

APPENDIX (A)
TO THE
REPORT of the GENERAL BOARD of HEALTH
ON THE
EPIDEMIC CHOLERA
OF
1848 & 1849.

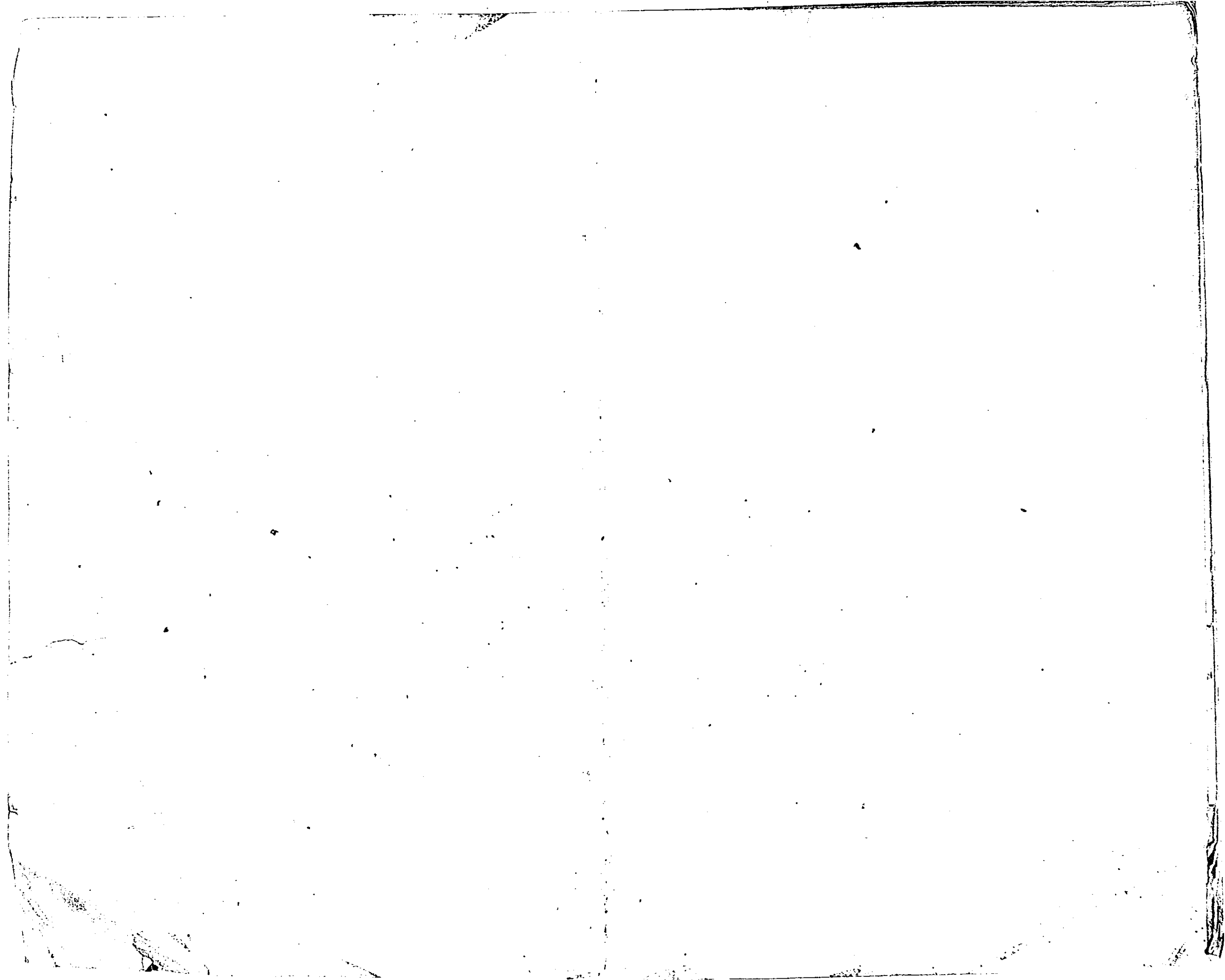
REPORT BY Dr. SUTHERLAND.

Presented to both Houses of Parliament by Command of Her Majesty.



LONDON:
PRINTED BY W. CLOWES & SONS, STAMFORD STREET,
FOR HER MAJESTY'S STATIONERY OFFICE.

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LIST OF PLANS.

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locating itself in the same filthy closes, occupying the same ill-ventilated, over-crowded tenements, not unfrequently carrying off its victims from the self-same rooms which its fatal ravages nearly depopulated in the epidemic of 1832.

APPENDIX A.

REPORT ON THE EPIDEMIC CHOLERA
OF 1848-49.

MY LORDS AND GENTLEMEN,

As cholera in its epidemic form may be said to have subsided for the present, with the exception of a few scattered cases, it becomes a portion of my public duty to report to the General Board of Health on the progress of the epidemic, and on the manner in which the regulations issued to the various public bodies have been carried into effect, and the results which have followed.

On the 26th September, 1848, when on the eve of proceeding to Germany in company with Mr. Grainger, to inquire into the progress of the cholera in that country, we were directed to go to Hull in consequence of the appearance of several cases of the disease on board a vessel in the port. After completing our inquiry, and when about to sail for Hamburg, Mr. Grainger was directed by telegraphic dispatch to proceed thither alone, while I remained in Hull, whence I was directed to go to Sunderland to inquire and report as to certain cases of cholera stated to have occurred on board vessels which had arrived from Hamburg. While so engaged, I was directed by telegraph on the 6th October, 1848, to proceed to Edinburgh, an outbreak of the disease having taken place in that city.

I left Sunderland immediately, and arrived in Edinburgh the same evening, when I learned that two cases of cholera had occurred simultaneously, one in an underground flat of a house at the top of Leith-walk, and another in Leith in a wretched lodging-house in a narrow, filthy cul-de-sac behind King-street. This latter case took place under the same roof, and within a few feet of the spot from whence the epidemic of 1832 commenced its career. The particulars of these cases, and the circumstances attending the subsequent progress of the disease, were at the time fully reported to the Board. Suffice it to say that cholera, true to the laws by which epidemics are governed, followed the usual track of the fevers by which Edinburgh and Leith are scourged, locating itself in the same filthy closes, occupying the same ill-ventilated, over-crowded tenements, not unfrequently carrying off its victims from the self-same rooms which its fatal ravages nearly depopulated in the epidemic of 1832.

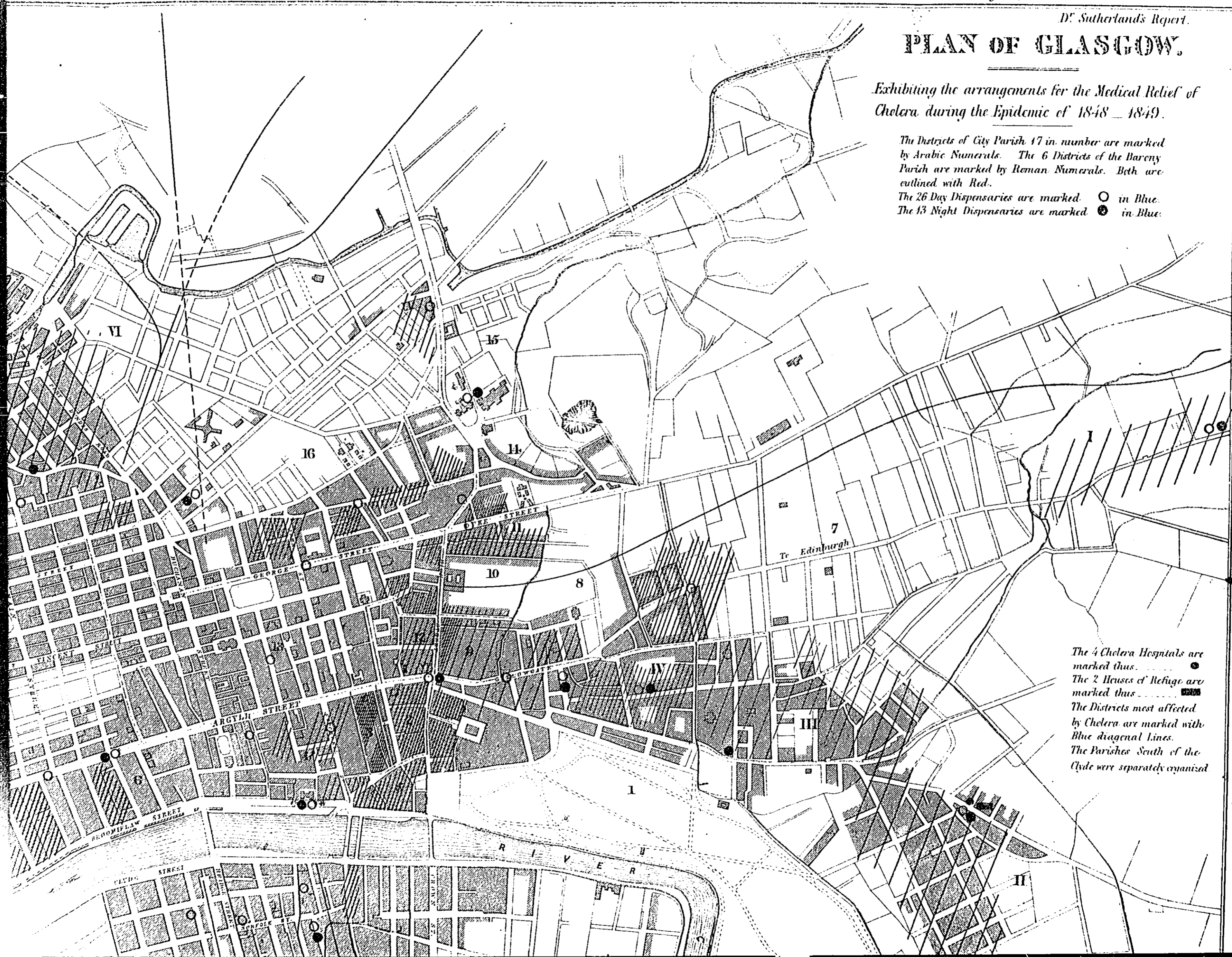
D^r. Sutherland's Report.

PLAN OF GLASGOW.

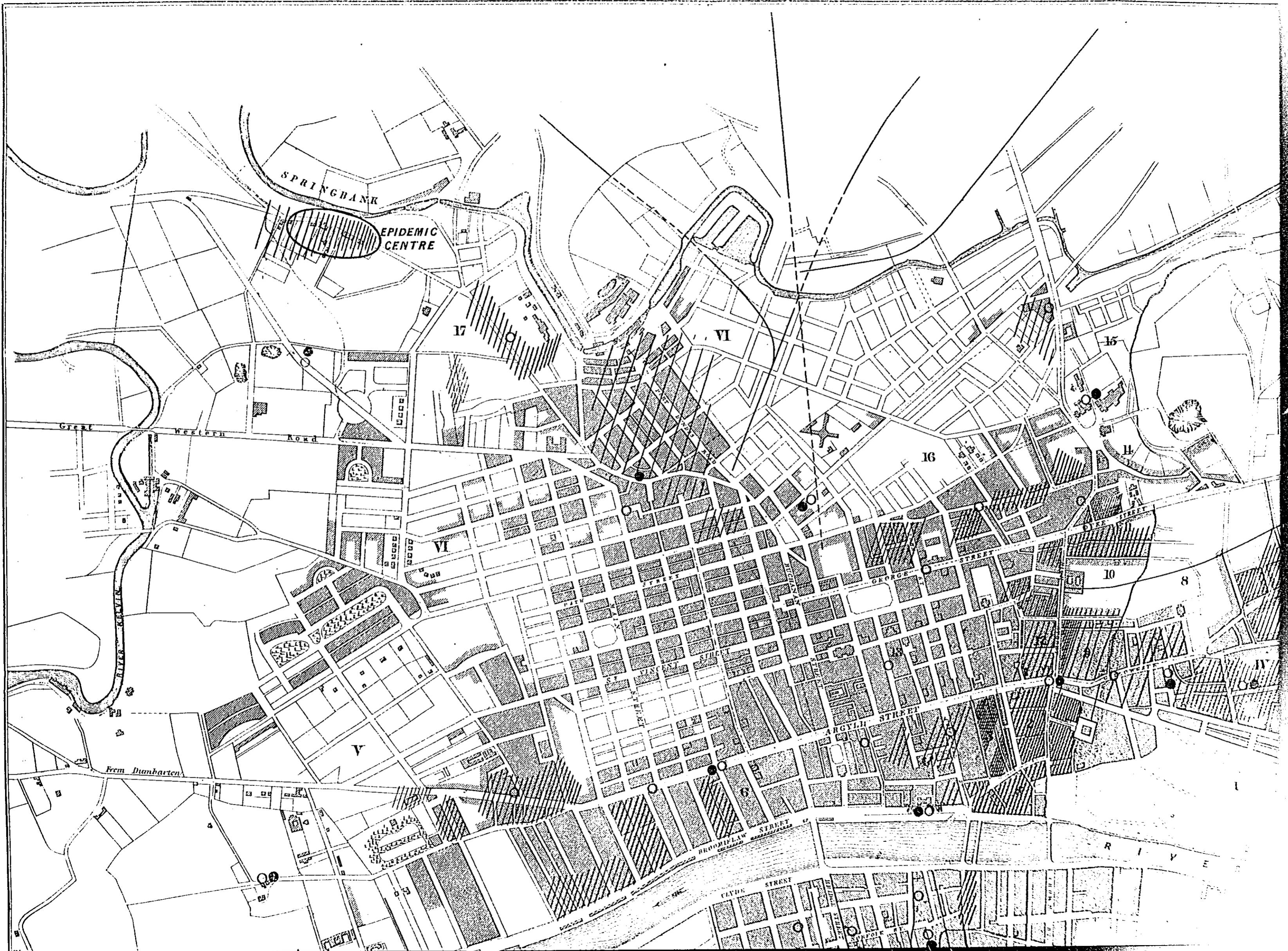
Exhibiting the arrangements for the Medical Relief of Cholera during the Epidemic of 1848 - 1849.

The Districts of City Parish 17 in number are marked by Arabic Numerals. The 6 Districts of the Barenny Parish are marked by Roman Numerals. Both are outlined with Red.

The 26 Day Dispensaries are marked ○ in Blue.
The 13 Night Dispensaries are marked ● in Blue.

