

**The history of sanitary progress in Croydon : a lecture delivered at the Literary and Scientific Institution, on Wednesday, April 6th, 1859 / by Alfred Carpenter.**

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**Publication/Creation**

Croydon : Printed by Gray and Warren, 1859.

**Persistent URL**

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THE HISTORY  
OF  
SANITARY PROGRESS  
IN CROYDON:

A LECTURE

DELIVERED AT THE LITERARY AND SCIENTIFIC INSTITUTION,

*On Wednesday, April 6th, 1859;*

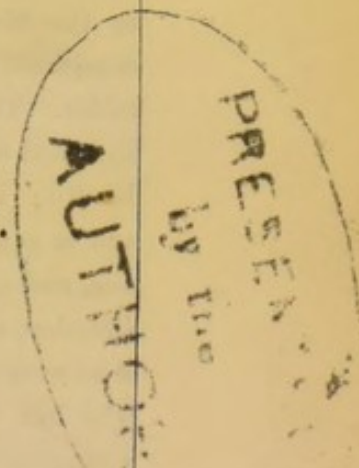
BY

ALFRED CARPENTER, M.B.

PUBLISHED BY DESIRE.

CROYDON: PRINTED BY GRAY AND WARREN, HIGH STREET.

1859.



## P R E F A C E .

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THE facts contained in the accompanying pages, having been considered worthy of a more general diffusion than can be obtained within the walls of a Lecture Hall, I have great pleasure in submitting them to the public at large, hoping that they may assist in promoting the advance of Sanitary Science and the welfare of our fellow creatures. Some portion of the matter formed part of a paper on the same subject, which was read at the meeting of the *Association for the Promotion of Social Science*, held at Liverpool last year, and some of the most striking points were then commented on in the scientific journals. The events of 1858, and also of the present year, still further shew the value of a careful attention to sanitary arrangements; and it may be reasonably hoped that the facts placed on record, will serve as beacons to guide us for the future, and save us from the errors of the past. Whatever merit may be due to the Lecture, is entirely owing to the materials provided by the Mortality Tables published by Mr. Westall, and it must be considered principally as the reflector of the facts contained in those tables. The reflection would have been still more perfect, if I could have had access to the materials in the possession of the Local Board of Health; I have however thought it best to keep an independent course, and to avoid all appearance of partizanship—to praise where praise is due, and not to withhold blame when cause for it arises. The welfare of Croydon, as well as the real interests of her inhabitants (myself included), is so wrapped up in her perfect healthiness, that it behoves every one who has the opportunity, to keep an argus-eye upon her sanitary arrangements:—no further apology is necessary for the course I have considered it right to take.

A. C.

*Croydon; April 8th, 1859.*



THE HISTORY OF  
SANITARY PROGRESS IN CROYDON.

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THERE is an old fable, well known to most people, styled, "The city in danger:" a council of the citizens was held, and the principal men of the place were invited to give their opinions as to the best method of resisting the approaching enemy. It may strike many that I am about to exemplify that fable, and imitate the shoemaker in thinking there is nothing like leather; but, if you carefully consider the purport of my discourse, you will discover that such is not the case. I look upon physic in the same light as I do a standing army, that is, as a great, although a necessary evil; the necessity for which is much increased by circumstances over which we have great control, and which can be very much mitigated at a comparatively reasonable cost. It is in reality far more profitable to a man, for his legal adviser to prevent a law-suit, than to gain an action for him; it is far more glorious to prevent a war than to gain a battle; it is far more profitable and glorious to the country, to prevent the development of disease than to cure it when developed; more profitable in all three cases to the country than to the lawyer, the soldier, or the physician individually, for, however triumphant each may be in the courts of law, on the field of battle, or at the bedside of the patient, there is sure to be a certain loss of life or property valuable to the community at large, which loss cannot be compensated for by any advantages gained. No class sees this self-evident truth so clearly as the one most interested, and if self-interest alone were their guide, none would so strongly oppose the introduction of sanitary legislation as the members of my own profession; I need scarcely ask you, if they really do so oppose sanitary arrangements.

The medical men of Croydon have in most cases consistently and continually supported sanitary progress. On going through the mass of papers I have collected upon



the subject, I find they were many years ago anxiously alive to its necessity, and foremost among its supporters: not being at that time one of the number, I may point to the fact that public duty was made to supersede private interest, and that the pioneers of sanitary science here, as well as all the world over, have been principally medical men. Joined with them, there have always been some energetic philanthropists, who have not hesitated to state their convictions, notwithstanding the ill odour into which plain speaking always brings a man; and Croydon now numbers several such among her inhabitants. I need only mention Sir F. B. Head, who has much advanced the cause of cleanliness by his writings in the *Quarterly Review*, and Mr. C. W. Johnson, who for many years was an active member of the Metropolitan Commission of Sewers, and who, in conjunction with Mr. Chadwick, materially advanced the cause of sanitary reform in London, and greatly aided it in this place also. Many inhabitants, too, nobly withstood the outcry raised against the first proceedings of the sanitary reformers. The great apostles of the science will only be fully appreciated, like most really great men, after they have departed from us; and the names of Southwood Smith, of Grainger, and Simon, will, in future days, shine the more for the neglect with which their labours and observations have hitherto been treated by the world at large.

