulty exists on this head, the certificate of having a horse should not be signed. The position of the Field Hospital on the line of march is in the immediate rear of the troops and in front of baggage. The hospital itself is not baggage, but has its own guard and escort and occupies a special place of its own. It does not come under the orders of the Baggage Master, although its baggage, that is to say, the kits of the hospital establishment and their tents do form part of the baggage column. The tents of the Field Hospital are part of its working equipment, and these are not baggage, but are as much part of its equipment as medicines or instruments are; in fact more so, for without shelter serious cases simply die. The baggage of the hospital takes its turn with that of other Corps in leading the baggage column. A roster for this is generally kept by the Brigade or Divisional Staff.

It cannot be too often repeated that great care is needed in preventing the hospital column from straggling; and Officers and Warrant Officers should set a clear example on this head. Constant care and watchfulness is the only remedy for this indiscipline.

After one hour's marching the first halt usually takes place, and it is a very needful halt.

Men can then fall out, loads be eased, the sick looked to, water issued, and all made comfortable.

Three and-a-half miles per hour may be done if the column is in good marching trim.

When the "Halt" is sounded, the hospital bugler repeats the call.

The sick should be carried well to windward of the track to escape the dust of the road.

After the halt has lasted five or six minutes the "Fall-in" goes, and all Officers and men should at once rise and fall-in in their places.

When the order "Unpile Arms" is given, *dandies* are lifted and all made ready to move off as the column moves off.

Previously-made beaf tea can be issued during the halt to any serious cases, and milk or cold tea may also be given. A fire is easily lighted.

At the end of the second hour's marching, say, after seven or eight miles have been finished, comes the "Breakfast Halt."

This generally lasts for three-fourths of an hour, and the men eat their cold meat and bread, and the sick can be fully and carefully attended to.

The moment the "Halt" goes, the hospital should close up to "Attention," move to the windward of the track (take ground to the right or left) and halt, and all mules should, if possible, be unloaded, and all kahars watered. The kahars should be fallen in by *dandies*, marched 10 or 12 paces away, made to sit down in order of their *dandies*, and so get their water from the *bheesties*. If this is not done, fighting and confusion occur, and the weaker ones get no water. This is constantly the case.

Puckals are needed at the rate of one pair per 40 men for this purpose. Kahars cannot possibly work without water, and great care is needed on this head. I have seen frightful suffering from want of water in Afghanistan and the Soudan, amongst this unfortunate follower class.

Some cold meat cut and cooked from the day's ration is

a very useful adjunct to this midway halt and meal, and the sick benefit by this arrangement. The loads should be replaced after half-an-hour's rest, and the column get together ready for the "Fall-in" and the "Advance." Warm tea can always be given at this long halt, as fires are easily lit, and the tea is an enormous stimulant.

If an Officer is to go ahead to take up the camping ground, he may ride forward from this place, and sometimes the Transport Sergeant may be sent ahead to see that wood, forage and supplies are being made ready, for he is also a supply agent.

The camp color men march with the Advance Guard and the Officer or Sergeant reports himself to the Officer of the Q. M. G.'s Department to take up the hospital camping ground.

This done, the long flag-staff and red cross flag are hoisted as a guide to the hospital marching into camp.

The various camp lines are then opened out, and the sites of the various portions of the camp, *viz.*, sick tents, staff tents, Officers' tents, transport lines, &c., &c.

The camp is best pitched in a hollow rectangular form, and the official plan is not a satisfactory model.

It is alway advisable to send out a man to guide the hospital column to its camp.

When close upon the camp site, halt the Field Hospital and do not allow men or animals to enter on the site until it is completely marked out.

The hospital column should form up in front of the hospital camp in the same order in which it formed up in the morning before marching off. The *dandies* should be formed up in order and laid on the ground; the sick men who are riding should dismount and stand by their mules, and the Hospital Corps and kahars should be marched into the centre road of the hospital camp for fatigues. An

Officer, Warrant Officer and some men may remain with the sick.

A fatigue party should arrive from the regiment to pitch the camp and unload the baggage.

Fatigue parties of Hospital Corps and kahars should be told off for the various duties, *viz.*, pitching the sick men's tents, dispensary, office, Warrant Officers', Officers', unloading equipment, &c.

The chief cook should be assigned the site for the kitchen, and he should hasten to make tea for the sick. This is of vital importance.

The *bheesties* fill up the tent buckets and the tent *chagals* ready for use, and start to the water-sources for a supply, being careful to give the first supply to the cooks. The Q. M. G. points out the water-sources to the Officer or N.-C.O. who takes over the camp site.

The *jemadar* sweeper should pitch the latrine tent and enquire where the latrine trenches for the native establishmen are to be placed, and at once send a fatigue party there, dig the trenches, and surround them with bushes stones, &c., for concealment.

During all this fatigue no Officer, Warrant Officer or man should leave the parade, nor see after his own tent or property until all the wounded and stores are housed.

The Writer gets the office tent pitched and prepares the indent forms for rations and supplies, also the "states," the diary, the order book, etc., as may be needed.

As soon as the tents are pitched, the wounded are carried in their *dandies* into their tents and laid on the ground, and the poles, covers, &c., placed near the tents. The riding patients give up their mules to the muleteers and move to their tents. Men should be kept together by tents, so as to ensure method and order in assigning them to their places.

As soon as the wounded are housed and the loads unpacked and placed in their places, the regimental fatigue party may be dismissed, and the Hospital Corps allotted for duty at the the sick tents, &c. The kahars should be marched to their lines in the rear of the hospital, and an inlying picket of 6, 12 or 18 men kept ready on duty at the entrance to the hospital camp with *dandies* in case of an alarm.

The men of the Guard pitch their own tents, and no kahar or native fatigue men should be given to them. A sentry is at once posted, and when thought desirable, the rifles and ammunition of the sick may be placed for safe custody in the Guard tent.

The fatigues are not ended in a Field Hospital until the last camel load of equipment has marched into the hospital camp. Officers visit their wounded once on their being placed in their tents and order any diets or food needed or urgent drugs; but wounds cannot be dressed at this time.

It is advisable to postpone wound dressings until Officers and wounded have had some food and rest. Three P.M. might suit, and in the three hours between 3 P.M. and 6 P.M. all dressings can be finished.

If only a few have to be done, 4 P.M. until 5 P.M. would suit; but it is better to separate the ordinary visit to the wounded from the long, tedious dressing work.

When the first visit is over and food and drugs ordered, the Section Officers attend at the hospital office, make their report in person to the Senior Medical Officer, apply for any urgent help they need, and when all reports are received and orders issued, are dismissed from the parade. That is to say, Officers are on parade before the march, during the march, and until dismissed by the Commanding Officer after the march is over and the urgent work done. This routine applies also to the Warrant Officers and all the men.

The Senior Officer of the hospital having received the

reports of the Section Officers, filled up the diary, issued the urgent orders for the day, and signed the requisitions for supplies, visits the hospital, generally sees that all is in order, and then retires for food and rest after the march.

The Writer is ready to go for Brigade Orders; and at a fixed hour in the afternoon all Officers and Warrant Officers attend for evening visit, which evening visit should be finished by the afternoon parade hour of the hospital which may be at 5 P.M. or 6 P.M. as may suit the climate and the season.

I regard this afternoon parade as vital and essential in every way. The "Dress" should sound at 4-30 and "Fall-in" at 5 P.M. Every one should attend who belongs to the hospital. Brigade Orders are then fully known, and published in Hospital Orders. All native establishments inspected, sick men removed, loads made ready for the morning, camel men warned, muleteers told off, fatigue parties detailed, and every possible precaution taken to prevent any delay or confusion in the morning. Camel loads are made up into units for the camels, mule loads laid out for the mules tents not needed are struck, and the rations for the following day duly received. Take great care on this head.

Every Officer and subordinate at this parade can report his group of work correct, and if not, can report what is defective or what he needs.

When everything is correct and so reported, the Officers "Fall-out" and parade is dismissed, and the night duties posted.

Sick men from regiments should arrive at 4 P.M. on marching days, and great care is needed as to their rations, kits, medical history sheets, &c. The carriage for their kits is always a source of trouble and needs careful attention. Their Regimental Commanders supply the transport for these men's kits. Constant confusion occurs on this head.

Discharged men should leave at 4-30 P.M. for their regiments, so as to give time to have them settled in their companies before dusk comes on. Their names should go to their company at 10 A.M.

If the hospital is complete, the Orderly Officer of the day pays a final visit at 9-30 P.M. and sees all correct: if small in size, the Senior Warrant Officer may do it, but comes and reports all correct to the S. M. O. in camp personally, and enquires for final orders.

Absolute quiet is needed in camp after the "Last Post," and the kahars are great sinners in respect of irregular noises after the camp is supposed to be at rest. Very summary punishments alone put a stop to this great irregularity.

The things to guard against on a marching day's routine are: Late rising of the staff, by Officers and Warrant Officers not appearing for fatigues, wrong allotments of transport animals, straggling of Officers or men from the column on the march, absence of staff from the evening parade, confusion about carriage for sick men's kits, and, finally, noise in the camp after "Lights Out" and "Last Post" has gone.

At the end of such a marching day there will be few Medical Officers who will not be tired and weary.

The Routine of a Halting Day in a Field Hospital.—Let us continue the night of the marching day just dealt, with, and let us imagine that Division Orders, say, tomorrow, will be a halting day.

All through the night, the hospital red light should burn, fires for cooking food for the sick be burning unless special orders are issued by the General Officer forbidding even these fires. Kahar patrols are posted to aid the sentry in watching the camp, and the muleteers post their own stable picket over the mules in the mule lines. The stealing of mules is a constant episode in border wars.

