

Extracts from

**ON THE MODE OF COMMUNICATION
OF CHOLERA.**

(Pamphlet, August/September 1849)

It is not the intention of the writer to go over the much debated question of the contagion of cholera. An examination of the history of that malady, from its first appearance, or at least recognition, in India in 1817, has convinced him, in common with a great portion of the medical profession, that it is **propagated by human intercourse**. Its progress along the great channels of that intercourse, and the very numerous instances, both in this country and abroad, in which cholera dates its commencement in a town or village previously free from it to the arrival and illness of a person coming from a place in which the disease was prevalent, seem to leave no room for doubting its communicability.

Extracts from

**ON THE PATHOLOGY AND MODE OF
COMMUNICATION OF CHOLERA.**

London Medical Gazette 44 (1849): 745-52,
923-29)

If there really be such a disease as Asiatic cholera, distinct from the ordinary English cholera which prevails in autumn, with which it is confounded by the Registrar-General, . . .

On examining the history of cholera, one feature immediately strikes the inquirer –viz. the evidence of its **communication by human intercourse**. In its progress from place to place it has nearly always followed the great channels of human intercourse. In spreading along the highways in India, it often spared the villages that were situated at a little distance from the main road, on either side. When a body of troops were attacked with it on their march, it often remained with them through countries having a very different climate and physical character from that in which they contacted the malady; and they often communicated it to towns and villages previously free from it. In extending itself to a fresh island or continent, the cholera has always made its appearance first at a sea-port, and not till ships had arrived from some infected place. Crews of ships approaching a country in which the disease was prevailing, have never been attacked until they have had communication with the shore. The cholera, moreover, in progressing from one place to another, has never travelled faster than the means of human transit, and usually much slower. Such are the general considerations

**ON THE MODE OF PROPAGATION OF
CHOLERA.**

Medical Times 3 (29 November 1851): 559-62.

Although the more severe cases of common English cholera cannot always be distinguished from the malady called Asiatic cholera, yet hardly any one doubts the distinct nature of these diseases, or that the latter was a stranger to Europe prior to the year 1830. A careful consideration of Asiatic cholera shows clearly enough that it is **propagated by human intercourse**. It has proceeded in various directions along the great channels of intercommunication, never progressing faster than people travel, and generally much more slowly. In attending to an island or a fresh continent, it always makes its first appearance at a seaport, and it never attacks the crew of a ship from a healthy port that is approaching an infected country, till their actual arrival. Many instances have occurred in which quarantine or *cordons sanitaires* have protected places from the cholera, either altogether, or for a time; and the most conclusive part of the evidence, is the number of instances in which the malady has been introduced into healthy localities by persons who have been taken ill after their arrival from places where cholera prevailed.

which show that cholera is communicated by human intercourse; and there are besides instances so numerous of persons being attacked with the disease within a day or two after immediate proximity to the sick, that it seems impossible to attribute the circumstance to mere coincidence.

The duration of cholera in a place is usually in a direct proportion to the number of the population. The disease remains but two or three weeks in a village, two or three months in a good-sized town, but in a great metropolis it often remains a whole year or longer. I find from an analysis of the valuable table of Dr. Wm. Merriman, of the cholera in England in 1832,*

(*Trans. of Roy. Med. and Chir. Soc. 1844.)

that 52 places are enumerated in which the disease continued less than 50 days, and that the average population of these places is 6,624. 43 places are likewise down in which

Dr. Bryson related several instances of this kind in the paper that he read before this Society, and a number more might be now related did the time permit: indeed, the cases in which the progress of cholera can be traced in this manner are the rule rather than the exception, and are, at all events far too numerous to be set down as mere coincidences. It may be remarked, also, that coincidences of this sort are not found to obtain in rheumatism, ague, or indeed in any but epidemic diseases, the whole of which I look upon as communicable from one patient to another, this communication being probably the real feature of distinction between epidemic and other diseases.

Another circumstance strongly confirmatory of the communication of cholera, is the direct relation which exists between the number of the population and the duration of the disease in different towns and villages. The accompanying figures were compiled by me from Dr. W. Merriman's valuable table of cholera in England in 1832 : -- (b)

(b) Transactions of Royal Medical and Chirurgical Society, 1849 [?? – date is illegible on copy] [559a/559b]

Number of Places.	Duration in Days.	Average Population.
52	0 to 50	6,624

the cholera lasted 50 days, but less than 100; the average population of these is 12,624. And these are, without including London, 33 places in which the epidemic continued 100 days and upwards, the average population of which 123; or if London be included, 34 places, with an average of 78,823. The following short table will show these figures in a more convenient form: –

No. of Places.	Duration in days.	Average population
52	0 to 50	6,624
43	50 to 100	12,624
33 or 34	100 and upwards	38,123 or 78,823

This difference in the duration of cholera points clearly to its propagation from patient to patient. If each case were not connected with a previous one, but depended on some unknown atmospheric or telluric state, why should not the twenty cases that happen in a village be distributed over as long a period as the twenty hundred cases which occur in a large town? The views propounded in this paper offer a more ready explanation of the decline of the disease for want of fresh victims, than the usual theory of contagion or infection; for all the members of the community are not liable to be reached by a poison which must be swallowed, as they would be by one in the form of an effluvium.

43	50 to 100	12,624
33 or 34	100 and upwards	38,123 or 78,823

It will be seen, that 52 places are enumerated in which the cholera continued less than 50 days, and that the average population of these places was 6,624; that there are 43 places specified in which the disease lasted 50 days, but less than 100, the average population of these places being nearly twice as great as that of the former; while in the remaining 34 towns, in which the cholera continued for 100 days and upwards, the average population was very much greater still, being 38,000 or 78,000, according as London is omitted from or included in the list. I believe that the same rule has obtained during the recent epidemic, but I have no precise information on the point. It is hardly necessary to remark, that if the cholera cases were not connected one with another, there would be no reason why the few cases which happen in a village should not be scattered over as long a period as the thousands which occur in a great metropolis.

I shall perhaps be thought singular in asserting, that there is no evidence opposed to the propagation of cholera by its communication from individual to individual, or in favour of any other origin of the disease.

It is quite true that a great deal of argument has been employed on the opposite side, and

that many eminent men hold an opposite opinion; but, besides the objection that negative evidence ought not to overthrow that of a positive kind, . . .

the instances that are believed to oppose the proofs of communication are reasoned upon in the opinion that cholera, if conveyed by human intercourse, must be contagious in the same way that the **eruptive fevers** are considered to be, viz., by emanations from the sick person into the surrounding air, which enter the system of others by being inhaled, and absorbed by the blood passing through the lungs. There is, however, no reason to conclude *à priori*, that this must be the mode of communication of cholera; and it must be confessed that it is difficult to imagine that there can be such a difference in the predisposition to be affected or not by an inhaled poison, as would enable a great number to breathe it without injury in a pretty concentrated form (the immunity not having been earned by a previous attack, as in the case of measles, &c.), whilst others should be killed by it when millions of times diluted. The difficulties that beset this view are of the same kind, but not so great, as those which surround the hypothesis of a cholera poison generally diffused in the air, and not emanating from the sick.

On the other hand, there are a number of facts which have been thought to oppose this evidence: numerous persons hold intercourse without becoming affected, and a great number take the disease who have had no apparent connection with other patient. These facts, however, have always been examined with the conviction that cholera, if communicable, must be contagious in the same way that the eruptive fevers are believed to be –viz. by effluvia given off from the patient into the surrounding air, and acting on other persons either directly or through the medium of fomites.

The chief facts which are believed to be opposed to the extension of cholera by communication are the following: That many persons are placed in close relation with the sick, nurse them, and wait upon them, and sometimes even sleep in the same bed, without becoming infected with the malady; that quarantine and *cordons sanitaires* often fail to arrest its progress; and that persons are often attacked with it who have had no intercourse with the sick or their friends.

These facts are thought to be opposed to the communication of cholera, because it is assumed, that this disease, to be communicated, must extend itself, as the **eruptive fevers** are believed to do, by means of some emanation given off from the patient into the air; or, if not in that way, then by contact with the patient, or articles of clothing, etc., which have been near him. But, without assuming such hypotheses, the circumstances above mentioned would not in any way oppose the evidence of the communication of cholera. Nearly every one of these facts is equally true of syphilis as of cholera. Persons nurse and wait on syphilitic patients and might even sleep in the same bed with them without contracting the malady; and it is very doubtful, whether quarantine regulations, however strict, would prevent its communication, as they would be evaded. These circumstances are not considered to interfere with the proofs of the contagiousness of syphilis, only because we happen to know the way in which it is communicated and when we shall know equally well the way in which cholera is communicated, I do not doubt that we shall find them equally in applicable to that disease.

A consideration of the pathology of cholera is capable of indicating to us the

Reasoning by analogy from what is known of other diseases, we ought not to conclude that cholera is propagated by an effluvia. In all known diseases in which the **blood is poisoned** in the first instance, general symptoms, such as rigors, headaches, and quickened pulse, precede the local symptoms; but it has always appeared, from what the writer could observe, that in cholera the alimentary canal is first affected, and that all the symptoms not referable to that part are consecutive, and apparently the result of the **local affection**. In those cases in which vertigo, lassitude, and depression precede the evacuations from the bowels, there is no reason to doubt that exudation of the watery part of the blood, which is soon copiously discharged, is already taking place from the mucous membrane; whilst in the cases in which the purging comes on more gradually, there is often so little feeling of illness that the patient cannot persuade himself that he has the cholera, or apply for remedies until the disease is far advanced,--this being a circumstance which increases the mortality. The quantity of fluid lost by purging and vomiting, taking into consideration the previous state of the patient, the suddenness of the attack, and the circumstance that the loss is not replaced by absorption, has seemed sufficient, in all the cases witnessed by the writer, to account, by the change it must occasion in the quantity and composition of the blood,* for the collapse, difficulty of breathing, and, in short for all the symptoms, without assuming that the blood is poisoned, until it become so by the retention of matters which ought to pass off through the kidneys, the functions of which are, however, suspended by the thickened state of the blood, which will scarcely allow it to pass through the capillaries.