Having been the pupil of the two men whose names I have last mentioned, it will not strike you as being much out of my course, if I ask you to glance over the history of sanitary progress in Croydon, and allude to the various circumstances which have influenced its past, or may influence its future: that future will be prosperous, or the contrary, in proportion to the way in which our present advantages are treated, and the successes which have attended our exertions against the onward march of disease followed up. It is my intention to place before you some of those advantages; to trace out the causes which have contributed to the production of those advantages; and point out how they may be imitated in other places; and likewise to shew the dangers which may beset us if we do not follow up the victories which have fallen to our share.

I do not expect to find any in this assembly, and I hope very few in our town, who will deny that it is the duty of every one to prevent illness and death whenever it is in his power, although I fear many will differ from me as to the real value of human life—it seems principally to be a matter



of £. s. d., and I fear there are many in the world who would not sink a single shilling to save the life of their nearest neighbour. 'The great enemy to the progress of sanitary science is the probable increase in the rating of a place, which is expected to follow upon the execution of such works as science calls for. An illness or a death prevented is not so clearly understood by an individual householder; it might not (he reasons) have happened in his street at all—it might not have happened to him, or his, under any circumstances—but a demand for five pounds by the rate collector instead of fifty shillings, is a very tangible circumstance, and one quite sufficient to determine his opposition "to the new-fangled notions, which are only brought forward by a lot of quacks for their own benefit; he is not going to stand it, not he, fifty shillings is fifty shillings, and he really can't afford to spend so much without the least chance (as far as his opinion goes) of a profitable return, and he don't mean to do it, that's more." Such is the forcible language held by many in every town in which an attempt is first made to introduce sanitary arrangements; it is only after disease and death have struck dismay into many households, after many a wife has been left a widow, many a child become fatherless, many a parent childless, that science steps in and tries to repair that which in many cases is irreparable; it is considering the present, or disadvantages only, and not looking to future results, that leads to opposition upon the rating score, and it is that ignorance of the theory of probabilities which necessarily exists among almost all classes, that has hitherto prevented the proper appreciation of sanitary science. It becomes the duty therefore of every place that has felt the benefits of such an outlay, to proclaim those benefits to the world at large. I believe it will be hereafter found, that every parish placing little value upon human life—every parish allowing small-pox, fever, scarlatina, and cholera to have full sway—will have a high poor rate, and land and houses will have therefore a diminished value, compared with other places where human life and health are better cared for. A high poor rate, due allowance being made for certain other circumstances, is caused by frequent illness, permanent disease, and early death among the parishioners; preventable disease is especially the most fruitful source of such results—it takes from us the blood and sinew of our country, and makes our strong men weak, our children weaker still.

With reference to this point, Dr. Southwood Smith, in his



evidence before the Health of Towns' Commission, said, "The period during which fever does the most damage, is "from the age of 20 to 40—the period of maturity, the "most precious portion of the term of existence, that during "which the individual is most fitted for all the duties and "enjoyments of life, during which he is most capable of "promoting the happiness of others, and of securing and "appreciating his own; the poorer classes usually marry "and have families at earlier ages than the middle and "higher; during the succeeding ten years they have young "families to support, often very numerous; the heads of "families being more subject to fever than any other class "of persons, being attacked precisely at that period of life "when they have the greatest number of young children "entirely dependent on their daily labour for support;" "this," says Dr. Smith, "is deserving of consideration, "viewing the subject merely with reference to the pressure "on the poor rates; but viewing it in its larger relation to "the well-being of the humbler classes, it appears to me to "deserve great attention." Mr. Chadwick also states, in his sanitary report, that "premature death in one year left 43,000 widows chargeable to the rates of the different parishes in England, and 112,000 orphans were relieved from the same source; and from reliable data obtained from other sources, it may be taken for granted that 27,000 of these widows, and 100,000 of these orphans would not have required relief, if preventive measures had been in force in those parishes to the same extent as they now exist in Croydon." What a saving this would have effected! 27,000 able-bodied men to add to our national wealth! and whose premature death must be looked upon as national loss, independently of the drain upon the poor rates, which must necessarily follow, for years to come, upon so much attendant misery. It becomes, therefore, important for those towns which have invested money in sanitary operations, to declare to the world at large the results of their investment; that must not be shewn by opinion only, but by undeniable data, so that the example may be followed or avoided as the success is decided or the reverse. It will not therefore be lost time to consider the effects of sanitary operations in Croydon, especially as a sufficient length of time has elapsed to enable us to judge of those effects, and to refer them to their proper causes.