At whatever time the camp "Rouse" goes, the hospital

establishment should rise, and a morning parade of all the Hospital Corps, Purveyor's establishment and kahars and muleteers take place at 7 A.M., corresponding to the morning parade of the native establishment in cantonments.

All men of the establishment should then be examined, and any sick taken out from among them for inspection by the S. M. O. or other Officer detailed for the duty. All European orderlies and Writers also attend at this early morning parade, and set to work after it.

I have found 8 A.M. a suitable hour for the Warrant Officers to visit their sick, and 8-30 A.M. a good breakfast hour on halting days for staff and patients. Half-past nine is a good hour for office, and all Officers should report themselves there at that hour before visiting their wards or sick tents.

The S. M. O. then issues to them any general verbal orders he desires to give, or they consult with him as to any matters needed by them.

The S. M. O. then deals with prisoners, sick of his own establishment, and receives the reports of the Purveyor, transport staff, or other officials of the hospital, and issues verbal orders, giving notes to the Acting Adjutant or Orderly-room writer about entering the orders, in the Order Book.

When routine papers are signed and orders issued, the S. M. O. goes round the hospital, seeing every detail and every needful case, and returns to office at 11-30 A.M., when Officers again attend, give in their reports or requisitions, bring up their men for discharge or for convoy to the rear, and final orders for the day are issued. The attendance of Officers at office is essential.

It is better to postpone the long and tedious dressing of wounds until after office is over, say, 12 noon, as otherwise Officers delay so long over these dressings that their reports

or urgent demands cannot be heard, and the S. M. O. is in the dark as to their needs.

Dinners will be served at 2 P.M., evening visits made from 3 or 4 to 5 P.M. At 5 P.M. evening parade and the same routine as on a marching day, and every Officer and man attending for orders for the morrow, and remaining until the parade is dismissed, for in war time one never knows what changes one hour may require in the routine, and all should attend. No Officer and no man should, at any time in the field, leave the hospital camp without asking permission, and also leaving clear directions as to where he is to be found.

The establishment of a mess is of much importance, so as to ensure that Officers will remain in the camp for meals, as also on account of the social comforts and advantages that result from such an institution. Owing our most unsatisfactory system of mobilization it is almost impossible to arrange for a mess beforehand.

CHAPTER VI.

Suggested Codes of Standing Orders for Officers, Warrant Officers and Men of the Field Hospital.

Orders applicable to all Officers.—No Officer is to leave the hospital camp without the permission of the Officer Commanding the Field Hospital, and all Officers leaving camp should keep the Officer Commanding informed as to where they can be found.

2. Officers should be present on parade half-an-hour after the "Rouse," and should in this matter afford an example to all officials serving under them.

3. When marching at "Attention," all Officers should be mounted and should keep in the place assigned for them by the S. M. O. The Officer Commanding the hospital at

"Attention" should ride at the head of the hospital column.

Officers in charge of sections should ride at the head of their sections at "Attention," and should at times visit the whole of the section and see that it is well locked-up.

The Senior Apothecary should ride in the rear of the hospital column, and should report to the S. M. O. if the pace is excessive or that any straggling is occurring.

The Apothecaries of sections should ride in the rear of their sections.

The hospital establishment should march in "Fours" at the head of their sections. "Detachments Front."

European N.-C. O.'s, Writers, Orderlies and men attached to the hospital should march in "Fours" in front of the native establishment.

If an Officer is on Baggage Guard, or other duty, the Warrant Officer of his section should lead the section, and the head ward servant march in the rear of the section.

At the word of Command "Field Hospital, Attention," all Officers and men should resume at once their fixed places in the column.

4. Syces should march at the head of the sections their masters belong to, and be found in the rear of the native detachment at the head of the section.

5. Officers' other servants, not syces, should march with their masters' baggage in the rear.

7. Every Officer should have his pocket-case at all times on his person and ready for use.

The Duties of the Senior Warrant Officer, S. M. D.—1. The Senior Medical Warrant Officer is responsible to the Senior Medical Officer for the safe custody of all tents, camp equipage, ordnance equipment and barrack furniture, in addition to the charge of medical and surgical equipment,

and should count them daily on arrival in camp, and on halting days every forenoon ; any missing articles should be at once reported to the Senior Medical Officer.

2. At once on the arrival of the hospital in camp the office should be opened in the office tent, and the requisitions for the day made ready ; this is very essential.

3. The Senior Apothecary of the hospital should personally report all correct or otherwise to the Senior Medical Officer or Orderly Officer at "First Post." He should receive the reports of the Warrant Officer on duty, Transport Sergeant, Hospital Store-keeper, &c., before making his report to the Senior Medical Officer.

4. If not needed by the Senior Medical Officer he may be sent on to the next camping ground to mark out the future camp, but should not leave the hospital column until after the midway halt.

5. He should see that the Writer packs up the office loads and assists in striking and pitching the office tent.

6. On the line of march at "Attention" his place is in the rear of the hospital column.

7. He should visit the entire hospital three times daily, *viz.*, early morning, midday and at night, and see that the Warrant Officers are at work, and report any irregularities to the Senior Medical Officer.

8. He should see that a Transport muleteer is at all times ready with his mule at the office to convey urgent letters.

9. He should cause the hospital flag to be lowered at sunset, and the hospital distinguishing lamps lighted at the same time and kept alight until sunrise.

10. He should ascertain from the Senior Medical Officer where the latrines are to be placed, and give the needful orders to the head sweeper on the subject, and should visit the latrine himself daily. Before marching off he should

see the latrine filled in and report the fact to the Senior Medical Officer.

11. He should take the order of the S. M. O. as to the location of the kitchen for the patients, and should see that the *bheesties* go at once for water on arrival in camp.

12. He needs at all times to have a note book and pencil with him.

13. He takes receipts from all persons for any article of equipment detached from the hospital, carefully filing the same in the Guard Book.

14. He takes over the camp equipage from the Ordnance Department, and, in returning it, makes out the necessary delivery vouchers.

15. In the absence of the Officers he takes command of all parades and carries out the routine laid down for his guidance by the Senior Medical Officer.

16. He should see all haversacks and field companions at once replenished after any engagement, and keep the Senior Medical Officer informed of any needful drugs running low.

Duties of Medical Warrant Officers doing duty.—They should be dressed carefully and cleanly, and be an example to the men of the A. H. N. C. in careful attention to the Field Service Dress Regulations.

2. The revolver with lanyard is always to be worn on the line of march.

3. The pocket-case should be worn in a leather pouch on the Sam Browne belt behind. It should always be worn.

4. The W. O. on duty should wear his sword-belt, but no sword, when on duty within the hospital.

5. On coming on duty he should see that dressings, &c., are ready, in case of any wounded man coming into camp.

6. He should see that a detachment of *doolie* bearers is

at all times ready to turn out if needed—to be located near the Guard tent of the hospital.

7. He should see that the Writer goes at once for Orders on the "Divisional Order" Bugle sounding.

8. He should arrange to call the cooks, one hour before the "Rouse" and see that they get up to make the tea on marching days.

9. If there is no gong he should keep watch that the meals are served at the regular hours laid down in Hospital Orders.

10. If there is an Officer on duty he at once reports any sick men coming in the hospital to him for examination.

11. The moment the "Rouse" goes he sees that all the establishment and patients at once rise and make ready for the march. He personally visits the tents of the subordinate staff, patients, kahars, &c., and sees that they are rising.

Duties of the Pack-Store Sergeant.—When a Pack-Store Sergeant is detailed for a Field Hospital, his C. O. hands over his defaulter sheets, last ration certificate and his arms and ammunition to the Officer Commanding the Field Hospital.

The Sergeant is thenceforth rationed by the Officer Commanding the Field Hospital.

2. He should always be carefully dressed.

3. He is at all times on the march to be in possession of his rifle, side arms and ammunition.

4. If not mounted, or not needed for special duty, he marches with the European N.-C. O. and men of the hospital staff in front of the hospital column, but behind the Hospital Guard.

5. When a patient is admitted he checks over his kit and accoutrements, and sees that they agree with any list sent in for receipt. He initials the receipt before laying it before the Senior Medical Officer for signature.

6. He places the arms and ammunition of the sick in custody of the N.-C. O. of the Guard if necessary.

7. At once on the "Rouse" going he turns out, packs his kit and arranges for its carriage on the animal assigned. He falls in at the fatigue parade in front of all native establishment, and, if he is senior, he calls the roll of European Orderlies and Writers on parade and reports them present to the Officer or Warrant Officer commanding the parade.

8. He sees to the loading of the patients' kits, and hands over the camels or waggons containing them to the files of the Guard detailed for their escort. If there is a mule arm-rack in use, he is particularly careful that it is kept under the immediate supervision of a European soldier of the Guard or escort.

9. He gives general assistance in loading the mules and camels and assists at the evening parade in allotting loads, and he draws from the Transport Sergeant any carriage needed for the patients' kits.

10. Under the orders of the Senior Medical Officer he assists the Warrant Officer in sub-charge in checking the camp equipage and seeing that it is in good order, and reports any wear and tear or loss of tents to the S. M. O. so that the Store-keeper's *dhurzis* may repair it.

11. He lays out the hospital camp and sees at night that all camp colors, etc., are ready for the following morning, and he forms up his camp color party, and under, the order of the Senior Medical Officer moves off with it with the Advance Guard, if so ordered in Division Orders.

12. He takes over the ground for the camp from the Staff Officer assigning the ground, and makes everything ready for the hospital to march on to it.

13. His duties are not finished until all baggage animals have arrived in camp, and have been unloaded and all tent

equipment, loads and kits checked and counted. He then reports to the Senior Apothecary.

