

ON THE MODE OF COMMUNICATION  
OF CHOLERA.

(Pamphlet, August/September 1849)

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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.

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

ON THE PATHOLOGY AND MODE OF  
COMMUNICATION OF CHOLERA.

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923-29)

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*Reasons for considering cholera a local affection of the alimentary canal -- proofs of its communicability -- difficulties in the way of the ordinary doctrine of contagion. Cholera poison is contained in the evacuations, and communicates the disease by being swallowed : illustrations of this in the houses of the working classes – in mining districts. Cholera communicated by drinking water : cases illustrating this. Difference of elevation in London influences cholera only through the drinking-water. Communication of cholera through the water in York, Exeter, Hull.*

Writers on cholera, however much they may have differed in their views concerning the nature of the disease, have generally considered it to be an affection of the whole body, and consequently due to some cause which acts, either on the blood or the nervous system. The following are the reasons which have led me to entertain the opinion that cholera is, in the first instance at least, a local affection of the mucous membrane of the alimentary canal; an opinion which I thought almost peculiar to myself when I was first led to adopt it, but which, as I have since been informed, others were beginning to entertain.

In those diseases in which there is reason to conclude that a morbid poison has entered the blood, there are symptoms of

ON THE MODE OF PROPAGATION OF  
CHOLERA.

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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. 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

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.

Reasoning by analogy from what is known of other diseases, we ought not to conclude that cholera is propagated by an effluvium. 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

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 more purging in some of the less severe cases than

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 :  
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(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
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,

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.

\*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

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.

An important part of the pathology of every disease is the knowledge of its cause. To ascertain the cause of cholera, we must consider it not only in individual cases, but also in its more general character as an epidemic. 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

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. 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

force of circulation is greatly reduced.

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. The affections they induce are amongst the most chronic, whilst cholera is one of the most acute; but duration does not of itself destroy all analogy amongst organic processes. 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.

Whilst it is matter almost of certainty that intestinal worms are in this way communicated, it is never possible to trace the communication from one person to another: hence, if this be the mode of the propagation of cholera, there must often be great difficulty in detecting it. 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

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 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. 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

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 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

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 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.

surrounding air, and acting on other persons either directly or through the medium of fomites. But with a fresh pathology of the disease this opposing evidence requires to be reconsidered, and will, in the sequel, be found to afford the strongest confirmation of the communication of the disease.

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

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 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 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 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.

The views here explained open up to consideration a most important way in which the cholera may be widely disseminated, viz., 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. The joint town of Dumfries and Maxwell-town, not usually an unhealthy place, has been visited by the cholera both in 1832 and at the close of last year with extreme severity. On the last occasion the deaths were 317 in Dumfries, and 114 in Maxwell-town, being 431 in a population of 14,000. The inhabitants drink the water of the Nith, a river into which the sewers empty themselves, their contents floating afterwards to and fro with the tide. Glasgow, which has been visited so severely with the malady, is supplied, as I understand, with water from the Clyde, by means of an establishment situated a little way from the town, and higher up the stream, and the water is professed to be filtered; but as the Clyde is a tidal river in that part of its course, the contents of the sewers must be washed up the stream, and, whatever care may be taken to get the supply of water when the tide is down, it cannot be altogether free from contamination. In the epidemic of seventeen years ago, the cholera was much more prevalent in the south and east districts of London, which are supplied with water from the Thames and the Lea, where these rivers

hands of persons waiting on the patient become soiled, and unless these persons are scrupulously cleanly in their habits, and wash 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.

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 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 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 diarrhœa in the late epidemic, chiefly among the poor, informed

are much contaminated by the sewers, than in the other parts of the metropolis differently supplied. And this is precisely what has occurred again, as will be shewn further on.

The opinions now made known have been entertained by the author since the latter part of last year, and were mentioned by him to several medical gentlemen in the winter,—amongst others, to Dr. Garrod and Dr. Parkes; but he hesitated to publish them, thinking the evidence in their favour of so scattered and general a nature as not be likely to make a ready and easy impression. Within the last few days, however, some occurrences have come within his knowledge which seem to offer more direct proof, and have induced him to take the present course.

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,

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.

With only the means of communication which we have been 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.)

The part of the metropolis most severely visited by cholera in 1832, was the Borough of Southwark, in which 97 persons

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

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 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 20<sup>th</sup>, in a little girl, who had been labouring under diarrhoea for four days. This case ended favourably. On the 21<sup>st</sup> 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

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 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.

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

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 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 above two cases commenced, a number of patients were taken ill nearly together: four on Saturday, July 28<sup>th</sup>, seven or eight on the 29<sup>th</sup>, and several on the day following. The deaths in the cases that were fatal took place as follows:--One on the 29<sup>th</sup>, four on the 30<sup>th</sup>, and one on the 31<sup>st</sup> July; two on August 1<sup>st</sup>, and one on August the 2<sup>nd</sup>, 5<sup>th</sup>, and 10<sup>th</sup> 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 20<sup>th</sup> and 21<sup>st</sup> 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.