In those diseases in which there is reason to conclude that a **morbid poison** has entered the blood, there are symptoms of general illness, usually of a febrile character, before any **local affection** manifests itself; but so far as I have been able to observe or to learn from carefully recorded cases, it is not so in cholera. On the contrary, the disease begins with the affection of the bowels, which often proceeds with so little feeling of general illness, that the patient does not consider himself in danger, or apply for advice till the malady is far advanced. It is true that, in a few cases, there are dizziness and faintness before discharges from the bowels actually take place, but there can be no doubt that these symptoms depend on the exudation from the mucous membrane, which is soon afterwards copiously evacuated. With respect to certain rare cases of cholera, without purging, Dr. Watson has remarked in his Lectures, that when the bodies of such patients have been opened, the characteristic fluid was found in the bowels. Another reason for looking on cholera as a local disease is, that the affection of the stomach and bowels is sufficient to explain all the general symptoms. The evacuations, in the cases I have witnessed, have always appeared sufficient to account for the collapse, when the suddenness of the attack is considered, and the circumstance that absorption is probably suspended. The thickened state of the blood arising from the loss of fluid accounts for the symptoms of asphyxia, by the obstruction it must occasion in the pulmonary circulation. The recent analyses of the blood of cholera patients, by **Dr. Garrod**, afford the strongest confirmation of this view; for he found it to contain a much greater amount of solid materials in proportion to the water, than in health or other diseases. If there has been

manner in which the disease is communicated. If it were ushered in by fever or any other general constitutional disorder, then we should be furnished with no clue to the way in which the **morbid poison** enters the system; but if it commences by a **local affection** of any particular part, and the system at large only suffers in consequence of the local affection, then it is pretty evident, that the material cause of the disease must have been applied to the part first affected. From all that I have been able to learn of cholera, either by my own observation or that of others, it has appeared, that the illness always commences with the affection of the alimentary canal; and in all the cases that I have seen, the loss of fluid from the stomach and bowels has been sufficient to account for the collapse, when the previous condition of the patient was taken into account, together with the suddenness of the loss, and the circumstance that the process of absorption appears to be suspended. Certain fatal cases of cholera without evacuations have occurred; but, whenever there has been an examination, of the body in such cases, the excretions peculiar to cholera have been found in the bowels. It appears, indeed, that the cholera poison never enters the circulation, and that the blood does not become contaminated in this disease, except when congestion of the kidneys follows as a secondary affection. The irritation of the bowels accounts for the cramps; and the loss of the water and saline constituents of the blood is the cause of the collapse and the symptoms of [559b/560a] asphyxia. The careful analyses of the blood by **Dr. Garrod** have confirmed the fact, that its solid constituents are relatively much increased by the loss of water. On this account, it becomes so thick that it circulates with difficulty through the capillaries of the

*The valuable analyses of **Dr. Garrod** have recently fully confirmed what had been stated in the former visitation of Europe by the cholera, viz., that the solid contents of the blood of patients labouring under this disease are greatly increased in proportion to the water—a state of the blood that is not met with in any other malady.

It is generally assumed that the blood becomes so altered by the cholera poison, that its watery and saline parts begin to exude by the mucous membrane of the alimentary canal; but it is more consonant with experience, both therapeutical and pathological, to attribute the exudation to some local irritant of the mucous membrane; no instance suggesting itself to the writer in which a poison in the blood causes irritation of, and exudation from, a single surface, as in cholera; for the sweating, as the patient approaches to collapse, is only what takes place in other cases from loss of blood, during fainting, and in any state in which the force of circulation is greatly reduced.

more purging in some of the less severe cases than in the rapidly fatal ones, it only shows that, in the former, absorption has been still going on, or else that some of the fluids which have been swallowed have passed through the bowels. The drain of fluid into the alimentary canal suspends the urinary secretion, either totally or in great part, and the kidneys become congested from the altered state of the blood: hence any little urine that is secreted is albuminous; and if the kidneys do not soon recover from the congestion, urea accumulates in the blood in those cases in which the patient survives the stage of collapse. Although in a great number of cases the symptoms of cholera manifest themselves suddenly, and are not amenable to any known treatment, yet in other cases the disease commences gradually with diarrhoea, and in this stage there is evidence to show that it can usually be cured by the ordinary remedies for diarrhoea. Now this circumstance is a strong reason for concluding, that the mischief in cholera is at first confined to the mucous membrane; for it is not easy to conceive that chalk, and opium, and catechu, could neutralize or suspend the action of a poison in the blood. [745/746] Indeed, diseases caused by a morbid poison in the blood, such as the eruptive fevers, cannot be cut short, either by local or general means, but run a definite course.

lungs, while the diminished quantity of salts renders it still further unfitted to undergo the usual changes in respiration.

The injection of a weak saline solution into the veins of cholera patients in the state of collapse has often been attended with the most surprising effects of a temporary nature, at once restoring the patient, who the minute before was nearly dead, to a state of apparent health and strength. It was justly remarked by Dr. Budd, in a clinical lecture delivered at King's College Hospital, that, if the patient's symptoms depended on a poison circulating in the blood, they could not be removed by

Having rejected effluvia and the poisoning of the blood in the first instance, and being led to the conclusion that the disease is communicated by something that acts directly on the alimentary canal, the excretions of the sick at once suggest themselves as containing some material which, being accidentally swallowed, might attach itself to the mucous membrane of the small intestines, and there multiply itself by the appropriation of surrounding matter, in virtue of molecular changes going on within it, or capable of going on, as soon as it is placed in congenial circumstances. Such a mode of communication of disease is not without precedent. The ova of the intestinal worms are undoubtedly introduced in this way. . . .

That a portion of the ejections or dejections must often be swallowed by healthy persons is, however, a matter of necessity. The latter even are voided with such suddenness and force that the clothes and bedding scarcely fail to become soiled, and being almost devoid of colour and odour, the presence of the evacuations is not always recognized; hence they become attached unobserved to the hands of the person nursing the patient, and are unconsciously swallowed, unless care be taken to wash the hands before partaking of food: or if the person waiting on the sick have to prepare food for the rest of the family, as often happens, the material of communication here suggested has a wider field in which to operate; and where the

In the meantime we have arrived at two conclusions – first, that cholera is a local affection of the alimentary canal; and secondly, that it is communicated from one person to another. The induction from these data is that the disease must be caused by something which passes from the mucous membrane of the alimentary canal of one patient to that of the other, which it can only do by being swallowed; and as the disease grows in a community by what it feeds upon, attacking a few people in a town first, and then becoming more prevalent, it is clear that the cholera poison must multiply itself by a kind of growth, changing surrounding materials to its own nature like any other morbid poison; this increase is the case of the *materies morbi* of cholera taking place in the alimentary canal.

The instances in which minute quantities of the ejections and dejections of cholera patients must be swallowed are sufficiently numerous to account for the spread of the disease; and on examination it is found to spread most where the facilities for this mode of communication are greatest. Nothing has been found to favour the extension of cholera more than **want of personal cleanliness**, whether arising from habit or scarcity of water, although the circumstance hitherto remained unexplained. The bed linen nearly always becomes wetted by the cholera evacuations, and as these are devoid of the usual colour and odour, the hands of persons waiting on the patient become soiled, and unless these persons are scrupulously cleanly in their habits, and wash

the injection of a simple saline solution. The saline solution merely restores the water which has become deficient, and supplies salts analogous to those which have been lost.

If the poison which communicates cholera from person to person does not enter the blood, it is evident that it must multiply itself on the surface of the alimentary canal, and must be contained in the evacuations from the stomach and bowels. The proofs that the cholera poison is contained in these discharges and that the disease is communicated by their being accidentally swallowed, are of a general as well as a particular kind.

It has been constantly observed, that the **want of personal cleanliness** aided very much the propagation of cholera, although no explanation could be given of the circumstance; it is very evident, however, that without habits of strict cleanliness persons waiting on the sick must get their hands soiled with the cholera discharges, and must unknowingly contaminate the provisions they handle, in eating their own food or preparing that of others. The sudden discharge of the evacuations, which often soil the clothing or bed linen, and the little colour or odour they possess, very much increase the liability to their being swallowed in this way, and under

patient, or those waiting on him, are occupied in the preparation or vending of provisions, the disease may be conveyed to a distance, and into quarters having apparently no communication with the sick.

All the observers who have recorded their opinions on the subject, agree in attributing a great influence to **want of personal cleanliness** in increasing the prevalence and fatality of cholera. Dr. Lichtenstädt, in a work on Cholera published in 1831, states, "that at Berditscher, in Volhynia, a place of a few thousand inhabitants, no less than 900 were attacked in thirty-one days. Amongst 764 of these were 658 Jews, and only 106 Christians although the Jewish population is far from being proportionally so great; and among the Christians the deaths were 61.3 per cent., while among the Jews they were 90.7 per cent. The only reason assigned by the reporter for these extraordinary differences is the excessive disregard of cleanliness among the Jewish inhabitants."*

*Edin. Med. And Surg. Journal, vol. xxxvii.

The first appearance of cholera in many of the towns of this country in 1832 was in the courts and alleys to which vagrants resort for a night's lodging, where it often lingered for some time before spreading to the more cleanly part of the people.

their hands upon taking food, they must accidentally swallow some of the excretion, and leave some on the food they handle or prepare, which has to be eaten by the rest of the family, who amongst the working classes often arrive to take their meals in the sick [746/747] room: hence the thousands of instances in which, amongst this class of the population, a case of cholera in one member of the family is followed by other cases; whilst medical men and others, who merely visit the patients, generally escape. The post-mortem inspection of the bodies of cholera patients has hardly ever been followed by the disease that I am aware, this being a duty that is necessarily followed by careful washing of the hands; and it is not the habit of medical men to be taking food on such an occasion. On the other hand, the duties performed about the body, such as laying it out, when done by women of the working class, who make the occasion one of eating and drinking, are often followed by an attack of cholera; and persons who merely attend the funeral, and have no connection with the body, frequently contract the disease; in consequence, apparently, of partaking of food which has been prepared or handled by those having duties about the cholera patient, or his linen and bedding.

some circumstances render it almost certain. For instance, when a large family, or more than one family are crowded into a single room, and when the same persons have to attend to the patient, and also to prepare and serve the meals for the rest of the inmates, without the materials for washing the hands, even if the inclination should exist, it is next to impossible that the provisions should be eaten without being contaminated with the peculiar discharges of the patient; and these are the circumstances under which the disease is found most frequently to spread among the inmates of a room.

Mr. Baker, of Staines, who attended 260 cases of cholera and diarrhoea in the late epidemic, chiefly among the poor, informed me in a letter, with which he favoured me in December, 1849, that "where the patients passed their stools involuntarily the disease evidently spread." Deficiency of light is a great obstacle to cleanliness, as it prevents dirt from being seen, and it must aid very much the contamination of the food with the cholera evacuations.

The assistance which crowding lends to the spread of cholera could be explained on the hypothesis of effluvia or

miasmata given off from the patient into the surrounding air; but the extension of the disease from want of cleanliness, deficiency of water, and deficiency of light, cannot be explained on such a hypothesis. The non-communication of cholera in cleanly families, where the hand-basin and the towel are in constant use and where the apartments for cooking and eating are distinct from the sick-room; and also its non-communication, as a general rule, to medical men and other visitors of the sick belonging to the educated classes of society, are fully explained on the doctrine here laid down, although these circumstances are inexplicable on the supposition of its spread by means of effluvia. Its fearful extension in certain pauper asylums for children and lunatics is also clearly accounted for, together with its non-liability to spread in more commodious and better regulated establishments.