The water supply is one of the most important elements in the proper conduct of sanitary operations: our enquiry



must therefore embrace the geological situation of the town, so as to arrive at the extent of its available sources of that essential agent in the production of cleanliness;—without water no sanitary operations can be properly carried out. Our enquiry therefore resolves itself into four heads, viz.:—

1. THE CONDITION OF CROYDON AS REGARDS ITS GEOLOGICAL SITUATION AND WATER SUPPLY.
2. THE SANITARY CONDITION OF THE TOWN BEFORE THE APPLICATION OF THE HEALTH OF TOWNS' ACT.
3. THE CONDITION DURING THE PROGRESS OF THE WORKS.
4. THE RESULT OF THOSE WORKS, AND THE EFFECT THEY HAVE HAD UPON THE VALUE OF HUMAN LIFE.

If sanitary science is anything else than a name, the results after an interval of six years ought to be visible, and the statistics of the town during those years, as compared with a preceding period, ought to leave conclusive evidence either for or against its usefulness.

We will first consider the Geological condition of Croydon. This has been so often described, that it becomes somewhat hackneyed to speak of it as standing upon a stratum of gravel, intervening between the London clay upon the north and the great chalk formation on the south. Such however is not its true geological situation, for it stands partly upon the lower beds of the great London Clay formation, known to geologists as the Woolwich beds, shewing themselves above ground at Park Hill and Croham Hurst, and extending thence in a north-easterly direction into Kent; these beds are distinct and well defined, and where they dip beneath the surface, they are covered with a thick layer of diluvial drift and gravel. This condition is seen in the gravel pit just beyond the East Croydon Station. The town therefore stands upon the verge of the great London basin, at the point of its junction with the chalk, an illustration of which is seen in the great chalk pit in Coombe Lane, beyond the reservoir: the clay indigitates with the chalk in different parts of the town in a very irregular manner, whilst in some situations, as on Duppas Hill and the Waldrons, clay, sand, gravel, and chalk are huddled together, apparently in inextricable confusion: the surface of the earth in the town itself shelves down to the valley of the Wandle, which river rises in the lower parts of the town, running thence to Waddon: this valley consists at its upper part of a thick



bed of gravel, mixed with a considerable quantity of alluvial detritus and plastic clay where it rests upon the Woolwich beds, but at the upper end, viz., towards the Brighton road, it consists principally of gravel and angular flints, and rests directly upon the chalk. The mixture of clay with gravel is readily seen on a large part of Croydon Common, so that water stands in the old gravel pits even at the highest levels, instead of draining off to the valley of the Wandle, as it would certainly do if the bed consisted of gravel only. In various parts of this Croydon Common bed, distinct ridges of clay crop up, and erect effectual barriers to the passage of water, whilst more to the south these uprising ridges are the crests of former chalk cliffs, the ledges and shelves being filled up with sand. This mixture of chalk cliffs, sand, clay, and small rounded pebbles, is well observed in the cutting through the crest of the hill as you approach the village of Sanderstead: the road has been lowered so as to diminish its steepness, and at the sides of the cutting these sharp chalk ridges are observed, just as they stood out of the sea at some former period of the earth's history, and may possibly represent a state similar to that now observed at the back of the Isle of Wight, where the Needles tower to the sky, far above the waves of the British Channel. I will not now stay to enquire by what mighty convulsion of nature the valley of the Wandle and Croydon Common became dry land, nor ask for how many ages the small rounded pebbles upon the Addington Hills, must have rolled upon the edge of that mighty sea which swept over the very spot upon which we now stand; the fact cannot be doubted, that the site of London was the bottom of some enormous estuary, or immense sea, the principal remains of which are the river Thames, and the bed of soil to which the term of London Clay has been applied by geologists;—this formation extended to Croydon on the south, and near to St. Albans on the north, the Woolwich beds being the inferior beds of the formation. Below is the Cretaceous formation, which appears beyond the clay at St. Albans on the north, just as it appears to the south at Croydon. The layer of flints and gravel which lines the upper part of the valley of the Wandle, lies upon the chalk, and extends for miles along the valleys which pierce the chalk ranges: we see it along the Brighton road as far as Hooley. These valleys have considerable bearing upon the question of our water supply.

In times gone by, when Croydon was rural, and not



suburban, each house had its own well, now and then deep and giving out bright, clear, health promoting water, being uncontaminated with those organic matters which too frequently in after times found their way into the wells. As population increased houses multiplied, and gardens became curtailed; shallow wells were dug, which were supplied only by surface water—perhaps they were in close proximity to a cesspool of the same depth and size; and thus the water supply of a large part of the population depended upon a flow liable to contamination from many different causes. The supply altogether failed in dry seasons, whilst in wet seasons it was present in abundance. When Mr. Ranger visited the town in 1849, Mr. Westall made enquiry as to the character of the water supply at 1550 houses: he found that 755 were not supplied at all, 275 had an insufficient supply, and of bad quality, being in many cases totally unfit for use, whilst scarcely more than 500 had a satisfactory quantity of water. There was one irregular period at which water existed in immense quantity, even on the very surface of the ground, especially along the Old Town and the Brighton road; this happened when the so-called Bourne waters were out, a very curious intermittent stream, worthy of more than a simple notice.