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 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

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. 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,\*

(\*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

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,

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.

These houses are numbered from 1 to 17 in Albion Terrace, and are supplied with water from a copious spring in the road in front of the terrace, the water of which is conducted by a brick barrel drain between Nos. 7 and 8, to the back of the houses, and then flows right and left to supply tanks in the ground behind each house, the tanks being made of brickwork and cement, covered with a flat stone, and connected with each other by stoneware pipes six inches in diameter. A leaden pipe conveyed water from each tank to a pump situated in the back-kitchen. There is a cesspool behind each house, under the privy, and situated four feet from the water-tank. The ground was opened, and the drains examined under the superintendence of Mr. Grant, the Assistant-Surveyor, behind the houses No. 1 and No. 7. The cesspools at both these places were quite full, and the overflow-drain from that at No. 1 choked up. At this house the respective level of the cesspool and the water-tank were measured, and the top of the overflow-drain from the cesspool was found to be fifteen inches above the top of the tank, and the intervening ground was very wet. The overflow-drain mentioned above had no bottom, or one so soft that it could be penetrated with a stick; and it crossed at right angles above the earthenware pipe of the water-tank, the joints of which were leaky, and allowed the water to escape. Behind No. 7, Mr. Grant found a pipe for bringing surplus water from the tanks, communicating with a drain from the cesspool; and he found a flat brick drain laid

in other places drinking-water already contaminated would be nearly altogether washed away, and replaced by a fresh supply.

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

(\*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. 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

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 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/561 a] 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,

over the barrel drain before mentioned, which brings the water from the spring. It appears, from a plan of the property, that this drain, which is continued in a direction towards the sewer in Battersea Fields, brings surface-drainage from the road, and receives the drains from the cesspools, the house-drains from the sinks in the back kitchens, and the surplus water, or some of it, from the [water-]tanks. There is every reason to believe that this drain is stopped up, but that has not yet been ascertained; at all events, it was unable to convey the water flowing into it during the storm on July 26th, as it burst near the house No. 8, and inundated the lower premises of that and the adjoining house, No. 9, with fetid water; and it was from this time that the water, which had occasionally been complained of before, was found by most of the people in these seventeen houses to be more or less impure or disagreeable. The water broke out of the drain again at No. 8, and overflowed the kitchens, during a heavy rain on August 2<sup>nd</sup>. It should be particularly remarked, that the [water-]tanks are placed on the same level, so that pumping from one will draw water from the others, and that any impurity getting into one tank would consequently be imparted to the rest.

The first case of cholera occurred at No. 13, on July 28<sup>th</sup> (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 diarrhœa on July 30<sup>th</sup>: she recovered. On August 1<sup>st</sup>, a lady, age 81, at No. 6, who had had some diarrhœa eight or

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

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 connection with it, but that it depends altogether on the water used by the people. Not because the water carries the poison to

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 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 diarrhœa on July 30; she recovered. On August 1, a lady, aged 81, at

ten days before, which had yielded to her own treatment, was attacked with cholera; she died on the 4<sup>th</sup> with congested brain. Diarrhœa commenced on August 1<sup>st</sup>, in a lady aged 60, at No. 3; collapse took place on the 5<sup>th</sup>, and death on the 6<sup>th</sup>. On August 3<sup>rd</sup>, 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 28<sup>th</sup>, two on August 3<sup>rd</sup>, four on the 4<sup>th</sup>, two on the 6<sup>th</sup>, two on the 7<sup>th</sup>, four on the 8<sup>th</sup>, three on the 9<sup>th</sup>, one on the 11<sup>th</sup>, and one on the 13<sup>th</sup>. 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

every individual case, but because it supplies a number of scattered cases which diffuse the disease more generally. 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. 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

No. 6, who had had some diarrhœa eight or ten days before, which had yielded to her own treatment, was attacked with cholera; she died on the 4<sup>th</sup>, with congestion of the brain. Diarrhœa commenced on August 1, in a lady, aged 60, at No. 3; collapse took place on the 5<sup>th</sup>, and death on the 6<sup>th</sup>. 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 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 4<sup>th</sup>, 2 on the 6<sup>th</sup>, 2 on the 7<sup>th</sup>, 4 on the 8<sup>th</sup>, 3 on the 9<sup>th</sup>, 1 on the 11<sup>th</sup>, and 1 on the 13<sup>th</sup>. 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

the first patient, at No. 13, on July 28<sup>th</sup>; 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 water was found to be polluted by the contents of the drains and cesspools to a great extent. That removed by Mr. Grant from the tank behind No 1, had, when first taken out, an odour distinctly stercoraceous. It is less offensive now, at the end of twelve days, than when it was removed. It does not become clear on standing, owing to a kind of fermentation going on in it, which prevents the mud from entirely settling to the bottom of the vessel. After being filtered through paper, it is quite clear, but retains a slight disagreeable taste, and froths on being agitated. On evaporating 1000 grains to dryness, there is a residue of nearly two grains over and above the residue of salts obtained by evaporating water obtained from a pump which is supplied from the same spring. This excess consists, there is no doubt, of soluble organic matters, the exact nature of which has not been determined. In the water-tank behind No. 7, there was a dark-coloured offensive deposit, six to nine inches deep, although the depth of the tank was only two feet. There was also a scum on the surface of the water. Some of the deposit, which was removed, has been undergoing putrefactive fermentation, and giving off sulphuretted hydrogen, ever since, having a tendency to expel the cork from the bottle in which it is kept. It possesses the odour of privy-soil very distinctly. Various substances have been found in it which escape digestion,

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, 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;

other persons were attacked, and in two days more the disease prevailed to an alarming extent.