14. If senior, he reports all nursing orderlies and European staff as present to the Senior Warrant Officer at "First Post."

15. He constantly watches the rifles of the sick and has them cleaned and oiled by the convalescent patients or others when needed. The arms should be inspected every Saturday by the S. M. O., and, if kept in the sick tent, daily by the Officer in charge of the sick in the tent.

16. If he be the Senior N.-C. O. he gives the needful orders to the Guard on arrival at the hospital, and practically acts as Sergeant-Major for European troops employed at the hospital.

17. When the campaign is over his duties are not over until all the camp equipage is safely returned to the Ordnance Department, and he is needed for at least ten days after arrival at the demobilization station before the S. M. O. reports to the district P. M. O. that his services can be dispensed with.

Duties of the Hospital Writer.—When the Writer of a Field Hospital is detailed in Orders for this duty, his C. O. hands over his defaulter sheet, last ration certificate, &c., to the O. C. the Field Hospital. The Writer brings with him his arms and accoutrements.

2. He is responsible for the pitching and striking of the office tent and the safe custody of the office boxes.

3. Immediately on arrival in camp, he opens the office in the office tent.

4. Besides these duties, he is available for all general fatigues, and is always present at evening parade.

5. At the morning start, after seeing the office loads made ready, he acts as a marker and assists in forming up the hospital column before marching off.

6. On the line of march he marches with the European detachment of the hospital staff in front of the A. H. N. C., but in rear of the Hospital Guard. He may be utilized in laying out the hospital camp.

7. He is needed for at least ten days after arrival of the hospital at the demobilization station in closing returns.

8. He goes to the Brigade Head-quarters when "Brigade Orders" sound to get the Brigade Orders. These he shows to the S. M. O. and Adjutant, and takes orders as to Hospital Orders.

9. The office boxes and records are entirely in his charge for the S. M. Officer.

The Transport Sergeant.—This N.-C. O. is detailed by the Commissariat Department, and when so detailed he reports himself for duty to the Officer Commanding the Field Hospital.

2. He will be carefully dressed himself, and will see that the kahars and muleteers are also clean and regularly dressed. This is constantly overlooked.

3. He is present at the hospital fatigue parade every morning, and reports himself to the Officer and Warrant Officer commanding the parade.

4. He is responsible that the kahars and muleteers rise at the "Rouse," strike their tents, pack their kits, load their camels, and are ready at the "Fatigue" call to take their part in the loading duties.

5. He arranges that the camels are brought into camp at night, and that they are ready for loading at the "Fatigue" call on marching mornings.

6. He parades all his establishment morning and evening on halting days and in the evening on marching days, for the personal inspection of the S. M. O. or Officer detailed for the parades, and sees that no sick or ailing men remain in the lines without being reported sick. He makes

out sick reports for all sick transport followers, and takes them, in the first instance, to the hospital for inspection.

7. He watches the kits of his establishment and sees that no extra weight is carried; no easy task.

8. He supervises the work of the hospital Store-keepers, and arranges any difficulty that may occur in the drawing of rations for the sick and the hospital establishment, as he is Supply Sergeant.

9. He remains on the camping ground until every animal of his charge is loaded, and has moved off, when he may ride forward and report the fact to the S. M. O. He may, however, have to remain with the camel column of the hospital, in which case he takes the orders of the Officer or Warrant Officer of the Hospital Baggage Guard marching with the camels.

10. If marching with the Field Hospital column, his place is in the rear of the loaded mules. He should always be mounted at "Attention" if allowed a pony.

11. At all long halts on the march he takes the orders of the S. M. O. for unloading the hospital mules so as to rest them.

12. He accompanies the S. M. O. in his morning visit to the transport lines of the hospital, and if the Orderly Officer visits in the evening, he also accompanies him round the mule lines.

13. He is responsible for the cleanliness of the transport lines in every detail, and should arrange that the muleteers themselves remove the mule litter, and the camelmen, the camel litter, to the appointed place outside the camp.

14. He attends the evening parade of the hospital, learns the number of loads requiring to be carried, and draws the extra carriage needed to carry the kits of the sick from the Officer Commanding the sick man's regiment.

15. He posts the stable picket of the muleteers, and makes his report at "Tattoo," to the Senior Warrant Officer, that all is correct or otherwise.

16. If allowed to ride on from the mid-day halt, he takes with him the filled up requisitions for firewood, forage, and supplies needed at the new camp, and on the hospital marching into camp takes empty mules and a fatigue party to bring the supplies into camp.

17. He attends at the S. M. O. office daily at Orderly Room hours and gives his report in person, and receives orders as to duties needed of him.

The Hospital Store-keeper.—He should join the Field Hospital at least ten days before the day the hospital marches, and be medically examined as to fitness. Some of these men are old, feeble, and useless in the field. They are caste-ridden, and will not handle meat rations in the field.

2. He draws the commissariat equipment from Commissariat charge, opens every box and package, checks every article and sees that it agrees with the regulation scale laid down.

3. He parades the *dhobies, durzies* and other Commissariat servants for medical inspection by the S. M. O.

4. If possible, he lives in the Field Hospital mobilization camp during the time it is being mobilized.

5. On the line of march the senior Store-keeper marches with the Field Hospital heavy column, and watches the carriage of the equipment in his charge. He keeps the *durzies, dhobies,* &c., under his eye, and utilizes them as a fatigue party in loading, &c., not allowing them to shirk or straggle, which, being wholly indisciplined, they constantly do.

6. He draws the requisitions from the Senior Apothecary and brings the food supplies into camp at once. He draws the rations for the following day early in the

evening, and reports their safe receipt to the Senior Apothecary.

7. So long as he can obtain supplies direct from the Commissariat, he keeps the hospital stores in the boxes intact, and, if they have to be used, he takes the earliest opportunity of replacing them—medical comforts especially.

8. He keeps an account with the Warrant Officers of sections of all articles drawn from his store for patients' use.

9. As he is entirely under the orders of the S. M. O., he should not receive orders from any other person whatever, or, if he does receive any order, he should at once report the matter to the S. M. officer. He attends office daily.

10. He should see that his men rise at the "Rouse,"—pack their kits, strike their tents and are ready at the "Fatigue" bugle to take their part in the general loading duties.

He should not leave the parade until every one of his loads have arrived. This done, he reports all correct, and waits the general dismissal of the parade.

He attends the evening parade with his men, and makes all his loads ready for the morning march, reporting all correct every evening.

11. He is needed for at least ten days after the campaign is over at the station of demobilization, and should hand in a certificate that all the Commissariat equipment has been handed in complete, except articles lost, and those should be brought before a Board.

Head Ward Servant acting as Sergeant-Major, A. H. N. C.—A Head Ward Servant is needed to act as Sergeant-Major of the A. H. N. C., and to keep the roster for duties and generally to supervise the native establishments of the whole hospital of 100 beds. He is not attached to any section, but is one of the Hd.-Quarter Staff of the Hospital.

2. He should see that the native men rise at the "Rouse," pack their kits, strike their own tents, and are

ready for the general attendance on the sick by the time that the "Fatigue" bugle goes.

3. He parades the native establishment, sees that they are properly dressed, falls out any sick men for treatment, and assists in telling-off the various fatigue parties for the hospital starting on the march.

4. He forms up the native detachments for the march, gives orders to the mates of *doolie* bearers for their guidance, and aids in every way the working of the hospital.

5. On the line of march he remains at the rear of the hospital column unless needed elsewhere, being near the Senior Apothecary.

6. He takes the native establishment to bathing parades and for clothes-washing every Saturday at 12 noon, or so, according to orders; otherwise they become covered with lice.

7. He watches the kits of the A. H. N. C. or sees that they do not exceed the regulation allowance.

8. He accompanies the Senior Apothecary on his visit at "Tattoo," and reports the native staff as correct or otherwise.

H. W. Servant acting as Quarter-Master-Sergeant.—It is advisable to have such an official to be the assistant, in detail matters, of the Senior Apothecary and to act under his orders. He would also assist in laying out the camp and marching on in advance with the camp colour party. He is a most useful man to develop. He belongs to no section, but is a Head-Quarter's Staff official.

The Head Sweeper, Head Cook and Head Bheestie.—These men need to be active and intelligent, and to work hard during the campaign. They should all at once on arrival in camp enquire where their various places of work or supply is to be located, and set to work at once to carry out their duties. They are not attached to sections like the men of their branches.

CHAPTER VIII.

The Field Hospital as a Bearer Company on the Battle-Field.

When a battalion goes into action and its men fall wounded, its regimental ambulance men carry the wounded to the Regimental Doctor, and he gives them a rough and hasty field dressing.

No regimental hospitals now exist in the Army, and the Field Hospitals are generally four or five miles, perhaps, in rear of the fighting line, struggling on the crowded roads that lead to the rear of an army actually fighting.

The Field Hospital, therefore, can rarely come up to the battle-field in time to afford immediate succour to the already partially-dressed battalion wounded, who need to be collected in a central spot, thoroughly dressed, fed, and transmitted to the Field Hospitals further in the rear.

There is, therefore, a distinct gap in the ambulance arrangements which needs filling in—a bridge, as it were, has to be thrown over to link the battalion medical aid with the Field Hospital in the rear.

These links are the Divisional or Brigade Bearer Companies of the Medical Corps, affording aid to the wounded of all Corps and all classes of troops in the Brigade or Division to which they are posted.