The great fatality of cholera among all the **mining** populations of this kingdom has been very remarkable in both the epidemics of that disease. The chief reasons of this are as follow: -- The miners generally remain eight hours in the pits, and take food with them, which they eat whilst at work. There are neither privies, hand-basins, nor towels in the mines; and when a case of cholera occurs in a pit, the hands of the workmen, in the dark subterranean passages, can hardly fail to become soiled with the discharges. Should [560a/560b] we have a return of the cholera, I believe that many thousands of lives might be saved by dividing the time of labour into two periods of four hours, dissuading the workmen from taking food into the mines and enjoining them to wash their hands on going home before taking any food. There are other causes to be afterwards mentioned which contribute to the

It has been found that the **mining** population of this country has suffered more from cholera than any other, and there is a reason for this. There are no privies in the coal pits,*

(*Dr. D. B. Reid, in Second Report of Commissioners for inquiring into the state of large towns and populous districts. Appendix, Part ii. p. 122.)

and I believe that this is true of other mines: as the workmen stay down the pit about eight hours at a time, they take food down with them, which they eat, of course, with unwashed hands, and as soon as one pitman

gets the cholera, there must be great liability of others working in the gloomy subterranean passages to get their hands contaminated, and to acquire the malady; and the crowded state in which they often live affords every opportunity for it to spread to other members of their families. There is also another cause which favours the spread of cholera amongst many of the mining populations, to which I shall have to allude shortly, in treating of the water.

When the cholera makes its appearance in a mining district it would be advisable that the men should work during two "shifts" in the twenty-four hours, of four hours each, instead of one "shift" of eight hours; and should be dissuaded from taking food to their work, and recommended to wash themselves on going home, as I believe they usually do.

extension of cholera in several of the mining districts, viz., the contamination of the wells and brooks with the evacuations of the people.

It can hardly be anticipated, from the nature of the subject, that we should be able to obtain distinct evidence of the cholera evacuations having been taken with the food. The following cases, perhaps, afford as decisive proof of this variety of communication of cholera as can be expected. In the beginning of last year, a letter appeared in the *Provincial Medical and Surgical Journal*, from Mr. John C. Bloxam, in the Isle of Wight, being an answer to the inquiry on cholera by Mr. Hunt. Among other interesting information, Mr. Bloxam stated, that the only cases of cholera that occurred in the village of Carisbrook, happened in persons who ate of some stale cow-heels, which had been the property of a man who died in Newport, after a short and violent attack of cholera. Mr. Bloxam kindly made additional personal inquiries into the case, in consequence of questions I put to him, and the following is a summary of the information contained in his letter: –

The man from whose house the cow-heels were sent for sale died on Monday, the 20th of August. It was the custom in the house to boil these articles on Monday, Wednesday, and Friday; and the cow-heels under consideration were taken to Carisbrook, which is a mile from Newport ready boiled, on Tuesday, the 21st. Eleven persons in all partook of this food, seven of whom ate it without any additional cooking. Six of these were taken ill within twenty- four hours after eating it, five of whom died, and one recovered. The seventh individual, a child, who ate but a small quantity of the cow-heels, was unaffected by it. Four persons

partook of the food after additional cooking. In one case the cow-heels were fried, and the person who ate them was taken ill of cholera within twenty-four ours afterwards, and died. Some of the food was made into broth, of which three persons partook while it was warm; two of then remained well, but the third person partook again of the broth next day, when cold, and, within twenty-fours after this latter meal, she was taken ill with cholera of which she died. It may be proper to mention, although it is no unusual circumstance for animal food to be eaten in hot weather when not quite fresh, that some of the persons perceived the cow-heels to be not so fresh as they ought to have been at the time they were eaten, and part of them had to be thrown away a day or two afterwards, in consequence of being quite putrid.

A man living in West-street, Soho, who kept a horse and cart, was employed, in the beginning of September, 1849, to remove some furniture from a house in Lambeth. The furniture had been the property of a woman who died of cholera, and had just been buried. The bedding and night-chair were left just as they were when the patient died. This man was taken with cholera during the night, within thirty-six hours after removing the furniture and other effects and he died of the attack. I saw him with Mr. Marshall, of Greek-street, and we both remarked that his hands were very dirty, and had apparently not been washed for some days.

If the views here explained be correct it is evident that the cholera poison may often be conveyed to a distance with provisions, as in the instance of the cow-heels above-mentioned, when there is no evidence of personal intercourse. There is also another very important medium for transmitting the cholera poison from the sick to the healthy

The views here explained open up to consideration a most important way in which the cholera may be widely disseminated, viz.,

With only the means of communication which we have been

by the emptying of sewers into the drinking water of the community; and, as far as the writer's inquiries have extended, he has found that in most towns in which the malady has prevailed to an unusual extent this means of its communication has existed.

considering, the cholera would be constrained to confine itself chiefly to poor and crowded dwellings, and would be continually liable to die out accidentally in a place, for want of the opportunity to reach fresh victims; but there is often a way open for it to extend itself more widely, and that is by the mixture of the cholera evacuations with the water used for drinking and culinary purposes, either by permeating the ground and getting into wells, or by running along channels and sewers in to the rivers.*

(*See review in Med. Gaz. present vol. p. 466.)

without immediate intercourse. It is the water which people drink and in this case the proofs are often of a more direct and decisive nature.

The deficiency of water had often been spoken of, but the quality of the water had hardly ever been publicly mentioned as contributing to the increase of cholera till August 1849, when Dr. Lloyd related to the South London Medical Society some occurrences that had taken place in Rotherhithe, and a pamphlet of mine, containing other instances, and some reasoning on the subject, appeared at the same time. Mr. John Grant, Surveyor to the Commissioners of Sewers for Surrey and Kent, also drew up a report in the same month, respecting the contamination of a well, in a [560b/561a] court in Thomas-street, Horsleydown; and attention having been strongly directed to the matter, several other instances of the connexion between violent outbreaks of cholera and the contamination of the drinking water were related.

One of the most fatal instances of communication of cholera by means of water, is that which occurred at **Albion-terrace**, Wandsworth-road -- a row of seventeen houses, most of them detached a few feet from each other, and constituting the genteel suburban dwellings of a number of professional and tradespeople. All the houses were supplied with water on a uniform plan, from a spring in the neighbourhood, the water being conducted into a tank placed behind each house, from which it was pumped into the kitchen when required. The tanks were all connected together by pipes, and the surplus water flowed away into a drain, which received the contents of the house drains and cesspools. The various drains and pipes were so constructed that the water was liable to become tainted, and it had been occasionally

[two point-source epidemics discussed in reverse order from 1851 article]

In **Albion Terrace**, Wandsworth Road, there has been an extraordinary mortality from cholera, which was the more striking, as there were no other cases at the time in the immediate neighbourhood; the houses opposite to, behind, and in the same line, at each end of those in which the disease prevailed, having been free from it. The row of houses in which the cholera prevailed to an extent probably altogether unprecedented in

[two point-source epidemics discussed in reverse order from 1851 article]

The instance of **Albion Terrace**, Wandsworth Road, was a still more striking one of the communication of cholera by means of water. As the account of the occurrence was quoted in a Review in the Medical Gazette,*

(*Present vol. p. 468)

and some further particulars supplied by me in a note,*

this country, constituted the genteel suburban dwellings of a number of professional and tradespeople, and are most of them detached a few feet from each other. They are supplied with water on the same plan. In this instance the water got contaminated by the contents of the house-drains and cesspools; the cholera extended to nearly all the houses in which the water was thus tainted, and to no others. . . .

Various substances have been found in it which escape digestion, as the stones and husks of currants and grapes, and portions of the thin epidermis of other fruits and vegetables. Little bits of paper were likewise found. Some of the water removed from this tank continued to ferment till a day or two ago, but is now quite clear and transparent; and although there are some portions of the fibrous structures of vegetables lying at the bottom of the bottle in which it is contained, the water itself has neither taste nor smell, and cannot, by either physical or chemical examination, be distinguished from that of the spring whence it originally proceeded.

The **first case** of cholera occurred at No. 13, on July 28th (two days after the bursting of the drain), in a lady who had had premonitory symptoms for three or four days. It was fatal in fourteen hours. There was an accumulation of rubbish in the cellar of this house, which was said to be offensive by the person who removed it; but the proprietor of the house denied this. A lady at No. 8 was attacked with choleraic diarrhoea on July 30th: she recovered. On August 1st, a lady, age 81,

(*Ibid, p. 504.)

I need not now relate the particulars, but will briefly state that, owing to a storm of rain and thunder, such a connection was established between the drains and water, that, on a case of cholera occurring in any one of seventeen houses, the evacuations might enter the water supplied to all the others. Such a case did occur, and in a short time the prevalence of cholera was such as I believe had not before been known in this country; whilst at the same time there was but little of the disease at the time, or I believe since, in the surrounding streets and houses. I will take this occasion to remark that we have now an explanation of the reason why the cholera has on some occasions increased very much immediately after a thunder storm, and on other occasions has very much diminished. The cause of this lies in the rain, and not in the thunder. In some places drains containing cholera discharges would be made to overflow into a brook or river, or other source from which water was obtained, whilst in other places drinking-water already contaminated would be nearly altogether washed away, and replaced by a fresh supply.

complained of previously; but during a storm of rain on July 26th, the chief drain burst, and its contents became mixed with the water in the tanks. I had an opportunity of finding afterwards in the water, the stones and husks of currants and grapes and various other substances which had gone through the alimentary canal. The more gross materials, however, settled to the bottom of the tanks, and the water pumped up was not so bad as to excite suspicion or attract much attention except in two or three of the houses.