Mr. C. W. Johnson has shewn, by statistical data published in the Cottage Gardener for 1854, that whenever the rainfall was equal to 30 inches, the Bourne made its appearance about the close of that year, or early in the ensuing spring, and that it flowed whenever the rainfall much exceeded 30 inches; it has made its appearance very copiously at least five times in the present century, viz.:

1818,	33·4	inches of rain,
1821,	34·5	”
1825,	36·3	”
1841,	33·3	”
1852,	34·2	”

These intermitting streams are not unusual in the neighbourhood of the bases of both North and South Downs, and many very ingenious theories have been broached to account for them—some of these very far-fetched: the streams evidently arise from the over-charged hills giving out the water at their bases, instead of allowing it to sink down through the more dense chalk strata and impermeable layers of flints, which exist in the hills themselves. When we take into account the extent of the North Downs, reach-



ing from Farnham to Rochester, and frequently attaining a considerable elevation, it is quite evident that immense volumes of water may be poured out at any convenient place towards which the strata may incline, and will continue to flow as long as the hills themselves contain more than a certain quantity of water above the water-line of the valleys below. Such a place exists at Birchwood: the chalk hills rise rapidly upon all sides save one to the west; there a narrow gorge or valley extends with a gravelly bottom, along the hollow of which the Bourne runs, until it reaches Foxley Hatch gate; then it turns to the north round the bold western extremity of Riddledown, and advances to Croydon, saturating the gravel of the valley of the Brighton road, until it reaches the town itself, which is in the very mouth of the valley here widening out, with Croydon Common on one side and the Wandle river on the other; at South End it turns to the left, and courses (or rather did, until a channel was made for it) through the Old Town, frequently flooding the neighbourhood to the alarm of the residents, and the great injury of those who had not prepared for its coming: its advance is very gradual, for it has to fill up interstices in the gravel beds, and when it departs in the same quiet manner, it leaves destruction behind it—the grass in the channels along which it flowed is destroyed, having become coated with a white deposit of lime, and thus marks the course it took above ground through the whole of the ensuing year. In ancient times it was regarded as one of the woe waters of England, which Mr. Johnson very satisfactorily and judiciously accounts for by remarking that, “We may discern as the flowing of the Bourne followed wet and unwholesome seasons, why our ancestors, in more superstitious days than our own, not altogether without reason, fell into the error of regarding the phenomenon as the harbinger of woe.” This Bourne water runs from nearly the same source as that now supplied to the Croydon public, not however in the same condition as when it reaches the town above the ground, for having percolated through several miles of chalk, it is not charged with the same salts of lime as in the Bourne water proper: in wet seasons being given out considerably below the source of the Bourne, the salts contained in it are differently combined, just as in the artesian wells of London. These wells derive some part of their supply from the same source, yet they contain a completely different set of salts in a different state of combination, the



salts of lime being replaced by those derived from the inferior beds of the London clay. The quantity of water which came down by the Bourne in 1852—53, equalled many millions of gallons daily, independently of that which did not rise above ground, but yet found its way into or beneath the Thames. The stream still continues to run, and daily yields an enormous amount of water to the artesian wells of London: those wells will fail before our water supply will shew symptoms of exhaustion—in fact it is only bounded, as far as our wants are likely to be concerned, by the capacity of the well and the steam power employed. It is a question whether our town well has materially interfered with the shallow wells previously existing; a great complaint has been made because the latter have failed; this has probably been brought about more by the formation of the Bourne culvert, and the removal of the mill dam which formerly existed below the Parish Church, than the drain caused by the town well. The water supplied by the town well is not the only source whence a supply could have been obtained in Croydon: there is yet another source on Croydon Common, where much of the rain that falls upon the western extremity of the range of hills constituting the Woolwich beds of the London clay, finds its way to the surface of the earth. The immense volume of water coming from this source was evident in the ballast pit at the East Croydon Station, where a steam-engine has been at work for the last two or three years, pumping more than 240,000 gallons of water daily, for the supply of the Crystal Palace and the Brighton Railway Company, without doing more than keeping the ballast pit dry enough for working. This water is softer than that derived from the Bourne, not containing so much lime in solution as the latter. Lime in solution is the only fault of the Croydon water; but the major part is deposited on boiling, the hardness being reduced from 16 to 4: boiled, therefore, it becomes the purest and nearly the softest water that can be obtained. When first drawn from the pipe it is frequently quite white; this state is caused simply by pressure; a quantity of air has been forced into the water, either during the pumping process, or from the pipes becoming empty during the night, when it is turned off at the main: when the water is again turned on, the immense pressure causes the whole of the air in the pipes to be forced into the water in a very minute state of subdivision, which therefore gives a white appearance to the water itself—this state only exists for a short time after it has been drawn.