The English Bearer Company corresponds to the *Sanitats Detachment* of the German Army, and to the *Ambulance Divisionnaire* of the French; it is a highly mobile, well-equipped unit, but without tents, with the equipment carried on mules, and consisting of a body of Officers and men of the Medical Corps, of strength and activity, with stretchers, surgical appliances, cooking vessels and medical comforts, and blankets needed for the first real aid to wounded men. This light and highly mobile unit pushes straight on to the battle-field, and actually under fire.

Its Officers and men hurry forward and touch the rear of the fighting line, and these take over, the already partially dressed, regimental wounded from the regimental aid and Doctor, and free the battalions of all such *impedementa*, rendering them quite ready to push on rapidly after the enemy. They take over the wounded of the whole Brigade. No better work can be done in the army by a sharp, intelligent and devoted Officer than to successfully command a Bearer Company in war.

He should see well—which some Doctors don't; ride well; be active to a degree, and ready in resource. He takes every opportunity of keeping touch with the battalions and frees them of every wounded man. This is the most important aim.

He concentrates these at the Brigade "dressing station;" lays out the wounded as it were in a great open air hospital; feeds them, operates on them, dresses their wounds, shelters them with blankets in the night, guards them against the marauder and the straggler, and finally carries them to the Field Hospital and hands them over there, and then gathering up his men and his transport and his equipment, hastens after his Division to do the same duty in to-morrow's fight.

Can any duty need more trained activity, more readiness, more thorough mobility, more discipline, more complete and perfect training, more cohesion, and almost automatic action of Officers and men? Yet this unit, which exists in every foreign army and in England, has no independent existence in the Indian Army, but is a scratch detachment, of the very scratch Field Hospital.

It has already been shown how feeble an organization is a hastily mobilized, rapidly thrown together Field Hospital. It is shaky in the extreme, and cohesion—there can be none.

Now, the order in the Indian Army is, that when an action is imminent, a scratch Bearer Company of Medical Officers and men are to be detached from the far-in-the-rear Field Hospital, and these are to collect the wounded, dress them, and eventually carry them to the Field Hospital.

In petty border skirmishes against muzzle-loading muskets of savage mountaineers, this may suit. It will fail ignominously against the breech-loader.

The Indian Bearer Company is utterly, scratch; even its equipment is supposed to be partially made on the field by that dubious workman—the hospital carpenter. The detachment of so many Officers and men cripples entirely the Field Hospital from whence it comes, and prevents any wounded being sent down the communication line, as it absorbs the sick carriage in front.

What is needed is to have a separate and distinct unit for this purpose, as in England, independent of the Field Hospitals altogether. In any real war this would be essential. What would suit would be the equipment of a 100-bed Field Hospital, without tents, but with the carriage and transport for 200 sick men at least.

This extra Field Hospital, with double the ordinary transport, would divide into two Bearer Companies for the Division it belonged to; would gather in the Brigade wounded and dress them and care for them and give them over to the Field Hospital. It would then rejoin its Division and would, when its transport was withdrawn or diminished at the end of the war, resume its place as a Field Hospital in the line.

What a wounded man wants when hit is immediate, but necessarily rough, aid. I am hit and bleeding, and my battalion Doctor hastily dresses me. If I am gathered up and carried to a collecting and dressing-station and feel that

I am amongst comrades; that I will not be cut up by marauders, nor be left to be ridden over by Cavalry; if I get a drink of tea, a nip of brandy and a blanket, and some food, I bear with patience the exposure, and the biting frost of an Afghan night. There are many more in similar plight round me. I see I am being cared for, and I rejoice that I am not yet killed, and all things seem golden as we lie by the fire in the keen frosty night. The hard-working Doctors are moving about; the whole place is a big bustling *al fresco* hospital, and I can wait here forty-eight hours, if you please, if I know I am in good hands. The average man thinks thus.

To die for England is sweet and decorous, but to lie forgotten in a bye-way after the fight is terrible. To linger slowly to death in some deep ravine; to hear afar the sounds of the bugles and see the fires of the *bivouac* to which my shattered limb will never allow me to crawl; to be starving with hunger while the blood wells slowly from my wound; to be consumed by a devouring thirst, and hear close by the rippling stream one cannot reach; to feel the frosty night wind is chilling my heart's blood; not to be able in those last few fleeting hours to whisper in a comrade's ear those last farewell words to wife and child whom one shall see no more; to perish after the fight by the knife of the midnight robber or prowling marauder; all these things make even war more terrible, and add an unutterable horror to what is at all times horrid enough. The remedy against all these things is the well-organized, well-commanded and well-equipped Bearer Company led by the Doctor trained as a soldier, and who feels at every beat of his heart for that last soldier-boy lying far away from the fight who must be sought out and gathered in and cared for. If such an organized company exists and is well trained, the horrors I refer to need never occur; but

if it is to be merely the accident of an accident, the scratch offspring of a very scratch parent, the tumbling-to-pieces outcome of tumbling-to-pieces organization, then, for this soldier lad if he is wounded, I guarantee nothing, for how can I do it on so shifting, so uncertain a basis, but I will turn to the nation that bred him and the people who claim him as their soldier, to the county from whence he came, and the village far away where lies his home, and to that great Empire under whose orders he marches, whose flag flies over him, whose drum-beat he has followed round the world, in whose cause he has given up civil liberty to serve as a soldier for her sake, and to sacrifice health and strength and life in her many wars, and I ask; IS THIS TO BE ALWAYS SO, AND HOW LONG IS IT TO ENDURE? In the hours of bitterest need, when shattered and torn and helpless, is there to be no more certain aid than this most make-shift of attempts at relief?

I feel in my heart that such an appeal, fully and openly made, would receive from the most generous and warm-hearted of nations the most complete of answers, and that if she hesitates to-day, it is not from selfishness, but because from her long ignorance of war in her fields and homesteads: she does not understand what is wanted to mitigate suffering, nor does she know how defective is the existing Indian help.

When I see, year after year, the splendid, the lavish, the inexhaustible bounty of England given to every sorrowing people, to every suffering nation, to every far away disaster; when I think of her philanthropy, deeper and wider than the splendid Empire she governs, I feel that had she known, she would never have allowed so feeble, so fragile, so defectively-organized an aid to exist for her soldiers in war.

Are these men to be forgotten in their utter extremity by a nation which has showered her charity on every

people under heaven, and to whom in their troubles no nation on the earth appeals in vain.

How often in Indian campaign after campaign, when I have seen the deadly weakness of the Medical Corps, the paltry means at its disposal, its feeble and defective *personnel*,—the offscouring of the bazaars, ignorant, untrained undisciplined, hungry, mobilized in a hurry, with no drill, no defined system, without cohesion, and with a hazy and defective status for Officer and man belonging to it, have I not said in my bitter anxiety: what would England say if she only knew all this!

I seemed to be as it were on a loosely-bound-together raft, afloat in a stormy ocean, the raft freighted with a mass of shattered human life, toil-worn, wounded, their health and strength perished in the service of that mother-land beyond the seas, and on this sinking and waterlogged make-shift, it was my task to pilot my perishing comrades to the shore of shelter and proper rest.

When I saw the difficulties, the dangers, and the feeble means given me to achieve my ends and my aims towards those men, I felt like the shipwrecked mariner over whose raft dash the surging waves of hopelessness and despair, freezing his companions, numbing his own life and energy, and in the end consigning all to destruction.

In those hours and days and weeks of the bitterest anxiety, of unceasing dread of break-down, of hourly proofs of miserable preparations in peace, wearied with the reiterated complaints of my brother Surgeons who seemed so often to have lost heart in the overwhelming difficulties they had to deal with, one thought rose always in my mind,—the thougt and the hope that England might one day know the truth, and with strong hand and steadfast heart make such conditions impossible ever again in her far away Eastern armies.

I felt, then, that she never meant that I, who toiled and laboured, and struggled hard for her soldier-children in their feebleness, in their utter prostration, in their maimed helplessness, should be in the army, a mere hanger-on and a tolerated incumbrance; that to me for my aid to care these wounded English boys, a follower of the army, ignorant, hungry, savage, undisciplined, hopeless in his stupidity, unarmed, undrilled, completely untrained, alone should be given. That no English soldier should be there to help me; that I should wear out my strength and my life alone, striving to organize and give cohesion to a hopeless mass of ignorant natives of the most inferior and ignorant classes; that I should hear but one long cry of hopelessness and despair from the Surgeons, however high or junior their status, and that their life was seemingly crushed out of them by the almost impossible nature of their task.

In those hours of bitter anguish, in the days of killing toil, in those long dreary marches, when I wasted my strength in striving to guard my wounded and my sick from being choked to death by swarms of baggage and crowds of followers, far through the thickening dust-clouds that choked me, but utterly suffocated my sick, I saw the Sun of Hope shining: that Sun was England, far away across the ocean and in my despair, I said in my heart a thousand times: if England only knew, she would never allow it.

To-day I repeat the same words, and I feel that in our struggle for the soldier in his pain and suffering, although unexpressed in words, the heart and the hope and the loving sympathy of England is with us, and only needs to be educated to our wants to meet them to the full.

England, mother of right and justice, could never have meant that any of her sons should be put in so false so utterly painful, so hopelessly disheartening a position

as I, and hundreds of men of my special service have been placed in in war in endeavouring with the feeblest help to carry on the care of her stricken children. Did she know, she would assure my status, guard my self-esteem, protect me in the faithful discharge of my work, and give to me with a just and reasonable hand the aid I needed and that the conditions required.

The only cure for the despair and the hopelessness I see amongst the Medical Corps in every campaign, is the full ventilation of their lawful demands and their wants in the clear light of day, and let England then, after full knowledge, decide what care or protection she desires to give to her wounded sons in the countless wars she wages. When she understands all, all will be surely granted. In the constant wars, great and small, in which England, as an Empire, has, during the past twenty years, been engaged in, on no single occasion after a fight where her soldiers have been killed and wounded has the beloved Queen of this great Empire failed to send her telegraphic messages of sympathy with her wounded soldiers and her hopes for their speedy recovery.

