

that it would be preferable to dispose, if possible, of the existing hospital on the best terms which could be procured, and to re-build it on a carefully selected site.

Matters stood thus, until the early part of the year 1871, when our present Lieutenant-Governor again referred the subject to the Government of India. His Honor observed that the abandonment of the hospital, and the construction of another building in its stead on a different site, was likely to raise very wide and difficult questions regarding large hospitals in general, as well as this particular one, and the Lieutenant-Governor was hardly prepared to solve these difficulties at once, or in fact, to go much further into the matter, unless he was quite clear as to the extent of pecuniary aid he was likely to receive from the Government of India towards the undertaking. In reply to this communication, it appears that the Supreme Government were still ready to abide by their former promise of giving three lacs of rupees, if the public would subscribe an equal amount, and they further suggested, if it were determined to abandon the present building, that a site should be chosen for the new hospital near Sealdah. Estimates were therefore called for, and it was discovered a sum of no less than fifteen lacs of rupees would be required to meet the expenses of removing the hospital, a part of this sum being covered by the sale of the existing building. As there would evidently be no small difficulties in raising so large a sum of money for the purpose, the Lieutenant-Governor again called on the Principal of the Medical College to take the whole subject into his grave consideration, and after full consultation "with all officers concerned," to submit his opinion to the Lieutenant-Governor. It appears that the Principal and one of the five officers in charge of the in-door patients of the College Hospital, who was consulted on the subject, informed Mr. Campbell that nothing short of a new hospital and college from the foundation, would meet with the objects they had in view, "that although the hospital has become (September 1871) better than it was, since more land was taken up, since the drainage has been improved, and the number of beds in each ward has been decreased, nevertheless, the constant recurrence of pyæmia, osteo-myelitis, hospital gangrene, and other mortal septic diseases distinctly proves that the building is still altogether unfit for the reception of any class of patients, whether medical, surgical or obstetric." The Lieutenant-Governor "received this intimation with much regret, but the report wholly discouraging any scheme which it might be possible to effect with the sum of six lacs which His Honor had hoped to make available for the purpose, there is nothing for it but to drop the subject for the present."

It was probably wise policy on the part of those consulted in this matter to set their faces against attempting to patch up a faulty building, nevertheless we should have been glad to have seen the opinions of "all the officers concerned" in the treatment of the in-door patients of the Medical College Hospital on the subject, for we cannot forget that hospitals like men seem to have their ups and downs in life. Mr. Lister informs us that the Glasgow and Edinburgh Infirmaries, from being the most unhealthy in the kingdom, have lately become model hospitals.

We are convinced of one thing however, and that is, if it be true that a number of our own poor countrymen together with natives of India, are year after year allowed to die in this hospital, consequent on diseases contracted within the very

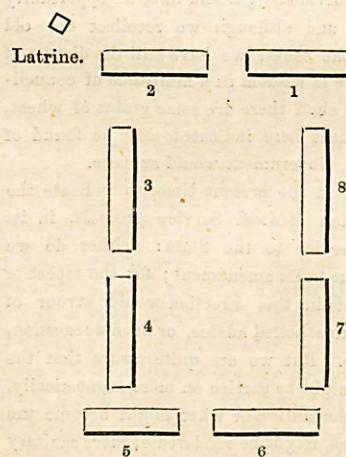
premises provided for their treatment when prostrated by sickness, it is time for some one to bestir themselves: nor can it be said that the college authorities have not done their best to urge the matter on the attention of Government, and the correspondence above referred to has already extended over a series of three years, terminating by Mr. Campbell declaring he must "now drop the subject for the present." But it cannot be possible that the curtain should be permitted to fall at this stage of the proceeding. The Government do not seem to question the accuracy of the statements made by their own officers, that the vast building called the Medical College Hospital, mainly erected with public money, and entirely supported from the funds of the State, is receiving year after year people into its wards who die in consequence of the faulty circumstances of the place. But how quick are those in authority to evince their just indignation, if a planter, who, unforewarned, locates his coolies on an unhealthy spot of land, neglects to look after their lines; here, however, in the centre of the metropolis of India, is a Government establishment into which, it is said, are received year after year, not those who are strong and able to fight their own battles, but the weak, the wounded, and in fact the homeless, friendless, maimed and diseased poor, and yet the Government three years ago allowed that the "mortality among the patients treated at the hospital had year after year been justly attributed to the faulty construction of the building, and insalubrity of its situation," and now assert that they are unable to do more for these poor patients than express their regret that the correspondence regarding them "must drop for the present." It seems to us, to say the least of it, somewhat inconsistent to compel tea-planters to look after their coolies both in health and sickness, and at the same time retain the patients in the Medical College Hospital, if their circumstances are in truth such as above described.

