

DOCUMENT 3 (Online Companion)

A new hypothesis about the contagious propagation of cholera: John Snow, *On the Mode of Communication of Cholera*, 1849¹

(I occasionally altered the following transcription to reflect modern rules of capitalization and syntax.

See <http://johnsnow.matrix.msu.edu/work.php?id=15-78-28> in Snow's Works for an unaltered transcription and PDF of the original.)

A fortnight after the General Board of Health issued its first circular on a second possible visitation of Asiatic cholera on 5 October 1848, the Westminster Medical Society resumed weekly meetings after the summer break. The second presentation of the evening focused on cholera treatment. During the discussion period, a society member recommended "application of heat" during the advanced stages. "Dr. Snow objected . . . [on the grounds that] in cases of asphyxia such application was injurious. Cholera was not asphyxia, but . . . resembl[ed] it, so far as the internal congestion was concerned."² In the third week of October, therefore, Snow believed that cholera was a disease that primarily affected the blood.

Shortly before the new year, however, he began to think otherwise.

[5] 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 [5/6] 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 [contagion] 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—that is, by **emanations from the sick person into the surrounding air, which enter the system of others by being inhaled** and [then] absorbed by the blood passing through the lungs. There is, however, no reason to conclude a priori, that this must be

human intercourse:

Meaning at time was "communication to and fro between countries; [and] . . . social communication between individuals" (*OED*).

eruptive fevers: Diseases characterized by a rash or pustules such as measles, smallpox, etc. (*DMS*).

emanations . . . inhaled . . . blood: Infection, a contagionist theory.

¹ Dated 29 August, published early September <<http://johnsnow.matrix.msu.edu/work.php?id=15-78-28>>. Extracts from 5–15, 23–31.

² *Lancet* 2 (4 November 1848): 507–08; <<http://johnsnow.matrix.msu.edu/work.php?id=15-78-B7>>. In late-stage cholera, coagulating blood vessels prevented patients from breathing properly.

Documents 5 and 7 contain discussion of causation by general, atmospheric currents.

generally diffused:

Notion that an epidemic influence in the atmosphere pervades an entire country, a region, and/or a distinct locality.

effluvia: Emanations from animal matter undergoing pathological change or decomposition. See Glossary.

the mode of communication of cholera; and it must be confessed that it is difficult to imagine that there can be such a difference in the predisposition to be affected or not by an inhaled poison, as would enable a great number to breathe it without injury in a pretty concentrated form (the immunity not having been earned by a previous attack, as in the case of measles, etc.), 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 **effluvia**. In all known diseases in which the blood is poisoned in the first instance, general symptoms, such as rigors, headaches, and quickened pulse, precede the local symptoms. But it has always appeared, from what the writer could observe, that in cholera the alimentary canal is first affected. All the symptoms not referable to that part are consecutive [come afterwards] and apparently the result of the local affection. In those cases in which vertigo, lassitude, and depression precede the evacuations from the bowels, there is no reason to doubt that exudation of the watery part of the blood, which is soon copiously discharged, is already taking place from the mucous membrane; whilst in the cases in which the purging comes on more gradually, there is often so little feeling of illness that the patient cannot persuade himself that he has the cholera, or apply for remedies until the disease is far advanced, this being a circumstance which increases the mortality. The quantity of fluid lost by purging and vomiting, taking into consideration the previous state of the patient, the suddenness of the attack, and the circumstance that the loss is not replaced by absorption, has seemed sufficient, in all the cases witnessed by the writer, to account, by the change it must occasion in the quantity and composition of the blood,³ for the collapse, difficulty of breathing—in [7/8] short, for all the symptoms, without assuming that the blood is poisoned until it becomes 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.

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,

³ Snow's footnote: "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." Snow was referring to an article by Alfred B. Garrod, a fellow Westminster Medical Society member and former faculty colleague at the Aldersgate School of Medicine; "On the pathological condition of the blood in cholera," *LJM* 1 (May 1849): 409–37.

both therapeutical and pathological, to attribute the exudation to some local irritant of the mucous membrane; no instance suggesting itself to the writer in which a poison in the blood causes irritation of, and exudation from, a single surface, as in cholera; for the sweating, as the patient approaches to collapse, is only what takes place in other cases from loss of blood, during fainting, and in any state in which the force of circulation is greatly reduced.