This telegram of priceless value to the wounded is sent to the General Commanding the troops, and it is sent on to me amongst other Doctors to communicate to the wounded soldiers under my care.

It reaches me in the middle of my labours in my 50-bed Hospital, surrounded by maimed and shattered soldiers.

Knowing what a splendid ~~number~~ it will be to those exhausted men who lie around haggard, blood-stained, their faces covered with a mud of dust and sweat, their eyes bloodshot with the heat and the exposure, their khaki coats stained with the salt of their dried perspiration that has sweated under their accoutrements, I call out in a loud

voice: "Good news from England, men; a message from the Queen," and I read out the words:

"The Queen desires that her deepest sympathy be given to her wounded soldiers and she hopes for their speedy recovery."

On the worn and haggard faces of those pain-stricken men, weary to death with the sufferings and fatigues of the day and the night comes the sunshine of Hope, and the joy that men feel to think that, in their loneliness and their wretchedness, there is one who, embodying as she does, the hopes, the wishes, and the thoughts of her people, bears them in mind in their great tribulation.

From blanched lips and pallid cheeks and throats, weak with the weariness of thirst and pain, comes the cry: "God bless the Queen, and thank her, Sir, for us."

If I could best carry out their wishes, if I could break through the chain of official delays and send to their Queen direct a message, how much good might be done and how much bitter suffering saved to me and my wounded in all our future wars.

Had I power I would thus address her:—

"Madam,—

"I present my humble duty to your Majesty and beg to tell you that your loving message of sympathy and hope for your wounded soldiers has given them the deepest comfort in their troubles, and will support them in the long days of suffering still before them until they reach England again.

"As a faithful servant of Your Majesty I would fail entirely in my duty to you as my Queen, and the head of this great Empire, if I did not tell you with what overwhelming difficulties I am striving to do my duty to you and your Majesty's wounded soldiers.

"I am here to-night on this distant battle-field and am responsible for the working of a Field Hospital for 50 beds.

All day long the wounded have been pouring in, and I have to-night, in and round the tents, 53 wounded English soldiers in every stage of human suffering.

"To care for them and to help me to tend them I have not one single European soldier orderly, nor a single nurse.

"The whole aid given me for this overwhelming task is ten native ward servants, which is the number laid down by Field Regulations to care for 53 wounded Englishmen.

"These native attendants are ignorant, feeble, underfed followers of the army without a vestige of discipline, and hopeless in their stupidity. These native ward servants have to-day marched 15 miles; they have had no food since late last night; I must in a short time let them have some rest, and let them cook their food, and how am I with only ten natives, as a whole, to care for and attend to 53 wounded English soldiers.

"There is not one Officer or man in all my establishment who has even seen a Field Hospital in peace, they are entirely at sea as to the routine of work, my two young Surgeons have come from far away stations, and my Apothecaries I never saw before.

"I will toil to the death for you as my Queen, and for the land you govern, but I humbly pray you will consider my hopeless weakness in *personnel* and the defective Corps given me to carry out this care of the wounded with whom, as their Sovereign, you so deeply sympathize.

"Owing to defective arrangements and caste prejudices not one of the sick bearers (*doolie* bearers), nor one of the Store-keeper's men will give one of my wounded soldiers a can of tea, nor a bowl of soup, nor apply a bandage, nor place a dressing, and I am trusting entirely to the ten native ward servants, and I cannot do the work well, toil, strive and labour how I may.

"Your Majesty will remember the Egyptian Campaign of

1882, when Sir James Hanbury was Chief of the ~~Indian~~ Medical Service in the field there.

"A pang of sorrow went through England at the thought that Ismailia Hospital failed to work, and many bitter words were said against my brother Officers of the Medical Service.

"But what were the facts? It was proved before Lord Morley's Committee that the English Orderlies allowed to nurse the sick, *viz.*, 37 for 200 wounded were hopelessly insufficient, and that Committee recommended, and it has since been made the Army Regulation, that the number in future will be 64 Orderlies for 200 sick, and not 37, as previously, *in* all our English Field Hospitals.

"No human energy, even of the most superlative type, can do our war work without help,—and that help we urgently need—and I pray that Your Majesty will be pleased to cause inquiry to be made and to raise our establishments to 20 native orderlies, instead of 10 for every 50 sick—and that a detachment of European Orderly nurses shall always form part of an Indian Hospital.

"I also very humbly pray Your Majesty to order that an inquiry be instituted to see if it be not possible to so consolidate the medical establishments that they will be made a Corps under medical command, and that men with caste prejudices be excluded from such a Corps. It is only Hindus who have such prejudices; Mussulmans will do all the work we need.

"If Your Majesty will be graciously pleased to consider this very humble prayer, untold advantages in war and peace will result to your soldier-sons who, scattered over an enormous Empire, are daily fighting not only with human enemies, but also with climate and disease."

If I could so telegraph, or that some good fairy would carry to the Queen such a message, how pleasant then it

would be to go to war as a Medical Officer, where now we go in fear and trembling of break-down during the whole course of the operations.

When the wounded are gathered in, they need, above all things, refreshment—soup would be splendid, but it takes time, to make, but tea would be always useful; and it is so easily made, so portable, and so stimulating that its need in the dressing-station is essential.

If men's wounds are dressed, and they get a cup of soup and some brandy, they will do very well for some hours.

There should be a bugler with every Company, and he should sound the "Ambulance" call all over the field, so as to draw attention to the aid party; and to give every wounded man the chance of attracting attention to himself if possible.

When ambulance men are sent back with wounded to the Field Hospital, they rarely return to the Company; it is better to allow no wounded to pass back beyond the dressing-station—but keep all the wounded there until the fight is over, and the Field Hospital marches, or may march, right on to the field. This would be a very happy solution, but it is difficult to achieve; although always to be borne in mind as a possible solution of many difficulties.

The Bearer Company may also be ordered to organize itself into a convoy to convoy wounded men towards the base. It then becomes practically a marching hospital, and should be worked on the plan and routine laid down for such organizations.

CHAPTER IX.

Field Service Model Orders, Letters and Telegrams, sent and received during the Campaign.

I propose to give a few model orders, telegrams and letters, &c., which may help to explain the probable course of events in war time.

1.—*Telegram from P. M. O., Simla, to A. M. O., Meerut, August* 1, 189 .

Confidential.—A mobilization of 3 Meerut Field Hospitals may take place in September. Warn Army Reserve men. Enlist 100 men into the A. H. N. C.

2.—*Telegram, August 28th, P. M. O., Simla, to A. M. O., Meerut.*

Mobilization begins September 1st. No. 1 Field Hospital to be ready by the 10th, No. 2 by 20th, and No. 3 by 30th September. No. 1 to proceed to Jellalabad, No. 2 to Barakab, and No. 3 to Bhosawal.

3.—*Telegram, September 10th,* 189 , *A. M. O., Meerut, to P. M. O., Simla.*

Cannot obtain any recruits at existing pay-rates. Transport mules only sufficient to equip Nos. 1—2 Hospitals.

4.—*Telegram, 12th September* 189 .

Government of India sanction pay-rates as for sepoys, as a temporary measure, and free kit. Transport in readiness and will join No. 3 Hospital at Peshawar. Entrain without transport.

5.—*Orders by Divisional A. M. O., Meerut.*

No. 1 Field Hospital, Surgeon-Major Smith, M.S., will be mobilized from to-morrow, 1st September. The lists of

personnel as in the Station Hospital Office will be adhered to.

6.—*No.* 1 *Field Hospital, Meerut Division, by Surgeon-Major Smith, Commanding, September* 10*th.*

No. 1 Field Hospital, M.D., will entrain at the troop siding at 4-30 P.M. to-day *en route* for Peshawar.

7.—*Field Hospital Orders. Peshawar, September* 12*th.*

The Field Hospital will proceed to-morrow by route march, *viâ* Khyber Pass, towards Dakka.—"Rouse," at 5 A.M.—March, 6-30 A.M.

8.—*Division Orders by Major-Genl. Tomkins, Comdg.* 1*st Division, Afghanistan Field Force. Jellalabad,* 20*th September* 189 .

No. 1 Field Hospital, Meerut Division, is posted to the 3rd Infantry Brigade, which Brigade will furnish a guard, escort and fatigue parties, as will be arranged by the Medical and Brigade authorities.

9.—*Telegram from P. M. O.,* 1*st Division, Afghanistan Field Force, to A. M. O., Meerut Division. Bamian, November* 10*th,* 189 .

A draft of 1 Warrant Officer and 10 men needed to complete establishment of No. 1 Field Hospital, Meerut Division. Surgn.-Captain Robinson, M.S., is returning invalided as unfit for field service, but fit for garrison duty. Please detail an Officer of the same rank to start in relief forthwith.

10.—*Field Hospital Orders, October* 20*th,* 189 . *Camp, Oxus Valley.*

In accordance with Brigade Order of to-day's date, the Field Hospital will hand over all its sick and wounded to

No. 3 Field Hospital at Mahomed Kela Khan, and will act as a Bearer Company to the Brigade in to-morrow's advance on Rustumabad.

The sick will be transfered at 4 P.M. this afternoon. Captain Taylor, M.S., will take over their documents and personally hand the men over to No. 3 Field Hospital. The Transport Sergeant will provide transport for 40 men with kits to be paraded in front of the Field Hospital at 3-45 P.M. this day.