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

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. This circumstance shews, in a remarkable manner, the power of spontaneous putrefaction to free water from all impurities of an animal or a vegetable nature.

Many of the patients attributed their illness to the water: this is here mentioned as shewing that they had drank of it, and at the same time found that it was impure. As explaining how persons might drink of such water before finding out its impurity, it may be stated that the grosser part of the material from drains and cesspools has a tendency, when mixed with water, to settle rapidly to the bottom. The only houses supplied with the same water, after passing the tanks in Albion Terrace, were four in Albion Street; but three of these have been empty for months, and the fourth is inhabited by a gentleman who always suspected the water, and would not drink it. There were two or three persons attacked with cholera amongst those who came to nurse the patients after the water was condemned, and who, consequently, did not drink it; but these person were liable, in waiting on the patient, to get a small portion of the evacuations into the stomach in the way first pointed out; and

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 greater part of Westminster abounds in nuisances, and is crowded with very poor and destitute people. The average elevation of it is exactly the same as that of St. Saviour's and St. Olave's, Southwark, but the mortality from cholera, in Westminster to the end of September has been but [749/750] 69 in the 10,000; whilst in St. Saviour's it has been 162, and in St. Olave's 152 or 179, according as the deaths in St. Thomas's Hospital are left out or included. The greater part of Pimlico and Chelsea have the same elevation as the Borough, but the mortality in them has been less than one-third as great as in the Borough. 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

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 it.

“The first case of cholera in this court occurred on July 20<sup>th</sup>, in a little girl, who had been labouring under diarrhoea for four days. This case ended favourably. On the 21<sup>st</sup> 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 28<sup>th</sup>, seven or eight on the 29<sup>th</sup>, 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 20<sup>th</sup> and 21<sup>st</sup> 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

there might be food in the houses previously prepared with the tainted water. It is not here implied that all the cases in Albion Terrace were communicated by the water, but that far the greater portion of them were; that, in short, it was the circumstance of the cholera evacuations getting into the water which caused the disease to spread so much beyond its ordinary extent.

The mortality in Albion Terrace is attributed by Dr. Milroy, in a published report to the General Board of Health, chiefly to three causes: firstly, to an open sewer in Battersea Fields, which is 400 feet to the north of the terrace, and from which the inhabitants perceived a disagreeable odour when the wind was in certain directions; secondly, to a disagreeable odour from the sinks in the back kitchens of the houses, which was worse after the storm of July 26; and lastly, to the accumulation in the house No. 13 before alluded to. With respect to the open sewer, there are several streets and lines of houses as much exposed to any emanations there might be from it, as those in which the cholera prevailed, and yet they were quite free from the malady, as were also nineteen houses situated between the sewer and Albion Terrace. As regards the bad smells from the sinks in the kitchen, their existence is of such every-day, and almost universal prevalence, that they do not help to explain an irruption of cholera, like that under consideration; indeed, offensive odours were created in the thousands of houses, in London, by the same storm of rain on July 26<sup>th</sup>; and the two houses in which the offensive smell was greatest, viz. Nos. 8 and 9, —those which were flooded with the contents of the drain, —were less severely visited with cholera than the rest; the inhabitants having only had diarrhœa or mild

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.

I will now proceed to narrate some circumstances that have occurred in the provinces. The drainage from the cesspools found its way into the well attached to some houses at Locksbrook, near Bath, and the cholera making its appearance there this present autumn became very fatal. The people complained of the water to the gentleman belonging to the property, who lived at Weston, in Bath, and he sent a surveyor, who reported that nothing was the matter. The tenants still complaining, the owner went himself, and on looking at the water and smelling it, he said that he could perceive nothing the matter with it. He was asked if he would taste it, and he drank a glass of it. This occurred on a Wednesday; he went home, was taken ill with the cholera, and died on the Saturday following, there being no cholera in his own neighbourhood at the time.

When the cholera made its appearance at York, about the middle of July last, it was at first chiefly prevalent in some narrow streets near the river, called the Water Lanes. The inhabitants of this spot had been

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 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

attacks of cholera. The accumulation in the house No. 13 could not affect the houses at a distance from it. It remains evident, then, that the only special and peculiar cause connected with the great calamity which befel the inhabitants of these houses, was the state of the water, which was followed by the cholera in almost every house to which it extended, whilst all the surrounding houses were quite free from it.