Official Paper.

AN INQUIRY INTO THE CIRCUMSTANCES ATTENDING AN OUTBREAK OF CHOLERA IN H. M.'S 15TH HUSSARS AT SECUNDERABAD IN THE MONTH OF MAY 1871.

By Surgeon W. R. CORNISH, Sanitary Comrs. for Madras.
(Concluded from page 266, Vol. VI.)

Position of barrack blocks in reference to cholera.



Outbreak almost simultaneous in all the blocks but one.

54. The barrack blocks, eight in number, are arranged somewhat in the form of a square (as per the diagram in the margin). The several blocks were not all equally visited by cholera. The blocks marked 2, 3, 7, and 8 gave a larger proportion of cases than the others, and the blocks 2 and 3, in particular, were remarkable for the large number of cases they furnished. In only one block (No. 5) which was occupied by a small number of details, was there an absence of cholera on the first day of the outbreak, and the men of this barrack began to suffer on the day of removal to camp.

55. The following table shows the stress of the disease on each barrack :—

BARRACK.	How occupied.	No. of men present on 24th May.	Attacked in barracks	After removal to camp.	Total.	Percentage of attacks to strength.
No. 1	C. Troop	35	3	3	6	17.1
" 2	E. "	40	6	9	17	42.5
" 3	A. "	37	5	7	12	32.4
" 4	B. "	36	4	2	6	16.6
" 5	Details of B., C., D. and F.	18	...	3	3	16.6
" 6	Band	28	3	...	3	10.7
" 7	F. Troop	39	4	4	8	20.5
" 8	D. "	41	4	5	9	21.9

56. And besides the inhabitants of the barracks, the residents in hospital and family quarters were affected on the first day of outbreak. One patient in hospital was seized, and a man and child in contiguous quarters in the first range of the married quarters. Although, therefore, the inhabitants of certain barrack blocks did, undoubtedly, suffer more than others, it cannot be said that any particular section of the regiment escaped the visitation.

57. With regard to No. 2 Barrack, occupied by the E. Troop, which suffered most severely of all, there was an old latrine and urinal to the windward about twenty yards distant. These buildings had been demolished before my visit, but subsequent to the outbreak. The latrine is said to have been offensive at times. It was probably much resorted to during the night of the 24th May, being more conveniently within reach, than the latrines to the south of the barrack square. It is possible, therefore, that the inhabitants of the Nos. 2, 3 and 8 blocks may have been more exposed to emanations from a latrine containing choleraic stools, than the other troops of the regiment.

58. Dr. Anderson, Assistant Surgeon of the regiment, has advanced a theory to account for the virulence of the cholera in particular barracks. In the bazaar to the west of the barracks and hospital, and only a few yards distant from the hospital, the Cantonment Committee had been widening a road; and to effect this, several old huts were pulled down, and the debris deposited to raise the level of a waste piece of ground just outside, and to the west of, the hospital wall. Dr. Anderson has suggested that the disturbance of this old soil might have extricated cholera virus contained in it, which would be blown by the north-west wind then prevailing over the hospital and barracks, particularly those blocks which were the most affected. * * * * *

59. I need only remark here, in regard to this theory, that it is not consistent with the actual facts of the introduction of cholera into Secunderabad. Dr. Anderson was not in possession of those facts at the time when his report was drawn up. Against the view of the disturbance of the soil being accountable for the local outbreak, it may be noted that neither the people engaged in the work, nor the bazaar people living in the immediate neighbourhood suffered, nor did the hospital apothecary and his family, whose quarters abut closely upon the locality where the hutting debris was deposited, nor did one of the detachment of Native Infantry that guarded the barracks after their vacation by the Hussars, get an attack of cholera, and out of thirty-two persons in hospital, the building nearest to the debris, only one was attacked. Moreover, there had been no rain previous to the outbreak to moisten and restore to vitality any hidden cholera contagium in the disturbed soil. On examining this debris, some three weeks after the outbreak, it appeared to consist of inoffensive material, mostly red, sun-dried clay, with admixture of ashes, broken pottery, bricks, &c.