It would scarcely be right to dismiss this subject without alluding to the expense of our abundant water supply. I find that the cost for the six years during which the works have been in operation, has been about £1,200 per annum, and taking a report of the surveyor made 11th of January last as my standard, when the consumption for one half-year is computed at 168,000,000 gallons, and the expenses at £593 4s. 9d., it will amount to something like a shilling for 15,000 gallons—a cost which will not render useless waste less reprehensible, but which surely ought not to interfere with that abundant use which our sanitary arrangements require, to render the system free from objection.

We now come to the second division of our subject, viz.: the sanitary condition of Croydon anterior to the introduction of the Health of Towns' Act. It is so usual for persons of every shade of opinion to be biased by their connections, and to imbibe the ideas of those with whom they associate, especially upon matters of local importance, that had we to depend upon evidence given now as to the condition of Croydon previous to the formation of the Local Board of Health, some doubt might be thrown upon its truthfulness—the picture would be considered by many as overdrawn to serve an evident purpose, and to bolster up a theory; but we fortunately possess evidence actually obtained ten years ago, as shewn in the Report of the Health of Towns' Association, where we find, at page 6, Croydon described as the worst district in the county in a sanitary point of view; “no sewers at all,” drainage very defective, and such as it was sending its products into streams and ponds, the water of which was used for domestic purposes;—the Town Commissioners of that day never exercised the power they had of providing drainage and water supply, because it would have necessitated the infliction of a rate, of which they appeared to have the greatest dread and abhorrence. According to the report quoted, the minutes of that board contained no evidence of enquiries upon these points; the board considered the water supply of too little importance, and as having scarcely anything to do with the general health and welfare of the poor. The report is full of statements of the bad sanitary state of the place, and at a later date Mr. Ranger presented a report to the General Board of Health, being the substance of a preliminary enquiry into the sewerage, drainage, and water supply of the town: it consisted of the evidence of townsmen—men of standing and matured judgment—and it gives a terrible picture of the arrangements of



the town: stagnant ditches, many feet wide, charged with decaying animal and vegetable matter, giving out noxious exhalations, causing epidemics, "which of late years (1848) (says a medical gentleman of experience) have greatly increased." Mr. Hubbert, the then surgeon to the poor of the parish, did not hesitate to do his duty; he described fever as rife in all parts, and he particularly mentioned Union Street, Scarbrook Hill, Barrack Field, Pitlake, Surrey Street, Tamworth Road, and the Old Town, as places from which it was seldom or never absent. In a report made to the Board of Guardians, October 30, 1848, he states, with regard to a certain portion of Croydon Common, "that the poor have no drains to their cesspools and pigstyes, and that the collecting holes are overflowing with decaying animal and vegetable matter; small pox, fever, and diarrhoea are rife, and I feel" says Mr. Hubbert, "that I have only discharged a duty in venturing to draw your attention to such a state of things." Mr. Ranger's report is full of evidence of the same character. Long however before it was published, the sanitary state of the town had occupied the attention of many of the inhabitants; the fearful condition of the town caused much disquiet to the thinking part of the population—to those men who asked themselves what effects resulted from these causes, and who, well aware of the answer to that question, made representations to the General Board of Health, by whom Mr. Ranger's enquiry was instituted. The enquiry was held publicly in March, 1849, so that all sides had an opportunity of stating their opinions. At that enquiry Mr. Westall gave in the report of a committee of townsmen, which goes far to prove the horrid state into which the town had been plunged by the total neglect of all sanitary regulations. Voluminous extracts might be made from the report,\* but it may be summed up as proving—

1. The entire absence of proper drainage;
2. The filthy condition of the courts and yards;
3. The equally filthy condition of several ponds in the centre of the town, with open cesspools on their banks, being also receptacles for all the dead dogs and cats of the district, and into which the principal street drains discharged themselves; likewise,

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\* This important paper was signed by the following gentlemen, who deserve great praise for their boldness in taking up the matter so vigorously:

G. W. Mathew

Robt. Pledge

Edwd. Westall.

Geo. Price

J. W. Edwards



4. The presence of an open water course, running through the Old Town, receiving in its course the contents of cess-pools and drains, including that from the Union House, and, with the ponds before mentioned, viz.: Lauds', Scarbrook, and New Lane ponds, receiving the sullage of the town, and the refuse of the slaughter houses. The stench in summer was said to be quite unbearable; fever was always present in the houses near their banks. Mr. Penfold reported that the inhabitants generally threw their sullage into the public drains of the streets—drains only intended for surface water—which caused both street and drain to be in a constantly filthy state.