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 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

in the habit from time immemorial of fetching their water from the river at a place near which one of the chief sewers of the town empties itself; and recently a public necessity had been built, the contents of which were washed every morning into the river just above the spot at which they got the water. In a short time from twenty to thirty deaths occurred in this locality; but the medical men considering the impure water injurious, the people were supplied from the water-works, with water obtained from the river at a point some distance above the town, and the cholera soon almost ceased in this part of the city, but continued to spread in some other parts. The cholera having thus abated in the Water Lanes, the gratuitous supply of water was cut off, and the people went to the river as before. There were still cases of cholera in the town, and it soon broke out again in this locality, and in the first few days of September eight deaths occurred among the persons who used water obtained direct from the river. The tap for general use was again opened, and the river water interdicted, and the cholera again ceased, and has not recurred. These circumstances were communicated to me by a friend on whose accuracy I can rely, and an extract from his notes on the subject afterwards appeared in the Yorkshire-man Newspaper.

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 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

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 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 diarrhœa, 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 diarrhœa, 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



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 23<sup>rd</sup>, 1848, to August 25<sup>th</sup>, 1849.*

[table repositioned to end of document]

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 the reach of the tide; but whether they still supply themselves in part from the river at

child that had died of the cholera. Within five days from this time, there were seven fresh cases in 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 personal cleanliness: so that whilst they would be exposed to only the same number of scattered cases, they would

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 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, diarrhœa, 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]

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. The Chelsea Company, which supply

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, but as the banks of the

[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.

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.

It will probably be objected to the views advanced in this paper, that animal poisons, when swallowed, are generally destroyed in the stomach by the process of digestion; and, indeed, it is not improbable that the material which gives rise to cholera is often thus destroyed, and its effects resisted, since the complaint is very often observed to come on when the digestive powers have been weakened by a fit of drunkenness.

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

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.

## PART II.

*Communication of Cholera through the water at Dumfries – at Newburn-on-the-Tyne – at Bilston – Exemption of Birmingham and other towns from cholera – Propagation of cholera by means of water in India – The materies morbi probably sometimes*

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

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 25<sup>th</sup>. A seaman, named John Harnold, left the vessel, and went to live at No.8, New Lane, Gainsford Street, Horsleydown. On the 28<sup>th</sup> 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 patient, that all the characteristic symptoms of cholera were present. Mr. Bowie, who inquired on behalf

*destroyed by the digestive powers – Proof of communication of cholera derived from the period of its duration – Its decline explained – Measures for preventing the propagation of cholera by means of either food or water.*

The former part of this paper concluded with the instances of Exeter and Hull, in both of which towns there had been, amongst other sanitary measures, a new and increased supply of water between 1832 and the present year; and in connection with this change was an immense difference in the prevalence of cholera for the better or the worse, according as the evacuations or the patients were shut out from, or admitted to, the water. In the next town I have to mention the drinking-water has remained the same and the two epidemics have been almost equally fatal.

The inhabitants of Dumfries drink the water of the river Nith, which flows through the town, and into which the sewers discharge their contents, which float afterwards to and fro with the tide. In 1832 there were 418 deaths from cholera out of a population of 11,606, being at the rate of 360 in 10,000, or 1 in every 28 of the inhabitants. The present epidemic visited Dumfries at the close of last year, and carried off 431 persons, or 1 in every 32, out of a population now numbering 14,000; so that the mortality has been excessive on both occasions.

There is no spot in this country in which the cholera was more fatal during the epidemic of 1832 than the village of Newburn, near Newcastle-upon-Tyne. We are informed, in an excellent paper on the subject by Dr. David Craigie,\*

(\*Edin. Med. and Sur. Jour. vol.

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)

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

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.

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

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 22<sup>nd</sup> of September, and not on the 28<sup>th</sup>, and Mr. Russell attended the next case in the same room on September 30<sup>th</sup>. 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, and had no doubt of this being a genuine case; and he has seen a

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that exactly one-tenth of the population died. The number of the inhabitants was 550; of these, 320 suffered from the epidemic, either in the form of diarrhoea or the more confirmed disease, and the deaths amounted to 55. Being aware of this mortality, I wrote, about the beginning of the present year, to a friend in Newcastle – Dr Embleton – to make inquiries respecting the water used at Newburn, and he kindly procured me some information from the Rev. John Reed, of Newburn Vicarage, which I received in February, as well as an answer from Mr. Davison, surgeon, of Newburn, to whom I had written in the meantime. I learnt from these communications that the people were supplied with water in 1832, as at present, from three wells, two of which were very little used, and that the water in the third well is derived from the workings of an old coal mine near the village. The water of this well, as I was informed, although generally good when first drawn, becomes putrid after being kept two days. It was considered that the evacuations of the people could not get into any of the wells; but the vicar thought that the water of a little brook which runs past the village, and falls into the Tyne immediately afterwards, might find its way into that well which is chiefly resorted to. Putrefaction, on being kept a day or two, is so much the character of water containing animal matter, that after receiving confirmation of my views respecting the communication of cholera by water from many other places, I recently wrote to Mr. Davison again on the subject, and he has kindly taken a great deal of trouble to investigate the matter further. He informs me that the brook is principally

deaths from cholera and diarrhoea in Hull amounted to nearly 3000, and occurred among all classes of the community.