60. The ground on which the barrack blocks 1 and 2 stand is at an elevation of thirty-three to thirty-six feet above the main drainage outlet of the barracks. From these blocks the ground slopes away to the south-east, so that the blocks 5 and 6 are about twelve feet below the level of 1 and 2. The side blocks of the square are at intermediate elevations, blocks 3 and 8 being about six or seven feet below 1 and 2.

As regards cholera, one of the block (2) on the highest elevation gave the most cases, while the blocks 5 and 6 at the lowest level of all, gave the smallest proportion. It must be noted, however, in regard to block 2 that an old latrine was inconveniently close, and to windward, and that there is a strong probability of this latrine having been much resorted to on the night of the 24th May, by those affected with premonitions of cholera.

61. *Water-supply.*—There is a fine old well, sunk to a great depth in solid or decomposing granite, to the east of blocks 7 and 8. This well formerly supplied the drinking water of the regiment, and was used generally for cooking and domestic purposes. The water on 23rd June was more than forty feet from the surface of the ground. The sides of the well are walled in with stone masonry, and a parapet and paved surface around it. Water is drawn in a leathern bag, by bullock power, and run into a cistern, whence it is taken to the cook-rooms, lavatories, &c., for use. As regards the contamination of this well from surface fouling of the barrack soil, it is difficult to see how it can take place. There is only one damp spot in the masonry lining, about twenty-five feet below the level of the ground, but no water was running into the well from the surface soil. The water in fact is a sub-soil water, percolating through deep strata and crevices in the rock.

62. A specimen of the water from this well having some time ago been analyzed by the Chemical Examiner to Government and reported as containing an undue proportion of organic matter, it was disused for drinking purposes. A new wall to the north of the barracks was subsequently sunk, the water of which was favourably reported on, but in walling up the interior, mortar was used, the lime of which dissolving had such an effect on the water as to make it temporarily unfit for use.

63. Pending the arrangements for a supply of good water to the barracks, a system has been in vogue of sending for drinking water to other wells in the cantonment. A pockally maistry and eight barrel carts are employed daily for bringing drinking water for the use of the Hussar barracks, hospital and family quarters. For some time the water was obtained from the large well in the old Horse Artillery lines at B. gumpett, but a native having drowned himself in the well, the people of the neighbourhood ceased to use the water, and at the time of the cholera outbreak, the drinking water of the Hussars was drawn from one of the wells close to the water course which bounds the Secunderabad general parade ground and near the Sapper lines.

64. Along this water course, which forms the south-western boundary of the general parade ground, numerous wells have been sunk. The water here, in the dry season, is not more than ten or twelve feet from the surface, and in the rains it rises very near to the level of the surface soil. The soil along the banks of the nullah is deeper and more alluvial in character than elsewhere. In the eastern or upper part of this natural valley and drainage channel, the well water is reputed to be very good. The cantonment burial ground lies close upon, and to the east of the nullah, and in the rains the newly-made graves are full of water, which water must ultimately drain into the wells lying at a lower level along the banks of the stream.

As a matter of fact, the well from which the drinking water of the Hussars was obtained, lies about 400 yards below the burial ground.

65. In this situation, and within a short distance of each other, are four wells, two on either side of the nullah, and close upon a public road along which much traffic passes between the Secunderabad bazaar and places to the west. These wells are essentially public wells, open to any body who is at the trouble of lowering a chatty to draw water. They are masonry lined, have parapet walls, and platforms, though the latter are insufficient to prevent soakage into the soil around. The bed of the nullah close by, and the ground on the margin, is occasionally defiled by ordure, probably by travellers on the adjacent high road. On the whole, however, the surface of the ground about these wells is kept clean. Whatever defilement occurs, takes place I imagine during the night, when detection of the offenders would be difficult or impossible.

66. When the outbreak of cholera occurred on the night of the 24th May, suspicion immediately fell upon the quality of the water used, but the theory subsequently advanced by Dr. Anderson, as to the possible effects of the disturbance of the soil

of the old buildings, seems to have directed inquiry away from this important subject.