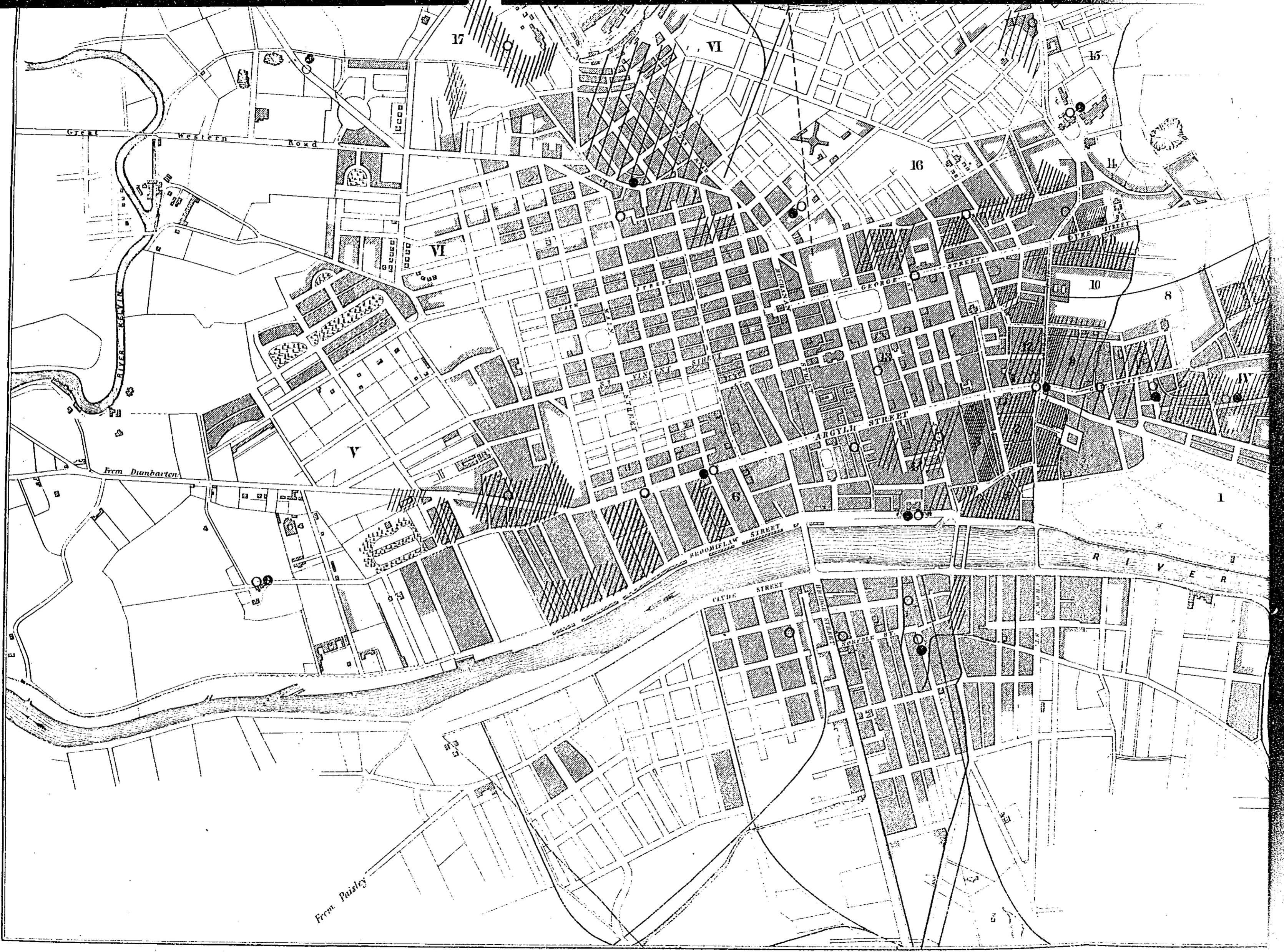


The 4 Cholera Hospitals are marked thus ●
The 2 Houses of Refuge are marked thus ●
The Districts most affected by Cholera are marked with Blue diagonal lines.
The Parishes South of the Clyde were separately organized





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In a few days after the disease had struck the northern metropolis, it appeared in the neighbouring towns of Newhaven, Portobello, Loanhead, and a number of other localities, and reached the west of Scotland on the 11th November, when it attacked the city of Glasgow, and subsequently a large number of manufacturing towns and villages in Lanarkshire, Ayrshire, Dumfriesshire, and other counties in the south and west of Scotland. A few sporadic cases and local outbreaks of the disease occurred in England during the same period. The first stroke of the epidemic appeared to have subsided early in May, 1849, although the disease still lingered in many parts of the country. It again assumed an epidemic form in the latter end of May, and during the summer and autumn nearly every large city and town in England was attacked, as well as several towns in Scotland, the last severe seizure being that of the inmates of Taunton Union workhouse, in the beginning of November. The following affected places have been at various times under my inspection:—

Edinburgh	Loanhead
Leith	Newhaven
Portobello	Musselburgh;
and other places in the vicinity of the Scottish capital.	
Stirling	Coatbridge
Glasgow	Carnbroe
Dumfries and Maxwell-	Paisley
town	Pollockshaws;
with other villages in Lanarkshire and the neighbouring counties.	
Kilbirnie	Sunderland
Kilmarnock	Inverness
Hamilton	Plymouth, where I went to
inspect an emigrant ship on board of which the disease had appeared.	
Merthyr Tydfil and	Dundee
Dowlais *	Arbroath
Cardiff	Liverpool
Bristol	Wolverhampton
Clifton Union	The Metropolis partially.
Taibach and neighbouring	Bilston
villages.	Willenhall
Gloucester	Alnwick
Romsey	Manchester
Hull	Sheffield
Leeds	Taunton.

I had, besides, to maintain a large correspondence with other places which I was not able to visit personally.

Were I to report specially on the circumstances attending the epidemic attack in each individual city and town, some amount of repetition would be necessary, and to avoid this I shall state as briefly as possible all those general principles which the extensive opportunities of observation at my disposal appeared to establish, and use the experience of individual towns, as illustrations in order to impress the deductions more clearly on the mind.

* At the commencement of but not during the epidemic.

In carrying out this plan, it will be necessary to revert to and affirm afresh well-known and acknowledged truths in sanitary science; but the subject is one of so much national importance, and the facts so liable to be forgotten, that they require to be kept before the public to obviate as far as possible the recurrence of those disastrous results which in several instances have arisen from the neglect of past experience.

It must now be considered an established truth in science, that the health, the well-being, and the duration of the life of man are intimately connected with the observance of the natural laws of the universe in which he dwells. The acknowledgment of this fact is not, however, sufficient to ensure obedience to those laws. Men must be taught individually and collectively to obey them; each man for himself; every family, in order to ensure its possession of that immunity from disease which the Great Creator obviously intended his creatures to possess; and all men acting in their social or corporate capacity for the protection of each other, and of the entire community.

There is a free choice given. On the one hand there is obedience and health, with all the numberless blessings and privileges which go with it; on the other, there is neglect and its infallible consequences, which no human power can fully avert when they are entailed, and these are disease, death, pauperism, loss of property, ignorance, debasement, crime.

The social evils of this neglect are at present ramified throughout the entire framework of society. A vast amount of property has grown up in all parts of the country, of which it is not too much to assert that it is as productive of misery to the people, as it is unproductive of legitimate revenue to the possessor. Large masses of population are congregated together without any attention to those conditions on which their healthy existence depends, and until very recently it was even denied that there were any special causes of disease which occasioned a greater mortality in towns than was the common lot of the human race. Melancholy experience has however proved that unless a very different view be taken of those new duties which devolve on all men, by the very act of their social union, and suitable means of protection adopted, our country will exhibit a progressive descent in the health and productive power of its people, and a corresponding degradation in their moral and social condition, of which, indeed, a low sanitary state must now be considered as an almost invariable exponent.

SECTION I.

LOCALIZING CAUSES OF CHOLERA.

BEFORE proceeding to describe the various measures of a medical preventive nature carried out under the regulations of the General Board of Health, it is necessary that I should enter shortly into the reasons for their adoption, by describing those special conditions attending the epidemic seizure which they were intended to meet. Sufficient evidence will presently be advanced to show that cholera is by no means so capricious in

its attacks as has been generally supposed, but that on the contrary it is propagated according to certain fixed laws, although the limits of these have not as yet been precisely defined. Whether or not there be sufficient proof that the epidemic influence progresses from point to point, and that it is not always universally diffused over the whole face of a country,—whether or not there be also evidence to show that the intensity of that influence is not necessarily equal throughout the area within which it operates,—and whether or not human means have any control over these properties of the epidemic; it is nevertheless of extreme importance to know that there are other laws, the modifying conditions of which can be to a great extent influenced. By far the most important of these laws is that which will frequently be referred to under the term *localization*, or, in other words, that property which is possessed by certain states of the constitution, or by certain well-marked characteristics of special localities, by virtue of which the epidemic obtains such power over the resisting vital forces of individuals, as to produce that class of phenomena usually ranked under the general designation of cholera.

During the late epidemic the following were among the more frequent indications of the prevalence of an epidemic constitution:—

General malaise.

Uneasiness of stomach or bowels.

Slight dyspepsia.

Flatulence.

Derangements of the nervous and vascular systems, such as transient sensations of giddiness, or fulness in the head, or partial coldness of the surface, &c.; occasionally a slight degree of timidity; sometimes a tendency to sore throat, or symptoms approaching those of influenza.

An open state of the bowels, proceeding to relaxation or painless diarrhoea.

Such symptoms have very frequently prevailed over considerable epidemic areas, without leading to any more serious disease. It has happened, however, that in certain constitutions, predisposed by irregular and dissipated habits, these slight premonitions have been followed by rapid and fatal attacks of cholera. It appeared as if the weakened vital stamina, after resisting to a certain point, suddenly gave way, while the natural powers of other individuals, which had not been put to so severe a test, were sufficient to preserve life.

Under similar circumstances specific acts of intemperance in food or drink, over-fatigue, or perhaps sudden alarm, have destroyed the resisting power. I have likewise known a number of instances in which individuals, living in comparatively healthy situations, have been suddenly destroyed by the use of purgative medicine, and that in very moderate quantity. Saline purgatives, which under ordinary circumstances may be used with advantage, are invested with poisonous properties in relation to the altered constitutional state produced by the epidemic influence. A similar fact has been observed in regard to almost every form of aperient. A case came under my own knowledge, in which an ordinary dose of rhubarb and magnesia with mint-water produced a rapid and fatal attack of cholera in a healthy young woman who had taken the medicine as an aperient.

Improper articles of food have not unfrequently produced a like result; a remarkable illustration of which will be found in the case of the Prussian sailors on board the barque "Pallas."

The influence of such causes in producing attacks of cholera has not been uniformly great. In some epidemic attacks imprudences have been committed with impunity, which in others have been attended with fatal results, while under neither of the circumstances alluded to did the disease distinctly localize itself. It appears reasonable, therefore, to conclude, that it is possible for the population of one locality to become more predisposed than that of another similarly circumstanced, simply from the greater intensity of the epidemic influence.

It is of great importance to keep in mind this distinction, because, in issuing instructions for the guidance of the population, as to diet, regimen, &c., it would be manifestly insufficient to take the previous experience of any one locality as a foundation on which to rest those precautionary measures to be recommended for every other. I have met with instances in which eminent members of the medical profession objected to certain of the recommendations of the General Board of Health, in regard to the points under discussion, from their not being entirely borne out by their own experience. It would certainly be more satisfactory were it practicable to advise those measures which would be precisely adapted to every given condition, but, as such is not the case, general recommendations founded on the broadest basis of experience must obviously be the best.

It is possible to conceive that an epidemic constitution might be so intense as to destroy every human being exposed to its influence, although living under the best possible sanitary conditions, just as if the atmosphere were to become suddenly converted into carbonic acid gas. Such, however, does not appear to be the function of epidemics. They are *corrective* rather than *destructive*, and one of their special objects seems that of arousing mankind, by signs which cannot be mistaken, to a sense of the necessity of recognising and obeying the laws of his physical existence. They have an indirect bearing also on his moral state, by exciting to action the dormant powers of observation, intelligence, and sympathy; while on the other hand, those very sanitary evils which tend to propagate epidemics have a direct influence in degrading the human race, and in leading to ignorance, vice, and crime.

Under such circumstances men are most readily affected by the passion of fear, and the instinct of self-preservation leads them to inquiries and physical reforms which remove those material causes from which originates a debased state of health both of body and mind.

Epidemics invariably haunt the same localities. A few scattered drops of the storm may fall elsewhere, but its violence is spent where its purifying influence is most required. I shall presently describe and illustrate those conditions which cholera finds most congenial. It is under these that a new class of phenomena is developed. We find certain appearances among the people, which, when once observed, can hardly be forgotten. The countenance has a peculiar aspect, half anxious, half apathetic. The eyes are suffused, and often surrounded by a faint areola. The skin has a dusky reddish hue, as if from impeded circulation. I have found such persons averse to exertion, and indisposed to take any steps for their safety. They have usually denied being ill, and refused to leave the locality; and I have not

unfrequently been able to predict the deaths of individuals from their positively objecting to being interfered with. Existing cases of fever, or other epidemics, change their aspect and fall rapidly into hopeless collapse. A very fatal disease suddenly breaks out, marked by the following symptoms:—

Diarrhoea.

Purging of serous matter.

Vomiting.

Cramps.

Coldness.

A peculiar aspect of countenance and expression of voice.

Pain in the stomach and bowels.

Intense thirst.

Suppressed urine.

Difficult respiration.

Collapse.

A brownish purple aspect of the skin, with occasional eruption.

Blueness.

Pulselessness.

Shrivelling up of the body, and wrinkling of the skin of the hands, just as if they had been soaked in water.

A certain listlessness of mind, from which, however, the patient can be roused into clearness of intellect, the body appearing almost dead before life is extinct.

Death.

The development of these diseased states has occupied very different periods of time in different localities and constitutions. Sometimes their course has extended over a period of several days, and at others death has ensued within two or three hours of the moment of seizure. A state of hopeless collapse has sometimes been produced in a few minutes, by the passing of a single large watery evacuation, in persons who had risen from bed apparently in their usual health. Instances have also occurred of persons dropping down in the street and dying shortly after.

It has been generally observed that the larger proportion of attacks have taken place through the night, a point in the history of the epidemic which is well illustrated by the following table supplied to me by Dr. Alex. M. Adams, Glasgow:—

Period of Attack.	8 A.M. till 12 Noon.	12 Noon till 4 P.M.	4 P.M. till 8 P.M.	8 P.M. till Midnight.	Midnight till 4 A.M.	4 A.M. till 8 A.M.	Totals.
Cases .	35	18	32	33	56	51	225
Deaths .	26	8	19	18	20	27	118

It will be perceived that between the hours of 8 P.M. and 8 A.M. the cases amounted to 140, and the deaths to 65, against 85 cases and 53 deaths occurring during the corresponding twelve hours of the day.

The most important practical point which it behoves us to know is, that the severe manifestation of the presence of cholera described above

does not take place over the whole district covered by the epidemic influence. Were this the case, a large proportion of the people in affected countries must necessarily perish. All experience has, however, proved that a certain portion escape, while another portion are destroyed, and the fatal outbreaks of the disease are invariably connected with one or more of the following local defects:—

Overcrowding.

Dampness.

Filth.

Want of ventilation and atmospheric pollution.

Proximity to graveyards and other nuisances, pigsties, offensive sewers, &c.