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 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

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.

These opinions respecting the cause of cholera are brought forward, not as matters of certainty, but as containing a greater amount of probability in their favour than any other, in the present state of our knowledge. Nearly all medical men admit a cholera poison, whatever their opinions may be with respect to contagion; and many of them even speak of the purging as an effort of nature to get rid of the poison: they cannot, then, in either case, suppose that the evacuations are free from it, or that, being swallowed, the stomach should always have the power of destroying it, and preventing its producing its peculiar effects; therefore the views here stated seem to have a fair claim to the consideration of the profession. At all events, the mode of communication of cholera is a question of the most vital importance with respect to its prevention. Who can doubt that the case of John Harnold, the seaman from Hamburgh, mentioned above, was the true cause of the malady in Blenkinsopp, who came, and lodged, and slept, in the only room in all London in which there had been a case of true Asiatic cholera for a number of years? And if cholera be communicated in some

formed by water which is constantly pumped from coal pits in the neighbourhood. About half a mile before reaching Newburn it receives the refuse of a small village, and between that village and Newburn it runs through a privy used by the workmen of a steel factory. In Newburn this brook receives the contents of the open drains or gutters from the houses. The drain which conveys water from [923/924] a coal mine or drift not worked for a great number of years, to the well mentioned above, passes underneath the brook at one part of its course, and from that point runs alongside of the brook to the well, a distance of about 300 yards. Mr. Davison says that it is disputed whether there is any communication between the drain and the brook, but that it is highly probable that there may be, and that an occurrence which took place a few months ago seems to prove that there is. Some gas-water from the steel manufactory mentioned above got by accident into the brook, and some of the people affirm that the water in the well was strongly impregnated with it.

The first case of cholera in Newburn was that of a young man living close to the brook, about 100 yards above the place at which it passes the well. He was taken ill on the 29th December, 1831, and died, in the stage of consecutive fever, on Jan. 4th, 1832. There were some cases of diarrhoea in the village, but no new cases of cholera till the night of January the 9<sup>th</sup>, during which night and the following morning thirteen persons were taken ill. During the night of the 12th four persons were attacked; by the 15th there were fourteen new cases, and on this day the late vicar died – the Rev. John Edmonston. By the next day at noon there were at least fifty new cases. A few days after this 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 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

instances, is there not the strongest probability that it is so in the others –in short, that similar effects depend on similar causes?

The belief in the communication of cholera is a much less dreary one than the reverse; for what is so dismal as the idea of some invisible agent pervading the atmosphere, and spreading over the world? 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 would have been more satisfactory to the author to have given the subject a much more extensive examination, and only to have published his opinions in case he could bring forward such a mass of evidence in their support as would have commanded ready and almost universal assent; but being preoccupied with another subject, he could only either leave the inquiry, or bring it forward in its present state, and he has considered it to be his duty to adopt the latter course, and allow his professional brethren to decide what there may be of value in his opinions; and he will be happy to receive any information bearing on the points discussed

disease began to subside, and by the 2d of February had almost disappeared. As several days elapsed between the first case of cholera and the great outbreak, it is probable that the water in which the soiled linen must have been washed, and which would necessarily run into the brook, was the means of communicating the disease to the thirteen persons taken ill on the night between the 9th and 10th of January; unless, indeed, the intermediate cases of diarrhoea could transmit the disease. There have been a few cases of cholera at Newburn the present year, and five deaths, but I have not yet ascertained whether any of them occurred in houses the gutters from which enter the brook above the well; if so, probably some accidental circumstance has intervened to prevent a catastrophe like that which took place in the former epidemic.

The state of the water is often a means of the spread of cholera in mining districts, in addition to the more constant cause pointed out in the former part of this paper. In some places the mines divert the springs, and cause a great scarcity of water, thus limiting the means of personal cleanliness; in other places the people have to use water pumped out of the pits, which of course is liable to be contaminated by the faeces of the miners: this is the case to some extent in the neighbourhood of Bilston, in Staffordshire, as I learn from Dr. Ogier Ward, and also from the Health of Towns Report.\*

(\*Appendix. Part 1, p. 35. Since the above was written I have received, through the Rev. J. Win. Owen, a note from Mr. Wm. M. Hancox, surgeon of Bilston, from which I likewise learn that 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 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

in his paper.

Frith Street, Soho,  
Aug. 29, 1849.

cholera first made its appearance there this year in a street parallel with the course of a brook which receives the refuse of the whole town; and that "in a small square of buildings consisting of about ten houses, ten persons died of the disease. Most of the inhabitants of this range of houses were in the habit of using water that filtered itself into wells from this stream.")