Dr. Cowen, Deputy Inspector-General of Hospitals, Hyderabad Subsidiary Force, in his letter, No. 924, of the 26th May, 1871, to the Inspector-General, British Medical Service, observes:—

“There is a report that the puckallies (water-carriers) have been supplying, at night, water from a well which has been condemned for drinking purposes, but as yet we have not been able to satisfy ourselves that such has really taken place.” Subsequent enquiry failed to elicit any facts on this subject.

67. The well alluded to as “condemned” was the one described in paragraph 59 within the barrack enclosure. On comparing the amount of readily putrifiable organic matter in the “condemned” well with that of the water actually in use, it was plain to me that the regiment had, at great trouble and expense, been procuring a dubious supply from a distance, when a cleaner water, and one less liable to extraneous pollution, existed at the barrack doors. What the relative condition of these waters may have been on the 24th May I do not know, but on the 28th June one litre of the filtered water drank by the Hussars took grms. 0.0004 of oxygen to destroy the putrid organic matter, while the water of the old condemned well took only half the quantity in the same time.

68. There is really no trustworthy evidence as to the exact source from which the drinking water of the corps was obtained on the 23rd and 24th May. The suspicion that the puckallies, to save themselves trouble, had brought water for night use from a nearer source than the parade ground, arose amongst the men of the corps, and was probably well founded, though no evidence could be obtained to show positively the source of the water. The native in charge of the water carts, supposing that water from a nearer source had been taken, would naturally endeavour to conceal the circumstance, his duty being to see that the supply was brought from the parade ground well. There were nearer sources close at hand, *i.e.*, the well in the horse lines, and another near the horse-keepers’ huts, both of which are within an easy distance of the Chilkulgoodum village, where the cholera camp of bandy drivers was detained on the 23rd May. Either of these wells might have been used by people with cholera, and have supplied the water for night use in barracks on the 23rd or 24th May, but the evidence for or against this view of the question is wholly untrustworthy. It is plain that a suspicion existed at the time of outbreak that the water had been taken from an impure source, though no one seems to have suspected that the ordinary source of supply might have been temporarily contaminated by cholera matter.

69. Yet nothing could be more probable or easier of accomplishment. The wells on the parade ground are all open-mouthed, and unprovided with the simplest appliances for raising water. They are crowded all day long by people from the neighbouring bazaar, who bring their own ropes and chatties to draw and carry water. The chatties are constantly washed at the well, and any foul matter adhering to the outside would be pretty certain to find its way into the well waters. It is quite possible that chatties from an infected house, solid with cholera matter, might have been washed at the wells. Cholera had been brought into the bazaar not later than the 20th of May, and had begun to show its powers of extension in various localities almost immediately after this date, and the bazaar people had begun to suffer before the actual outbreak in the Hussars. It has been said that the Sappers and Miners got their water from the identical well which supplied the Hussars, and that they did not suffer from cholera, but the evidence as regards this point is not conclusive. There were some cases of cholera in the Sapper lines and adjoining village.

70. So far as the evidence goes to connect the outbreak of cholera in the Hussars with impure water, we must content ourselves with the following facts:—

1st.—That the ordinary water-supply of the corps was taken from a well or wells on the parade ground, to which the general public had free access, and that the method of drawing water was such as to render the water constantly liable to contamination.

2nd.—That fatal cases of cholera had occurred in the Secunderabad bazaar previous to the outbreak in the Hussars.

3rd.—That the use of the well or wells in question by persons from cholera-tainted localities cannot be directly proved.

4th.—That although water may have been occasionally drawn from another source nearer barracks, there is no evidence to connect the use of such water with the cholera outbreak.

71. The water of the well on the parade ground, at the date of my visit, was not in a satisfactory state. After standing for a short time it deposited a greenish sediment consisting mostly of desmidiaceae. It had an unpleasant odour of vegetation, and was cloudy and opaque. Numerous infusoria were seen under the microscope, and amœba-like forms existed in great number. No doubt all these things may and do exist in water without giving rise to cholera, but it may safely be affirmed that the drinking water of the regiment was by no means free of suspicion at the time of the outbreak, and that there was a very strong probability of the well or wells having been polluted by travellers or others, who had been exposed to choleraic influences.

72. So long as water is taken from public wells, which are hourly resorted to and defiled by any body who wants to draw water, it is quite certain that troops or other communities drinking of such water are liable to cholera poisoning whenever the contagium of the disease may be existing in the locality.