Narrow, closely-built, and confined neighbourhoods, bad water, natural defects of situation. The impregnation of the subsoil of towns with organic matters from filthy streets, cesspools, and other nuisances. Imperfect sanitary works, and other similar causes.

It will be observed that the diseased conditions likely to arise from the influence of such causes are those connected with atmospheric impurity, a deranged state of the digestive functions, and depression of the vital powers. In all localities where they exist there is a great preponderance of disease and mortality; but I am inclined to consider the epidemic susceptibility, properly so called, as distinct from the ordinary diseased states. It is not always the most sickly who suffer from epidemics; on the contrary, a large number of victims from fever and cholera are taken from amongst persons in the prime of life; and it has been often remarked, that the wards of cholera hospitals have shown a considerable proportion of robust men and women amongst their occupants.

The following table of the ages of 2322 cholera cases, and 1058 deaths from cholera, occurring in Glasgow, will prove how heavily the epidemic fell on the productive periods of life:—

Ages . . .	Under 10 Years.	10	20	30	40	50	60	70
		to 20.	to 30.	to 40.	to 50.	to 60.	to 70.	to 80.
Cholera cases.	192	315	616	532	415	138	93	21
Deaths . . .	91	113	269	234	195	77	65	14

It thus appears that, out of 2322 cases, not fewer than 1148, or nearly 50 per cent., occurred between the ages of 20 and 40; and that, out of 1058 deaths, 503, being a similar percentage, occurred between the same ages: circumstances which show how important it is in a social point of view that every resource of science should be put in requisition to extirpate the haunts of epidemics. Another proof of the peculiar nature of epidemic susceptibility is afforded by the fact that there have been numerous examples of persons going from healthy districts into localities affected by cholera, and after remaining there a day or two, but without necessarily coming in contact with any diseased individual, dying of the epidemic after their return home, their mere presence in such places

for a certain time being sufficient to produce death. To this class of cases belong a number of the presumed instances of contagion. We have thus two classes of attacks—the first taking place in persons habitually living in unhealthy situations, and in whom the addition of the epidemic influence to pre-existing susceptibility had produced a fatal result; while in the second class, the simple fact of an individual being suddenly exposed to the influence of an affected locality, and without having been apparently exposed to predisposing causes, has led to similar consequences.

All the facts which I have observed have appeared to point to a solution of the following kind: namely, that under the unhealthy conditions above mentioned the epidemic has the power of intensifying itself, or, in other words, multiplying its force of attack, until at last it produces results closely approximating to those of aerial poisons. It appears as if some peculiar organic matter, which constitutes the essence of the epidemic, when brought in contact with other organic matter proceeding from living bodies, or from decomposition, has the power of so changing the condition of the latter as to impress it with poisonous qualities of a peculiar kind similar to its own.

If we could suppose that certain organic impurities, existing in the atmosphere of unhealthy neighbourhoods, passed into the blood through the lungs, so as to follow the circulation, and that similar impurities taken into the stomach with articles of food or drink were likewise absorbed into the blood; if we could moreover suppose that the epidemic influence possessed the power of assimilating such organic matter to its own poisonous nature, we should be enabled to include a number of complex phenomena under a hypothesis which would indicate the requisite measures of prevention.

It is of more importance, however, to know that there are very satisfactory deductions of a practical nature from the phenomena themselves; but before proceeding to discuss these, I shall give the following illustrative facts from the history of the late epidemic:—

ILLUSTRATIONS OF THE LOCALIZING CAUSES OF CHOLERA.

1.—*Errors of Diet.*

I place this illustration first, rather because of its order in time than in importance, for it enables me to give some account of several of the earliest fatal cases of cholera which occurred in England during the late epidemic.

In the end of the summer and early part of the autumn of the year 1848, unequivocal appearances manifested the presence of the epidemic influence on several points of the east coast of England. Occasional outbursts of diarrhoea took place in several towns, and I have been informed that in a village in Holderness, where an epidemic typhus raged, a number of cases suddenly assumed symptoms closely resembling those of cholera. At this period the cholera was ravaging the cities of Northern and Western Europe, and it appeared as if the disease were making unsuccessful attempts to locate itself in this country. In the latter end of August and early in September one or two cases of a very suspicious character took place in Hull, but the disease showed no dis-

position to establish itself at that period. In the course of the month of September the city of Hamburg was suffering severely; and as a good deal of steamboat intercourse exists between that place and Hull, it happened, as was to be expected, that several cases were imported into the latter town, which afterwards proved fatal in different inns and lodging-houses, but in no one instance was there any spread of the disease by communication. At this period a circumstance occurred of a somewhat remarkable nature. A Prussian barque, the "Pallas," had been laid up for a length of time in one of the Hull docks, in consequence of the Danish blockade. Her captain resided at Barth in Pomerania, and when the blockade was removed he engaged nine men to accompany him to Hull, in order to man the vessel. He brought these men to Hamburg by railway, kept them from entering the town, and conveyed them to the river-side, where he hired a boat and saw them rowed out to the steamer which lay in the river. In the course of the evening the vessel drew up to the landing for the purpose of taking in part of her cargo, and three of the men went on shore. They slept at a public-house not far from the quay, and next morning at six o'clock the captain found them all on board quite sober and in good health. At this time there was a good deal of cholera on board the merchant-ships in the Elbe, the river appearing to be the centre of the epidemic attack, but none of the men referred to had been in contact with any affected individuals. They had, however, remained upwards of fifteen hours on the river. The vessel sailed for Hull, and had on board a quantity of plums for the market, of which the men ate largely on the passage. Early on the morning of the second day after leaving Hamburg the steamer arrived at Hull, and the men went on board the "Pallas" the same afternoon. They slept in the round-house on deck, and at nine o'clock next morning the captain was called up and informed that one of the men was dying. He was in a state of approaching collapse and died the same night. Within little more than twenty-four hours afterwards, other four of the crew were attacked, two of whom died. The rest of the men were sent on shore and suffered more or less from diarrhoea, which, however, easily yielded to treatment. The "Pallas" was closely wedged in amongst other vessels, and all communication with her was forbidden. Had the disease been contagious, the precautions which were taken could hardly have prevented its spreading, especially as the crew had actually slept two nights in the town, but no such occurrence took place. It becomes an interesting inquiry as to how these men became affected by the disease. The advocates for the contagious nature of cholera might possibly find countenance for their views in the fact stated, that a number of the crew went on shore at Hamburg, into the very neighbourhood where the disease raged at the time, but it happens that of the four most severe cases, three of which terminated fatally, not one of the sufferers had been on shore at all, although the fifth and slightest case, which recovered after a few hours' illness, occurred in the person of one of the men who had been on shore, and who was moreover the individual last attacked. The simple facts of the case appear to explain the whole occurrence. The men were brought from a healthy town into an epidemic centre, where they remained a sufficient time to have the constitution thoroughly affected by its influence. Possibly they

might have resisted the morbid state, had it not been for the very serious error as to diet which they committed. The eating of a few plums would certainly, under ordinary circumstances, have produced no such fatal results, but during an epidemic constitution such indulgence is well known to be fraught with extreme danger.

The General Board of Health requested that the sanitary state of the town of Hull should be examined, in order to ascertain whether any serious public danger existed. After a careful inquiry by Mr. Grainger and myself, we were able to report that the class of diseases which were then prevalent in the town, and had been so for some time previously, afforded no ground for alarm, as in our opinion the cholera cases had been imported, just as any other form of disease might have been, that they presented no evidence whatever of being contagious, and that nothing further was necessary than to organize such a preventive machinery as the westward progress of the epidemic indicated as desirable.

Within some weeks from this time one or two cases took place in the town, but at a considerable distance from the point where the "Pallas" had lain, and which she had left shortly after the deaths had occurred on board. Several fatal cases also took place on board of vessels which had come from Hamburg; but it was not till the month of July, 1849, that the cholera appeared in Hull as an epidemic.

While in Hull the attention of Mr. Grainger and myself was drawn to the injurious effects of the quarantine which had been imposed on vessels arriving from affected ports. We found that actually no provision had been contemplated for the discovery and treatment of premonitory cases occurring on board such vessels, and that it was only after the disease had gone on to developed cholera that assistance would have been sent for, while the distance of the quarantine-ground from the town would have almost certainly insured the death of every individual attacked, on account of the long delay which must have taken place before medical aid could be obtained. It is one of the absurdities of the system of quarantine, when applied to cholera, that it is directed against the introduction of a disease presumed to be contagious, and which experience has proved cannot become epidemic unless certain conditions prevail, which must be existing for some time before any case of the disease can occur. The whole mischief is, in fact, done quietly and unobtrusively before any alarm can be taken. It is also one of the inevitable dangers of the system, that human life must be sacrificed in the vain attempt to realize an impossible result. I look upon the evidence of the non-contagious nature of cholera, and of its dependence upon an epidemic constitution and suitable localizing circumstances in the population, as afforded by the whole history of the disease in Hull, to be perfectly conclusive.

2.—*Overcrowding, defective Ventilation, &c.*

In the beginning of November, 1849, cholera visited the town of Taunton, under such circumstances as to afford valuable experience in regard to the effect of specific localising causes. Though requiring improvement, the town itself was generally in a much better state than others which had been attacked by the disease. At one extremity of

Taunton is situated the workhouse, and at the other the county prison, the sanitary conditions of which differed most materially from each other. The whole population of the town does not much exceed 16,000, and from its small size we have the best possible means of judging of the effect of the epidemic influence upon three classes of people, the inhabitants of the town, the inmates of the workhouse, and the prisoners within the walls of the gaol. From the absence of any marked localising cause, the population generally was not greatly predisposed to attacks of the disease, and the only result was the occurrence of cases of diarrhoea.

Very different was the fate of the inmates of the workhouse, the arrangements of which were such as could not fail to be productive of disease. The situation occupied by the building was badly drained, the refuse being carried by a sewer to a cesspool in the garden, which was uncovered till a short period before the attack of cholera began. The house is remarkably low, and consists of a front building, with branches or rays, which project into the yard behind. This yard is surrounded by low badly constructed sheds, which were used partly as offices, partly for wards; and in one of them is situated the girls' and infants' schools belonging to the establishment. The internal arrangements of the house are exceedingly defective. Its passages and staircases are not constructed so as to facilitate ventilation. The ceilings of the wards are not nearly high enough for safety, being generally not more than 8 feet 9 inches in height. The water-closets opened into the wards or staircases, and in the sick ward this convenience formed part of the ward itself. The building was intended to accommodate 410 inmates, and there were 276 within its walls when the disease broke out. The ventilation of the wards was very bad, and the population overcrowded, notwithstanding that the numbers were so much reduced.

Mr. Foster, the medical officer of the establishment, gives the following evidence as to the result of this state of things:—

"On visiting the wards at night has found them close and offensive, and has repeatedly complained of the windows being shut. The ventilation is bad. Considers that, even with the reduced population which existed in the wards lately, the space was not above two-thirds of what was requisite for safety. . . . The house is liable to offensive smells from the water-closets, especially in the sick ward. It has been represented to the guardians; but nothing has been done. . . . Considers the present sick wards as not at all fit for sick, more especially for pulmonary disease, the windows opening immediately over the heads of the beds."

The greatest degree of overcrowding existed in the girls' school-room, which was a slated shed, 50 feet long, 9 feet 10 inches broad, and 7 feet 9 inches high to the top of the walls, over which was a sloping roof. In this miserable place were huddled together 67 children, with about 68 cubic feet of air to each. The infant-school, which was situated under the same roof, was only fit for a coal-cellar.

The means and appliances of personal cleanliness within the workhouse were defective. Mr. Foster says,—

"The people are generally of dirty habits, and cannot be kept clean. There are no washhand-basins for the inmates. There are none in the sick wards to my knowledge. Has often seen the sick washing themselves in chamber-pots. The paupers wash in a long trough."

12 *Fatal effects of Overcrowding and defective Ventilation.*

The result of these causes in predisposing to disease is fully exemplified by the following evidence given by Mr. Foster. He says,—

“The union house is very subject to epidemics, to measles, scarlet fever, typhus, diarrhœa constant, especially in children, dysentery, scurvy. . . . So far as I know, no child dry-nursed has been raised beyond 4 years of age; and the only child which attained that age has died of cholera.”

The following table exhibits the proportion of deaths to the inmates for a series of years; and, granting that a large proportion of these may occur in persons who enter the house in a sickly state, there can be no doubt that it exhibits an excessive mortality:—

Table of Annual Mortality in Taunton Union Workhouse.

	Years.	Average Inmates.	Deaths.
	1842-43	322	44
	1843-44	293	39
	1844-45	305	41
	1845-46	280	33
	1846-47	306	56
	1847-48	343	60
	1848-49	361	72

About two months before cholera appeared, bilious diarrhœa prevailed in the workhouse. Early in October it began to advance, and a man died of dysentery. The first case of cholera occurred on the 3rd of November, and in ten minutes from the time of seizure the sufferer passed into a state of hopeless collapse. Up to 4 P.M. of the 5th of November, no fewer than 42 cases and 19 deaths had taken place; and in the course of one short week 60 of the inmates were swept away.

The girls' school-room, which was by far the most unhealthy part of the building, furnished the largest proportion of victims. The total number of children in this shed before cholera appeared was, as has been stated, 67. Of these, three were removed the moment the disease broke out, and one of them was attacked, but recovered. 33 out of the remaining 64 were seized, 25 died, and only 8 recovered. The 31 who escaped were removed, partly to a large airy schoolhouse in the neighbourhood, and partly by parents and friends to different places. Of the 15 taken to the school-house, 12 were suffering from diarrhœa; but by constant care, and a complete change of food, procured, not from the union house, but from the town, all recovered. A curious circumstance occurred with respect to the boys' school. This apartment was rather worse than that of the girls; but the boys, who were good and obedient in other respects, could not be kept from breaking the windows. In the girls' school the windows were never broken; and Mr. Smith, the chaplain of the workhouse, states his firm belief, that it was to the better ventilation, which the broken windows maintained in the boys' school, that the children in some measure owed their lives.*

The following are the statistics of the mortality from cholera:—

Cholera in Taunton Union Workhouse.

Girls' school	25
Boys' school, including master	10
Men from 16 to 60 years of age	9
Women do. do.	9
Men above 60	4
Women do.	2
Infants	1
Total	60

Let us next contrast the position of the county gaol with respect to the prevailing epidemic. I found the cells occupied by the prisoners in the new part of the building had the following dimensions:—

Height	9 ft.
Length	13
Breadth	7
Superficial area	91
Cubic contents for one prisoner	819 cubic feet.

The cells in the other parts of the building had the following dimensions:—

Length	10 ft. 6 in.
Breadth	8 6
Height	8 6
Superficial area	89 3
Cubic contents for each prisoner	935 cubic feet.