In other districts, again, the ground is so saturated with the refuse of a large population congregated in spots which have neither sewers nor drainage of any kind, and often not even privies, that the impurities get into the wells. This is the state of Merthyr Tydvil, as we are informed by Sir H. T. de la Beche.

(\*Ibid, p. 145.)

When the cholera was at Kendal in 1832, the only place in which it was particularly prevalent was a spot called Robinson's Yard, in which there were 20 cases and 6 deaths, out of a population of 96. "From the dunghill and privies" in this yard, "there is every reason to believe that moisture percolated the earth and vitiated the water in the well, as they were more elevated, and consequently the moisture, except by evaporation, could escape in no other direction. The water, moreover, seemed impure, and it was nauseous to the taste."\*

(\*Dr. Proudfoot on the Epidemic Cholera of Kendal, Edin. Med. and Surg. Journ. Vol. xxxix., p. 79.)

In a court, also, in Windsor, in

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 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



which the cholera was lately prevailing, it was found that the contents of the drains had got into the well from which the people obtained their water.

There are several large and populous towns which nearly altogether escaped the cholera in 1832, and have had a like exemption from the epide-[924/925]mic that is now subsiding. There have been a few cases in these towns, it is true, and this makes the evidence to be derived from them more instructive; for as these cases were chiefly those of persons newly arrived from places where the disease was prevailing, and of a few individuals who were in close proximity with them after their arrival and illness, we learn that though the cholera was imported to these places and capable of affecting others, yet some means of communication necessary for its diffusion was wanting, or failed to operate. We shall find that in all these towns there was no connection between the sewers and drinking water by which the cholera could be propagated. Birmingham being a very large town, its freedom from cholera has attracted a great deal of attention, and not a few attempts have been made to solve what was thought to be a singularity, though, as we shall find, it is not really so. Birmingham possesses an advantage in point of salubrity in its elevated position, but Walsall, in the neighbourhood, which is as much elevated above the level of the sea, suffered rather severely from cholera both recently and in 1832; and Dowlais, in South Wales, at twice the elevation, was severely visited with cholera during the epidemic of 17 years ago. Birmingham is drained into the River Rea and its tributaries. "The state of the river Rea, which may be regarded as the cloaca or main sewer of the town, is very bad. The

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.

stream is sluggish, and the quantity of water which it supplies is not sufficient to dilute and wash away the refuse which it receives in its passage through the town. In hot weather it is consequently often very offensive, and in some situations it is at the seasons covered with a thick scum of decomposing matters.”\*

(\*Local Reports on the Sanitary Condition of the Labouring Population of England. 8vo. 1842, p. 194.)

From this quotation it appears that if effluvia from sewers caused the prevalence of cholera, Birmingham ought not to have escaped. The state of the river may, indeed, have since been altered, but the description would, at all events, apply to 1832. There is one good property about the river which has escaped the observation of the reporters—viz., that the water is rendered too impure for any one to think of drinking it. The inhabitants are supplied with water from springs and wells, and by water-works, from the river Taine, which is quite uncontaminated by the sewers. In Birmingham, consequently, there is no opportunity for the communication of cholera through the water, and the activity of the local Board of Health, in paying attention to every case amongst the poor, has no doubt been the means of preventing the spread of the disease from one individual to another by contamination of the hands and the food.

Bath has enjoyed an almost total exemption from cholera both recently and in 1832, although Bristol has on both occasions suffered rather severely, and this year the epidemic has prevailed in some villages still nearer than Bristol. Bath is supplied with water conveyed in pipes from the hills

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 to the same atmosphere, who did not drink the water, altogether escaped.

The large public institutions of 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

surrounding the town, whilst the sewers empty themselves into the river Avon, from which but a very few of the poor people ever obtain water. Cheltenham has enjoyed a like immunity from cholera, with Bath, and the drinking-water there is quite free from connection with the sewers.

The above-mentioned three towns possess some physical advantages, in addition to the purity of the water, over some of the places in which cholera has been prevalent; but such is not the state of Leicester. It is situated in a low elevation, and entire quarters of the town are liable, after heavy rains, to be covered with offensive water from the overflowing of the open sewers and badly constructed drains; and it contains a large population of underfed operatives; yet there has been scarcely any cholera there either in 1832 or the present year. Leicester is supplied with water from springs and pumps, and partly by spring water conveyed in pipes; and the river which flows through the town and receives the sewage, is so much altered by the refuse of dye works, that the water is quite undrinkable.

Preston and Oldham, in Lancashire, are supplied with water from surface drainage on the neighbouring hills, and there has been scarcely any cholera at either of these places. The greater part of the town of Paisley is supplied in a similar way; and I am informed that the cases of cholera which have occurred there in the recent epidemic [925/926] were confined to a quarter of the town to which this supply of water does not extend. Nottingham is supplied with filtered water obtained from the river Trent, some distance above the town. In 1832 this supply did not extend to all the inhabitants, and the cholera was somewhat prevalent amongst the poor, of

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. The first cases of cholera which occurred in London in the autumn of 1548 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 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 30<sup>th</sup> – 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,

whom it carried off 289; the population of the town being 53,000. Since that time the water has been extended copiously to all the inhabitants, and there have been but six deaths from the epidemic in the present year. The local Sanitary Committee place the supply of water amongst the chief causes of this immunity from cholera,\* and I believe justly.