“The **first case** of cholera occurred at No. 13, on July 28, (two days after the bursting of the drain,) in a lady who had had premonitory symptoms for three or four days. It was fatal in fourteen hours. There was an accumulation of rubbish in the cellar of this house, which was said to be offensive by the person who removed it; but the proprietor of the house denied this. A lady at No. 8 was attacked with choleraic diarrhoea on July 30; she recovered. On August 1, a lady, aged 81, at No. 6, who had had some diarrhoea eight or ten days before, which had yielded to her own treatment, was attacked with cholera; she died on the 4th, with congestion of the brain. Diarrhoea commenced on August 1, in a lady, aged 60, at No. 3; collapse took place on the 5th, and death on the 6th. On August 3 there were three or four cases in different parts of the row of houses, and two of them terminated fatally on the same day. The

at No. 6, who had had some diarrhoea eight or ten days before, which had yielded to her own treatment, was attacked with cholera; she died on the 4th with congested brain. Diarrhoea commenced on August 1st, in a lady aged 60, at No. 3; collapse took place on the 5th, and death on the 6th. On August 3rd, there were three or four cases in different parts of the row of houses, and two of them terminated fatally on the same day. The attacks were numerous during the following three or four days, and after that time they diminished in number. More than half the inhabitants of the part of the terrace in which the cholera prevailed were attacked with it, and upwards to half the cases were fatal. The deaths occurred as follows; but as some of the patients lingered a few days, and died in the consecutive fever, the deaths are less closely grouped than the seizures. There was one death on July 28th, two on August 3rd, four on the 4th, two on the 6th, two on the 7th, four on the 8th, three on the 9th, one on the 11th, and one on the 13th. These make twenty fatal cases; and there were four or five deaths besides amongst those who were attacked after flying from the place.

The fatal cases were distributed over ten out of the seventeen houses, and Mr. Mimpriss, of Wandsworth Road, who attended many of the cases, and to whose kindness the writer is indebted for several of these particulars, states that cases occurred in the other seven houses, with the exception of one or two that were empty, or nearly so. There were five deaths in the house No. 6, and one of a gentleman the day after he left it, and went to Hampstead Heath. The entire household, consisting of seven individuals, had the cholera, and six of them died.

There are no data for showing how the disease was probably communicated to

attacks were numerous during the following three or four days, and after that time they diminished in number. More than half the inhabitants of the part of the terrace in which the cholera prevailed were attacked with it, and upwards of half the cases were fatal. The deaths occurred as follow; but as some of the patients lingered a few days, and died in the consecutive fever, the deaths were less closely grouped than the seizures. There was 1 death on July 28, 2 on August 3, 4 on the 4th, 2 on the 6th, 2 on the 7th, 4 on the 8th, 3 on the 9th, 1 on the 11th, and 1 on the 13th. These make 20 fatal cases; and there were 4 or 5 deaths besides amongst those who were attacked after flying from the place.”

The fatal cases were distributed over ten of the seventeen houses, and cases occurred also in the other seven houses, with the exception of one or two that were empty, or nearly so. In short, the cholera extended to all the houses supplied by the contaminated water, and to no others; for there were hardly any cases in the immediate neighbourhood at the time.

There are no data for showing how the disease was communicated to the first patient, at No. 13, on July 28; but it was two or three days afterwards, when the evacuations from this patient must have entered the drains having a communication with the water supplied to all the houses, that other persons were attacked, and in two days more the disease prevailed to an alarming extent.

the first patient, at No. 13, on July 28th; but it was two or three days afterwards, when the evacuations from this patient must have entered the drains, having a communication with the water supplied to all the houses, that other persons were attacked, and in two days more the disease prevailed to an alarming extent.

[. . . several more paras on this outbreak]

In Thomas Street, **Horsleydown**, there are two courts close together, consisting of a number of small houses or cottages, inhabited by poor people. The houses occupy one side of each court or alley--the south side of Trusscott's Court, and north side of the other, which is called Surrey Buildings, being placed back to back, with an intervening space, divided into small back areas, in which are situated the privies of both the courts, communicating with the same drain, and there is an open sewer which passes the further end of both courts. Now, in Surrey Buildings the cholera has committed fearful devastation, whilst in the adjoining court there has been but one fatal case, and another case that ended in recovery. In the former court the slops of dirty water poured down by the inhabitants into a channel in front of the houses got into the well from which they obtained their water, this being the only difference that Mr. Grant, the Assistant-Surveyor for the Commissioners of Sewers, could find between the circumstances of the two courts, as he stated in his report to the Commissioners. The well in question was supplied from the pipes of the South London Water Works, and was covered in on a level with the adjoining ground; and the inhabitants obtained the water by a pump placed over the

There are two courts in Thomas Street, **Horsleydown**, exactly resembling each other; the small houses which occupy one side of each court being placed back to back, and the privies for both courts being placed in the intervening back areas, and emptied into the same drain which communicated with an open sewer passing the end of both the courts. In Trusscott's Court, as one of them is called, there was but one death from cholera, whilst in the other, named Surrey Buildings, there were eleven deaths. In this latter court the refuse water from the houses got into the well from which the people obtained their water. The succession of the cases illustrates the mode of communication. There were first two cases in Surrey Buildings, the evacuations of these patients being passed into the bed, as I was in-[474/748] formed by Mr. Vinen, of Tooley Street, who attended them; in a few days after, when the water in which the soiled linen had been washed must have become mixed with that in the well, a number of cases commenced nearly together in all parts of the small court.

A similar instance of communication of cholera through the water occurred nearly at the same time "in Thomas-street, **Horsleydown**, where there are two courts close together, consisting of a number of small houses or cottages inhabited by poor people. The houses occupy one side of each court or alley, the south side of Trusscott's-court, and the north side of the other, which is called Surrey-buildings, being placed back to back, with an intervening space, divided into small back areas, in which are situated the privies of both the courts, communicating with the same drain; and there is an open sewer which passes the further end of both the courts. Now, in Surrey-buildings, the cholera committed fearful devastation, whilst in the ad- [561a/561b] joining court there was but one fatal case, and another that ended in recovery. In the former court the slops of dirty water, poured down by the inhabitants into a channel in front of the houses, got into the well from which they obtained their water, this being the only difference that Mr. Grant, the Assistant-Surveyor for the Commissioners of Sewers, could find between the circumstances of the two courts, as he stated in his report to the Commissioners. The well in question was supplied from the pipes of the South London Water Works, and was covered in on a level with the adjoining ground; and the inhabitants obtained the water by a pump placed over the well. The channel mentioned above commenced close by the pump. Owing to something being out of order, the water for some time past occasionally burst out at the top of the well, and overflowed into the gutter or channel, afterwards flowing back again mixed with the impurities; and crevices were left in the ground or pavement, allowing part

well. The channel mentioned above commenced close by the pump. Owing to something being out of order, the water for some time past occasionally burst out at the top of the well, and overflowed into the gutter or channel, afterwards flowing back again mixed with the impurities; and crevices were left in the ground or pavement, allowing part of the contents of the gutter to flow at all times into the well, and when it was afterwards emptied a large quantity of black and highly offensive deposit was found in it.

The first case of cholera **in this court** occurred on July 20th, in a little girl, who had been labouring under diarrhoea for four days. This case ended favourably. On the 21st of July, the next day, an elderly female was attacked with the disease, and was in a state of collapse at ten o'clock the same night. This patient partially recovered, but died of some consecutive affection on August 1. Mr. Vinen, of Tooley Street, who attended these cases, states that the evacuations were passed into the beds, and that the water in which the foul linen would be washed would inevitably be emptied into the channel mentioned above. Mr. Russell, of Thornton Street, Horsleydown, who attended many of the subsequent cases in the court, and who, along with another medical gentlemen, was the first to call the attention of the authorities to the state of the well, says that such water was invariably emptied there, and the people admit the circumstance. About a week after the above two cases commenced, a number of patients were taken ill nearly together: four on Saturday, July 28th, seven or eight on the 29th, and several on the day following. The deaths in the cases that were fatal took place as follows:--One on the 29th, four on the 30th,

of the contents of the gutter to flow at all times into the well, and when it was afterwards emptied, a large quantity of black and highly offensive deposit was found in it.

“The first case of cholera **in this court** occurred on July 20th, in a little girl, who had been labouring under diarrhoea for four days. This case ended favourably. On the 21st July, the next day, an elderly female was attacked with the disease, and was in a state of collapse at ten o'clock the same night. Mr. Vinen, of Tooley-street, who attended these cases, states that the evacuations were passed into the beds, and that the water in which the foul linen would be washed would inevitably be emptied into the channel mentioned above. Mr. Russell, of Thornton-street, Horsleydown, who attended many of the subsequent cases in the court, and who, along with another medical gentleman, was the first to call the attention of the authorities to the state of the well, says that such water was invariably emptied there, and the people admit the circumstance. About a week after the above two cases commenced, a number of patients were taken ill nearly together: four on Saturday, July 28th, seven or eight on the 29th, and several on the following day. Eleven of the cases were fatal. The deaths occurred in seven out of the fourteen small houses in the court.

“The two first cases on the 20th and 21st may be considered to represent about the average amount of cases for the neighbourhood, there having been just that number in the adjoining court about the same

and one on the 31st July; two on August 1st, and one on August the 2nd, 5th, and 10th respectively, making eleven in all. They occurred in seven out of the fourteen small houses situated in the court.

The two first cases on the 20th and 21st may be considered to represent about the average amount of cases for the neighbourhood, there having been just that number in the adjoining court, about the same time. But in a few days, when the dejections of these patients must have become mixed with the water the people drank, a number of additional cases commenced nearly together. The patients were all women and children, the men living in the court not having been attacked; but there has been no opportunity hitherto of examining into the cause of exemption, as the surviving inhabitants had nearly all left the place when the writer's attention was called to this circumstance.

Dr. Lloyd mentioned some instances of the effects of impure water at the South London Medical Society, on August 30th.*

(*See Report in Med. Gaz. p. 429.)

In Silver Street, Rotherhithe, there were eighty cases, and thirty-eight deaths, in the course of a fortnight early in July last, at a time when there was very little cholera in any other part of Rotherhithe. The contents of all the privies in this street ran into a drain which had once had a communication with the Thames; and the people got their supply of water from a well situated very near the end of the drain, with the contents of which the water got contaminated. Dr. Lloyd has informed me that the foetid water from the drain could be seen dribbling through the side of the well, above the surface of the water. Amongst other sanitary measures recommended by Dr.

time. But, in a few days, when the dejections of these patients must have become mixed with the water the people drank, a number of additional cases commenced nearly together.”

(a)

(a) The passages in the above account. Included within inverted commas, are quoted from a pamphlet, by the Author, “On the Communication of Cholera.”