There is a corridor having a common ventilation with 71 cells. It is 30 feet high, 100 feet long, 12 feet broad, and has 36,000 cubic feet of contents. A system of ventilation passes through every cell, and a temperature is maintained that hardly varies three degrees in 24 hours. Each prisoner has the means of personal cleanliness. He has a water-closet, washhand-basin, and unlimited water-supply. He has a good diet, and cleanliness is strictly enforced throughout the building. The following table of the usual health of the prisoners, put in evidence by the governor, Mr. Gane, will show the result of these excellent arrangements:—

Table of Sickness and Mortality in the County Gaol, Taunton.

Years.	Prisoners.	Infirmary Cases.	Deaths.
1842	840	60	3
1843	1026	60	2
1844	1122	35	1
1845	959	46	1
1846	821	25	1
1847	973	18	1*
1848	1199	33	2

During the presence of the epidemic in Taunton, not a solitary case either of cholera or diarrhœa occurred among the prisoners in the gaol.

* 83 years of age.

Opportunities rarely offer, such as those afforded by the instance before us, of testing the truth of the principles of preventive science. There were three classes of persons living under different circumstances.

1st. Those within the walls of the gaol, who, although in confinement, were surrounded by the appliances of health.

2nd. The population of the town, many of whom inhabit dwellings whose sanitary condition is by no means so good as that of the prison.

3rd. The unfortunate inmates of the workhouse, who were exposed to almost every conceivable disadvantage in regard to health.

The results were, perfect safety to the first from the lightest touch of the epidemic; the townspeople escaped with some cases of diarrhœa, but without a solitary instance of cholera; while out of 276 inmates of the workhouse, no fewer than 60, or nearly 22 per cent., died of cholera within a single week, and nearly all the survivors suffered to a greater or less extent from cholera or diarrhœa.

3.—Unwholesome Water.

I have frequently had occasion to refer to the very injurious effects resulting from the use of impure water during the late epidemic. In nearly every city or town affected this element has been more or less prominent, and a number of most severe and fatal outbursts of cholera were referable to no other cause except the state of the water-supply. Such has especially been the case when the water was obtained from wells into which the contents of sewers or privies, or the drainage of graveyards, had escaped. The predisposition occasioned by the continued use of such water is perhaps the most fatal of all; and the proportion of deaths to attacks has generally been much greater in epidemic seizures resulting from it than from any other predisposing cause.

The water has at times been most offensive to the smell; but occasionally the only apparent impurity has been a little muddiness. I have known water pronounced to be, chemically, wholesome, occasion the death of a large number of persons, although I never met with an instance in which the microscope did not detect the presence of a considerable amount of organic matter.

I select the following illustration out of a number, because it is accompanied with statistical data:—

While cholera was prevailing in Manchester, a sudden and violent outbreak of the disease took place in Hope-street, Salford, apparently connected with the use of water from a particular pump-well. As some difference of opinion had arisen on the subject, I procured samples of the water, which were slightly muddy in appearance, and, when examined under the microscope, gave the usual indications of the presence of organic matter. I then obtained the statistics of the streets where the water was used from Mr. Currie, one of the acting medical officers of the union. The houses were found to be supplied from a variety of wells, and also from the pipe-supply. The table on next page gives the result of the inquiry, and the number of epidemic cases. Wherever the source of the water-supply is not stated, it may be considered as good; and where it is designated as "pump-water," the people had used the water complained of.

Table of Houses in Hope-street, Salford, showing the effect of Impure Water in predisposing to attacks of Cholera.
(East side of Street.)

No. of House.	Source of Supply.	Diarrhœa Cases.	Cholera Cases.	Deaths from Cholera.
No. 2 to 13 . . . . .	..	..	..	..
„ 14	Pump-water . . . . .	..	1	1
„ 16 . . . . .	..	..	..	..
„ 18	Pump-water . . . . .	..	1	1
„ 20 to 32 . . . . .	..	..	..	..
„ 34	Pump-water . . . . .	..	2	2
„ 36 to 38 . . . . .	..	..	..	..
Cellar	Pump-water . . . . .	..	2	1
No. 40 to 42 . . . . .	..	..	..	..
Derbyshire-court . . . . .	..	1	..	..
No. 3, Swann's-court . . . . .	..	..	..	..
„ 4	Pump-water occasionally	1	..	..
„ 5 . . . . .	..	..	..	..
„ 6	Pump-water . . . . .	..	1	1
„ 8 to 10 . . . . .	..	..	..	..
„ 11	Pump-water	2	..	..
„ 13 . . . . .	..	4	..	..
„ 16 . . . . .	..	..	..	..
(West side of Street.)				
No. 3 . . . . .	..	..	..	..
„ 5	Pump-water	1	..	..
„ 7 . . . . .	..	3	..	..
„ 9 to 13 . . . . .	..	..	..	..
„ 15	Pump-water	2	..	..
„ 17 . . . . .	..	3	..	..
„ 19	Pump-water	1	3	3
„ 21 . . . . .	..	..	..	..
„ 23	Pump-water . . . . .	..	1	1
„ 25	Ditto	1	1	1
„ 27	Ditto	2	..	..
„ 29 . . . . .	..	..	..	..
„ 31	Pump-water	1	..	..
„ 33	Ditto . . . . .	..	1	1
„ 35	Ditto	1	..	..
„ 37	Ditto . . . . .	..	3	3
„ 39	Ditto	4	..	..
„ 41	Ditto . . . . .	..	1	1
„ 43	Ditto	1	..	..
„ 45	Ditto occasionally	2	..	..
„ 47	Pump-water . . . . .	..	1	1
„ 49 to 55 . . . . .	..	..	..	..
Muslin-street to Christ Church-street.				
No. 4	Pump-water . . . . .	..	..	..
Heap's-court	Ditto . . . . .	..	4	4
Pump-court	Ditto . . . . .	..	3	3
Cow-lane	Ditto . . . . .	..	1	1
Several houses were shut up.				

GENERAL RESULTS.

		Total Diarrhœa Cases.	Total Cholera Cases.	Total Deaths.
Number of houses using } water from the pump . }	30	19	26	25
Number of houses using } other water . . . }	60	11	None.	None.

The following are specimens of the complaints made against the water by the people in the neighbourhood:—

“The water looks rather muddy, and has not been clean since the pump was mended.”

“Dreadful heavy dirty water-settlings from a canfull.”

“Has seen the sludge boil like barm at top, and it left something on the pan like soapsuds. The week we began to use the pump-water the man died.”

John Holding states that he was stopped from using a pure well-water, and was obliged to use the pump-water. On Saturday, Sept. 29, he “Got two cans of water from Pump-court.” “A lodger was seized with cholera on Monday, and died next day.”

Another complainant states—

“That he was afraid of using the pump-water, on account of the water in which the bedding of two persons who had died of cholera had been washed having been thrown into the gutter, and he thought it ran into the well.”

It appears that the well had been repaired, and, from some cause or other, a sewer which passes within 9 inches of the edge of it had become obstructed and leaked into the well.

The statistical evidence given in the preceding page affords a melancholy and convincing proof of the enormous destruction of human life which may ensue from a very slight degree of negligence or accident.

4.—*Injurious effect of Town Refuse.*

The advocates of sanitary improvement have long asserted that the exhalations from town refuse have a direct effect in lowering the standard of the public health, in predisposing to epidemic attacks, and to the slower but no less certainly fatal operation of other diseased conditions. We should expect, therefore, that persons living close to accumulations of such refuse would suffer severely, especially if an epidemic happened to touch the neighbourhood.

To illustrate this fact, and at the same time to demonstrate the extreme importance of the sanitary principles involved in the cleansing operations so strenuously, and in some instances so fruitlessly, put forward by the General Board of Health in its Regulations and Notifications, I shall select one very melancholy and striking instance of the fatal results arising from the neglect of its orders in this particular:—

On the east side of the town of Hull lies a suburb called Witham, in which there is a triangular space of ground bounded by the street called Witham, Great Union-street, and Church-street. This triangle is surrounded by houses, so as to leave an open space in the centre of nearly

three acres in extent, about two acres of which is used as a place of deposit for part of the night-soil of the town and other manure, which is interspersed in heaps among the houses, and close to the doors of dwellings. These noxious matters are collected by a number of persons who make a trade of accumulating and selling them for agricultural purposes, and they have become so accustomed to live amongst this horrible garbage, that they not only heap it up against the walls and immediately under the windows of their houses, but it is stated that they have come to consider the atmosphere of the locality “rather wholesome and agreeable than otherwise.”

In the month of July, 1849, I went over the neighbourhood, and certainly few places have presented more elements of disease and mortality. The surface appeared to be one mass of heaped up filth. An offensive open ditch ran through the ground, and the whole atmosphere was sensibly polluted to some distance. Mr. Chatham, clerk to the Guardians of Sculcoates Union, in which Witham is situated, states in a published letter, that from an examination of the registers of deaths for the district, he found “that although the average age of all persons who die in other parts of the town is 23 years, the average age of all persons dying in Witham and Drypool is only 18.” This fact, at all events, affords one indication of great local unhealthiness.

At the time I made the inspection, there was no cholera in the district, or near it, but in addition to pointing out these collections of filth as requiring immediate attention, I deemed it to be my duty to address a written protest to the Board of Guardians against a state of matters which ought not to have been permitted to exist after the issuing of the regulations of the General Board of Health nine months before. There is every reason to believe that had these nuisances been summarily dealt with when the first warning was given to the town in September, 1848, a great part, if not the whole of the appalling catastrophe which took place might have been averted. In the letter referred to I used the following words:—“In the whole course of a pretty extensive experience, it has never been my lot to be brought in contact with a state of things altogether so abominable, or considering the present state of the public health, so dangerous.” Most fearfully was the prediction realized. Nothing effectual was done: indeed, I question whether in the pressing emergency which followed much good in the way of protection could have been accomplished. The real time for preparation had been allowed to pass over. The epidemic at last touched the district and committed the most fearful ravages among the people. In Mr. Chatham’s published letter already quoted, he says briefly, “I am enabled to prove, from the records in my possession, the truth of his (Dr. Sutherland’s) assertion. In fact, the deaths occurring from cholera in the streets surrounding the muck garths in Witham were upwards of 80—a greater proportion, considering the area and population, than in any other part of the town.”

A plan of the neighbourhood will be found in plate 1 (see Report, p. 45), showing the localities of *ninety-one* deaths from cholera, the actual number of persons who were swept away by the pestilence on the outskirts of a triangular space measuring little more than 200 yards on the side. I have never known an open neighbourhood of this size yield so large a number of deaths. To get the number of attacks we must nearly double the number of deaths, if the proportions held good here as elsewhere;

and although no human words can express the domestic misery that has been occasioned, it will require very little arithmetic to calculate the pecuniary loss which has been entailed on the community, by permitting a few petty private interests to stand in the way of the public safety.

The Sculcoates Guardians were latterly very active in prosecuting offenders, but Mr. Chatham's letter states that "after upwards of 100 convictions under the Nuisances Removal Act, the Guardians have only applied for their enforcement against one person, and the application for distress warrants in that case was, as the public are well aware, refused." So much for the value placed on the lives of the people by those whose duty it was in law to protect them!

5.—*Dampness in the Subsoil.*

A very frequent cause of the localization of cholera is dampness in the atmosphere, especially such as proceeds from the proximity of river-banks, and the presence of water in the subsoil on which the houses are built. One or other of these causes is present in a great majority of instances, but the effect of a wet subsoil and certain of the conditions from which it arises, have not hitherto attracted that degree of attention which their importance merits.

At first sight it might appear that houses built on hill-sides, at a considerable elevation above the neighbouring low ground, ought to be exempt from the attacks of epidemic disease. Their airy exposed situation, and great apparent facilities for drainage, might be supposed to render them specially conducive to health, but such is by no means a necessary consequence of the simple accident of elevated position. It has been considered a mark of the peculiarly capricious and erratic nature of cholera, that it has sometimes attacked lofty situations, while it has left the neighbouring valleys untouched. During the late epidemic several examples occurred of extremely violent outbreaks in towns, and even in individual houses built on the sloping sides of hills. I might instance the cases of Hamilton in Lanarkshire, Maxwelltown in Dumfriesshire, and Dowlais in South Wales, with a number of other places similarly situated.

The reason of this predisposition will be easily understood by an individual illustration. The one I shall select is that of the village of Spring Bank, which may be considered as the epidemic centre of Glasgow. This case is especially illustrative, because there is a head of water in the Forth and Clyde Canal, not many yards from, but considerably above the level of the foundations of, the houses. The pressure of the water keeps the hill-side in a state of perpetual dampness, and the water collects in any hollows which may exist in the ground. The consequence is, that the atmosphere is moist both within and without the houses.

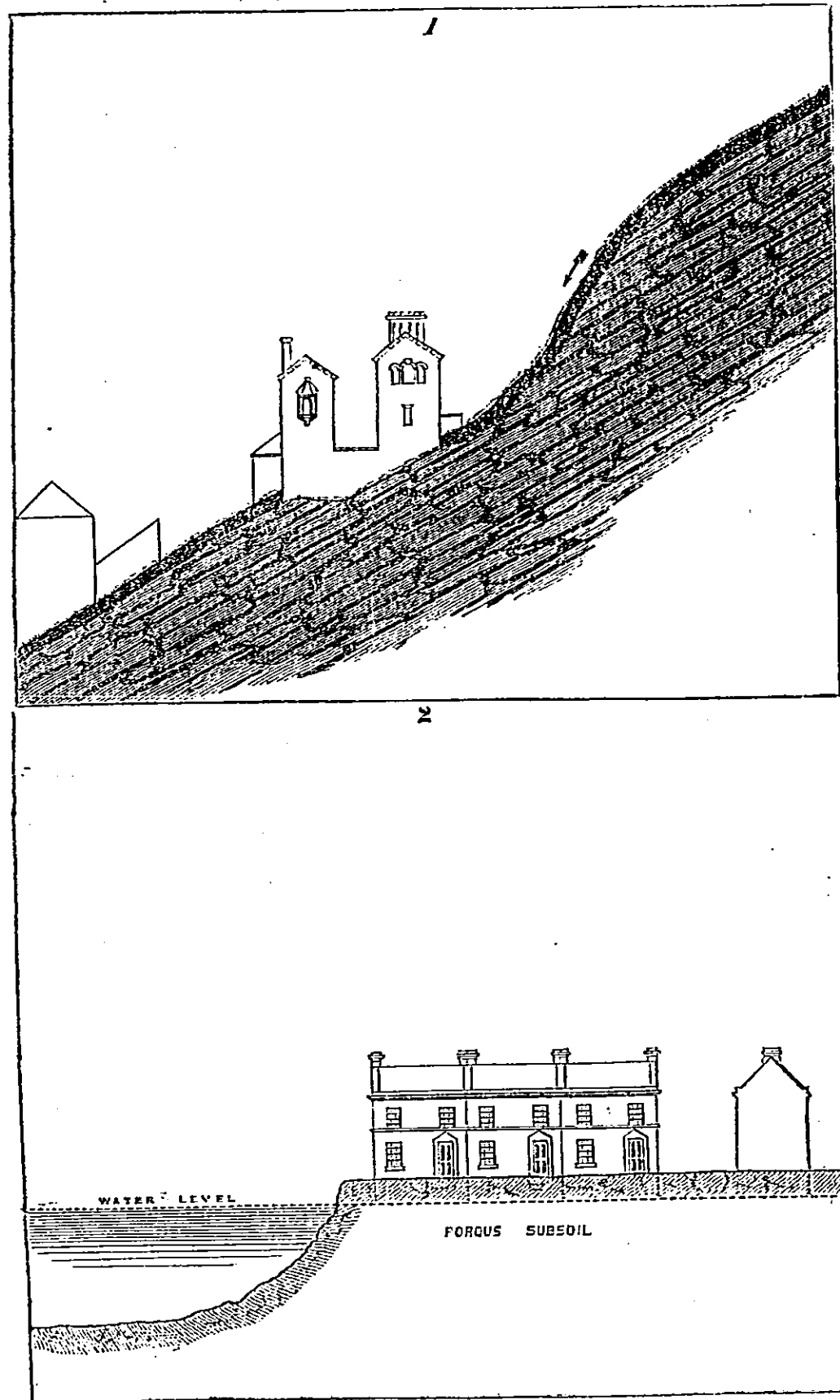
In other instances a similar effect is produced by the lateral exudation of moisture from slopes of hills proceeding from the natural drainage, the usual rainfall in its passage from the surface of the hill to the low ground appearing at various points on the hill-side. It must be obvious that, if a street of houses be built across the natural course of the drainage, the foundations will obstruct the downward flow of the water, and accumulate it in the ground immediately behind the houses. In one such instance a stream of water actually percolated the back wall of a cottage from the slope above, and escaped upon the public road after passing through the house. This dwelling was attacked with cholera.