(\*See Med. Gaz., p. 672.)

However injurious impure water must be to the health, there is no reason to suppose that it can assist in the spreading of cholera unless it contain the excretions of the patients. Stafford is an illustration of this. In that town, as I learn through the kindness of Dr. Harland, there is not a single sewer, and the liquid refuse from the houses runs down the channels on each side of the streets. It is common at the poorer houses to have holes dug in the ground to allow the waste and refuse water to run into. The town is built on a bed of sand, and water is everywhere found it 8 or 10 feet below the surface, and the whole of the inhabitants have pumps convenient to their dwellings. Dr. Harland, from whom I have these particulars, says he has no doubt that in many cases the refuse liquid must percolate through the sand and get into the pump water; and he has known some instances in which the filthy surface water was allowed to get into the wells. There has been scarcely a case of cholera at Stafford at any time, although the disease has been very prevalent at Bilston, and many other places in Staffordshire, both recently and seventeen years ago. As almost every house has its own well, it is evident that the water does not afford the means of

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 5<sup>th</sup> 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 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

disseminating the cholera in Stafford; but if the disease had been introduced to any extent by other means, the pollution of the wells would no doubt have rendered it more prevalent amongst the limited number of people using the water of such wells.

There are several towns in which the cholera has prevailed to a considerable extent, although the water cannot be blamed, so far as I have been able to learn. But under those circumstances it appears that the malady has been confined almost exclusively to the poor, and has spread chiefly by personal communication. So far as my inquiries have extended respecting the more considerable provincial towns, the results of them has been as follows: – In those towns supplied with water from a river where it contains the sewage of the town, the disease on making its appearance has become very prevalent. All those towns that have enjoyed a comparative immunity from cholera are supplied with water that is uncontaminated; and lastly, the cholera has prevailed to a considerable extent in some towns in which the water can have had no share in the extension of it. The profession may expect to receive at considerable amount of information on this subject shortly, from the replies that will be made to the questions lately issued by the cholera Committee of the College of Physicians.

As we are never informed in works on cholera what water the people drink, I have scarcely been able to collect any information on this point, respecting foreign countries. There are, however, one or two circumstances that I may mention. In 1831, when the cholera had extended itself across Poland, the Hungarians placed a strong cordon of military posts to guard all the

of [611b/612a] plants and the lower forms of 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

passes and defiles of the Carpathian mountains. The epidemic, however, soon showed itself on the south-west side of the chain of mountains; it first appeared in the town of Eperies, situated on one of the streams issuing from the Carpathian mountains, and two days afterwards it appeared at Tockay, a town situated about 70 miles farther south at the junction of this stream, named the Bodrod, with the Theiss.\*

(\*Dr. Craigie in Edin. Med. and Surg. Journ. Supplement, Feb. 1832, p. 150.)

Dr. Parkes informs us in his valuable work on cholera, that in the epidemic at Moulmein, in 1842-3, this disease was confined for many months almost entirely to the houses situated on or over the river; and that "one side of the main street runs close to the river, and the great majority of [926/927] cases occurred on this side; comparatively few on the other." Dr. Parkes has informed me that he has no doubt that the people living near the river drank the water obtained from it; and the river of course received the refuse of the houses near to it. The circumstances detailed in the following passage from the same page (161) of his work, seem to illustrate very well the communication of cholera through the drinking-water, and are at all events better explained by this view of their cause than any other. "The only Europeans attacked at the commencement of the epidemic were the sailors belonging to the ships in the river: the ships nearest the shore suffered most. Thus nine cases occurred on board H. M. brig Britomarte, lying close in shore; she was moved about a mile away, into the centre of the river, and no more cases

given off from the surface of the river; but this would not explain the influence of the 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 diarrhœa. 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

occurred. Three cases occurred on board H. M. brig Syren, also lying in shore: she was also moved into the centre of the river, and the cholera immediately ceased. The 63d regiment sailed in September and October, 1842, for Madras. One transport being accidentally detained three days in the river, had fourteen cases of cholera during the voyage; the other transports, four in number, got to sea at once, and had no cholera. A few cases occurred during this time among the Europeans on shore, but these consisted only of those who lived close to the river."

On some occasions in India the cholera has increased in prevalence with such rapidity that it has been thought that contagion would not account for the immense number of new cases: if, however, any of the discharges from the patients accidentally found admission to a limited source of water, we can perceive how that circumstance might account for these sudden outbreaks of the malady, in a warm climate where the drinking of water must be frequent and universal. Whether they have been really due to this cause can only be determined by persons resident in the country.

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

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

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.

The above evidence of the communication of cholera through the drinking-water, confirms the view of the disease being propagated by the swallowing of the *materies morbi* in the cases resulting from personal intercourse; for if the evacuations can produce the disease when largely diluted, a fortiori must they be capable of causing it when undiluted.