73. As regards the European troops at Trimulgherry, the only difference between them and the Hussars, in regard to water-supply, was that the Trimulgherry wells were kept solely for the use of the troops and followers. The wells are all of great depth, so as to be impracticable to natives, who draw for themselves, by a chatty tied on to a rope.

All the water from these wells is lifted by bullock power in large leathern bags into masonry reservoirs, and thence removed to the various barracks by carts or puckallies’ bags.

74. While the Hussars were suffering from the cholera outbreak, the troops at Trimulgherry escaped absolutely. At a later date cholera extended to the native villages all round Trimulgherry, and, on the 25th of June, or one month after the outbreak in Secunderabad, the Artillery at Trimulgherry became slightly affected. The water in the Trimulgherry wells at this time had sunk very low, and the quality, as regards putrid organic matter, was not satisfactory. The muddy deposits, in fact, at the bottom of the wells were every day shaken up, when water was drawn.

75. I entertain a strong opinion that if the Hussar regiment had received its water-supply solely from the old well within the Secunderabad barracks, this remarkable outbreak would never have occurred. Still, as I have said before, the evidence in regard to the actual pollution of the water-supply is not sufficient to convince those who decline to accept the view that water is the most common medium by which cholera is communicated from man to man. To me it is a very suggestive fact that a small body of men drinking water from a public well, should be suddenly seized with a most violent form of cholera poisoning, while much larger bodies of men at Trimulgherry and in the cantonment generally, drinking from wells not accessible to the public, should have escaped. Supposing the public well to have been directly contaminated by accidental circumstances with cholera matter, it is quite possible that the regimental supply was drawn soon after contamination, and the men may have thus got the poison in a concentrated form. It is worthy of note, in connection with this view of the question, that cholera appeared almost simultaneously in the regimental hospital, in the barracks and ranges of family quarters. The family quarters stand high, and are well above the barracks, but their drinking water, and that used in the hospital, was brought from the same source. The regimental apothecary and his family, residing close to the hospital, drank the water from the old “condemned” well in the barracks, and they had no symptoms of cholera.

76. Beyond the water-supply, the conditions of existence of the Hussars did not differ from those of other European troops in the command. The food, drink, canteen supplies, &c., were of precisely the same nature.

77. If the atmosphere had been generally infected with the germs of the disease, these would naturally have been deposited at Trimulgherry and other parts of the cantonment, quite as readily as in the Hussar barracks and native bazaar; but, as a matter of fact, we know that cholera was brought along the eastern coast road into the native bazaar, and to a village close to the Hussar barracks, and that it was in these localities only that the disease assumed epidemic proportions. The outbreak in the Hussars, however, was out of all proportion more severe than anything that occurred in the bazaar.

78. It is, I think, very significant of the character of the cholera outbreak, in relation to the simultaneous poisoning of the whole corps, that the largest number of cases should have occurred within the first twenty-four hours, and that the virulence of the outburst should have declined after the third day. This is just what might have been expected to occur when a number of persons had been exposed to the cholera influence for a limited period only. They would not all fall sick precisely at the same instant, but at varying intervals of time, according to their individual constitutional powers of resting the causes of disease. That a few persons were secondarily affected in the camp is, I think, but too probable, and it may be that this was especially the case as regards the residents of the married quarters, who had shown but slight evidence of cholera poisoning before their removal to camp.

79. That the stress of the disease, however, fell upon those who were attacked within the first two days is evident from the fact that of fifty-four admissions thirty-two died, or in the ratio of 59.2 per cent. of attacks, while of the thirty-one admissions occurring subsequently after shifting to camp seven only died, or in the ratio of 22.5 per cent. of attacks.

80. The drinking water of the regiment, from whatever source it was procured, was passed through the usual chatty filters, which filters are mainly kept in the verandahs of the barracks, hospital and married quarters. What the actual condition of these filters might have been on the 24th May, I do not know, but as the apparatus differs in no degree from the old-fashioned barrack filter, it is quite plain that the water coming out of the filters, would not be much better than when it went in. The arrangements, indeed, for the supply and filtration of water continue to be eminently unsatisfactory.

81. The proportion of cholera attacks seems to have been, in some degree, affected by the age and length of residence of the men, and it would be appear from the following table that the residents who had occupied the station from four to six years, suffered in a higher ratio than the younger soldiers. The men less than one year in the station, in fact, suffered the least of all:—

Strength of the 18th Hussars according to age and residence in India.