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 [8/9] 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 a 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 are voided with such suddenness and force that the clothes and bedding scarcely fail to become soiled. Being almost devoid of colour and odour, the presence of the evacuations is not always recognized. Hence, they [9/10] 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. 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. 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

Summation of Fecal-Oral Hypothesis

animalcules: Microscopic animals.

continuity of molecular changes: Snow's hypothesis of cholera's efficient cause; see efficient cause in Glossary.

ejections: Vomit.

dejections: Feces.

Normal Propagation of Cholera, According to Snow's Theory

unconsciously swallowed: Part of the efficient cause, according to Snow's hypothesis; whatever the continuity of molecular change produces in cholera patients has to be ingested by others for them to be victimized.

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.”⁴ The first appearance of cholera in many of the towns of this country [10/11] 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.

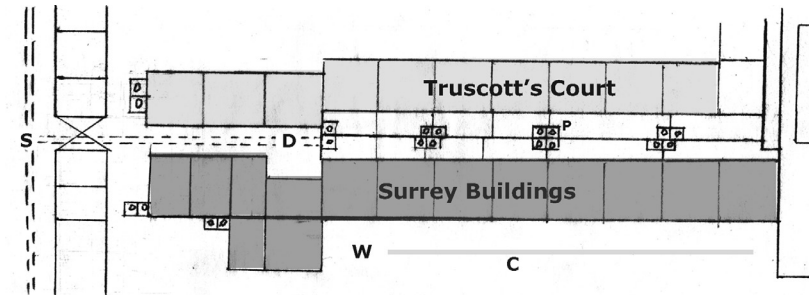
The views here explained open up to consideration a most important way in which the cholera may be widely disseminated, namely by the emptying of sewers into the drinking water of the community. As far as the writer’s inquiries have extended, he has found that in most towns in which the malady has prevailed 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 [11/12] 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 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 unlikely 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



Two Neighborhood [Point Source] Outbreaks, According to Snow's Theory

Surrey Buildings Outbreak

- Key to Sketch**
C Channel (gutter).
D Ditch carrying overflow from backyard cesspools to sewer.
P Privies (latrines).
S Open sewer in Thomas Street.
W Possible well location.

Adapted from *Bermondsey & Wapping, 1872*, and descriptions by Grant and Snow.

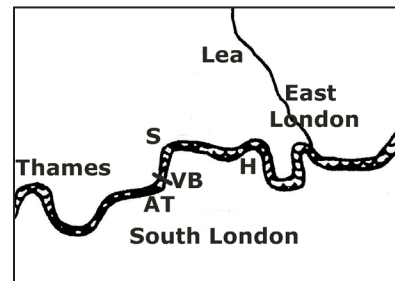
Truscott's Court, and north side of the other, which is called Surrey Buildings, being placed back to back. [There is] an intervening space divided into small back areas, in which are situated the privies of both the courts, communicating with the same drain. There is an open sewer which passes the further end of both [12/13] 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 [Surrey Buildings], 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 was 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



- Map Key**
1 St. Paul's Cathedral
2 Tower of London
3 Surrey Buildings, St. John, Horsleydown

(Modification of detail from Health of Towns Commission, *Districts of Sewers*, in *1845 Report*, facing 137.)

Municipal Propagation of Cholera, According to Snow's Theory



- Map Key**
AT Albion Terrace
H Horsleydown
S Soho
VB Vauxhall Bridge

Edmund A. Parkes: Former army surgeon in India; now General Practitioner and part-time inspector for the General Board of Health (GBoH). See Document 4-III (Online Companion).

⁴ Snow's footnote: *Edinburgh Medical and Surgical Journal* 37.

and was covered in on a level with the adjoining ground. 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, overflowed into the gutter or channel, and afterwards flowed back again mixed with the impurities. Crevices were left in the ground or pavement, allowing part of the contents of the gutter to flow at all times into the well. When it was afterwards emptied, a large quantity of black and highly offensive deposit was found in it.