The only circumstance of which I am aware that offers any material opposition to the views on the communication of cholera here explained, is that two or three members of a medical commission in Berlin, in 1831, are related to have swallowed a portion of the cholera evacuations experimentally. The reply that must be made to this is that the stomach has most likely the power of sometimes destroying the poison. There are many reasons for concluding that this is the case. Persons are more liable to the disease in proportion as they advance in age, as is shown by comparing the attacks at different ages with the numbers living of those ages,\*

(\*See Dr. Budd's Lecture, Med.

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 because the question had never suggested



Times, Oct. 20, p. 315.)

and as people advance in life the powers of digestion diminish. Whatever has a tendency to produce indigestion, increases the liability to an attack; as fear, anxiety and excesses in eating or drinking. To that part of [927/928] the subject which refers to the communication of cholera through the water of a river, two objections naturally arise – 1st, that the large dilution might be expected to render the poison innocuous; and 2d, that the whole, or nearly so, of the people using the water ought to be affected by it. One answer applies to both the objections: it is, that a poison capable of multiplying in the body must, one would conclude, be organized, and therefore consist of particles, however minute, any one of which happening to reach its suitable habitation without being destroyed, might induce the diseases. Or if the poison be really a chemical compound, capable of complete solution without losing its properties, it might yet be imbibed by minute cells, such as mucous globules or epithelial cells,\*

(\*I am indebted for the idea of epithelium cells conveying the poison, to Dr. Lankester, who indeed thought that I had suggested it.)

and be thus conveyed without being much diluted.

It has been asked how these views explain the cessation or decline of the disease; and whilst it must be at once admitted that we cannot actually tell why the cholera begins to decline in a place just when it does, it will on sufficient examination that

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

the period of prevalence and declension of the malady are such as afford strong evidence of its communication – evidence even of this being its sole cause. 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 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

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)

54, Frith-street, Soho-square.

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

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.

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.

The fact of cholera having spread from India over the greater part of the world, and then having retired within its former

bounds to extend again after a number of years, is thought by many to have no kind of analogy amongst the more familiar diseases; but it is only a more marked instance of what occurs constantly on a smaller scale, [928/929] in all diseases in which each case owes its origin to a previous one. It is only in a great metropolis that the eruptive fevers are all constantly present; in a village or small town they each disappear, and remain absent for a longer or shorter period either till they be re-introduced from some distant place, or by poison accidentally preserved. Small islands often remain free from some of these diseases for very long periods at a time.

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. 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, who says that the deaths from cholera are now approaching the average, – a disease imported from Hamburgh after being absent fifteen years, and evidently spreading by communication in

very numerous instances; we ought not to conclude that part of the cases must depend on some other occult cause, but rather, first to examine the one sufficient cause we have found, to ascertain whether it will not explain more and more of the facts the further they are inquired into; and to search whether the localities which are favourable to cholera do not promote it through physical conditions which favour its communication.

In concluding this paper it is necessary to point out the measures which, according to the opinions and evidence above detailed, might be expected to prevent the communication, and thus stay the ravages of cholera. They are fortunately of a kind that would not interfere with commercial intercourse, and which medical men would probably be willing to make trial of, whether they do or do not entirely concur in the absolute necessity of them. The most scrupulous attention to cleanliness should be inculcated on those waiting on the sick who ought especially to be careful to wash their hands before touching food. When cholera shews itself in a family having but one room, the patient should either be removed, or the other members of the family, except those required as nurses, should be provided with an asylum elsewhere, especially for cooking and eating their meals. As the evacuations might fly about as a fine dust whenever linen should be disturbed on which they had been allowed to become dry, it is desirable that the soiled linen and blankets should be immersed in water as soon as removed, and afterwards exposed to a boiling heat. The fruit that is hawked about the streets is kept at night in the rooms (and generally under the bed, if there be a bedstead) in which a crowd of people sleep, and in those courts and alleys

into which contagious diseases are often first introduced by vagrants: hence people should be dissuaded from buying such fruit. 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. And, lastly, whilst cholera in the country, people should avoid using water which receives the contents of drains or sewers, or the refuse of persons navigating the water. Since anything touched by the hands may enter the mouth, it would be desirable to avoid even washing with such water; and all events, when no other water can be obtained, so much of it as is used for drinking and culinary purposes should be filtered and well-boiled.

I take the opportunity of expressing the obligation I am under to several medical gentlemen, to some of whom I was previously unknown, for the trouble they have kindly taken in answering my enquiries.

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Table from MCC1:

*Deaths from Cholera in London, registered from  
September 23<sup>rd</sup>, 1848, to August 25<sup>th</sup>, 1849.*

Districts of London	Population in 1841	Deaths from Cholera	Deaths to each 1,000 inhabitants

West . .	300,711	533	1.77
North . .	375,971	415	1.10
Central. .	373,605	920	2.48
East . .	392,444	1,597	4.06
South . .	502,548	4,001	7.95
Total . . . .	1,948,369	7,466	3.83