Ages.	Under 1 year.	Under 2 years.	Under 3 years.	Under 4 years.	Under 5 years.	Under 6 years.	Under 7 years.	Under 8 years.	Under 9 years.	Under 10 years.	Under 11 years.
16	2	1	1	...	...	...	...	...	...	...	...
17	3	...	1	1	...	...	...	...	...	...	...
18	10	...	...	...	...	...	...	...	...	...	...
19	6	...	...	...	...	...	...	...	...	...	...
20	4	1	...	2	1	...	...	...	...	...	...
21	2	1	8	...	...	...	...	...	...	...	...
22	...	3	5	2	...	...	...	...	...	...	...
23	...	...	4	1	1	1	...	...	...	...	...
24	...	...	1	3	...	...	...	...	...	...	...
25	1	1	3	2	1	7	...	...	...	...	...
26	1	2	1	4	1	7	1	...	...	...	...
27	...	3	1	2	1	7	...	...	...	...	...
28	...	1	...	1	1	11	1	...	...	...	...
29	...	1	...	1	1	4	13	...	...	...	...
30	...	1	...	1	4	8	42	1	...	1	...
31	5	2	5	4	8	42	1	...	1	...	...
32	1	1	2	2	1	25	...	...	...	...	...
33	1	3	5	5	...	24	...	...	...	...	...
34	6	2	4	1	2	9	1	...	...	...	2
35	1	2	2	2	2	9	3	...	...	...	...
36	3	1	2	...	1	4	...	...	...	...	...
37	...	2	2	...	2	1	...	...	...	...	...
38	...	...	...	...	...	5	...	...	...	...	...
39	...	...	2	...	...	2	...	...	...	...	...
40	1	...	...	...	...	4	...	...	...	...	...
41	...	...	...	...	...	2	...	...	...	...	...
42	...	...	...	...	...	2	...	...	...	...	...
43	...	...	...	...	...	1	...	...	...	...	...
50	...	...	...	...	...	...	...	...	1	...	...
Total.	47	28	50	34	27	189	7	...	2	...	1

In column No. 1, under 1 year in Secunderabad, percentage of attacks to strength

Do. "	2, do.	2 years	12.7.
Do. "	3, do.	3 years	21.42.
Do. "	4, do.	4 years	16.00.
Do. "	5, do.	5 years	26.47.
Do. "	6, do.	6 years	25.92.
Do. "	7, do.	7 years	17.46.
Do. "	8, do.	8 years	14.28.
Do. "	9, do.	9 years	50.00.

82. When the regiment moved into camp, it was accompanied by about 1,200 natives including horse-keepers, grass-cutters, lascars, coolies, toties, private servants, &c.

Out of this large strength, it is very remarkable that only one individual was attacked by cholera, viz., one of the hospital coolies, who recovered. A young officer of the regiment who had been much exposed to the sun, and constantly mixing with the sick and dying, suffered from symptoms suspiciously resembling those of cholera, but the case was not returned as one of cholera.

83. The removal of the corps into camp was evidently attended with good results. It is probable that all who were attacked up to the fourth or fifth day, had imbibed the seeds of the disease before moving out of the station. The cases occurring after the fifth day were very few indeed, and of a milder type.

84. The removal occurred during the prevalence of the hottest weather of the Deccan climate. The camps had to be chosen with especial reference to the amount of water available for the horses, and, this being the driest time of the year, it was not easy to find suitable ground within convenient distances. Early in June the south-west monsoon set in, and an agreeable change in the temperature resulted. The health of the corps generally improved while under canvas. One man died from insolation. Two of the sick, who were moved out with the regiment, took cholera. One of these (a case of chronic diarrhoea) died.

85. It would be presumptuous for any one, not on the spot at the time of the outbreak, to find fault with the arrangements made for the removal of the corps from the scene of disaster. The promptness of the removal of the regiment, and the complete provision of all requisites by the commissariat, quarter-master-general's and medical departments were, so far as I can learn, highly creditable to every one concerned.