The evils described are greatly aggravated if pigsties, manure-heaps, or other nuisances, are placed higher than the houses, especially if the ground be at all of a porous nature. In such cases the lateral drainage becomes polluted with organic matters.

Even surface-drainage, as at present carried out, flowing from the higher to the lower parts of towns, at times produces much mischief. Such an instance occurred when cholera was prevalent in Edinburgh. The disease carried off four or five individuals in a single house, fronting the open country, at the foot of one of the closes in the Canongate. There was not a single case of cholera in the neighbourhood except these, and the house was perfectly clean, and the locality well ventilated. The catastrophe arose as follows:—The drainage of the High-street and Canongate takes place on the surface, and is continually impregnated with night-soil and other impurities. In passing the mouth of the close in question, from some defect in the gutter, part of the drainage was turned aside and ran down the close. There was no escape for it at the lower end, where it accumulated and became extremely offensive. Only two or three families were exposed to the effluvia, and one of them was almost entirely destroyed. The cause was then recognised and removed. I cite these facts as affording individual illustrations of a class of causes which operate in rendering localities unhealthy which otherwise should not be so. Houses and towns built on hill-slopes evidently require sanitary precautions of a particular kind, and proper means should be taken to cut off the natural drainage from the site chosen, and to divert it in such a way as to render it innocuous.

Much of the evil resulting from the close proximity of rivers and canals proceeds from lateral infiltration of the subsoil, and not merely from the aqueous vapour which rises from the surface of the water itself. In the village of Spring Bank already referred to, many of the houses most severely attacked by cholera had their floors nearly on a level with the canal. A small house in which the first cases occurred is thus situated. It contained two inhabitants, both of whom died, and there was no other appreciable reason for the attack.

The epidemic seizure of the lower part of Inverness in April, 1849, affords another similar illustration. The site occupied by the houses is a flat gravelly piece of ground on the banks of the river Ness, and the foundations are rather below high-water mark. The whole of this gravelly subsoil receives the brackish water of the river, which can be obtained by digging a few feet below the surface. The natural disadvantages of such situations are greatly aggravated by improper attempts at sewerage, especially where there are tidal rivers such as the Thames. Besides the evils resulting from imperfect declivity, the sewers are back-watered at high tide, and actually become the means of distributing a polluted and unwholesome drainage through all their ramifications, by which the whole subsoil becomes infiltrated with impurities, the atmosphere rendered noxious by exhalations forced up from the sewers, and the public health endangered. To such causes must be attributed not a little of the fatal outbreak of cholera which occasioned such devastation in the southern portion of the metropolis during the late epidemic. I feel convinced that all attempts at intermittent drainage in these localities would only increase the evil, and that the mischievous results of such a system would be speedily manifested. It would be safer to



Origin of Damp Subsoil.

leave similar districts wholly unsewered than to adopt any method which would not secure the removal of the drainage as rapidly as it was formed. The accompanying sketches will render these two causes of dampness easily intelligible. (Plate 2.)

No. 1 shows a section of a row of houses built on a hill-slope, across the natural course of the drainage, which is interrupted both by the cutting across of the strata, and by the obstruction which the houses offer to the surface-drainage.

No. 2 shows the lateral infiltration of water from rivers and canals under the foundations of houses built on their banks.

6.—Defects in the Internal Economy of large Tenements.

There are certain peculiarities of structure in the houses of the older parts of Edinburgh and Glasgow which in my opinion have a powerful tendency to predispose their inhabitants to epidemic disease; and as these causes have not hitherto been brought forward prominently, I shall briefly describe them, and point out their effects during the late visitation of cholera. It is commonly believed that the chief causes of sickness are connected with the condition of the surface or subsoil of a town; but in the Scotch cities it is found that a great deal of epidemic disease occurs at the top of the loftiest tenements, where a comparatively pure atmosphere surrounds the dwellings. In order to elucidate this fact, it will be necessary to inquire into the internal arrangements of these buildings. The perishable nature of the structures in many of the English towns renders a complete reconstruction possible within comparatively short intervals of time, and a progressive improvement and amelioration can thus be effected. Such, however, is not the case in Edinburgh and Glasgow, very many of the houses of which have been inhabited for centuries, and to all appearances will last for centuries to come. Ancient mediæval structures, after having served as mansions during feudal times, have been divided and subdivided to suit the necessities of a new class of occupants, with little regard to the best methods of effecting the change, and with an utter forgetfulness of the comfort, health, and convenience of the tenants. Houses with eight or ten successive nests of families, piled one above the other, are by no means uncommon. Such tenements are hardly suitable for the purposes of modern civilization, and they can only be occupied without absolute danger to the health and morals of the inmates by a strict application of those resources which science has brought to bear on the social welfare of the people. The "lands," as they are called, have generally one common stair to give access to their teeming population, a circumstance which must always render a thorough cleanliness of these approaches next to impossible. Many of the stairs and the passages which branch off from them are dark and noisome; and from the absence of all domestic conveniences in the houses, they become depositories of filth of the most disgusting kind. The atmosphere in them is most impure, and often extremely offensive; and as the houses must be supplied with air through these channels, we need not be surprised to find that the supply is at times almost intolerable. The same want of conveniences leads to a most abominable state of the closes, which all police regulations have hitherto failed to improve materially, especially in Edinburgh, so that the ordinary channels through which the atmosphere reaches the inmates, even in the loftiest

and apparently best ventilated parts of the old town of Edinburgh, are impregnated with impurities, dissolved and carried along by the air.

There is no household water-supply to this class of tenements either in Edinburgh or Glasgow. The small quantity made use of is procured from public wells, or stand-pipes in the streets or closes, and has to be carried to considerable altitudes, so that the amount of labour required is a direct inducement to use as little water as possible. Were the whole requisite supply procured in this way, it would entail on each family the transport of between two and three hundredweight of water a-day to the height of 60 or 80 feet. There are no means provided by which the solid and fluid egesta of the households can be removed, except by the laborious process of carrying down the whole weight which had previously been carried up. There are neither water-closets, sinks,* nor dust-shoots, and the result of the want of these most needful conveniences is, that all the offensive refuse of the house must be retained within inhabited apartments, and in immediate proximity to the scanty water-supply. The atmosphere is rendered damp and foul by the exhalations, and the water unwholesome by absorbing them. It is true that the police send round carts for removing the refuse; but under the best possible arrangements of this kind, the house refuse must still be retained sufficiently long to be injurious, while the inmates not unfrequently find themselves inconvenienced by the operation of conveying it down from such an altitude at the precise moment fixed by the police for its removal. The practical result is, that it is often retained as long as possible, or thrown out of the windows into the closes below. It is even not a rare occurrence to find large accumulations of decomposing matter, which appear to have lain for years, in garrets and empty apartments of these lofty houses.

These circumstances fully explain the reason why large tenements are so liable to epidemic disease, apart from considerations of drainage or surface-cleansing; but there is yet another element of unhealthiness in the overcrowded population which inhabits them, and in the entire absence of any means of ventilation. Where there are a large number of families there must be a corresponding number of fires burning at all seasons, so that the temperature of the whole internal atmosphere is higher than of that without. There is a constant tendency of this warm impure air to ascend toward the higher flats by the staircases, through crevices in the ceilings, and even through the floor and plaster, both of which are porous. If what has been already stated as to these peculiar causes of disease be correct, we should naturally look for marked effects of an epidemic in the upper flats. I had been several times so forcibly struck with the occurrence of epidemic disease in the loftiest parts of Edinburgh, that, when cholera appeared in Glasgow, I requested the district superintendents of the city parish to keep records of the precise flats in which the cases occurred, and the results of this classification have confirmed the views above stated in a most remarkable manner. The houses in Glasgow, of which the statistics were kept, have rarely a sunk flat. There are generally two or three middle flats, that is, those comprehended between the ground-floor and the top flat. An account of the precise localities of 1106 cholera cases was kept, and the following is the result:—

* There is a very unwholesome substitute for sinks in some portions of Glasgow.

Proportion of Flats affected with Cholera in Glasgow.

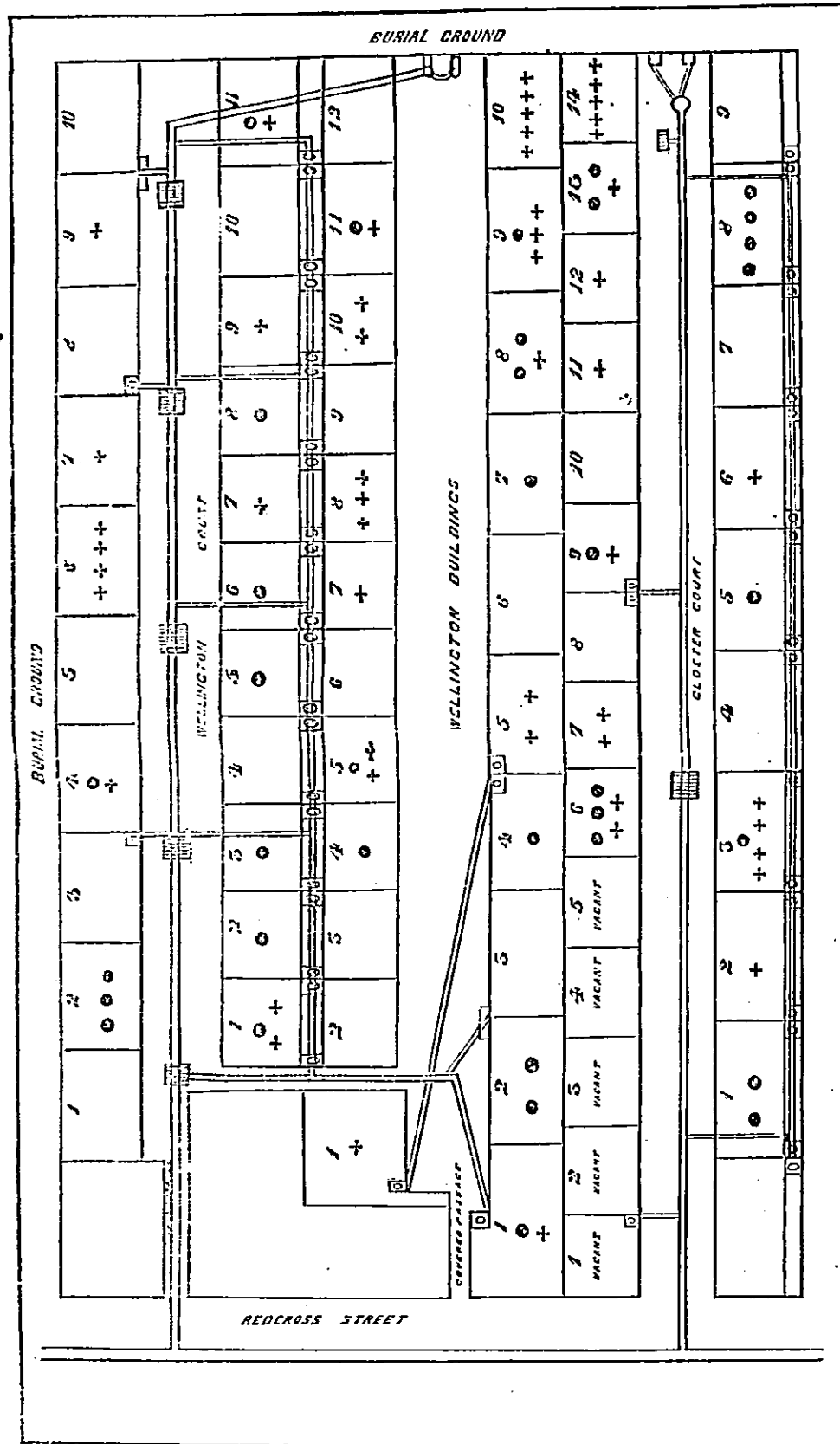
Flats.	Cholera Cases.	Percentages.
Sunk flats	29	2·61
Ground flats	311	28·1
Middle flats, two or three in } number in each tenement . }	408	36·89
Top flats	358	32·37

If the percentages of cases occurring in the middle flats were divided among them, it would give to the top flats a proportion of epidemic cases from 2 to 2½ times as great as that belonging to each of the middle flats. The latter are also by far the most populous. The sunk flats are too few in number to give a result; but the relative unhealthiness of different stories stands as follows:—The middle floors are the most healthy, as being equally removed from the effects of the upward drainage of the foul and unwholesome internal atmosphere, and the offensive exhalations from the uncleansed and undrained streets below. From their greater proximity to the latter cause of disease, the ground flats rank next in unhealthiness; while the top flats from becoming, as it were, cesspools for the aerial drainage of all the stories below, were found to be by far the most liable to attacks of epidemic cholera. The result is very striking, and points to the existence of causes of epidemic disease in the Scottish cities which have hitherto attracted too little attention. They are the same in character, but far more aggravated in degree than those which have been observed to exist in the upper flats of unventilated cottages and workshops by Mr. Chadwick and other observers.

7.—Defective Sanitary Alterations, &c.