The following instances were made known by **Dr. Lloyd**: –

In Silver-street, Rotherhithe, there were 80 cases and 38 deaths in the course of a fortnight, early in July, 1849, at a time when there was very little cholera in any other part of Rotherhithe. The contents of all the privies in this street ran into a drain which had once had a communication with the Thames; and the people got their supply of water from a well situated very near the end of the drain, with the contents of which the water got contaminated. Dr. Lloyd informed me that the fetid water from the drain could be seen dribbling through the side of the well, above the surface of the water. Among other sanitary measures recommended by Dr. Lloyd, was the filling up of the well; and the cholera ceased in Silver-street as soon as the people gave over using the water. Another instance alluded to by Dr. Lloyd was Charlotte-place, in Rotherhithe, consisting of seven houses, the inhabitants of which, excepting those of one house, obtained their water from a ditch communicating with the Thames, and receiving the contents of the

Lloyd was the filling up of the well; and the cholera ceased in Silver Street as soon as the people gave over using the water. Another instance alluded to by Dr. Lloyd was Charlotte Place, in Rotherhithe, consisting of seven houses, the inhabitants of which, excepting those of one house, obtained their water from a ditch communicating with the Thames, and receiving the contents of the privies of all the seven houses. In these houses there were twenty-five cases of cholera, and fourteen deaths; one of the houses had a pump railed off, to which the inhabitants of the other houses had no access, and there was but one case in that house. The people in Rotherhithe, where the mortality from cholera has been greater than in any other part of the metropolis, are supplied with water to a great extent from certain tidal ditches communicating with the Thames, and receiving besides the refuse of the houses in the neighbourhood; and Dr. Lloyd informs me that a line may be drawn between the places where ditch-water is used, and those supplied from the Water Works, and that the cholera has been many times more prevalent in the first mentioned places; although, in my opinion, the water supplied from the water works is itself not free from suspicion of having conveyed cholera poison, being obtained from the Thames. Rotherhithe is less densely populated than many parts of the metropolis which have been comparatively free from cholera, and those ditches, it should be remembered, are not very offensive to the smell; being only Thames water rendered a little richer in manure; being, in short, probably equal to what Thames water would be if certain of our sanitary advisers could succeed in having the contents of all the cesspools washed into the river. In Bermondsey, the district in which next to

privies of all the seven houses. In these houses there were 25 cases of cholera, and 14 deaths; one of the houses had a pump railed off to which the inhabitants of the other houses had no access and there was but one case in that house. (b)

(b) See Med. Gaz., 1849, Vol. II., p. 429.

The following instance, as well as some others of a similar kind, is related in the Report on Cholera by the General Board of Health: –

“In Manchester, a sudden and

Rotherhithe the cholera has been most fatal, the people also have to drink ditch water to a great extent. [748/749]

violent outbreak of cholera occurred in Hope-street, Salford. The inhabitants used water from a particular pump-well. This well had been repaired, and a sewer which passes within nine inches of the [561b/562a] edge of it became accidentally stopped up, and leaked into the well. The inhabitants of 30 houses used the water from this well; among them there occurred 19 cases of diarrhoea, 26 cases of cholera, and 25 deaths. The inhabitants of 60 houses in the same immediate neighbourhood used other water; among these there occurred 11 cases of diarrhoea, but not a single case of cholera, nor one death. It is remarkable, that, in this instance, out of the 26 persons attacked with cholera, the whole perished except one." – P. 62.

Dr. Thomas King Chambers informed me, that at Ilford, in Essex, in the summer of 1849, the cholera prevailed very severely in a row of houses a little way from the main part of the town. It had visited every house in the row but one. The refuse which overflowed from the privies and a pigsty could be seen running into the well over the surface of the ground, and the water was very fetid; yet it was used by the people in all the houses except that which had escaped cholera. That house was inhabited by a woman who took linen to wash, and she, finding that the water gave the linen an offensive smell, paid a person to fetch water for her from the pump in the town, and this water she used for culinary purposes, as well as for washing.

The time does not permit of my relating any more of the numerous instances in which severe outbreaks of cholera have been connected with adulteration of the water with the contents of drains and cesspools; and this is the less to be regretted, as the influence of this kind of water over the increase of

Many medical men to whom the above circumstances respecting the water have been mentioned, admit the influence of the water, without admitting the special effect of the new element introduced into it – viz., the cholera evacuations in communicating, the disease. They look upon the bad water as only a predisposing cause, making the disease more prevalent amongst those who use it – a view which, in a hygienic sense, is calculated to be to some extent as useful as the admission of what I believe to be the real truth, but which, I think, will be found to be untenable, when the circumstances are closely examined. If the bad water merely predisposed persons to be acted on by some occult cause of cholera to which it is supposed that all are exposed, those using such water ought to become more subject to the disease from the time it enters a town or neighbourhood; instead of which it has been shown in many of the above instances that no particular effect was observed amongst those using the water, until by the occurrence of a case or two of cholera, the evacuations entered the water, when, after a short period of incubation, there were several persons attacked nearly together.

cholera is now generally admitted.

In the seventh notification of the General Board of Health, on September 18, 1849, soon after attention had been first prominently drawn to this matter, the following passage occurs: – “The ascertained fact, that the use of vitiated water acts as a poison on the stomach and bowels, producing sickness, diarrhoea, and other symptoms resembling those of cholera, has recently received melancholy confirmation in numerous instances.”

Now, in these instances, the disease induced is admitted to have been actual cholera in the same notification, and in the subsequent report of the Board, and there is no evidence to show that vitiated water generally acts as a poison; on the contrary, in many of the instances in which these outbreaks of cholera occurred, the people had been drinking the same vitiated water since the cholera of 1832. However repulsive to the feelings the swallowing of human excrement may be, it does not appear to be very injurious so long as it comes from healthy persons, but when it proceeds from cholera patients, and probably patients with some other maladies, it is a means of communicating disease. [562b]

[continued in Medical Times 3 (6 December 1851): 610-12]

Although, as I have observed, the influence of vitiated water in aiding the spread of cholera is now generally admitted, it must be stated that it is not usually understood to act in the way I have explained; but the contaminated water is thought by many to predispose persons, so that an unknown cause of cholera may act upon them in some inexplicable way. The manner in which these outbreaks occur,

when caused by the contamination of a local supply of water shows however, that it does not act by merely inducing a predisposition. The water in many of the instances had been contaminated for months or even years, when a case or two of cholera occurring amongst the people on the spot, whose evacuations entered the water through the drains or otherwise, in a day or two afterwards there was a simultaneous outbreak of the malady amongst a number of the persons using the water; whereas, if the water had merely caused a predisposition, and was not acting as the exciting cause, the cases of cholera, however numerous in the locality, might be expected to be distributed over the period that the disease prevailed in the town or district in which the locality was situated. In a review in the *Medical Gazette*, in 1849, the remark was made, that as the communication of cholera to the first case in Albion-terrace could not be traced, and was of course not attributable to the water, which did not yet contain the cholera evacuations, the same cause which would produce that case would produce others in the immediate vicinity. This must be admitted to be possible; and in the same way, if a fire had taken place from some unknown cause in No. 13, and the whole row had been burned down, it must also be admitted that a fire might possibly have originated from the same unknown cause in all the other houses about the same time, and that the burning of the one had no connexion with that of the others. No one, however, would believe this to have been the case.

Besides the local outbreaks already alluded to, it can be shown, that the cholera was often communicated through the water, on a more extensive scale, by means of the sewers which empty themselves into various rivers, from which the population of many

towns derive their supply of water. In several towns of this country, among which are Birmingham, Leicester, Bath, and Cheltenham, there were only a few cases of cholera, either in 1832 or 1849 and those chiefly in persons who had arrived from other places in which the cholera was prevailing, or among the immediate attendants of these patients. Now, all these towns were supplied with water from sources quite uncontaminated with the contents of sewers. In some towns so circumstanced, there has been a good deal of cholera, but then it was confined to the poor, and to particular localities in the towns; but on the other hand, in all those towns in which the malady extended generally, and was not confined to the poor and dirty, this connexion between the sewers and drinking-water existed. A great part of London was in this condition in both epidemics; Exeter was so in 1832, and Hull in 1849. The difference between the two epidemics in Exeter and Hull, in connexion with an altered supply of water, is very remarkable. In 1832, the people of **Exeter** were supplied with water by water-carriers, who obtained it from two mill-streams diverted from the river; and one of the chief sewers of the town emptied into a branch of the river which divided into the two mill-streams. Cholera commenced with a woman and child who had just arrived from Plymouth, where the former had been nursing another child that had died of [610a/610b] the same disease. It soon became very prevalent and severe for the size of the town. There were 1135 cases, and 343 deaths. (a)

The first cases of cholera in **Exeter**, in 1832, were three in the same day besides one in St. Thomas's, a suburb of Exeter, in a gentleman just arrived from London, where the disease was prevailing. The other three

(a) See "History of the Cholera In Exeter in 1832." by Dr. **Shapter**, to whose kindness the writer is indebted for additional information.

were a woman and her two children; the former, with one of her children, had [750/751] returned from Plymouth the previous day where she had been nursing a child that had died of the cholera. Within five days from this time, there were seven fresh cases in is many different parts of the town, amongst persons having no intercourse with each other or the first cases. The disease soon became very prevalent, and in three months there were 1,135 cases, and 345 deaths.

Exeter is situated on ground which rises from the edge of the river to an elevation of 150 feet. In 1832 the inhabitants were chiefly supplied with river water by water-carriers, who conveyed it in carts and pails. Dr. **Shapter**, from whose work the above particulars are obtained, has kindly furnished me with information concerning the sewers, and maps of their position. The water-carriers, by whom Exeter was very greatly supplied, obtained their water almost exclusively from certain streams of water, diverted from the river in order to turn watermills; and one of the chief sewers of the town, which receives such sewage as might come from North Street, in which the first cases of cholera occurred, empties itself into the branch from the river which divides into the two mill-streams just mentioned. It must be remarked that the parish of St. Edmund, in which these streams of water were situated, had a lower mortality from cholera than other parts of the town like it densely populated and on low ground near the river. Dr. Shapter attributes this lower rate of mortality, and I believe rightly, to St. Edmund's being freely intersected by running streams of water. The people would probably not drink more of the water than in parts of the town where it was less plentiful, and had to be paid for, but they would have much better opportunities for

Subsequently to 1832, Exeter has been supplied by waterworks, with water derived from the river Exe, at a point two miles above the town and more than that distance above the influence the tide. In 1849, there were only about 20 cases of cholera in Exeter, nearly half of which occurred in strangers coming into the town, and dying within two or three days after their arrival.

personal cleanliness: so that whilst they would be exposed to only the same number of scattered cases, they would be less likely to have the malady spreading through families, and by personal intercourse. After the cholera of 1832 measures were taken to afford a better supply of water to Exeter; not, so far as I can find by Dr. Shapter's work, that its impurity was complained of, but because of its scarcity and cost. Water-works were established on the river Exe, two miles above the town, and more than two miles above the influence of the tide. Exeter is now very plentifully supplied with this water, and Dr. Shapter has informed me that this year there have only been about twenty cases of cholera, nearly half of which have occurred in strangers coming into the town, and dying within two or three days after their arrival.