11.—*Letter to D. A. A. G.,* 3*rd Brigade, from Medical Officer,* 1*st Field Hospital.*

Please detail escort of 25 men to accompany sick transferred to No. 3 Field Hospital at Mahomed Kela Khan, to be at Field Hospital at 3-45 P.M. to-day. The escort will return by 7 P.M. this evening.

12.—*Medical Corps Orders,* 1*st Division.*

It is notified to all Medical Officers of Corps and Batteries that No. 1 Field Hospital, Meerut Division, will, on to-morrow, act as Divisional Bearer Company. All wounded after being dressed by Regimental Medical Officers will be handed over to No. 1 Field Hospital—on the Field.

13.—*Heliographic Message—on the Field. From P. M. O.* 1*st Division, to Officer Commanding* 1*st Field Hospital.*

The Division will probably come into action at Kila Pezwan near the mounds on the extreme right. If possible open the dressing-station there. Have warned regimental Medical Officers of whereabouts of dressing-station.

14.—*Message by Mounted Orderly—on the Field.*

Surgeon-Lieutenant Jones, with No. 7 Mountain Battery, severely wounded; replace him by an Officer of the Hospital *pro tem.* He is being sent to you for care.

15.—*Message P. M. O., 1st Division, to P. M. O., Army Corps.*

Please detail Officer to replace Surgeon-Lieutenant Jones, No. 7 Mountain Battery, wounded. Have replaced him temporarily from No. 1 Field Hospital, Meerut Division.

17.—*Heliograph Message—on the Field. From Officer Commanding Bearer Company, 1st Division, to No. 3 Field Hospital, Rawal Pindi Division.*

Have 150 wounded collected here—will send them back the moment firing ceases. Please send forward all available carriage with this Orderly who knows the road. Great care needed in fording the Sujah-Rud. Am running short of brandy—need 2 dozen bottles—or equivalent in rum.

18.—*Message by mouth by A. D. C. to General Commanding 1st Division, to Officer Commanding 1st Field Hospital.*

"The General says there are at least 300 wounded of the enemy along the river bank and in front of the redoubt by the swamp. He wants you to help them if you can."

19.—*Verbal reply to A. D. C.*

"Tell the General I am sending back all the British wounded to No. 3 Field Hospital. They should be cleared off by sunset, and I will march my Hospital to the river bank you speak of, and work there during the night. I hope he will send us a strong guard, as this place is very exposed."

20.—*Officer Commanding 1st Field Hospital, M.D., to P. M. O. Division. 4 A.M.*

Sir,—I have 330 wounded of the enemy collected here by the river near the redoubt. I am quite unable to send them back as my transport is dead beat.

Will you order up a Reserve Hospital of the Division to come to this place, and pitch their hospital here. This will save much trouble.

21.—*Reply of P. M. O.*

All right—will send Reserve Hospital. Be ready to move forward with the passing force at 8 A.M. It assembles across the river by the ruins near the burning village.

If there is any delay in the Reserve Hospital coming, leave a detachment of your Hospital and push on. I will send them after you by noon. Hasten up your list of wounded. General called for it every quarter of an hour. Glorious day yesterday:—takens, no end of guns, and the enemy in full retreat.

22.—*Verbal Message sent by Officer Commanding Field Hospital to A. A. G., 1st Division.*

Go and tell the A. A. G. that we have rejoined his column with all available transport.

23.—*Message brought back by Officer sent with Message to A. A. G.*

Tell Major Smith we will come into action almost certainly this evening or early in the morning. The Cavalry scouts report that the enemy's retreat is stopped, and they are taking up a position.

24.—*Senior Apothecary, Field Hospital. Verbal report to Officer Commanding Field Hospital.*

The brandy is not sufficient to stand the strain of another big fight. Reply of O. C. Take this note to the Brigade Commissariat Officer and ask for ten gallons of rum, and bring it to the Hospital.

25.—*Officer riding into Hospital.*

The enemy have opened fire. Please open dressing-station. The wounded are already falling back on you.

26.—*Wounded arriving.—Officer Commanding Hospital gives verbal orders.*

Seperate the severe cases to the left of the dressing-station and the trivial to the right—keep the wounded Officers well apart. How they do stream in!

27.—*Medical Officer reporting to Senior Medical Officer of Hospital.*

We have 350 wounded round the station now, and the transport men say they can't pass to the rear, as the enemy's Cavalry are threatening the line of retreat.

Reply. Very well. Keep all the wounded in the dressing-station—night will be on us directly—make the transport men bring in plenty of dry wood; light good fires, make plenty of tea, and cover the men with blankets.

They will do capitally. I am applying for a stronger guard.

28.—*Message from Medical Officer to nearest Brigade Commander.*

Go and tell the General of that Brigade *bivouacing* to our right front that I have more than 300 wounded here, and that I would like to have a Company to cover our exposed flank during the night. The escort we have with us is quite insufficient.

29.—*Captain of Infantry marching up his Company.*

General Ross has sent a Company to cover your flank. It is so dark I can't see how your position extends. Will you please say where you wish the men to be extended.

30.—*P. M. O. of Division speaking next morning.*

Well, Smith, you have had a trying night. I fear however, all fighting is over. I saw the flag of truce from the enemy coming towards the *bivouac* as I left it. The Field Hospital can't be here before sunset. You must do the best you can, and draw rations for the wounded and cook them here.

How did you get through the night? Reply. Thirty men died in the night. I have 321 in the dressing-station. I buried all the 30 before sunrise this morning, so as to avoid any display.

31.—*Message to Reserve Field Hospitals.*

Push on Hospitals to the number of 350 beds to scene of action, and take over wounded in the dressing-station of No. 1 Field Hospital.

32.—*P. M. O. to Officer Commanding No. 1 Field Hospital.*

The Hospitals are hurrying up—you stay where you are and they will join you. Combine your staff with theirs and halt where you are—we won't go any further for sometime, if at all. Everything points to an armstice, and possibly peace.

33.—*Medical Corps Order.*

No. 1 Field Hospital will act as a sick convoy on the return march to Cabul, and will take over 50 wounded from the Consolidated Hospital at Ali Kheyl, and convey them to the Base Hospital at Kabul.

34.—*Field Hospital Orders, Camp Cabul.*

The Field Hospital will continue its march, *vid* Badhbak, towards India to-morrow. Under orders from the P. M. O. H. M. F. in I. Surgeon-Captain James, Apothecaries DeCruz and DeSilva and 20 men A. H. N. C. will be permanently transferred from this Hospital to the Station Hospital, Kabul, now being formed, and they will be struck off the strength from this date.

All documents to be handed over with the men to the Officer in charge Station Hospital, Kabul, at 5 P.M., to-day. The Hospital is in the western angle, Sherpur Cantonment.

35.—*Field Hospital Orders, Camp Jellalabad.*

The Field Hospital will entrain at 6 A.M. to-morrow morning and proceed by train towards Meerut, halting as follows:—

Peshawar	...	... 10th April
Rawal Pindi	...	... 11th „
Mian Mir	...	... 12th „
Arrive Meerut	...	... 13th „

36.—*Field Hospital Orders, Camp Meerut, April* 14.

The Field Hospital will commence demobilization on to-morrow:

(*a*) The spare transport to be returned to the Commissariat at 2 P.M.

(*b*) All stores to be checked by those holding them, and list of deficiencies to be sent into S. M. O.'s office by 10 A.M. to-morrow, &c., &c.

37.—*Div. Orders, Meerut, by G. O. C., at Meerut.*

A Board will assemble at the Station Hospital to report on deficiencies and losses in the equipment of No. 1 Field Hospital, during the recent Turkestan Campaign. Proceedings in duplicate to be submitted to the G. O. C. for approval.

38.—*Medical Officer, Station Hospital, to P. M. O., Meerut Division.*

SIR,—I have the honor to report that the demobilization of No. 1 Field Hospital, Meerut Division, is now complete, and that I have no further need of the *personnel*.

I accordingly replace the following staff at your disposal:—

Medical Officers	3
Warrant Officers	5
A. H. N. C.	36
A. N. H. C. Bearers	58

39.—*P. M. O.'s reply.*

Hand over all the staff you refer to to the Officer in charge, Station Hospital, Meerut.

40.—*Farewell Order of Surgeon-Major Smith on final dispersion of Field Hospital.*

No. 1 Field Hospital, Meerut Division, will cease to exist as an independent unit from to-morrow the 25th April 189 .

The Officer Commanding desires to place on record his appreciation of the good work done by the Hospital Staff during the recent campaign in the Oxus Valley.

Mobilized at Meerut from the Officers, Warrant Officers, and men of the Meerut Division of the Indian Medical Corps, cohesion and unity has from the beginning marked the work of the unit.

In the march through the Khyber, and the advance on Cabul through the Jugdulak Pass, discipline and order characterised the march of the Hospital.

The very trying advance over the Hindu Kush, and the Bamian Pass in the depths of winter, threw on all ranks a very great and heavy strain, and the devotion to the sick and the strict attention to discipline won from the Divisional General the highest commendation.

The pressure of work from the heavy lists of wounded, caused by the enemy's breech-loading fire, strained the Hospital routine to the utmost tensions; but, so far from failing, it worked with redoubled energy and success.

In the general action at Mahomed Kila on the Oxus Banks—where the Hospital acted as a Divisional Bearer Company—it is sufficient to say that every word of the praise given in General Tomkins' despatch was fully deserved.

The Officer Commanding the Hospital feels sure that all will agree with him that strict discipline—drill—military routine—and thorough devotion to duty, will always ensure success, even in so uncertain and trying a work as that which a Field Hospital will be always be, and he need not recall the words of General Ross who, on seeing the Hospital move off, cried out: "Well done, Field Hospital! You limber up like a Mountain Battery."