The first outburst of cholera in the city of Bristol took place in three courts in Red Cross-street, known by the names of Wellington-court, Wellington-buildings, and Gloucester-court, which cover a piece of land 56 yards in length by 37 in breadth. This measurement includes the houses in Red Cross-street, so that the actual area covered by the courts is about 1850 square yards. On this oblong piece of land are 6 rows of houses built back to back, making in all 66 dwellings. An overcrowded graveyard extends along two sides of the ground, and on the other two sides it is shut in by buildings, and two out of the three courts are entered from Red Cross-street by narrow covered passages about 10 yards in length, the third court being open. Were there no other unfavourable circumstance than the position which these courts occupy, it would be sufficient to account for their unhealthiness, the only ventilation they receive being from the adjacent burial-ground, the drainage from which no doubt also exercises a most injurious influence on the neighbourhood. The houses are very small, and when the disease broke out they were crowded with people. The supply of water was deficient and impure, and was derived for all the three courts from one pump in Wellington-court, into which there had been an escape of drainage, either from the sewer of the court, which passed

PLATE 3.



Plan of Courts in Red-Cross-street, Bristol, showing the position of the privies, drains, gully-holes, and burial-ground. The deaths from Cholera are marked by black discs, the recoveries by crosses.

close to it, or from the burial-ground. A sewer runs through Red Cross-street, which is connected with two drains in Wellington-court and Gloucester-court; but there being no fall to carry off the drainage, the court drains were constantly full of the refuse of the privies. These drains are in fact the cesspools of all the houses, and they communicate directly with the surface of the courts by a large number of ill-trapped gully-grates, the effluvia from which are at times most horrible. The people were obliged to cover the gratings with canvas pressed down by a weight.

The position and construction of the privies require also to be noticed. On one side of Wellington-court there are two in the houses, and one in the court itself. On the opposite side there are 11 houses, corresponding to the same number in the next court, called Wellington-buildings. Between these two rows of houses there is a narrow space, which contains the privies belonging to both. The privies in Wellington-buildings are placed some of them behind the houses, some within the houses, and some in the courts. In Gloucester-court there are two privies in the court, and three in the houses on the left-hand side. Behind the houses on the right-hand side there are 18 privies belonging to them and to the dwellings of the adjoining street. Many of the privies are badly constructed, and allow the percolation of soil through the masonry. These conveniences communicate directly with the court drains by branch drains passing underneath the floors of some of the houses, and were either not trapped at all, or so inefficiently done as to afford no obstacle to the escape of the poisonous effluvia which filled the interspaces between the houses, and found a ready entrance at all times into them by means of the back doors. The extent of these evils will be better understood from the accompanying plan (Plate 3). It would indeed be difficult for human ingenuity to contrive and arrange a set of conditions more thoroughly unhealthy, or more likely to predispose the inhabitants to epidemic disease. Sixty-six houses shut in on two sides by a graveyard, on the other two sides by the adjoining buildings, honeycombed with cesspools, the atmosphere of the dwellings and courts polluted by the continued admixture of putrid exhalations from a number of open conduits, so as to impregnate the whole air both internally and externally with a strong cesspool odour, notwithstanding the use of chloride of lime for the purpose of abating the nuisance; add to these things a deficient and poisonous water-supply, and an overcrowded population, and there will be no difficulty in accounting for the catastrophe which followed. I subjoin on the following page the statistics of the attack which took place on the 10th of June, 1849, sent to me by Mr. Williams, medical officer of the district, to whom I am also indebted for the plan of the locality.

A more deplorable event perhaps never occurred than these tables describe. A very slight consideration of the whole circumstances is in my opinion sufficient to prove that this great sacrifice of human life was occasioned by ignorance or negligence, as flagrant as any which from time to time gives rise to railway or other accidents. A glance at the plan will show that something like sanitary improvements had actually been contemplated; and no doubt it was believed that the object would be attained if only a sufficient number of drains and privies were constructed. Like every other step taken in a false direction, the

so-called improvements increased the evil they were intended to mitigate, and, with the other circumstances above detailed, caused the untimely death of many innocent persons.*

WELLINGTON COURT.

Houses.—Left side.			Houses.—Right side.		
No.	Cases.	Deaths.	No.	Cases.	Deaths.
1	..	..	1	3	1
2	3	3	2	1	1
3	..	..	3	1	1
4	2	1	4	..	..
5	..	..	5	1	1
6	4	..	6	1	1
7	1	..	7	1	..
8	..	..	8	1	1
9	1	..	9	1	..
10	..	..	10	..	..
			11	2	1
Total .	11	4	Total .	12	7

The three deaths in No. 2, on the left-hand side of the court, took place in a family who had just removed from Gloucester-court. An inspection of the plan will show at once why the left-hand side should have suffered less than the right. It will be seen that the latter has a row of open privies behind the houses, and that a death took place in every house under the floor of which a drain passed:—

WELLINGTON-BUILDINGS

Houses.—Left side.			Houses.—Right side.		
No.	Cases.	Deaths.	No.	Cases.	Deaths.
1	1	..	1	2	1
2	..	..	2	2	2
3	..	..	3	..	..
4	1	1	4	1	1
5	3	1	5	2	..
6	..	..	6	..	..
7	1	..	7	1	1
8	3	..	8	3	2
9	..	..	9	4	1
10	2	..	10	5	..
11	2	1			
12	..	..	
Total .	13	3	Total .	20	8

* Notwithstanding the terrible warning given in this case, and the temporary measures adopted at the time, I learn from Mr. Clark's report on Bristol, which I have seen while this sheet is passing through the press, that within twelve months after the catastrophe everything has reverted to its old condition, and were cholera to recur it would find its former haunts ready to receive it!

GLOUCESTER-COURT.

Houses.—Left side.			Houses.—Right side.		
No.	Cases.	Deaths.	No.	Cases.	Deaths.
1	uninhabited.*		1	2	2†
2	ditto		2	1	..
3	ditto		3	5	1
4	ditto		4	..	..
5	ditto		5	1	1
6	5	3	6	1	..
7	2	..	7	..	..
8	..	..	8	4	4
9	2	1	9	..	..
10	..	..	
11	1	..			
12	1	..			
13	3	2			
14	5	..			
Total .	19	6	Total .	14	8

The following is a summary of the attacks:—

Courts.	Inhabited Houses.		Cases of Colera.	Deaths.
	Attacked.	Free.		
Wellington-court .	14	7	23	11
Wellington-buildings	15	7	33	11
Gloucester-court .	13	5	33	14
Totals . . .	42	19	89	36

The total number of deaths from first to last was 44.

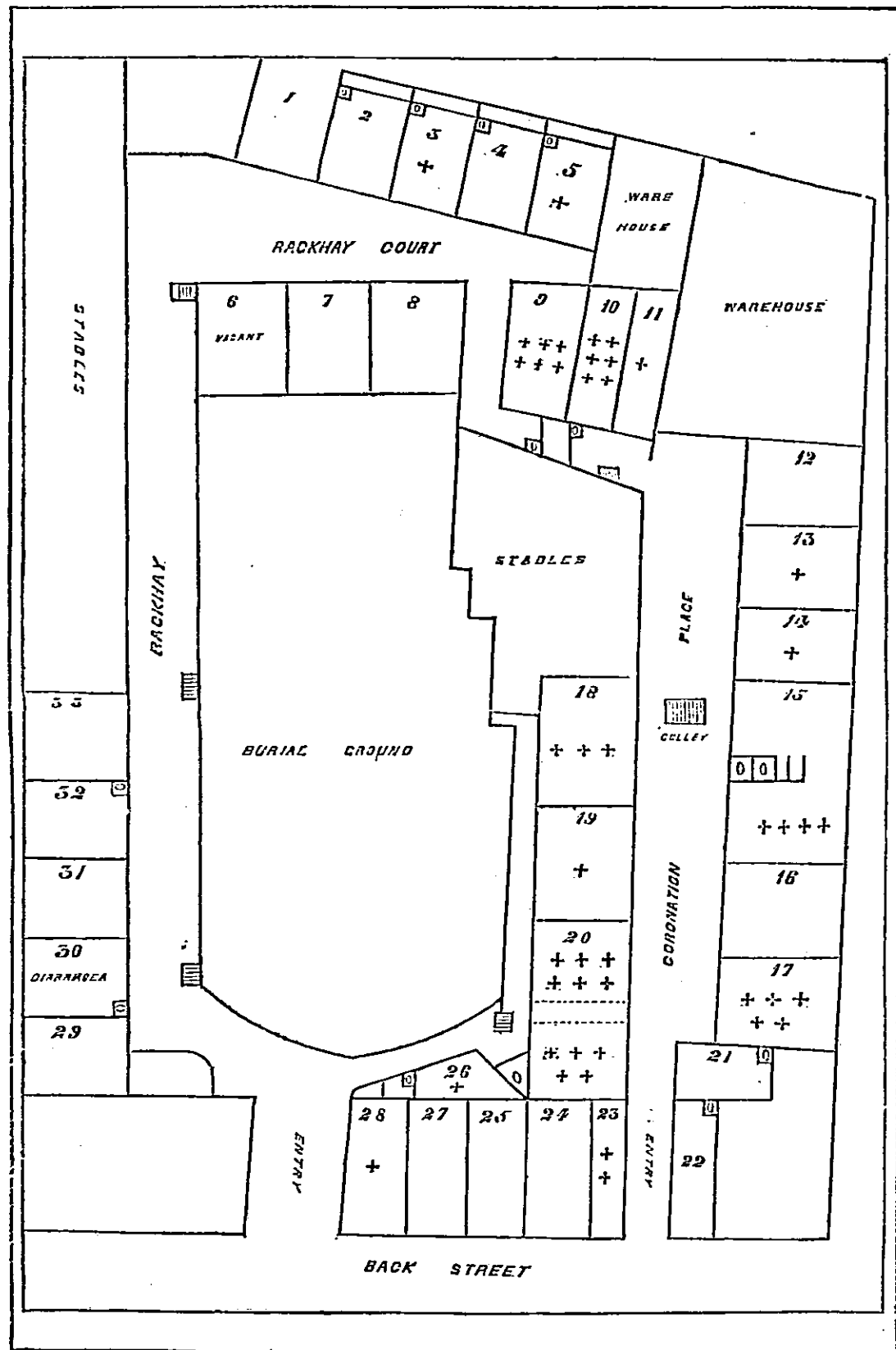
8.—Graveyards, &c.

Bristol affords more than one example of an outburst of cholera, in which a chief exciting cause was the existence of an overcrowded burial-ground in the affected locality. The most striking of these illustrations is afforded by a place called the Rackhay, situated in St. Nicholas parish, and behind the front row of houses in Back-street. The Rackhay consists of an irregular square of buildings, entered from the street by an arched passage, and having a burial-ground occupying the whole centre of the square, with only a narrow passage, varying in breadth from 6 feet to 11½ feet, between it and the houses. Running parallel with one side of this square, and separated from the burying-ground by a row of cottages, is a long narrow court called Coronation-

* The inhabitants of the first five houses fled on the appearance of the disease, and none of them suffered.

† These deaths took place immediately after the family had left Gloucester-court, on account of the attack of cholera. The only two privy-drains which pass under the houses are those in No. 1 and No. 8 on the right-hand side, where the greatest mortality took place.

PLATE 4.



Plan of the Rackhay and Coronation Court, Bristol. The crosses show the number of Cholera cases. The position of the gully-grates and privies is also shown.

place, which has a similar ventilation to that of the Rackhay. The burial-ground is about 80 feet in length, and between 40 and 50 in breadth, and the surface of the earth in it is about $4\frac{1}{2}$ feet above the level of the pavement in the courts. It is completely surrounded by houses, and there are drains with open gully-grates close under the external walls, the odour from which was most offensive, and had an unmistakable graveyard smell. The surrounding houses are 33 in number, and there are in addition two stables in Coronation-place, the walls of others forming part of the boundary of the Rackhay. A number of offensive privies are contained in the houses, and in Coronation-place is a large offensive gully-grate, while another opens into a small yard at the top called Gun-yard. The relative position of the affected locality will be easily understood from the annexed plan (Plate 4), which also exhibits the number of houses attacked, with the casualties in each. The following table exhibits the general statistics of the attack from the commencement to July 15th:—

Outbreak of Cholera in the Rackhay.

Houses.	Inmates.	Cholera Cases.	Deaths.	Houses.	Inmates.	Cholera Cases.	Deaths.
1	3	..	..	18	6	3	..
2	11	..	..	19	4	1	1
3	7	1	1	20	24	11	7
4	10	..	..	21	5	..	..
5	13	1	..	22	6	..	..
6	empty	..	..	23	2	2	1
7	8	..	..	24	3	..	..
8	8	..	..	25	4	..	..
9	8	6	4	26	4	1	..
10	8	6	4	27	8	..	..
11	2	1	1	28	9	1	1
12	4	..	..	29	2	..	..
13	11	1	1	30	10	diarrhoea	..
14	8	1	..	31	unaffected	..	..
15	16	4	2	32			
16	4	..	..	33			
17	14	5	3				

Up to the end of the attack the number of cases was as follows:—

Cholera	47
The deaths	33
The recoveries	14

It will be seen by a reference to the plan, that the disease confined itself chiefly to the houses on the right-hand side of the burial-ground, where the attack ran its course with great severity. Had it continued for a longer period, it is probable that not a house would have escaped, as diarrhoea had begun to appear in the houses on the left-hand side. There were no local sanitary defects which tended to make the Rackhay more liable to an epidemic outburst than other districts in the same neighbourhood, except the presence of the burial-ground, and the polluted state of the drainage, to which I have no doubt it materially contributed. At that period, however, the neighbouring localities escaped, with the exception of one small district close to another