86. In reviewing the past, however, I am not quite sure that the inhabitants of the married quarters would not have fared as well, if they had been left behind in their ranges. It is true that two cases had occurred in the married quarters before the move of the regiment, and that the officers of the medical department were quite justified, by existing regulations, in recommending the removal of the families, but in consideration of the fact that each married quarter could be separately vacated and disinfected as occasion required, and taking into account the discomfort and suffering entailed on women and young children, under the circumstances of a forced march, I think it would be well, in the event of a similar calamity recurring, to leave the women and children in quarters, unless the prevalence of disease amongst them imperatively demanded their removal into camp. It may be however that, if the women and children had remained behind, they would have continued to use a dubious water-supply, and have suffered from this cause as much as they actually did from the camp life.

87. We know as yet very little regarding the way in which removal from an infected locality assists in staying the disease. In the case of the Hussars, they had to proceed to a distance of nine miles from the station to find a spot where a sufficiency of water existed. The camp was shifted three times before the disease entirely disappeared. The marching, subsequent exposure, and discomfort must have been very trying to delicate women and children at the very hottest period of the year.

88. There are, I think, two very important lessons to be learnt from this very remarkable outbreak of cholera at Secunderabad.

(a.)—The first is that a prompter system of communication between district authorities is needed, so that the local Military authorities may invariably be warned of the approach of cholera when it is known to be prevailing in neighbouring districts.

The military station of Secunderabad being situated in the heart of the Nizam's dominions is badly off in regard to such warnings, as no registration of deaths is, I believe, attempted in that country; still the fact of cholera deaths in the Kistna and Nellore districts might, if furnished in time to the heads of the medical department at Secunderabad, have given warning of the possible approach of the epidemic along the eastern coast road, and more effective measures might have been taken for the surveillance of travellers along the road. The delay in forwarding the police reports from Juggiapetta prevented any warning being given.

(b.)—In the second place, the facts should, I think, teach us

that the arrangements for the water-supply of troops need much more attention than has hitherto been given to them. To draw water for the use of troops from a well, which may be fouled by bazaar residents or travellers a hundred times in a day, must always involve an element of danger; but with cholera actually present in the bazaar, the changes of communication of the disease to troops are infinitely increased.

89. In making these remarks, I do not pretend to say that in every case cholera is communicated by polluted water. The poison, doubtless, finds its way into the human economy by many other ways; but so long as the people of India are so habitually reckless in their contamination of water, it behoves those who are responsible for the lives and safety of British troops to see that every possible precaution is taken to ensure that their water-supply cannot have been exposed to the chances of defilement.

90. If it be considered absolutely necessary to continue the occupation of the Hussar barracks at Secunderabad, I would most strongly insist on the need of immediate provision for the improvement of the water-supply.

91. The new well built with this object has not been brought into use on account of the contamination of the water by the lime used in steining the well. I would suggest that this well be emptied, when probably all the soluble part of the mortar will have been dissolved. If the water is then found unobjectionable, I would suggest that the well be covered in and fitted with a force pump, such as is put up in the military prison at Trimulgherry, and that no water should be brought to the barracks, but such as has been drawn through the pump. The pump should be worked for several hours daily, so as to ensure percolation of fresh water through the sub-soil. If this well cannot be used, it would be better to depend entirely on the well in the barrack square rather than revert to the parade ground wells.

92. As regards the barracks, I do not advocate the spending of any money upon them more than is absolutely needed, to fit them for temporary occupation. Their site is radically defective, and experience has shown that, let what may be done to the buildings, troops occupying the locality cannot be ensured good health.

93. Since the cholera outbreak, the drains leading from the wash-houses have been taken up, and cess-pits for the reception of the used water constructed; but this, so far from being an improvement, seems to me to be more likely to be productive of nuisance than the old system of drainage. The bath-room drains should be of shallow cut stone, and open. The out-fall from the barrack buildings is good, and no water ever need stagnate in them.

94. I feel that I should be wanting in my duty to Government, if I did not take this opportunity of earnestly recommending the speedy completion of the new cavalry barracks on the particularly fine site chosen for the purpose near to Bolarum.

95. The design of the buildings already commenced, is that of the standard plan for double-storied buildings. In the climate of the Deccan, and with a dry sub-soil such as exists there, double-storied barracks are not essential to health. They are certainly less comfortable for the men than single-storied buildings on well-raised basements such as the artillery and 1st European Infantry Regiment are provided with at Trimulgherry. Whether the designs of the barracks be modified or not, I feel that the best chance of preserving the health of a cavalry regiment in Secunderabad lies in the abandonment of the condemned barracks, and the occupation of a thoroughly good site, such as has been selected for the erection of new barracks.