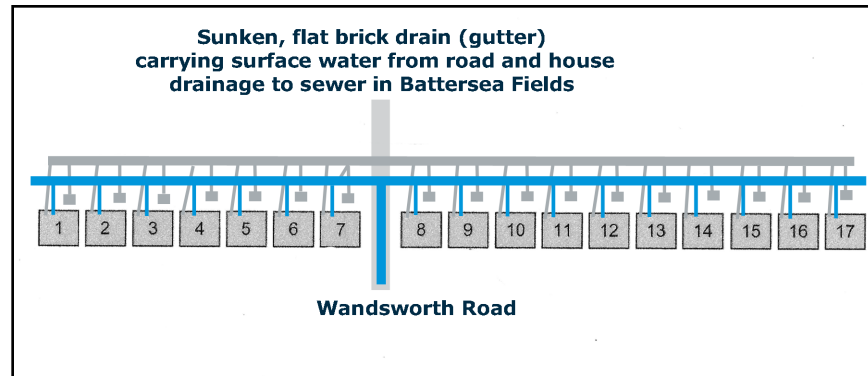
The first case of cholera in this court occurred on 20 July in a little girl who had been labouring under diarrhoea for four days. This case ended favourably. On the 21 July, the next day, an elderly [13/14] female was attacked with the disease and was in a state of collapse at ten o'clock the same night. This patient partially recovered, but died of some **consecutive affection** on 1 August. 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 [foul] 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 28 July, seven or eight on the 29th, and several on the day following. The deaths in the cases that were fatal took place as follows:—One on the 29th, four on the 30th, and one on 31 July; two on 1 August, and one on 2, 5, and 10 August, respectively, making eleven in all. They occurred in seven out of the fourteen small houses situated in the court.

consecutive affection:
A subsequent illness, possibly (but not necessarily) a recurrence of cholera.

Daily Diagram for Surrey Buildings Outbreak

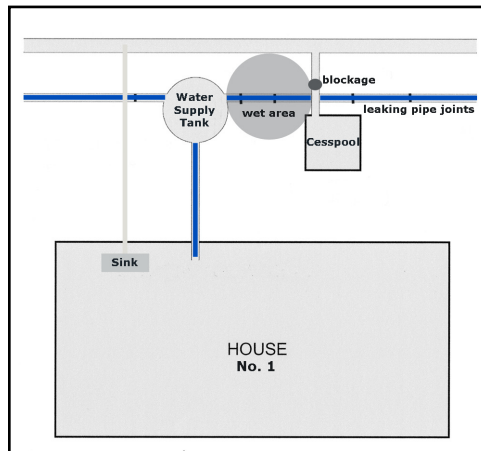
* Cholera Cases (primary cases in gray)
† Cholera Deaths

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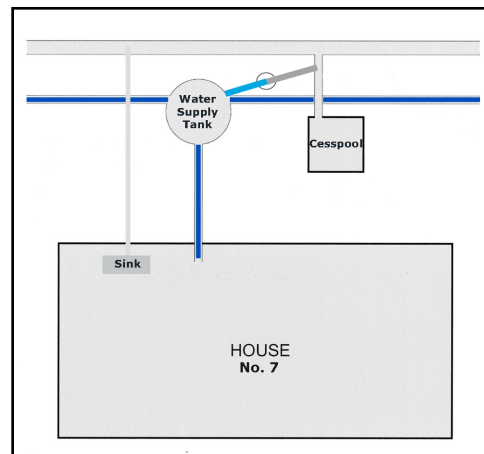


stoneware: "A hard dense kind of pottery ware, made from very siliceous [silica] clay, or a mixture of clay with a considerable amount of flint or sand" (OED).