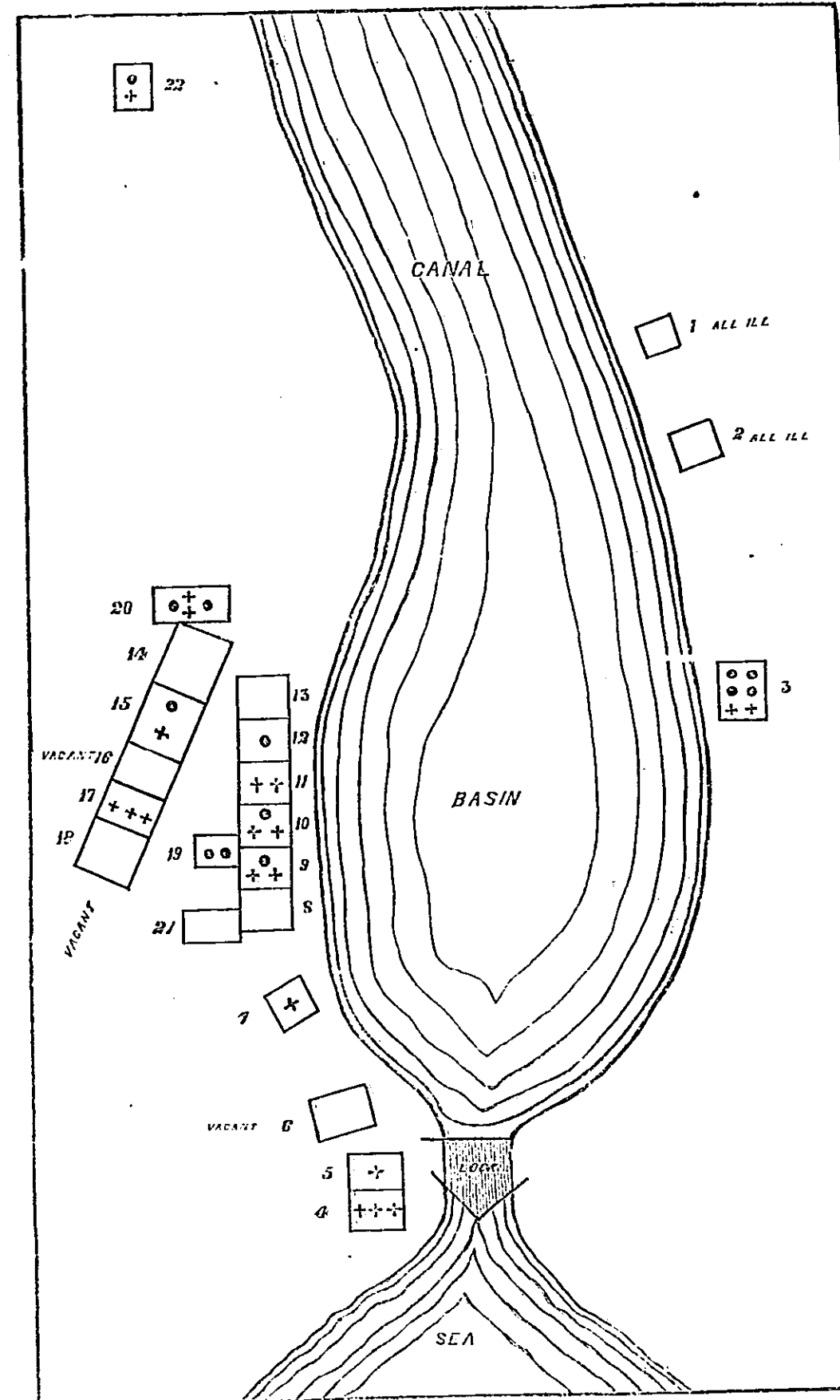
burying-ground, behind the opposite side of Back-street, where several severe cases of cholera occurred. It is impossible to decide whether the burial-ground was the sole cause of the visitation, but all the circumstances tend to prove that it was at least one of the most powerful agents in determining the localization of the epidemic.

9.—*Exhalations from Putrescent Mud.*

While epidemic cholera was prevailing in the town of Cardiff in the month of June, 1849, a sudden attack of the disease took place at a locality about a mile and a half distant from the town, under circumstances which could leave no possible doubt as to the *exciting cause* in that special instance. There is a considerable tract of unoccupied land between Cardiff and the sea through which the canal passes, and at the point where it enters the sea there is a lock and basin, on either side of which are a number of houses. There are also houses at some distance from the line of the canal, but they are exposed to conditions in every respect similar to the rest, with the single exception of their being placed beyond the reach of any exhalations which might arise from the canal. If the outbreak about to be described had arisen from merely general causes, the probability is that all the neighbourhood would have suffered equally; but every house escaped except those close to the side of the basin, and the reason of such a selection will be sufficiently obvious.

The position of the affected houses with regard to the exciting cause of the disease will be best understood by reference to the annexed plan (Plate 5).

On the 26th of May the end of the canal nearest the sea was emptied, in order to admit of repairs of the lock. By this process a large surface of black putrescent mud was exposed to the direct action of a hot sun, and the result was, that very offensive effluvia were immediately perceptible. The smell was complained of by the inhabitants of all the adjoining houses, and produced a variety of symptoms, varying in intensity in different individuals. The most common was general indisposition and oppression of the nervous power, marked by languor and lowness of spirits, and also with some degree of giddiness. To these in a number of instances succeeded general prostration, coldness, tremors, vomiting, diarrhoea, cramps in the bowels, developed cholera, and death. An intelligent woman described the manner in which she was seized, as follows:—She was affected with nausea, vomiting, cramps in the bowels, and purging, but she rallied from the disease, and finally recovered. In the same house, however, six persons were seized with cholera, and four died. A number of workmen were engaged in the repairs of the lock, some of whom lived at a distance in the country, and others lodged in the neighbouring houses. There were also loungers hanging about the works. Several of the workmen who slept in the country were seized with cholera on their return from their work, although there was no disease in the place where they lived. Amongst the men who lodged near the canal several were attacked, and the idlers also suffered more or less. One day, while I was at the lock, the timekeeper was suddenly struck down. The attack resembled a very violent cold stage of intermittent fever. It was, however, true cholera, from which by prompt treatment he recovered.



Sketch of the Sea Lock, and Basin of the Canal at Cardiff. Deaths from Cholera marked by black discs, recoveries by crosses.

The following table exhibits the number of casualties. The numbers of the houses refer to the corresponding numbers on the plan:—

Houses.	Inmates.	Cases of Sickness.	Deaths.
1	4	All more or less ill . . . . .	..
2	6	All ill, one severely . . . . .	..
3	6	6 cholera	4
4	9	3 cholera . . . . .	..
5	5	1 cholera . . . . .	..
6	Vacant.	..	..
7	5	1 cholera . . . . .	..
8	6	No sickness . . . . .	..
9	10	3 cholera	1
10	14	3 cholera	1
11	6	2 cholera . . . . .	..
12	4	1 cholera	1
13	6	No sickness . . . . .	..
14	2	No sickness . . . . .	..
15	8	2 cholera	1
16	Vacant.	..	..
17	14	3 cholera . . . . .	..
18	Vacant.	..	..
19	2	2 cholera	2
20	7	4 cholera	2
21	1	No sickness . . . . .	..
22	2	2 cholera	1

TOTALS.

Inhabited houses	19
Houses affected	15
Houses free	4
Total cholera cases	33
Other cases of sickness	10
Deaths	13
Total population	117

The works of the canal were finished as expeditiously as possible, and the water admitted. Persons on the spot stated that the air felt purer immediately, and the disease was arrested, partly from the removal of some of the people, and partly no doubt from the covering of the mud at the bottom of the basin with a stratum of water.

10.—*Drunkenness—Fatigue.*

The influence of habits or acts of intemperance in occasioning attacks of cholera has long been fully recognised. It will, therefore, be unnecessary for me to do more than give a few general conclusions and illustrations from the experience of the late epidemic. A striking instance of the fatal results of drunkenness occurred on board a vessel in the roadstead of Sunderland early in October, 1848. This vessel had arrived from Hamburg, and one death had occurred on board shortly after leaving that port. She was consequently put in quarantine, and I went alongside of her in a small steamboat, for the purpose of making the needful inquiries. I saw all the crew, who appeared to be in perfect health, and one middle-aged man was especially communicative, and afforded a good deal of information in regard to the vessel. I gave the people instructions how to act in case the disease should again appear, and

especially cautioned them to avoid intoxication, which I assured them would lead to certain death. This was about seven o'clock P.M., and, immediately after I left, the man referred to went down to the fore-castle, where he had secreted a bottle of brandy at Hamburg, and drank a large quantity. In an hour or two afterwards he was collapsed, and died the next morning at seven o'clock.

I have elsewhere instanced the case of the village of Carnbroe, in Lanarkshire, as affording a striking proof of the results of intemperate habits in predisposing to cholera.

Similar drinking habits led to a great increase of the cholera cases in Glasgow, in spite of the preventive measures, which had previously made a distinct impression; and it was observed that periodic augmentations of the disease were coincident with the earlier days in each week, which could only be attributed to the intoxication which followed the weekly receipt of wages. While discussing the removable causes of cholera, I cannot but express regret at the small amount of restraint which has hitherto been put on this abominable vice. The whole licensing system, and the way in which it is too frequently administered, are a public disgrace, and call urgently for reform. In every fresh outburst of cholera, persons of dissipated, intemperate habits have been the first to fall victims to the disease, and I feel assured that many lives were sacrificed which might have been saved, had the vice of drunkenness met with that discouragement on the part of authorities and the legislature which its detestable and brutalizing tendency, as well as its injurious effects on the public health, have so long demanded.

Effect of Fatigue.—During the prevalence of an epidemic constitution, fatigue is a powerful predisposing cause to attacks of cholera. I have seen a great number of instances of this amongst different classes of people. Persons engaged in iron-forges, and other equally laborious occupations, have suffered in large proportion. The length of time during which the exertion is continued appears to be a more important element than the actual present amount of work, and hence it has been necessary in a number of instances to place the men on what are called short shifts.

From want of attention to this matter, casualties have occasionally taken place amongst nurses in hospitals, and this class of cases is sometimes ranked amongst the results of contagion by inexperienced observers. Medical men have also suffered from a similar cause. I am not aware that any individual died while acting under my own special instructions, and I attribute this favourable result to my having endeavoured to impress upon them the necessity of avoiding over-exertion, and of making immediate application for additional medical aid as soon as they found it necessary. I am sorry to say that I have known instances where a different course was pursued from inadvertence. I met with one case in which the medical officer of a district gave each of his two assistants 24 hours' work and 24 hours' rest alternately. His object was a good one, but the result was fatal to the young men, and in little more than a week both were dead.

The preceding illustrations may be taken as examples of the class of causes which have led to severe outbreaks of cholera all over the country; and, in order to save repetition, I subjoin the following abstract of those defective sanitary conditions which I found in the various cities

and towns which were under my personal inspection during the late epidemic:—

Brief Abstract of Localizing Causes of Cholera.

EDINBURGH.—*Parts attacked.*—Usual fever localities; former seats of cholera; filthy closes and streets; no drainage; stairs, passages, and houses filthy, overcrowded, and unventilated; no domestic conveniences of any kind; water-supply bad; houses often dilapidated; pigsties, middensteads, and other worse nuisances; excreta and other household refuse retained in houses; closes and streets narrow, confined, and ill ventilated.

Parts which escaped.—The new town. Streets open, wide, well paved and sewered; houses clean, large and airy; good water-supply and drainage. Diarrhoea prevailed extensively, proving the presence of the epidemic, but only a very few cases of cholera.

I had three maps of Edinburgh prepared; one showing the usual fever tract; another the tract of the cholera; and on the third were marked the localities in which the sanitary conditions were found on inspection to be the most favourable for propagating epidemic disease. On comparing the three maps it was found that the markings in all coincided.

LEITH.—Cholera confined to old fever localities, and the seats of the epidemic of 1832. First case occurred in a house close to the one first attacked in 1832. Affected localities filthy, undrained; water-supply defective; badly paved, overcrowded, and unventilated.

PORTOBELLO.—Affected localities damp, unsewered, and without drainage. First cases occurred close to a stream of water, and in a dark cellar habitation under the level of the street.

NEWHAVEN.—Attack chiefly confined to cottages built on the slope of banks. No sewerage or drainage, and the percolation of the moisture from the bank rendered the foundations damp. Affected streets unpaved, or badly paved; middensteads close to the houses; refuse of fish allowed to accumulate; water-supply defective.

GLASGOW.—Cholera began at Springbank; affected houses close to canal, or considerably below its level; whole subsoil charged with water; no drainage; old quarries filled with putrescent fluid; pigsties, middensteads; whole district in a very bad sanitary state, and the usual centre from which epidemics begin and spread over Glasgow. The affected parts of Glasgow the usual epidemic localities. Long narrow closes with lofty houses, middensteads, cow-byres, stables, &c., all of which are sometimes under the houses; whole localities filthy, without domestic conveniences; no household water-supply; population greatly overcrowded; houses unventilated, often dilapidated; passages and staircases very filthy; no drainage; sewerage very imperfect and injurious. Diarrhoea prevailed over the whole city, showing the presence of the epidemic; but cholera confined to the worst localities, except in comparatively few cases, where the premonitory diarrhoea was neglected. As a general rule, the epidemic was most severe in those neighbouring villages in which sanitary precautions were most neglected.

DUMFRIES AND MAXWELLTOWN.—Have been very liable to epidemics

from time immemorial; situation of town in a hollow, surrounded by water of the Nith, and a large extent of wet moss-land; sewerage imperfect; no drainage; whole subsoil damp, and green mosses growing on the walls of the houses even of the best class. Whole town attacked with diarrhoea, but cholera chiefly confined to low damp localities, and there the better class of houses attacked. Parts inhabited by the poorer classes, where the disease was most prevalent, consist of long narrow closes, ill-paved and filthy, with numerous pigsties and middensteads. People accumulate manure for sale close to their dwellings. Water-supply derived from the Nith below the opening of the sewers, and carted in barrels through the town, and sold in small quantities at a high price. Town very filthy and neglected when cholera broke out. Houses dark, confined, unventilated, and in some instances overcrowded.

Maxwelltown is situated on the opposite side of the Nith, and is partly built on the slope of a steep hill, the houses abutting close upon the water. The whole of the affected district was exceedingly filthy, and contained large accumulations of manure and many pigsties. It is undrained, and the water from the hills percolates laterally under the foundations of the houses, so as to render them damp. The water-supply is derived from the river, at points where a good deal of filthy surface-drainage empties itself. From these co-existing causes, the population suffered very severely in proportion to their numbers.

COATBRIDGE, NEAR GLASGOW.—Damp; canal runs through the town; the chief localizing causes, want of drainage, deep gutters running in some instances close to the houses, and containing the accumulated filth of the households. Many of the houses attacked incapable of ventilation, from the impossibility of opening windows. Overcrowded lodging-houses.

CARNBROE IRONWORKS.—Situation elevated and open; undrained; houses without ventilation, and some overcrowded. A severe outburst of the disease took place after the people had been drinking for several days.

PAISLEY AND CHARLESTON.—Affected parts like the usual run of manufacturing towns, and displaying the usual absence of sanitary precautions. Amongst the same class of houses, those suffered most of which the water-supply was defective and derived from wells, while those supplied from the town waterworks suffered least. The suburb of Charleston was very severely attacked, and a number of cases of "cholera sicca" were described as having occurred. The locality is open, and somewhat elevated, but exceedingly wet, and has no drainage. The neighbourhood of the houses filthy, and abounding with dangerous nuisances. Water-supply derived from wells, which are very apt to get foul, from the infiltration of impure fluids from the surface. The whole subsoil charged with water, and a filthy stream runs through the place.

POLLOKSHAW.—Usual fever localities attacked. The first case of cholera, during the late epidemic, occurred in the same house and in the same bed in which the first case occurred in the epidemic of 1832. River-banks much affected. Apartments very small, close, and overcrowded. Whole town damp from want of drainage. Many pigsties and other nuisances.

HAMILTON.—Suffered severely; built chiefly on hill-slopes and hol-

lows, without drainage. Many of the houses attacked old and dilapidated; overcrowded. Whole sanitary condition defective, but the chief element appears to have been dampness in the subsoil, percolating from the slopes.

KILBIRNIE.—The whole town in a wretched neglected condition; no drainage or paving; damp and filthy in the extreme; middensteads full to overflowing under houses. A large open cesspool in front of some cottages in which a great mortality occurred. Another line of cottages had an open cesspool extending the whole length of the street, with privies over it. No conditions could well have been worse. The attack very severe.