96 * * * I much regret that so little of positive information should have been elicited during the inquiry, but the facts so far as they have been ascertained seem to warrant the conclusion:—

1st.—That cholera was introduced into Secunderabad by travellers passing over an infected area, on the eastern coast road.

2ndly.—That the outbreak in the 18th Hussars followed the appearance of the disease in the bazaar, and in a village in close proximity to the barracks.

3rdly.—That the simultaneous outbreak in the hospital, barracks, and family quarters of the Hussars points to a common exciting cause in relation to either air, food, or drink.

4thly.—That there is no evidence to show that the atmosphere around the Hussar barracks was differently constituted to that of other portions of the cantonment, and the food supplies were exactly of the same nature as those used by other corps.

5thly.—That the Hussar regiment, so far as is known, differed only from the other European troops, in using water from a public well that was liable to receive extraneous impurities.

6thly.—That the actual fouling of the parade ground wells by cholera matter, though exceedingly probable, cannot be directly proved.

W. R. CORNISH, F.R.C.S.,

Sanitary Commissioner for Madras.

BANGALORE, 1st August, 1871.

REVIEW.

Investigation into the mode of origin and spread of cholera. By TIMOTHY RICHARD LEWIS, M.B.—Remarks regarding the soil, &c., of certain places in relation to Pettenkofer's theory of the connection of cholera with the variation in the level of sub-soil water.

A report on Cholera. By D. DOUGLAS CUNNINGHAM, M.B.—Pettenkofer's theory illustrated in Madras.

It is a curious comment on the *novum organum* which is being incessantly impressed upon us in India, namely, that in scientific investigation the correct thing is to eschew opinion and theory and to "collect facts," that the only persons specially employed in medical or scientific investigation in this country have been directed to work under the guidance of two theories, those of Pettenkofer and Hallier. We shall see further on how the same logical process which guides the general conduct of this inquiry governs also its special developments. Every one knows that generalization is as necessary a means and instrument of extending our knowledge as observation, and we owe perhaps more of solid scientific acquisition to the one process than the other; for while observation begets theory and then verifies or refutes it, it is theory which stimulates, shapes and extends observation, and we most emphatically protest against a depreciation of the one process at the expense of the other. Both have their place and use, and if we are to wait for our opinions or laws, until all the particulars which support or prove them have been observed, (and even in observing generalization is indispensable) we shall have to wait a very long time.

Drs. Lewis and Cunningham have now been specially employed in investigating the origin and spread of cholera for nearly 3 years, and as they have each published a report of their labours, the time has come to test and criticise the results they have achieved. Their papers are published as appendices to the sixth and seventh reports of the Sanitary Commissioner with the Government of India. We have been so fortunate as to obtain a separate copy of Dr. Lewis's paper, and trust that Dr. Cunningham's observations will also be available in a separate form; for, whatever reason may exist for placing matter of this sort within the same boards as the arithmetical material which constitutes the balance of these bulky volumes—and we confess we can imagine none—it entails a certain amount of physical hardship, to be obliged when studying these valuable observations, to nurse a mass of matter besides, whose only connection with them is due to the binder. Both the papers now under notice consist of two parts, one concerning the spread of cholera through the agency of the soil, and the other the objects discovered by a microscopic examination of excreta and their meaning and interpretation. We might remark upon the absurdity of associating so closely two such different subjects of investigation, unless we are facetiously to assert that they both concern a study of *dust*, but let that pass. Reserving the microscopic and more valuable parts for a future number, we shall now compare and examine those parts having for their subject matter Professor Pettenkofer's theory. In doing so, it will save words, if we use the algebraical symbols, which have been adopted for the purpose of displaying this theory. Let x , therefore, be the specific cholera poison; Y the soil in which it is developed so as to produce z —the material capable of causing cholera in m —predisposed human beings, provided c —certain meteorological conditions exist. The equation comes to be $x + y = z + m + c$ —an epidemic of cholera. Dr. Lewis in his paper gives us a slight sketch of the theory and a few scraps of observation with regard to Allahabad, Cawnpore, Lucknow, Fyzabad, Agra, Morar, Meerut and Peshawur, in which places cholera appeared in 1869. There are also a few experiments regarding the porosity and permeability of soil, the amount of soluble organic matter contained in it, and the kind of organisms developed in a moistened specimen. These observations and