We will now consider the town of **Hull**, in which, together with other sanitary measures adopted since 1832, there has been a new and more plentiful supply of water, but with a different result to that at Exeter. In 1832 Hull was scantily supplied with water conveyed in pipes from springs at Anlaby, three miles from the town. About five years ago new water-works were established to afford a more plentiful supply. These works are situated on the river Hull, at Stoneferry, two miles and three quarters from the confluence of that river with the Humber. About half the sewage of the town is delivered into the river of the same name, the rest being discharged into the Humber, as appears from information and a map kindly furnished me by Dr. Horner, of Hull, who has been making great efforts to have better water obtained for the town. The tide flows up the river many miles past the water-works, carrying up with it the filth from the sewers. The supply of water is, to be sure, obtained when the tide is down,

In 1832 **Hull** was scantily supplied with water, conveyed in pipes from some springs situated three miles from the town; in the epidemic of that year the cholera was confined almost exclusively to the poor, and the deaths amounted to 300. Between that time and 1849, Hull, besides an improved system of drainage, obtained a more abundant supply of water. The water-works, however, are situated on the river Hull two miles and three quarters from its confluence with the Humber. About half the sewage of the town is delivered into the river Hull, and the tide flows up this river for many miles past the waterworks, carrying with it the filth from the sewers. In the late epidemic the deaths from cholera and diarrhoea in Hull amounted to nearly 3000, and occurred among all classes of the community.

but as the banks of the river are clothed with sedges in many parts, and its bottom deep with mud, the water can never be free from sewage. Moreover, there are some parts of the river above Stoneferry much deeper than the rest, and where the deeper water is, according to the testimony of boatmen, nearly stagnant; thus allowing the water carried up by the tide to remain and gradually mix with that afterwards flowing down. There are also boats, with families on board, pressing up the river to the extent of 5,000 voyages in the year. The water when taken from the river is allowed to settle in the reservoir for twenty-four hours, and is then said to be filtered before being sent to the town. In 1832 the cholera was confined almost exclusively to the poor, and the deaths amounted to 300.

This year, according to what I have gathered from the weekly reports, they [751/752] have been six times as numerous. Dr. Horner informs me that they have occurred amongst all classes of the community; that he thinks one in every thirty-three of the population has been carried off although 8,000 or 10,000 are said to have left the town to escape the ravages of the pestilence. All this has happened notwithstanding that the town is much better drained now than in 1832, and the drains in Hull proper are flushed frequently with water from the Docks.

The Registrar-General has very ably pointed out the connection between the higher rate of mortality from cholera on the south side of the Thames, and the lower level of the ground; but when this division of the metropolis is examined in detail, and compared with certain other parts of London, it will be found that the relation is not one simply of level, or of the state or the air in

Although there are a great number of pumps, supplied by wells, in this metropolis, yet by far the greater part of the water used for drinking and for culinary purposes is furnished by the various Water Companies. On the south side of the Thames the water works all obtain their supply from that river, at parts where it is much polluted by the sewers; none of them obtaining their water higher up the stream than Vauxhall Bridge, –the position of the South London Water Works. Now as soon as the cholera began to prevail in London, part of the water which had been contained in the evacuations of the patients would begin to enter the mains of the Water Works: whether the materies morbi of

In London the cholera was most prevalent during both epidemics in those districts supplied with water vitiated by the contents of sewers and cesspools, and indeed it generally bore an exact relation to the amount of vitiation.

The map from the second Report on the Health of Towns, which is suspended in the room, shows the districts of the metropolis supplied by the different Water Companies; and the other map, from Mr. Grainger's Appendix to the Report of the Board of Health on Cholera, is coloured to show the relative prevalence of the late epidemic in

cholera, –which, it has been shewn, there is good reason for believing is contained in the evacuations, –would be sent round to the inhabitants, would depend on whether the water were kept in the reservoirs till this materies morbi settled down or was destroyed; or whether it could be separated by the filtration through gravel and sand, which the water is stated to undergo.

Notwithstanding this filtration, the water in this part of town is not always quite clear, and sometimes it has an offensive smell when clear. The deaths from cholera in this district, which contains a very little more than a quarter of the population, have been more numerous than in all the other districts put together; as will be seen by the following table, taken from the reports of the Registrar-General. Out of the 7466 deaths in the metropolis, 4001 have occurred on the south side of the Thames, being nearly eight to each thousand of the inhabitants.

Deaths from Cholera in London, registered from September 23rd, 1848, to August 25th, 1849.

[table not included]

That division of London called the East District in the registration reports, is supplied with water entirely by the East London Water Company. In the Cholera of 1832 and 1833 the reservoirs of the company at Old Ford were entirely filled from the river Lea when the water flowed up with the rising tide from the Thames, in the neighbourhood of Blackwall; and the river Lea itself receives some large sewers. The Company have since obtained water from near Lea Bridge, above

connection with it, but that it depends altogether on the water used by the people. Not because the water carries the poison to every individual case, but because it supplies a number of scattered cases which diffuse the disease more generally.

different parts of London. A large district on the north of the Thames is supplied with the New River water, which is not contaminated by the sewers; another district on the same side of the river is supplied by the East London Water Works Company, with water obtained from the Lea, above the influence of the tide, and nearly, if not altogether, free from contamination. These districts are not much tinted with the blue of cholera in Mr. Grainger's map, except in particular spots in which there was generally a local supply of contaminated water, as, for instance, in the neighbourhood of Bridge-street, Blackfriars, where many of the inhabitants obtained water for drinking from St. Bride's pump, which was afterwards closed in consequence of its being ascertained that the well had a communication with a sewer which emptied into the Fleet ditch; and in the vicinity of Shoreditch and at Hackney, where Dr. Gavin found the contents of the privies overflowing or percolating into the wells in certain courts and allies. The north-west districts of the metropolis are supplied with water by the West Middlesex and Grand Junction Water Companies, who obtain the water from the Thames, near Hammersmith and Brentford, where the river is in a great measure free from sewage at particular times of the tide, and the water is also purified by subsidence in large reservoirs. The districts so supplied were not severely visited by cholera.

The district supplied by the **Chelsea** water-works, was not severely visited by cholera during the late epidemic, as appears by the cholera map, except in particular spots where contaminated water was used, as in the neighbourhood of Duke-street, Chelsea, where many of the people obtained water by dipping a pail into the Thames. Now, the Chelsea Company derive their supply of

the reach of the tide; but whether they still supply themselves in part from the river at Old Ford, where their chief works and reservoirs are still situated, and if so, to what parts of their district the water so obtained is sent, cannot be here stated, for want of exact information.

The cholera has prevailed to a considerable extent in the East districts, as will be seen by the Table, though not so much as on the south of the Thames.

The North districts have suffered very little from cholera as yet. St. Pancras and Islington, which comprise a great portion of this division, are supplied with the New River water, which is brought from Hertfordshire. Hackney is supplied by the East London Water Works; Hampstead by sources of its own; and Marylebone, which will again be alluded to, chiefly by the West Middlesex Water Works.

The whole of the Central Districts are likewise supplied from the New River, and this part of the town has suffered much less from cholera, hitherto, than the south and east divisions; although many portions of it are quite on a par with the worst parts on the south of the Thames as regards overcrowding and bad smells.

The West Districts, together with Marylebone, are supplied with Thames water by the West Middlesex, Grand Junction, and Chelsea Water Works. The West Middlesex Company obtain their water above Hammersmith, and the Grand Junction at Brentford; both these places, and especially the latter, are, by the meandering course of the river, several miles above London; and unless, perhaps, at certain parts of the tide, are free from sewage water, except that of certain towns, –as Richmond, Barnes, &c. –in which the cholera has not yet been prevalent.

Westminster, Chelsea, and Pimlico are supplied with Thames water from the **Chelsea** water-works; but as the same water is supplied to the Court and a great part of the aristocracy, the Company have large settling reservoirs and very expensive filters, by means of which, probably, the greater part of the cholera poison has been got rid of.

The registrar's district of Brixton is situated on rising ground, the elevation of which varies from 12 to 140 feet above Trinity high-water mark, giving an average elevation at least equal to that part of London situated on the north of the Thames; and it is inhabited very much by people in comfortable circumstances, occupying wide and open streets, and scattered rows of houses, or even detached villas; yet in looking over the reports, I find eighty-three deaths from cholera since May last. The population in 1841 was 10,175; this would yield 81 deaths in the 10,000, or twice as many as have occurred on the north of the Thames; but the population of Brixton has probably increased since 1841, by the building of new houses, more than in London generally. Still there can be no doubt that the mortality there from cholera has been much higher than in many of the worst parts to the north of the river; and the reason is not far to seek, for the greater part of the Brixton district is supplied by the Lambeth water-works with water obtained from the Thames near the **Hungerford** Suspension Bridge.

water from the Thames at Chelsea, where it is very foul; but having till lately to supply the Court and a great part of the nobility, they have large and expensive filters, and also very capacious settling reservoirs, in which the water is kept for a considerable time before its distribution. Dr. Hassall found the Chelsea Company's water to contain much less organic matter than that of the Companies supplying the districts on the south of the Thames; and he found it to be free from the hairs of the down of wheat, yellow ochreous substance, (believed to be partially digested muscular fibre,) and other substances which had passed through the alimentary canal, and were found in the Vauxhall and Lambeth Companies' water.(b)

(b) A Microscopic Examination of the Water supplied to the Inhabitants of London.

The districts of London, on the south side of the river, are [610b/611a] supplied with water obtained from the Thames near the **Hungerford** Suspension Bridge, and at Vauxhall, by the Lambeth, the Vauxhall, and the South London Companies. The water is very imperfectly filtered and has little or no opportunity to subside; and according to the evidence of Dr. Hassall, mentioned above, it contains a great deal of excrementitious matter. The cholera was very much more severe on the south side of the Thames than on the north, as appears by the map. There were other causes for this besides the water supplied by the Companies. The **wells** in this part of the town are very shallow, and are often vitiated by the contents of the cesspools, which percolate through the ground; and a yet more important cause of the great prevalence and fatality of cholera was

The Chelsea Company, which supply Chelsea, Pimlico, Westminster, and part of Brompton, get their water at Chelsea, only one or two miles above Vauxhall; but they take great pains to filter it carefully. It will perhaps be remarked that the dilution of the cholera poison in the Thames would most likely render it innocuous; but as far as can be judged from analogy, the poison consists probably of organized particles, extremely small no doubt, but not capable of indefinite division, so long as they retain their properties.

The water works supplying the South of London take water from the Thames mostly at places near which the chief sewers run into it. Moreover, the **wells** in this part of London are very liable to be contaminated by the contents of cesspools. Mr. Quick, engineer of the Southwark waterworks, in his evidence before the Sanitary Commissioners in 1844, said*

(*First Report, p. 396.)

that in the South side of the Thames the wells are often so contaminated owing to the cesspools and the wells being often about the same depth –viz. from eight to twelve feet, whilst on the north of the Thames the wells require to be from thirty to seventy, or eighty feet deep. These, together with the water from the ditches mentioned above, are the chief sources of the high mortality on the south of the Thames, and where they are not in operation there has been comparative immunity from the disease.