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

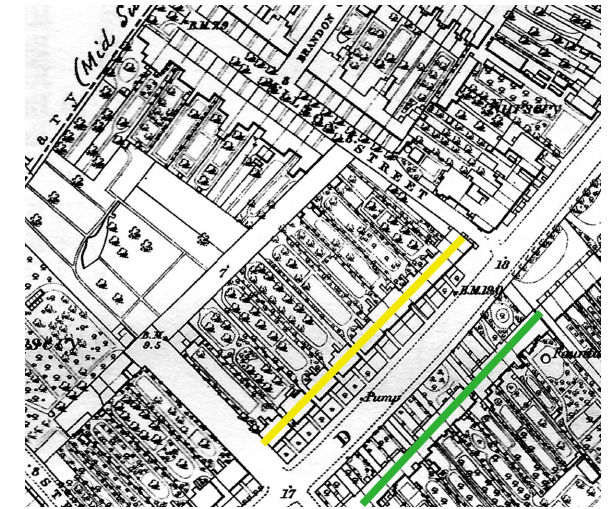


pipe for bringing surplus water from the tanks, communicating with a drain from the cesspool; and he found a flat brick drain laid over the barrel drain before mentioned, which brings the water from the spring. It appears, from a plan of the property, that this drain, which is continued in a



direction [16/17] 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 2nd. 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 28th (two days after the bursting of the drain), in a lady who had had premonitory symptoms for three or four days. It was fatal in fourteen hours. There was an accumulation of rubbish in the cellar of this house, which was said to be offensive by the person who removed it; but the proprietor of the house denied this. A lady at No. 8 was attacked with cho- [17/18] leraic diarrhoea on July 30th: she recovered. On August 1st, a lady, age 81, at No. 6, who had had some diarrhoea eight or ten days before, which had yielded to her own treatment, was attacked with cholera; she died on the 4th with congested brain. Diarrhea commenced on August 1st, in a lady aged 60, at No. 3; collapse took place on the 5th, and death on the 6th. On August 3rd, there were three or four cases in different parts of the row of houses, and two of them terminated fatally on the same day. The attacks were numerous during the following three or four days, and after that time they diminished in number. More than half the inhabitants of the part of the terrace in which the cholera prevailed were attacked with it, and upwards to half the cases were fatal. The deaths occurred as follows; but as some of the patients lingered a few days, and died in the consecutive fever, the deaths are less closely grouped than the seizures. There was one death on July 28th, two on August 3rd, four on the 4th, two on the 6th, two on the 7th, four on the 8th, three



Map Key
Yellow Albion Terrace
Green Prospect Place

(Modified detail from Ordnance Survey, *Battersea & Clapham 1870*; Godfrey, London Sheet 101.)

Milton Street, formerly Albion Street, intersects Wandsworth Road to the right of the terrace in this map. Albion Street and Albion Terrace were renamed Milton Street and Milton Terrace around 1860, and are so depicted in Stanford's Library Map of London (1862); see Document 3a (Online Companion).

				July 26 Surface-water drain overflows	27	28 * (#13) † (#13)
29	30 * (#8)	31	August 1 * (#6) * (#3)	2 Surface-water drain overflows	3 *** or **** ††	4 † (#6) ††† (many *s)
5 (many *s)	6 † (#3) † (many *s)	7 †† (many *s)	8 ††††	9 †††	10	11 †
12	13 †					

on the 9th, one on the 11th, and one on the 13th. These make twenty fatal cases; and there were four or five deaths besides amongst those who were attacked after flying from the place.

The fatal cases were distributed over ten out of the seventeen houses, and Mr. **Mimpriss**, of Wandsworth Road, who attended many of the cases, and to whose kindness the writer is indebted for several of these particulars, states that cases occurred in the other seven [18/19] 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 the first patient, at No. 13, on July 28th; but it was two or three days afterwards, when the evacuations from this patient must have entered the drains, having a communication with the water supplied to all the houses, that other persons were attacked, and in two days more the disease prevailed to an alarming extent.

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 [19/20] 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, 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 [20/21] 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 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 [21/22] 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

Thomas Robert Mimpriss: General Practitioner with surgery in Prospect Place, Wandsworth Road; LSA (1817); MRCS (1818). Member, South London Medical Society.

stercoraceous: Fecal.