It is sad to have to refer to the losses the Hospital has sustained, and a list of 1 Officer, 2 Warrant Officers and 15

men killed shows that the success obtained in the campaign has not been cheaply purchased.

The Officer Commanding wishes all ranks a hearty farewell, and happy days, after the fatigues of war.

CHAPTER X.

Demobilization.

This is about as difficult a matter as mobilization. It takes at least ten days at the station where the various head-quarters of the receiving departments are located.

The principle never to be lost sight of is this: In mobilization the first needful thing is the *personnel*; therefore get it first of all. In demobilization the thing needful to the last is *personnel*; therefore keep it to the very last.

The moment war is over everybody wants to cut away, Officers, Warrant Officers and men, native and European, and urgent orders will come to send the establishment broadcast over India. All this is wrong. It takes ten days at least to demobilize and to return stores and have Boards on losses, &c.

The first thing to do is to get rid of the large portion of the animal transport, except that needed for carrying stores to the railway or to store depôts. This done, every head of a sub. department should check his stores and equipment, *viz.*, the Apothecary and Pack-Store Sergeant all tents, furniture and ordnance stores. An Apothecary, all medical and surgical equipment. The Storekeeper all commissariat equipment. The Writer all statistical documents. A Warrant Officer all kits issued for the campaign, to Warrant Officers, N.-C. O. and men.

A list of all deficiencies should then be made out by departmental groups, and an application for a Station Board sent in. This Board should report on the losses or

injuries to various articles by groups, such as Commissariat or Ordnance, Military Works or Medical Store Department. The proceedings are then sent to the convening Officer for approval, and finally returned by him to the Officer in charge of the Hospital to be used as voucher to cover the deficiencies in his equipment when returning that equipment to store.

There will always be great wear and tear during any field service, and a very large margin is allowed to cover such loss to the State.

The great thing is to have at first a thorough counting of everything. All articles to be laid out clearly for inspection and then to carefully tabulate all losses. It may be useful to set apart a page in the diary or other book, and enter, day by day, the losses reported during the campaign as they occur.

Such losses may vary from a tent-peg to an entire Field Hospital, but all that is needed, besides constant care in the field, is the careful tabulation of all losses. Ordnance tents go to dreadful grief. Tent-pegs vanish like magic; and if the ground is stony, their destruction is considerable. Lanterns easily smash and buckets disappear. Keep a clear record of all, and, in the end, all will be well. The Commissariat equipment is also liable to great wear and tear, but here again careful recording is needed as to how losses occur.

Instruments need careful counting, and the pocket-cases of the Apothecaries often come to grief. Every loss should be put before the Board, including instruments and surgical equipment.

The various articles that remain are then, day by day, handed over to the departments who issued them and receipts carefully taken and placed in the receipt book or guard book. These guard books, diary, order book, all pay

documents, &c., should not be given into store with the Field Hospital equipment, but should be kept by the S. M. O. personally to enable him to answer the various references that will be made to him for months after, on every possible matter.

I will guarantee that the greatest trouble remains to the end. That is the paying up the establishment of all ranks. If it is done in a hurry and without due time and care, constant references will keep coming in for months. Officers receive no charge pay for individual sections, nor for any number of combined sections under three in number.

A final acquittance paper should be taken from every individual belonging to the hospital, that he has received his pay, allowances, &c, and has no claim against the Officer in charge. A certificate is needed from the Senior Apothecary that he has carefully packed up the instruments and stores, and that he is personally responsible for their correctness according to the list, except articles reported lost, before the Board was held. Day by day the various equipments and *matériel* will diminish, but ten days is the least amount of time needed for demobilization, to secure good work.

Officers Commanding should be well on their guard against Officers and Warrant Officers trying to get away by privately seeing the P. M. O. of the district. But no P. M. O. should allow himself to be approached in this way, but should wait until the Officer in charge sends in his final report that the Officer or Warrant Officer has finally handed over his charge and is no longer needed. If this is not done, it is quite certain that when Officers or Warrant Officers get away before the demobilization is complete, they will become involved in some supposed losses or misplacements, and the blame will be shunted on

to them. If they are absent, they will be unable to be heard in self-defence, and, furthermore, they throw all the weary demobilization work on their comrades. It is quite wrong.

Closing Statistical Records.—In a campaign with numbers of hospitals the statistical returns cause great trouble. A special Officer at the Base should act as Statistical Officer, and to him *nominal rolls* of the sick in every hospital, every Friday at noon, should be sent. He should keep one great Admission and Discharge Book, and so compile the returns of the campaign. This system, which seems tedious, will be found the only really true method. In small campaigns the P. M. O. should have a Secretary or Staff Captain who would receive nominal rolls of all sick present in all hospitals during the week, and he keeps one big Admission Book during the campaign.

I think, therefore, that at least ten days are needed before any one gets away, and it is good to abide by this rule. The S. M. O. should always make out for his own information a medal roll or list of all persons serving under his orders, so that later on, when called on to furnish medal rolls, he will know how he stands, and have no difficulty in forwarding the rolls.

CHAPTER XI.

Field Hospital Loading, Unloading and General Drill.

The need of a drill and a defined routine in the loading, unloading and marching of a Field Hospital is most essential. The Medical Service constantly neglects this duty, and, as a result, there are frequent break-downs and great wear and tear of individuals in trying to make unorganized units work efficiently with an organized army.

Until Field Hospitals parade at every Brigade parade and take their share in the drill exercises of the army, this liability to break-down will always exist.

Until opportunities are given for this drill, it is impossible to write a Field Hospital Drill Book, but such a book must one day be written. We may, however, glance at some matters where the elements of routine are visible. Infantry drill must form the basis of the routine, with certain movements for mules copied from Mountain Artillery drill.

Falling-in.—If space admits, men may fall-in in a line Two Deep, each section forming up in this manner under its Officer and Warrant Officer, like companies in a battalion, at wheeling distance. After being inspected as sections they may combine into divisions of a Field Hospital, that is to say, 50 beds of the present 100-bed hospital; these divisions may again combine until the men stand on parade as a full Field Hospital, mules, &c., being absent. The hospital Store-keeper's men allotted to sections should fall in with their sections and remain by them through the drill. A Field Hospital, so formed up, is like an Infantry company; the Officers would be so posted, and the Warrant Officers be in the supernumerary rank in the rear. If more than one or two Field Hospitals is on parade, the elements of a battalion exist, and for parades of the men only without mules, the battalion routine is the rule. After the men have been inspected the most usual duty needed is the loading of mules and camels. To do this the men should be formed into Fours-Deep and each section of Fours will make a "Loading Detachment."

Each detachment of Fours may be numbered from right to left, and any number of detachments may be set to work by the order—

"*No.* 1 *Detachment, take post for loading, Quick March.*"

Nos. 1 and 2 of the Four men move to the right and Nos. 3 and 4 to the left of the loads placed ready for the mules, and come to their front, facing as the mules face. The Four men then stand at "Attention" or stand at "Ease" until the loading drill begins.

For loading it is needful to place all the loads of a section in regular order and in line, generally down the centre road of the *section* if there be 100 beds in the hospital—or on either side of the main road of the hospital, if there be only two sections, 50 beds or so.

The mule loads to be laid out from No. 1 to Nos. 33 and 34 in regular sequence on the ground, and the muleteers ought to know the numbers of their loads, so that they can at once file on their loads when ordered.

Loads to be one pace apart if for the same mule, and two paces interval to be between each mule load, so as to allow the loading party room to work.

On the order "*Lash up the loads,*" one man goes to the mule intended for the pair of loads and takes the two pairs of loading ropes and issues them one to each of the Four men of the loading party. These men securely lash the load with the regulation knot. When this is done the men place the rings of the loading rope facing inwards towards the mule, and then front and stand to "Attention," waiting further orders.

On the order "*Prepare to load*" the Four men turn towards the load and seize the load, and on the order "*Load*" lift it and place the rings on the iron hooks on the saddle, and then on the word "*Front*" again resume their original position.

It is presumed that the muleteer is standing in front of the mule's head to prevent the animal bolting during the loading. The mules should file out of the transport lines in regular order at all times, numbers following each other

and should draw up, if possible, a mule length in the rear of the load, so that the loading ropes may be taken easily off the mule. The order "*Muleteers file on your loads*" will bring the mules between the boxes as already described, and the loading goes on as laid down above. The order "*Loading Detachments reform sections, Quick March,*" will bring the loading parties once more into their position on the parade, and they may form up in Two-Deep.

When the muleteer leads his mule between the loads, he stands looking to the front and holding the mule's bridle with his right hand close up to the mule's muzzle. On the order "*Prepare to load*" the muleteer places himself in front of the mule's head to prevent him moving during the loading. When the mules are loaded, they should move outside the Field Hospital camp and form up on the parade in front of it on a marker.

The principal way of forming up is in "Column of Sections." That is by bringing the loaded mules up two abreast in a long column of two mules carrying each two loads abreast of one another. The riding mules would also be two abreast, and the *dandies* in the same formation. If in this formation the A. H. N. C. and European Orderlies are at "Detachments Front" that is, they are formed up in Fours in front of the section and lead it on the march. If, however, any special reason exists, they may be at "Detachments Rear," and be massed in the rear of the section. But if any special reason exist, they may also be scattered along the column, one man with each mule, this, called "*Forming the Order of March.*" On the command "*Form the Order of March,*" the front rank moves along the off-side of the mule column, and the next rank along the near-side, and so on in succession until the detachments are extended along the column.