The part of the metropolis most severely visited by cholera in 1832, was the **Borough of Southwark**, in which 97 persons in each 10,000 of the population were carried off, being nearly three times the proportion of deaths that occurred in the rest of London. Now the population of Southwark at that time (such of them as did not use pump-water), were supplied by the Southwark Water Works with Thames water obtained at London Bridge, and sent direct to their dwellings

the existence of certain tidal ditches in Bermondsey and Rotherhite, the places in which the mortality was greater than in any other part of the Metropolis in the late epidemic. These ditches were the direct receptacles of the excrementitious matters of a large population, and furnished at the same time the only supply of water that could be obtained by a great number of the inhabitants. I was furnished by Mr. Grant with the result of a house to house visitation in Jacob's Island, which is surrounded by one of these ditches, and it shows that the mortality from cholera was much higher among the people who had no supply of water except from the ditches, than among those who had access to the pipe-water of the Company.

In the epidemic of 1832, the part of this Metropolis most severely visited by cholera was the **Borough of Southwark**, in which ninety-seven persons in each 10,000 of the population were carried off, being nearly three times the proportion of those that died in the rest of London. Now, the Borough at that time was supplied by the Southwark Water Works with Thames water obtained at London-bridge, and sent direct to the houses without the intervention of any reservoir.

The communication of cholera by means of the Water is well illustrated by the

without the intervention of any reservoir. The Thames has since become more polluted by the gradual abolition of numbers of cesspools in the metropolis, and the Southwark Water Works have been removed to Battersea, a little further from the sewers. I am endeavouring to compile a full account of the recent epidemic in London, in its relation to the water, but as it is not yet complete I must here be content with citing certain instances of severe visitation, or of exemption from its ravages.

instance of Moscow, which was severely visited by that disease in 1830, but much less severely in the second epidemic.

Subsequently to 1830 the greater part of the town, which is situated to the north of the Moscow river, obtained a supply of excellent water conducted in pipes from springs at a distance; and the cholera in 1847 was chiefly confined to those parts of the town which lie to the south of the river, to which the new supply of water did not extend, and where the people had still only impure river water to drink. (a)

(a) Report of Swedish Commissioners, quoted in the Second Report of the Metropolitan Sanitary Commission. 1848.

The Table [copied. and suspended in the room] from the Weekly Report of the Registrar-General of January 12, 1850, shows the mortality from cholera in the different districts of London supplied by the various Water Companies; and if the purification of the Chelsea water, and certain local contaminations of the water before mentioned be taken into account, the mortality will be found to bear a very close relation to the absence or presence of connexion between the sewers and the water supplied. It also appears from the same table that the average mortality from all causes in a series of years bears a relation to the quality of the drinking water. There is great reason to believe that typhoid fever and some other epidemic diseases are communicated occasionally through the drinking water; and there are a great number of facts in the history of the Plague that have led me to believe that it is communicated in exactly the same way as cholera. There are also many circumstances

which render it probable that the cause of one disease not epidemic and communicable from person to person, but endemic viz., ague -- often exists in the water of marshy districts, and is acquired by drinking the water; but there is not space to enter on these subjects at present. (b)

(b) Mr. Wm. Blower, surgeon of Bedford. speaking of Woot, . near Bedford, says, "A few wells have been dug lately, and good water has been obtained, and there is every probability, that if the water pits were filled up, and more wells-dug, and the draining completed, that sporadic typhus and ague which have so long infested this village, and occasioned so much distress and expense, might be entirely eradicated. A respectable farmer informed me that, in the neighbourhood of Houghton, a few years ago, his was the only family that used well water, and almost the only one that escaped ague." -- General Report of Poor-law Commissioners on the Sanitary Condition of Great Britain, 8vo. 1842. P. 66.

Mr. Grainger also quotes some instances, at page 94 of his recent Appendix to the Cholera Report, in which a number of persons contracted intermittent fever by drinking marsh water, while others, exposed no the same atmosphere, who did not drink the water, altogether escaped.

The large public institutions of

Bethlem Hospital is very copiously supplied with water from, an Artesian well on the premises, and I am informed that there have been but two or three cases of cholera out of a population of about seven hundred. Mr. Morton, Surgeon to the Queen's Prison, informs me that, although there has been a good deal of diarrhoea there have been but two cases of cholera in that establishment, containing a population, with the officers and attendants, of 300 and upwards, and one of the cases (the only fatal one) occurred in a patient who had been about a week in the prison, had suffered from an attack of cholera just before he entered, and had lost some members of his family by it. Now, the Queen's Prison is supplied with very good water from various wells within the walls. Bethlem Hospital is situated in Lambeth, where one in every eighty-eight of the population have been carried off by cholera; and the Queen's Prison in Southwark, where one in every sixty persons have died of it: and the latter establishment is closely surrounded by houses, in numbers of which the cholera has been very fatal. In another institution in

London, in which the [611a/611b] inmates are shut up from the rest of the community, showed the influence of the water, or the absence of that influence, in a remarkable manner during the late epidemic of cholera. **Bethlem Hospital** and the **Queen's Prison** are both supplied with water from deep wells on the premises, and, although situated on the south of the Thames, in a district in which the cholera was very fatal, there was not a death from that disease in Bethlem Hospital, with a population of more than 400, and only one death in the Queen's Prison, with a population of 300 and upwards. In Milbank Prison, on the contrary the cholera was very prevalent until the greater number of the prisoners were sent away. It was considerably worse, in fact, than among the population outside in the same neighbourhood. There were 113 cases and 48 deaths; the deaths amounting to 4.3 per cent. of the average number of prisoners. The water used in the Milbank Prison was obtained from the Thames at the spot: it was filtered, indeed, through sand and charcoal, but not kept for a while in large reservoirs like that sent from the Chelsea Water-works to the rest of Pimlico and Westminster. In Tothillfields Prison, supplied by the waterworks just mentioned, there were 13 deaths from cholera among 800 prisoners, but in all the other prisons on the north of the Thames which are supplied with water into which the sewage cannot enter, there was but one death. from cholera; that death took place in Newgate.

London, situated at the same elevation as those just mentioned, there has been, together with a difference of water, a difference in the relative prevalence and facility of cholera amongst its inmates and the surrounding population, but here it has been against the institution and in favour of those outside: I allude to the Millbank Prison. The cholera showed itself there soon after its appearance in London last autumn; and during the summer of the present year it became very prevalent, and the greater number of the prisoners were sent away. Dr. Baly stated before the coroner that the cases occurred in different parts of the prison, amongst persons having no connection with each other, and that the strongest and most healthy men were often its victims. The water used in the Millbank Prison is obtained from the Thames at the spot, and is filtered, through sand and charcoal and looks very clear. Before these investigations there could be no objection to such water; but it would appear, by the result that the filtration was not an effectual safeguard. I cannot help suggesting that the water used here may have had some connection with the dysentery which has been often prevalent in this prison, for dysentery has apparently been kept up in India by water containing human excrements; and the same circumstance was observed in the old barracks at Cork, by Mr. Bell, surgeon of that town.

(*Dr. Cheyne on Dysentery, Dublin Hospital Reports, vol. iii.)

The first cases of cholera which occurred in London in the autumn of 1848 are particularly interesting with reference to the influence of the water of the Thames. According to the valuable Report of Dr. Parkes on the subject, subsequently corrected by him in one or two particulars, in consequence of some information which I received from Mr. Russell, surgeon, of Horsleydown, the first case of cholera in London (when the disease was introduced into this country from Hamburg, the greatest commercial town on the continent of Europe, as it had been just seventeen years before) occurred on September 22nd, in a seaman named John Harnold, newly arrived by the Elbe steamer. It is, indeed, said that cases of cholera occurred in London prior to this; and Dr. Copland mentioned one in the *Medical Gazette* as having happened on July 11th, in a man who had been employed on board of a

Mr. Russell, of Horsleydown, who attended

the two first cases of the disease occurring in London last autumn—that of John Harnold, a seaman just arrived from Hamburgh, where the disease was prevailing, and that of a man named Blenkinsopp, who came, after the death of the former, to lodge and sleep in the same room, and had the cholera eight days after him*—states, that the next cases in Horsleydown, which commenced three or four days after wards, were in a situation a little way removed from that of the two preceding, and having no apparent connection with it, except that an open sewer, up which the tide flows, runs past both places, and the sewage from the houses in the first neighbourhood is, when the tide rises, carried past those in the second.

*some serious mistakes respecting these cases have crept into the documents furnished to Dr. Parkes by the General Board of Health, as subject matter for his inquiry into the bearing of the earliest cases of cholera on the question of contagion; as will be evident from a comparison of the following quotations from Dr. Parkes's paper, with the accompanying statement of the real circumstances:--

“The Elbe steamer left Hamburgh on the 22d September, and arrived in the river on the 25th. A seaman, named John Harnold, left the vessel, and went to live at No.8, New Lane, Gainsford Street, Horsleydown. On the 28th of September he was seized with symptoms of cholera, and died in a few hours. It is stated in a letter to the General Board of Health, from Mr. Russell, who attended the

steam-vessel from St. Petersburg, where the pestilence was then prevailing. But, looking on the case of John Harnold as the first, then the next case occurred in the same room, on September 30th – eight days afterwards – in the person of a workman, named Blenkinsopp. These cases occurred in New-lane, Gainsford-street, Horsleydown, close to the Thames. In the evening of the day on which the second case occurred in Horsleydown, a man was taken ill in Lower Fore-street, Lambeth, and died on the following morning. At the same time that this case occurred in Lambeth, the first of a series of cases occurred in White Hart-court, Duke-street, Chelsea, near the river. A day or two afterwards, there was a case at 3, Harp-court, Fleet-street. The next case occurred on October 2nd, on board the hulk Justitia, lying off Woolwich; and the next to this in Lower Fore-street, Lambeth, three doors from where a previous case had occurred. The first thirteen cases were all situated in the localities just mentioned; and on October 5th there were two cases in Spitalfields.

Now, the people in Lower Fore-street Lambeth, obtained their water by dipping a pail into the Thames, there being no other supply in the street. In White Hart-court, Chelsea, the inhabitants obtained water for all purposes in a similar way. A well was afterwards sunk in the court; but at the time these cases occurred the people had no other means of obtaining water, as I ascertained by inquiry on the spot. The inhabitants of Harp-court, Fleet-street, were in the habit, at that time of procuring water from St. Bride's pump, which was afterwards closed on the representation of Mr. Hutchinson, surgeon, of Farringdon-street in consequence of its having been found that the

patient, that all the characteristic symptoms of cholera were present. Mr. Bowie, who inquired on behalf of the Board into the particulars of the case, corroborated this statement. This may, then, be considered as an undoubted case of Cholera.”