Much further evidence might be adduced of the disgraceful condition of Croydon in 1848, but the above is amply sufficient for the purpose; bearing therefore in mind the foulness of the ponds and watercourses, the state of the courts and lanes, and the deficient and foul water supply, the character of the prevailing diseases, as well as the state of the bills of mortality, may be easily guessed at. The positive evidence upon this point has been obtained from statistical tables, compiled by Mr. Westall from official documents, which he obtained at great trouble and considerable expense, and I think with much advantage to the town of Croydon: these reports were commenced about four years since, and are now continued quarterly, the returns being forwarded to Mr. Westall every week by the registrar of the district. Without these returns, the Local Board of Health would have had no positive proof of the benefit of the works to human life, as the district of Croydon in the Registrar General's return includes many other parishes, besides taking no account of the great increase of population in the town itself; so that on this account there is no real correspondence between Mr. Westall's return and the Registrar General's. The population is computed by means of a return procured from the rate collector of the number of occupied houses in the district, this number being corrected by the population at the census of 1841 and 1851; thus it was found that the population in the year 1848, was 19,380, contained in 3,060 inhabited houses, and having a mortality of 546, including 173 cases of epidemic, or preventable disease: this mortality gave a death rate of 28·16 per 1000. Not only did the Registrar's book shew a large amount of these diseases, but Mr. Grainger's very elaborate report, made by order of the General Board of Health, and presented to both houses of Parliament in 1853, shews, in



tables compiled from the Union Medical Officer's books, an immense amount of zymotic disease: thus, taking a single week at random, as December 2, 1848, he found 34 fever cases in the medical relief book, exclusive of scarlatina and measles which also abounded, and on May 17, he remarked 17 cases in one medical officer's book alone. Mr. Grainger also found that the deaths from fever between 1840 and 1845, averaged 4·6 per cent., whilst all zymotic diseases equalled 20 per cent.; preventable disease being 1 in 5. In the next five years, viz.: to 1850, the deaths from fever had reached 7·6 per cent., preventable disease causing 1 death in every 3, and this without reckoning the cholera year of 1849.

Mr. Grainger sums up his very elaborate return by remarking, that all these recorded facts shew that in the more unhealthy parts of the town, and more particularly among the poor, Croydon has suffered severely from fever, which destroyed a considerable number of the inhabitants: "I may also add," says Mr. Grainger, "that on referring to the statistics of Surrey for 1841, it appears that on comparing the several registration districts in the county as to epidemic disease and mortality generally, that of Croydon holds an unfavourable position at each stage of life."

Can any one doubt for one moment, considering the state of Croydon, that this unenviable position was entirely due to the want of sanitary arrangements? which caused an immense increase of mortality in the worst parts of the town—an increase far outweighing any advantages gained by the greater healthiness of the higher and less closely populated parts of the parish. Mr. Westall's table shews that the number of deaths from zymotic disease was enormous in 1848—fever, small pox, measles, hooping cough, scarlatina, in fact all epidemic diseases, were severally fatal, raising the death rate to the high figure of 28·16 per 1,000.

Mr. Simon, in his remarks upon Dr. Hedlam Greenhow's communication to the General Board of Health, has shewn that the annual death rate ranges in England from 15 to 36 per 1,000, the average being about 22·6. From his tables it is evident that 16 or 17 is the highest point which ought to be reached, supposing all preventable diseases were removed from calculation: according to Mr. Westall's returns, therefore, 12 persons in every 1,000 were sacrificed annually—232 persons were destroyed every year by other than natural diseases; I use the term natural advisedly, for poisons are poisons, whether they be minerals, as arsenic, or the miasms which generate fever—deaths from these



causes are not natural; and if foul air and impure water were the causes of this excessive mortality, then their removal ought to diminish the death rate to 16 or 17 per 1,000 per annum.

As soon as the Local Board of Health was established, energetic measures were taken for the furtherance of that object: the first election of members was made in August, 1849, and the requisite works were commenced in the autumn of 1850, the intermediate time being occupied in procuring plans and estimates, &c., but it was not until the end of 1853, that the works anywhere approached completion. When the Local Board entered on their labours, it might be considered that a termination would come to all anxiety upon the subject of health—that Croydon would soon be cleansed and become the promised *model town*, the admiration and the envy of less favoured localities; little however did the inhabitants dream of the war of words and fight of pamphlets shortly to arise, and the belligerents, using Croydon as a shuttle-cock, rendered it a bye-word for disease, instead of a model town: fortunately for human nature, clairvoyance only foresees the future when it has become the past, or, if it could have foretold the future, I fear that the courage of the Local Board would have failed, ere they had encountered the struggle through which they have had to pass. The question of small-sized earthenware drains *versus* brick sewers of larger calibre, was convulsing the engineering world: the Local Board determined to adopt the former upon the recommendation of Mr. Donaldson, with the approval of the General Board of Health, and being near the centre of strife, the town was minutely watched by both the supporters and the opponents of that class of sewers. Great was the excitement of the latter to find that to all appearance their plan had failed in Croydon—disease appeared to be increased, not diminished; and the name of Croydon was forthwith seized upon, and hurled with full force at the heads of those who still supported the sanitary arrangements of the General Board of Health. At every meeting held to consider the state of the public health, the anti-sanitary party, joining with the brick-sewer party, overthrew the advances of the General Board in almost every town, and prevented the further extension of their principles, so that sanitary science was impeded. But in the meantime, a more perfect knowledge was gained through the mistakes perhaps unavoidably made in draining so large an area as Croydon, upon an almost untried plan.