If marching in "Column of Sections," that is, two abreast, then the order "*Form Column of Route*" will bring the

double into a single column of one loaded mule or one *dandie* only. This is needed in many bad mountain roads. The word "*Take ground*" is used for all turns. Thus "*Right take ground*" is equivalent to right turn, and "*Left take ground*" to left turn, the muleteer moving his mule round with the command. The word "*Reverse*" will cause a right-about turn and the word "*Left Reverse*" will cause all the muleteers to turn to the rear at once; turning the mules round by the left. "*Right Incline*" will move the column towards the right, and "*Left Incline*" towards the left.

The words "*Field Hospital*" should preface all commands as a preliminary warning.

Space between Mules.—On the line of march one yard.

Need of a Bugler.—For all drills and movements as in the daily working of the hospital, the need of a bugler is essential; any one who tries to do without this help will regret it exceedingly. It is advisable to send markers out on to the parade ground left spare in front of the hospital, which is generally 30 yards deep by 50 or 60 yards long. On this space the Field Hospital forms up before marching off.

If in column, a marker for the head of the column is needed, and for each sub-division a marker may also be posted, marking the head of the column of *dandies*, head of the riding mules, head of the equipment mules, head of the camels and head of the baggage.

If, however, this long column cannot form up owing to shortness of space, the hospital may form up in lines at close or open intervals, each group being formed in line at a distance of eight paces from each other.

The succession of lines will need a marker at the right of each thus, one for the line of *doolies*, one for the riding mules, one for the equipment mules, and so on—the succes-

sion of lines filling in more easily into a compressed space. These lines are turned to the right or left and marched off in succession to form column for the march.

POSITIONS OF OFFICERS, SUBORDINATES AND MEN.

Guard.—Ten paces in front of the hospital column. Half the Guard at the rear of the hospital column.

Escort.—Scattered along the hospital column in part, and half with the camel and baggage column of the hospital.

European N.-C. O. Writer and Orderlies not on duty.—At the head of the hospital column, ten paces behind the Guard. The bugler marches with these men.

If the order "*Detachments Rear*" is given, these men march in the rear of the section. At the order "*Form the Order of March*" they place themselves alongside every second equipment mule of the section and aid in getting it along if needed.

A. H. N. C.—In immediate rear of the European detachment in column of route.

Detachments Rear.—In rear of the section.

The Order of March.—With every alternate mule of the equipment mules.

S. M. O.—Leading the hospital column behind the Guard, but in front of the European detachment.

Other Officers.—Leading their sections.

Warrant Officers.—At the rear of their sections.

Senior Apothecary.—Rear of the hospital column.

Officers' and W. Os' Syces—At the head of their Officers' sections in rear of the A. H. N. C. detachments.

Other Servants.—With the baggage column.

Store-keeper.—With the equipment camels.

Transport Sergeant.—In rear mule column.

QUETTA, *November* 1891.

GEORGE J. H. EVATT, M.D.,
Surgn. Lt.-Col., M.S.

APPENDIX A.

FIELD SERVICE EQUIPMENT.

TABLE III.

The following Tables of the Articles to be worn on the person, and carried as kit, by British Officers and men is published as a guide, and may be modified if necessary. Only the uniform that is detailed below is to be taken. All kits of Officers and men, and all other baggage, stores, &c., to be weighed before leaving for service, and care is to be taken that the authorized weights are not exceeded :—

CARRIED ON PERSON.

ARTICLES.	Officers.	Warrant and N.-C. Os. and Men.
Helmet (in khaki cover without ornaments)	1	1
Khaki coats	1	1
Do. trousers (dismounted men)	...	1
Bedford cord pantaloons (Officers)	1	...
Walking boots ... pairs	...	1
High boots, brown leather	1	...
Putties ... pairs	...	1
Spurs (Officers)	1	...
Drawers (ditto) "	1	...
Flannel shirts	1	1
Socks, woollen pairs	1	1
Banian	1	...
Flannel belts	1	1
Braces	1	1
Pocket-handkerchiefs	1	...
Sword, Revolver } with belt and ammunition	1	*1
	1	*1
Watch	1	W. O. 1
Note-book	1	W. & N.-C. O. 1
Water-bottle	1	1
Haversack (with knife, fork and plate)	1	1
Knife, clasp with lanyard	1	...
Map, linen	1	...
Compass	1	...
Pocket, first field dressing	1	1
Emergency ration †	1	1
Pocket dressing case	‡1	‡1
Carried on Saddle by Officers—		
Cloak and cape	1	...
Field glasses	1	...
Mess tin	1	...
Baggage straps	3	...

* N.-C. Officers to carry arms and accoutrements.

† When detached for duty on which there is a possibility that the ordinary ration may not be available, each Officer, N.-C. Officer and man will carry one day's emergency ration. When troops are detached for such duty, the Medical Officer in charge will make immediate requisition on the Commissariat Department for the rations required.

‡ Medical Officer and Medical Warrant Officers only.

CARRIED IN KIT.

Articles.	Weight. lbs.	Weight. oz.	Number per Officer.	Number per Warrant and N. C. O's. and Men.
Khaki helmet cover	..	1½	1	1
Khaki coat	1	...	1	1
Khaki trousers	..	15	1	1
Cloth trousers (dismounted men) ...	2	3	...	1
Bedford cord pantaloons	2	8	1	...
Serge coat	2	..	1	1
Forage cap, service	...	5½	1	1
Great coat (dismounted men) ...	6	...	...	1
Walking boots and spare laces ...	3	8	1	1
Putties ... ... pairs ...	...	12	1	1
Drawers (mounted Officers) ...	...	14	2	...
Flannel shirts	1	2	2	1
Socks, woollen... ... pairs ...	...	4	3	2
Banians	...	6	2	...
Flannel belt	...	6	1	1
Pocket-handkerchiefs	...	1	5	...
Housewife	...	6	1	...
Holdall* { Officers	2	...	1	1
Holdall* { Men	1	2		
Towels	..	8	2	2
Blankets (the 3rd in cold season only)	4	8	3	3
Wolseley valise (or light bedstead) ..	9	...	1	...
Pillow-case	...	4	1	...
Water-proof sheet	2	8	1	1
Basin (canvas or rubber)	1	...	1	...
Tin of grease for boots	...	4	1	1
Small book	...	3	...	1
Field service Deptl. Code, Medl. ...	...	...	...	1
A. Regns. I., Vol. VI	...	...	1	1
Lett's Diary, small	...	4½	1	...
Writing case	1	...	1	...
Filter, pocket	...	7	1	...
Lamp or small lantern, &c. ...	2	...	1	...
Cardigan jacket	1	8	1	1
Mittens, warm, prs. { For cold season	...	3½	1	1
Warm coat { only	4	2	...	1
Balaclava cap	...	4	1	1
Cooking, utensils, sets	...	...	As required.	...
Enamelled tin plates, cup, &c. ...	...	...	Ditto	...
Log line for packing	...	...	Ditto	...
Total weight for Officers ...	70	...	...	...
" " " Warrant Officers ...	40	...	...	...
" " " N.-C. Officers and Men	36	...	...	...

* *To contain.—For Officers*, 1 brush, 1 comb, 1 cloth, 1 tooth-brush, 1 piece of soap, 1 nail scissors, spare buttons, 3 yards tape, 1 looking-glass, 1 razor, 1 strop, 1 shaving brush. *For Men*—As per Regns. (except knife and fork), also a supply of needles, thread, buttons, and a piece of soap.

APPENDIX B.

The Death-rate amongst Followers of the Army in Indian Campaigns.

As the whole of the Hospital Staff in India are "followers," and as such receive less food, less baggage allowance, and less tent accommodation than the sepoy or native soldier, it may be interesting to see the result of such a condition of affairs on the health of the "followers." The whole of the Army Hospital Native Corps, and all the sick carriers (*doolie* bearers) are officially followers, and although their work is exhausting to a degree and requires service day and night, their food allowance is below the sepoy standard. They also receive a bronze war medal instead of the silver one given to the sepoy. The following extract of a paper read at Rangoon by Deputy Surgeon-General Sibthorpe, Indian Medical Service, is so important, and reveals such a state of suffering and misery, that it may be quoted in full :—

Extract from the "Indian Medical Record," Calcutta, April 1st, 1892, page 129, 2nd column.

The Fearful Death-rate among Native Followers of the British Army in Burmah.

"In the Presidential Address of Deputy Surgeon-General C. Sibthorpe, Indian Medical Service, to the Burmah Branch of the British Medical Association, there occurs this significant passage—

"*General Hospital Native Troops and Followers.*

"Dr. Donnelly says—'Close on 6,000 (six thousand) persons passed through its portals only 400 (four hundred) recovered to return to their duties in the field.' This is a most awful indictment against the authorities concerned in the recruitment of this unfortunate, though necessary, section of the army in India.

"The condition of these followers is described as being deplorable. Says Dr. Donnelly, 'they were emaciated sometimes to the last degree, and this was not altogether owing to the malaria or actual disease, but was in a great measure produced by a want of food suitable for persons no longer in robust health.'

"Amongst those whose condition was most pitiable on arrival, few could help noticing the followers, their work had been heavy, many had been badly selected, and were quite unfit to cope with the climate and the privations; they were only fit to be sent to their own homes for discharge when they became fit to travel.

"This terrible mortality in itself—associated as it is with a definite and preventable cause—is a most calamitous indictment against the Indian Government. Of 6,000 native followers who passed through the portals of General Hospital, only 400 recovered to return to their duties in the field. And this from sheer neglect to provide the necessaries of life for the most dependent and helpless section of our army in a hostile climate."

This does not in any way include the followers who died before reaching the Base Hospital, who must have been very numerous.

PAMPHLETS

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