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 26th; 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 diarrhoea or mild 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 [22/23] by the cholera in almost every house to which it extended, whilst all the surrounding houses were quite free from it.

Sewage-Contaminated Thames Water Furnished by Private Companies

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 obtain 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 shown, 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. Sometimes it has an offensive smell when clear. The deaths from cholera in this district, which contains a very little more than a quarter of the population, have been more numerous [23/24] 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.

materies morbi: The efficient cause, or matter, that causes sickness.

Deaths from Cholera in London, registered from September 23d, 1848, to August 25th, 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

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 [24/25] 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 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, [25/26] 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, etc.--in which the cholera has not yet been prevalent. The Chelsea Company, which supply Chelsea, Pimlico, Westminster, and part of Brompton, get their water at Chelsea, only one or two miles above Vauxhall; but they take great pains to filter it carefully. It will perhaps be remarked that the dilution of the cholera poison in the Thames would most likely render it innocuous. But as far as can be **judged from analogy**, the poison consists probably of organized particles, extremely small no doubt, but not capable of indefinite division so long as they retain their properties.

It will probably be objected to the views advanced in this paper

judged from analogy: Analogical reasoning was still the only way to conceptualize whatever caused cholera morbidum. Microscopic analysis of choleraic dejections had produced no indisputable culprit.

Map below

(Health of Towns Commission, *Water Districts*, in 1845 Report, facing 137. Larger image in Supplementary Figures.)



that animal poisons, when swallowed, are generally destroyed in the stomach by the process of digestion. 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 [26/27] the possibility of its being transmitted a short distance through the air. For the organic part of the feces, 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 Hamburg, where the disease was prevailing, and that of a man named Blenkinsopp, who came, after the death of the former, to lodge and sleep in the same room, and had the cholera eight days after him⁵—states, that the [27/28] next cases in Horsleydown, which commenced three or four days

cryptogamic: Plants or organisms that reproduce by spores, including fungi.

⁵ 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 Hamburg on the 22d September, and arrived in the river [Thames] on the 25th. A seaman, named John Harnold, left the vessel, and went to live at No. 8, New Lane, Gainsford Street, Horsleydown. On the 28th of September he was seized with symptoms of cholera, and died in a few hours. It is stated in a letter to the General Board of Health, from Mr. Russell, who attended the patient, that all the characteristic symptoms of cholera [27/28] were present. Mr. Bowie, who inquired on behalf of the Board into the particulars of the case, corroborated this statement. This may, then, be considered as an undoubted case of cholera."

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

Now, the illness and death of John Harnold took place on the 22nd of September, and not on the 28th, and Mr. Russell attended the next case in the same room on September 30th. There were, in this latter case, rice-water evacuations, and, amongst other decided symptoms of cholera, complete suppression of urine from Saturday to Tuesday morning, and the patient vomited incessantly for twenty-four hours after this, and after wards had consecutive fever. Mr. Russell had seen a great deal of cholera in 1832, and had no doubt of this being a genuine case; and he [28/29] has seen a great deal of the disease lately, and still continues of the same conviction.

The mistake in the date alone at which the first case occurred, alters the bearing of all the facts submitted to Dr. Parkes, even should the particulars of all the other cases be correct. The writer

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 [28/29].

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. 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 Hamburg, 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 [29/30] true Asiatic cholera for a number of years? And if cholera be communicated in some 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. 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

accidentally detected the errors pointed out in this note by having to call on Mr. Russell in his inquiries respecting Surrey Buildings.

his opinions in case he could bring forward such a mass of evidence [30/31] in their support as would have commanded ready and almost universal assent. But being preoccupied with another subject,⁶ he could only either leave the inquiry or bring it forward in its present state. 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. He will be happy to receive any information bearing on the points discussed in his paper.

Frith Street, Soho

Aug. 29, 1849

⁶ Laboratory experiments and writing the serialized essay, "On narcotism by the inhalation of vapours"; part 12 (of 15) appeared in *London Medical Gazette* on 17 August 1849. See Snow's Works in this website.