As regards our part of the subject, it is not necessary to consider which are best for sewers, bricks or pipes—a judicious combination of both will probably be the plan for all future drainage operations, but I may remark that the Croydon Local Board have adopted the pipes, and unless they can be shewn to be hurtful, they must be continued: we know now that they are not hurtful if they are properly cared for, and that they can be made highly beneficial; it becomes then our duty to watch carefully that they be preserved intact—that they be not allowed to choke up and become nuisances, by which expensive works may be rendered necessary, and enormous outlays entailed upon the rate-payers;—I think this is worth mention, because Croydon successful, overthrows so many arguments that have been based upon its supposed failure, and so many are interested in its failure, that it behoves every one of us to consider the possible cases in which such a result may arise.

I may now take up the third portion of my subject, viz.: The condition of the town during the progress of the works. Several reports have been presented to parliament upon the subject—they remain as monuments of the perseverance of the reporters, and, in some cases, of a determination to see nothing good in the operations of the General Board. It is scarcely worth while, in a non-medical assembly, to enter very fully into the particulars of those diseases which became aggravated by the operations of the Board: it is sufficient to mention that disease, comparatively mild in its form, did become general, and that it was evidently caused by a concurrence of circumstances such as can never again arise. These circumstances were—

1. THE DISTURBANCE AND REDISTRIBUTION OF IMMENSE DEPOSITS OF FILTH: AND
2. THE PROBABLE POLLUTION OF EVERY WELL IN THE TOWN.
3. THE EXCESSIVE RAIN-FALL OF THE SEASON (34·16 inches), LEADING TO AN OVERFLOW OF THE BOURNE, AND FLOODING THE SEWERS AS FAST AS THEY WERE LAID DOWN.
4. AN UNFORTUNATE OMISSION TO VENTILATE THE NEW SEWERS IN A PROPER MANNER.

These circumstances were sufficient to account for all that occurred; and the unfortunate antagonism of pipes *versus* brick-sewers caused them to be fearfully exaggerated throughout the country. The rise of the epidemic was



curiously concurrent with the rise of the Bourne, and its decline commenced as that stream began to lessen. There was one other point rather striking in the course of the epidemic, and I quote Mr. Simon's able report, where he says that "its heaviest blows were struck not in poor houses, not in ill-drained houses, not in low-lying damp houses, but in houses where least of all one would expect any ordinary cause of fever to be in operation; in the lower parts of the town, where common causes of fever may be supposed infinitely more rife, the action of this epidemic was comparatively indolent and mild." The question may be asked as to the cause of this.

Croydon had long suffered the poor to nestle among the hotbeds of fever, but at last, awakening out of the sleep of danger, set her house in order, and thought by a money payment to remove the evil from her borders:—an all-wise Providence determined that the rich should not escape by payment merely, and punished the town by means of the very act that will effectually prevent the repetition of a similar evil, provided gross negligence be not hereafter practised by those in authority. This is a lesson which ought not to be thrown away: when a danger arises it is better to face it at once and remove it—let us not tamper with it, or temporise, in the hope (generally a delusive one) that it may not hurt us; it should be checked at once, ere it gains such head as necessitates evil by its very removal. The brave and honest man never fears to prepare for the worst, whilst he uses every effort to secure the best.

It was not until 1853 that any considerable portion of the drainage came into successful operation: in such a work stoppages, breakages, and defective house-work are not to be wondered at; the latter was especially caused by a penny-wise and pound-foolish system, ever present both in public and private affairs. Those faults had been repaired by the end of 1853; the want of ventilation had also been attended to; and statistical data may be safely taken at this time, as a starting point from which to measure the effect of sanitary regulations. Disease, as shewn by its death rate, stood at the same point as in 1848. That, like 1853, was the year preceding the cholera epidemic: at the end of 1853, evil was supposed to be banished as far from us as human ingenuity could banish it with our system of sewers. The mortality was marked by an excess fully equal to that of 1848: the number of deaths was 613, which, with correction for the increased population, gave a death rate



of 28.57; these included 191 cases of epidemic or preventable disease. If Mr. Simon's standard of 16 be taken as the natural mortality, 276 persons were sacrificed whose lives would have been saved under a more healthy condition of things. Here then was a problem about to be solved: given, a high rate of mortality and a new system of sewerage and water supply; find out the result at the end of five years. But before doing this, it will be well to enumerate the actual work accomplished by the Local Board, to the execution of which the results obtained are to be attributed.