INVERNESS.—Town generally very clean; and the affected district, to a superficial observer, might appear in a good condition. Cause of the disease, however, very obvious. Affected houses built on the shingly bank of the Ness, and their foundations below high-water mark; the whole subsoil percolated with water from this cause. A hole dug a few feet deep in the shingle and gravel, and at a considerable distance from the river, collects water immediately. Water-supply from the river; brackish and unwholesome. Cottages generally small and old, and no means of ventilation.

DUNDEE.—Sanitary condition of all the affected district extremely bad. Built on the slope of a hill, undrained, subsoil damp. A large tenement of houses suffered severely, situated in a narrow confined locality; its courts badly ventilated, undrained, and containing offensive nuisances; staircases and passages dark and narrow; houses small, badly constructed, and unventilated; population overcrowded. This tenement suffered from causes similar to those which exist in overcrowded work-houses. Affected parts in general filthy, and many nuisances. Atmosphere of the town rendered further impure by the use of foul water for the factory steam-engines, which is turned out to cool in large open reservoirs in the heart of densely-peopled neighbourhoods. The factory privies are emptied into certain of these reservoirs. A railway runs between the town and the river Tay, so as to cut off the natural drainage; and between the railway embankment and the shore there are enormous accumulations of sewerage and other offensive drainage, covering many acres. I consider the exhalations from these deposits to have exercised a very marked influence upon the health of the population living on the hill-slopes above and at a distance from the reservoirs.

SUNDERLAND.—A very severe outbreak of cholera took place at a large neighbouring colliery, in a number of cottages which had been built only a short time previously on a piece of land which had been a complete swamp and without any drainage. It was stated to me that the places were inhabited before the walls were dry, and that the disease appeared shortly afterwards. Sunderland parish was chiefly affected, the disease attacking the old epidemic localities. The town is built on the slope of a hill, without adequate drainage. The streets and closes are narrow, badly paved, and excessively filthy. The sewers, where they do exist, badly constructed, with enormous, untrapped, offensive gully-grates, close to several of which violent attacks of the disease occurred. These districts abound with offensive nuisances. There are no domestic conveniences, and the public thoroughfares are often made places of de-

posit for disgusting refuse; the pavement often full of holes, containing filth of all kinds. The houses unventilated, old, dirty, and many of them overcrowded. There is also a considerable cellar population. The higher, more open, and better paved, cleansed, and ventilated streets of Bishopwearmouth escaped almost entirely. There was a good deal of diarrhoea, marking the presence of the epidemic, but very little cholera. The similar districts of Monkwearmouth also escaped.

LIVERPOOL.—This large town has been long notorious for its extremely defective sanitary condition and its liability to epidemic disease. Since the epidemic of 1832 a great deal has been done in the improvement of its drainage, paving, and cleansing, and a vast number of its subterranean cellars have been evacuated. The remaining causes of unhealthiness are defective water-supply and drainage, and the existence of thousands of open cesspools and middensteads. These will, it is to be hoped, be rectified in time under the operation of the Sanitary Act, but there is one special element of disease which appears to have predominated in the present case. It is well known that Liverpool is the most densely built town in the kingdom, and that it has its population more closely packed and overcrowded than any other. Until this great evil can be remedied Liverpool will still be liable to epidemics, mainly confined to those localities where these defective conditions prevail. Occasionally the higher and suburban districts suffer from epidemic disease, which is attributable to the wet clay soil of the neighbourhood, and the almost total neglect of agricultural drainage.

MANCHESTER.—All the affected parts of Manchester were marked by distinct causes of disease, which will be found specified in the Report on the Relief Measures, while the better parts of the town escaped; this was specially observable in Chorlton, where cholera was distinctly localized by causes such as those mentioned. Chorlton affords a very striking example of every conceivable sanitary defect accompanying an epidemic seizure of extraordinary severity. This occurred in a small street of three houses, situated close to the Medlock, which at that point is neither more nor less than a wide, open sewer. Over this street an arch of a railway bridge passes, so as to exclude light and air. The only access is by a narrow, dark, filthy passage, and its only ventilation is tainted by the foul exhalations from the river. *No fewer than 12 cases of cholera occurred in this locality.* Although the wide, open, regular streets of Chorlton escaped the disease, there was one exceptional case, in which a number of houses built over the course of an old brook, now a common sewer, and having their drainage connected with it, were attacked. The exception in this case is a valuable piece of evidence. The Board of Guardians of Chorlton Union caused an inquiry to be made into the sanitary condition of Chorlton, Ardwick, and Hulme, the result of which was the production of three valuable reports proving the causes which led to the localization of cholera. *This enlightened proceeding, if followed by other Boards, would very soon lead to the discovery of the sources of much of the disease and pauperism which press so heavily on the country.*

The cholera in Salford occurred chiefly in narrow, confined, ill-ventilated, and badly drained streets, but some of the notorious fever localities escaped on account of alarm having been taken at their condition, and the

requisite sanitary improvements effected in anticipation of the appearance of the epidemic. One open street suffered severely from the use of unwholesome water. Every house in which this water was used was attacked either with diarrhœa or cholera, while the houses of the district in which it was not used escaped.

HULL.—From its peculiar local position and other circumstances the whole of the borough of Hull is in a defective sanitary condition, and, had the epidemic influence been more powerful than it really was, the calamity which befel the town must have been wide spread and destructive. The drainage of Sculcoates and North and South Myton takes place into open, stagnant, offensive ditches, and at present is altogether insufficient for the wants of the town. The subsoil is damp, and the atmosphere moist and heavy. The parts more peculiarly liable to epidemic disease are close, narrow, and ill-ventilated neighbourhoods, badly paved and cleansed, and abounding with pigsties and other nuisances. Many of the slaughter-houses are most offensive and disgusting, and do a great deal of mischief. Some portions of the borough in Sculcoates union were in a worse condition, in regard to cleanliness, than any localities I have visited. Before the cholera appeared they were covered with enormous manure-heaps of the most dangerous and offensive kind. I have elsewhere shown the fatal effects of these accumulations on the health of the neighbourhood. In fact, the cholera located itself in the worst parts of the borough; and in all the instances which came under my own personal observation, it made its selection where the population had evidently been suffering from the effect of long antecedent predisposing causes of disease. Here, as elsewhere, the better parts of the town and neighbourhood escaped.

WOLVERHAMPTON UNION.—Cholera first appeared at Bilston in this union. The town is remarkable for the absence of every precaution of a sanitary nature. It is closely built; a large part of it overcrowded; its cleansing and paving are bad; it has no drainage, and no proper water-supply. A brook runs through the town, which is little better than a common sewer, and the water has been used for domestic purposes by the adjoining population. It also supplies water to a steam-engine, which, after having been used for the purposes of condensation, is permitted to cool in a large pond in the immediate vicinity of the houses. This nuisance had been frequently complained of. Cholera broke out in the adjoining houses, and immediately afterwards attacked Wolverhampton and Willenhall. The parts of the former place which chiefly suffered were narrow, confined, undrained, unventilated, and overcrowded localities, while the more open and better parts of the town escaped. Willenhall is traversed by open, filthy, stagnant ditches, and the soil on which it is built is damp and undrained. These circumstances led to a very severe attack both of diarrhœa and cholera.

LEEDS.—Usual fever localities affected; imperfectly drained, paved, and cleansed; many open, offensive gully-holes; neighbourhoods close, ill-ventilated, and overcrowded; narrow courts and streets, with middens open, and privies close to, and in many instances under the houses; cellars numerous, and many overcrowded lodging-houses. Water-supply, where obtained from wells, frequently unwholesome; and exhibited, under the microscope, a considerable amount of animal and

vegetable matter, apparently proceeding from the percolation of impure fluids from the surface.

SHEFFIELD.—Nearly the whole town and neighbouring villages suddenly attacked by diarrhœa; cholera confined to a few localities close to the river-banks. One of the most prominent evils in the affected places, whether in Sheffield or the neighbourhood, was the state of the water, either being drawn from the river, or from wells which received impurities. This water, under the microscope, afforded indications of a large amount of animal and vegetable matter. The precautionary measures taken by the board of guardians were of so efficient a nature that the usual causes of disease were removed, while this one remained in a few circumscribed localities.

BRISTOL.—Cholera attacked old fever localities; some of the worst, which had been put in a good sanitary condition, escaped. The predominating causes were defective cleansing, especially in the outparishes; an inefficient and in some instances a positively dangerous state of the drainage, affording several striking illustrations of the evils of ill-considered sanitary alterations; overcrowded graveyards; narrow, close, confined localities; and the use of impure well-water, which in some instances was found to be extremely offensive, apparently from the influx of sewerage. The disease showed a strong tendency to locate itself in the neighbourhood of the harbours, and along the river-banks. The higher, more open, and better built portions of the borough, although exhibiting marks of the presence of the epidemic influence, nevertheless escaped the disease.

GLOUCESTER.—The attacks of cholera were in this city confined chiefly to low, close, overcrowded neighbourhoods. Scattered cases occurred in other unhealthy parts of the city, showing the prevalence of the epidemic constitution; but the disease, faithful to its law of localization, showed itself in the greatest proportion where the conditions were most congenial. Proximity to the river, the neighbourhood of nuisances, overcrowding, want of drainage, and an impure water-supply, were the obvious localizing causes.

CARDIFF.—This town is situated on flat, low, undrained ground, abounding with water, and a canal running through it. Though the whole locality is subject to these predisposing causes, it appeared that other conditions were required to excite the activity of the epidemic influence. The open, airy, clean localities escaped with some diarrhœa, while cholera attacked individual houses situated in close, confined, ill-paved neighbourhoods. Proximity to offensive nuisances or to the canal banks, and overcrowding of houses, in many instances entailed on the inhabitants severe outbursts of the disease. A remarkable instance of the effect of a distinct and specific local cause was shown during the repairs of one of the canal locks. A detailed account of this fatal catastrophe has been already given.

MERTHYR TYDFIL AND DOWLAIS.—Before the cholera appeared, Merthyr was perhaps one of the dirtiest towns in the country, and contained thousands of cartloads of manure and house refuse scattered over it. The inhabitants had no means of domestic cleanliness, and no water-supply; and the river which runs through the town is a common sewer,

from the quantity of filth and other matters which it receives in its course. The disease was most severe in those parts of Merthyr and Dowlais which are built on hill-sides—the law as to the natural unhealthiness of such localities, if unprotected by drainage, holding good in these as in other places. Few localities have suffered more than Dowlais, and it would be difficult to find one in which the sanitary conditions were altogether so bad. The paving was defective, no drainage, no water-supply, no household conveniences, no cleansing, and the atmosphere always in a comparatively impure state from the proximity of iron-furnaces. In addition to these predisposing causes, the houses were totally unventilated. Indeed, I do not remember to have seen a single window that would open at top.

TAIBACH.—This village is situated on a flat close to the sea-shore. There are extensive salt-marshes in the neighbourhood. The locality is damp and undrained, and the houses in some instances overcrowded. The ventilation has been obstructed by a railway embankment running through the town. I consider the natural defects in the position of this place and the habits of the population as having predisposed them to the disease.

ROMSEY.—Is built on flat land, permeated by water. It is traversed in all directions by watercourses, some of which run beneath the surface. It is undrained. The first attack of cholera took place in a very small detached house in a densely-peopled neighbourhood. On two of the sides of this house, and close to the foundations, there were two large cesspools filled with offensive matter. The houses in the immediate neighbourhood also suffered. They were remarkably small, without ventilation, and the population overcrowded.

PLYMOUTH.—An outbreak of cholera took place on board an American emigrant ship (the "American Eagle") which put into this port, after having lost a number of the passengers and crew. The chief circumstances of a local nature which appear to have determined the epidemic seizure were overcrowding and defective ventilation. The sufferers were all either steerage passengers or sailors, who slept in a very close crowded fore-castle. In neither case were the means of ventilation at all adequate. The cabin passengers, whose quarters were clean, open, airy, and thoroughly ventilated, and where every inmate had sufficient cubic space, escaped entirely. There was not even a case of diarrhœa among the cabin passengers, while those in the steerage suffered very much both from diarrhœa and cholera.

LONDON.—Previous to the introduction of the preventive measures into the metropolis, I was directed by the General Board of Health to inspect the districts most affected by the epidemic. The experience derived was most instructive, as it proved to a demonstration, that wherever the favouring conditions existed, the epidemic selected its victims from all classes of the population. In most other cities the worst districts are inhabited by the lower classes, but in some parts of the metropolis the great thoroughfares are inhabited by people in easy circumstances, while the immediate vicinity is crowded with the lowest class of houses. There are certain circumstances, however, common to all the inhabitants, and these are inefficient drainage, cesspools under or close to the houses, a subsoil saturated with organic matter, and not

unfrequently large accumulations of refuse in the cellars or basement of the dwellings themselves; the proximity of trades dangerous to health, which are permitted to be carried on without control; overcrowded graveyards; and defective water-supply. These causes affect the health of the entire community in certain parts of the metropolis, and I have little doubt that all classes of the population within the limits of the epidemic seizure suffered in a nearly equal proportion. The same classes in the higher, better drained, more open and healthy parts of the metropolis, either escaped the cholera entirely or were only affected by the milder diarrhœal stage; but even over the extensive surface covered by the epidemic, there were some spots in which the sanitary conditions were more than usually bad. The population crowded together, offensive ditches and sewers running close to the houses, the proximity of nuisances, and other similar circumstances, determined the selection of such spots for the special ravages of the disease. Certain local peculiarities also had a most marked and fatal effect upon the population. The south bank of the Thames, from its low level and utterly inefficient drainage, which, indeed, does more harm than good, suffered greatly, and afforded an instance of the injurious tendency of ill-advised sanitary works. The localities most affected are built on the ancient mud deposits of the river, and on made ground, which appears to be composed of unwholesome refuse of various kinds, the whole subsoil being more or less charged with organic matter. The water-supply in many instances was discoloured and very foul. London, indeed, affords illustrations of almost every imaginable sanitary defect and negligence. Those local causes of disease which are met with, either singly or combined in small proportion, in cities and towns in other parts of the country, are collected together within the circuit of the metropolis, and I know of no locality in which the influence of conditions injurious to health can be studied under a greater variety of aspects, or their effect on the propagation of epidemic diseases more distinctly traced.

SECTION II.

MANAGEMENT OF CHOLERA THROUGH ITS LOCALIZING CAUSES.

ON this subject there is evidence to show—

1st. That it is possible to prevent the localization of the epidemic, by removing the obvious topical causes which precede and accompany its attacks.

2nd. That, if from their magnitude or nature it be impossible to abate these causes, the same object may be attained by the removal and dispersion of the people.

I shall consider these in succession.

1. *Localizing causes removable.*—Had the warning voice of the former epidemic been heeded, and had proper steps been taken to remove those local conditions which all experience had shown to be