“If the disease was imported thus from Hamburgh, it did not spread in Horsleydown. Two days subsequently, indeed, Mr. Russell was sent for to a patient in the same house, who fancied he had cholera; but, on examining into particulars, it turned out that the individual in question had been greatly alarmed at the death of the seaman, and was suffering more from the effects of fear than anything else. He was quite well in a few hours. No other person was taken ill in the house or immediate neighbourhood, although, if the second case had not been inquired into, a vague story of communicated disease might have arisen in the neighbourhood.”

Now, the illness and death of John Harnold took place on the 22nd of September, and not on the 28th, and Mr. Russell attended the next case in the same room on September 30th. There were, in this latter case, rice-water evacuations, and, amongst other decided symptoms of cholera, complete suppression of urine from Saturday to Tuesday morning, and the patient vomited incessantly for twenty-four hours after this, and after wards had consecutive fever. Mr. Russell had seen a great deal of cholera in 1832,

well had a communication with the Fleet-ditch sewer, up which the tide flows from the Thames. I was informed by Dr. Dabbs, that the hulk *Justitia* was supplied with spring water from the Woolwich Arsenal; but it is not improbable that water was occasionally taken from the Thames alongside, as was constantly the practice in some of the other hulks, and amongst the shipping generally.

It must no doubt seem very unlikely to many that the materies morbi of a disease should pass for a distance of two or three miles through the water; but the propagation of [611b/612a] plants and the lower forms of

and had no doubt of this being a genuine case; and he has seen a great deal of the disease lately, and still continues of the same conviction.

The mistake in the date alone at which the first case occurred, alters the bearing of all the facts submitted to Dr. Parkes, even should the particulars of all the other cases be correct. The writer accidentally detected the errors pointed out in this note by having to call on Mr. Russell in his inquiries respecting Surrey Buildings.

The writer, however, does not wish to be misunderstood as making this comparison so closely as to imply that cholera depends on veritable animals, or even animalcules, but rather to appeal to that general tendency to the continuity of molecular changes, by which combustion, putrefaction, fermentation, and the various processes in organized beings, are kept up.

the cholera poison must multiply itself by a kind of growth, changing surrounding materials to its own nature like any other morbid poison;

animals by seeds and ova which can be transported to a distance would appear equally improbable, were it propounded for the first time. Analogy leads to the belief that, however minute the particles which propagate cholera, they must yet have a definite structure, (probably that of a microscopic cell), and must therefore not be capable of dilution, so as to be rendered inert.

In the autumn of 1849, Drs. Brittan and Swayne, of Bristol, considered that they had discovered the cause of cholera in a minute fungus; and Dr. Wm. Budd, of the same city, met with the supposed fungus in various specimens of water used as drink, in places where the cholera was very prevalent. It was, perhaps, too much to expect, that we should obtain a knowledge of cholera more exact than that which we possess of syphilis, small-pox, and other better known diseases; and the supposed fungi were resolved into other things. As many of these, however, were particles of bran and other matters which had passed through human intestines, the labours of these gentlemen confirm the fact of the water in various places being a medium of communication between the alimentary canals of cholera patients and those of other people.

In one of the Registration Reports, in the beginning of last year, Mr. Farr pointed out a remarkable connexion between the prevalence of the cholera of 1849 and the temperature of the Thames. The probable reason of this connexion is, that the cholera poison does not so well retain its properties unimpaired in water below 60° Fahr. as at warmer temperatures. Mr. Farr appeared to attribute the influence of temperature to the increased amount of vapour and effluvia given off from the surface of the river; but this would not explain the influence of the

The recognized physical conditions of the season do undoubtedly influence cholera. Although it can flourish in every temperature, warm weather is usually most congenial to its progress. In September last the number of cases began to decrease both in London and many parts of the provinces immediately after a considerable diminution in the temperature of the weather. This circumstance, however, is quite compatible with almost every theory of the cause of cholera. It certainly does not oppose the view of the communication of the disease; for whilst temperature modifies the habits as well as the constitution of man, it might also be expected materially to influence the cholera poison, when it has to remain any time out of the body between quitting one patient and entering another, for the lower forms of organisms to which the special animal poisons bear a marked analogy, are greatly influenced by heat and cold.

Assuming the views here entertained to be correct, it is not to be expected that we should be able to trace the communication of every case of cholera. The very nature of the mode of propagation of disease above explained must render it obscure and difficult of detection. And the difficulty is probably increased by the poison being conveyed by persons in whom the disease proceeds no further than diarrhoea. The communication of intestinal worms from one patient to another has never been detected, and yet we are obliged to conclude that their minute ova are swallowed, unless we not only adopt the hypothesis of spontaneous generation, but apply it to creatures much higher in the scale of development than do the usual advocates of the doctrine.

water on those who drink it.

It may be here remarked, that it would be unreasonable to expect to trace every case of cholera, either through the water, or by contamination of the food; more especially as it is sufficiently probable that the disease may be communicated by cases which proceed no further than preliminary diarrhoea. If the view here given be found to explain more of the progress of cholera the more it is inquired into, it must be held to account for the cases which cannot be traced, in the same way that generation accounts for the existence of plants and animals under circumstances in which we cannot always trace their parentage.

With regard to preventive measures, I entirely agree with the Registrar-General, that "internal sanitary arrangements, and not quarantine or sanitary lines, are the safeguards of nations." For I believe that quarantine would often be evaded, and is altogether unnecessary. The presumed sanitary measures however, should have a particular reference to the mode of communication of cholera, otherwise they may sometimes be prejudicial instead of advantageous. I have given one instance in the case of Hull, where the malady was nearly ten times as fatal in the late as in the former epidemic, on account of a more plentiful supply of water having been obtained without reference to its quality. In London, the late epidemic was three times as

fatal as that of 1832. This was, in my opinion, partly owing to the manifestoes of the General Board of health, which were understood to imply that the cholera was not communicable or catching in any way; and these documents had an immense circulation, by being copied into the newspapers. The effect was also due to presumed sanitary measures employed both in the interval of the two epidemics and during the late one. In the interval a great number of cesspools had been abolished, and a much larger amount of fæces became daily sent into the Thames, whilst a great portion of the people had still to drink the water; and during the epidemic itself, the flushing of the sewers increased the mischief in two ways: first, by driving the cholera evacuations into the river before there was time for the poison to be rendered inert by decomposition; and second, by making increased calls on the various companies for water to flush the sewers with, so that the water which they sent to their customers remained for a shorter time in the reservoirs before being distributed. It should be remarked also, that the contents of the sewers were driven into the Thames by the flushing, at low water, and remained flowing up the stream for four or five hours afterwards.

The sanitary measures required for the prevention of cholera, according to the views here explained, suggest themselves at once. They are as follow: –

1. The entire disuse of water into which sewers flow, or [612a/612b] which is navigated by persons living in boats, or which is in any other way contaminated by the contents of drains or cesspools.
2. An extended use of hand-basins and towels among the poor, together with sufficient water always in readiness.
3. Strict cleanliness in every one

If the writer's opinions be correct, cholera might be checked and kept at bay by simple measures that would not interfere with social or commercial intercourse; and the enemy would be shorn of his chief terrors. It would only be necessary for all persons attending or waiting on the patient to wash their hands carefully and frequently, never omitting to do so before touching food, and for everybody to avoid drinking, or using for culinary purposes, water into which drains and sewers empty themselves; or, if that cannot be accomplished, to have the water filtered and well boiled before it is used. The sanitary measure most required in the metropolis is a supply of water for the south and east districts of it from some source quite removed from the sewers.

It should be observed, that the mode of contracting the malady here indicated does not altogether preclude the possibility of its being transmitted a short distance through the air; for the organic part of the *fæces*, when dry, might be wafted as a fine dust, in the same way as the spores of cryptogamic plants, or the germs of animalcules, and entering the mouth, might be swallowed. In this manner, open sewers, as their contents

about the patient, or the dead body; and especial care in all such persons to wash their hands before touching food.

4. The separation of the healthy from the sick, and their removal to another abode, when they have no place but the sick room in which to prepare and take their meals.

5. The immersion of all soiled linen in water, until it can be scalded and washed; for if it should become dry, the *fæces* might be wafted about in the form of dust and so be swallowed by any one who should come near the linen.

In the way just indicated, it is probable that cholera may be occasionally communicated for a short distance through the air; and when small-pox and other diseases are communicated through the air, it is most likely by organised particles, which are wafted like the seeds of plants and the ova of some animals, and not by anything in the form of gas or vapour. Indeed there are neither facts nor analogy to show that any kind of epidemic disease whatever can be caused by the air, or even influenced by it, otherwise than indirectly. Epidemics have been attributed to the state of the atmosphere since the time of Hippocrates, and the antiquity of the belief causes it to be received as an indisputable axiom, although our better knowledge of the nature of the air, and of gaseous bodies in general, is capable of entirely disproving it. But the facts which disprove the atmospheric theory of diseases are often pressed into its service, and so handled as to lend it apparent support.

It is a curious circumstance that the medical men who are most active in advocating the sanitary measures which, as a general rule, would prevent the communication of cholera, for the most part disbelieve in its communicability, probably

are continually becoming dry on the sides,
might be means of conveying cholera,
independently of their mixing with water used
for drinking.

because the question had never suggested itself to them, except in the form of infection by means of effluvia, or of contagion by contact. What is still more remarkable is that these gentlemen generally look on the presence of all those circumstances which aid in the communication of cholera, when found in situations where the pestilence prevails, as proofs that it is not communicable. They speak of these circumstances as something which can explain the increased prevalence of the disease without its being communicable, although it has never been explained in this way, even by a hypothesis. One or two hypotheses have indeed been attempted, but have signally failed. One of the most able and experienced authors on cholera writes, for instance, as follows . – “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.” The above quotation is from Dr. Sutherland’s Appendix to the Report on Cholera; but the latter part of the supposition is quite incapable of being entertained for various reasons, one of which is, that the assumed epidemic influence, in order to be capable of acting in this way, must consist of some material mixed with the atmosphere, and if so, it would diffuse itself through the air, and would also pass along with the air. It could not travel against the

wind, or remain in a spot for weeks, without extending to the next parish when the air is moving at the rate of one or two hundred miles a day.

There is much evidence on the subject of this paper which I had not room to bring forward, and many important points connected with it that have not been able even to allude to; but I trust that I have succeeded in drawing the attention of the Society to the views I have endeavoured to explain, in such a way that they will be induced to consider the question carefully for themselves. (a)

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(a) This paper was originally read before the Epidemiological Society.