1. The water supply has been changed from one insufficient in quantity and bad in quality, to a constant, pure, and regular supply, which contains an almost inappreciable portion of organic matter; it is now laid on to 3,500 houses, and there is an average consumption of more than 200 gallons per day per house.\*

2. The filthy water courses extending through the Old Town and other places have been removed by means of an enormous culvert, extending from near the Stock Market to the present head of the Wandle; this culvert has diverted the surface streams, has drained many of the shallow wells, and acted as an agent in draining a great part of the Old Town.

3. This has been still further promoted by the removal of the mill-dam which existed below St. John's Church, at once causing a fall in the water line of the district to seven feet below the surface: the graveyard of St. John's Church used to have the water within two feet of the surface of the ground, sometimes even less than that before the dam was removed.

4. The several ponds called Laud's, Scarbrook, and New-Lane, and many other smaller deposits of filth, have been drained and filled up.

5. Nearly 2,600 cesspools have been destroyed, and a general system of drainage introduced by means of stone-ware pipes of small calibre, with which almost every house in the district has been connected.†

6. The slaughter-houses of the town have been placed under inspection, and the courts and yards cleansed, whilst

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\* The consumption is considerably less than it appears to be. The average is raised to this high figure, by reason of the great consumption of water by the Railway Company, the East India College, the Union House, some breweries, and other large establishments, besides that taken for the purpose of watering the streets, and loss by unavoidable leakages.

† Many cesspools still exist, which the Board ought to take measures to remove.



there has been a considerable improvement in the pavements of the town, although there is still room for further attention in this direction.

These alterations have been necessarily carried on in a gradual manner: it was not until the end of 1856 that the connection with the sewers became general, and the works of the Board completely carried out. The sewerage flows to an outfall lately removed from Pitlake to Brimstone Barn: it has been a sore blot upon the plan, and will ever continue a source of discomfort and uneasiness to the Board, as well as of serious expense to the inhabitants, until some method be arrived at of completely disinfecting the sewerage, or until it be removed by steam-power to some other locality—unless it should be hereafter arranged for it to go into the Metropolitan district, and thus be carried out to the sea. The outfall is undoubtedly the greatest difficulty the Board have had or will have to contend against; and it would be a great thing for the town if it were met fully and with energy, as otherwise it will be a fruitful source of law proceedings, which are even more expensive than the infliction of actual disease, but which, fortunately, at least in parish matters, kill no one. I cannot leave this part of my subject without emphatically protesting against the pollution of any water courses by sewerage matters: we have no right to do injury to others that good may come to ourselves, and so long as we do evil, mischief and expense will happen to us. I have omitted to name several other works carried out by the Local Board, because they refer rather to public convenience than to public health: these have tended somewhat to increase the rate-payers' charges, but have been in most cases very good investments.

One word as to the expense incurred by the Board in effecting these alterations. This can only be judged of by comparing the rates levied in Croydon with those raised in other places. The mere sum expended will be no guide to us in determining the effect the works have had upon the value of property. To get at a general idea upon this head, I applied to the collectors of rates, in 48 towns and districts, including all those in our own neighbourhood. I received replies from 26 of those places. It is certain that they did not make their rates appear higher than they really were, yet, whilst the general average derived from those returns, as set before you in the diagram,\* is 5*s.* 9½*d.*, Croydon, for this

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\* Refers to a table shewn at the Lecture.



year, has a charge of 4s. 11d. only, a sum including that which the majority of the other places have not, viz., the cost of a good system of drainage. The way in which the rates are levied, varies in such a curious manner, that a general average only can be arrived at. I may mention, also, that the majority of other places have to pay five times the sum we have for water, or else they have to bear the expense and trouble of pumps and wells, which are here not necessary: this must, in large establishments, decrease the work of the house servants in a material manner. The rates are really scarcely greater than they were before the Local Board came into existence; the increased health and comfort of the poor having materially decreased the charges levied for their maintenance. I was perfectly unaware of the great difference in favour of Croydon, when I commenced these enquiries, and fully expected to find that the general idea that our rates were high, was a correct one.

The work done has been thus set before you, and also the cost—it is now time to speak of the result: this could not have been at present shewn in any very positive manner, if one of our own townsmen, firmly convinced of the wisdom of that work, and fully persuaded of the results likely to accrue, had not collected week by week the returns obtained from the registrar of the district, by which means a proof-positive has been obtained of the effects upon the character of disease. Mr. Westall's Mortality Tables therefore become an undeniable index of the state of our sanitary arrangements. When Mr. Simon made his report to the Local Board in February, 1853, he concluded in these words: "If you have given your constituents the benefit of effective, rapid, inodorous sewerage, with a pure and constant water supply, instead of cesspools with their soakage—if you have made six feet difference in the water level of your low-lying district—if you have removed such ponds and ditches of filth as existed within the town,—these are inestimable contributions to the public health, which must give their fruits, I am persuaded, so soon as you remove those interfering causes which have hitherto masked the result. And contrasting Croydon as it will then be, with Croydon as it must have been before your Board began operations, I cannot but believe that its salubrity will be raised far beyond the standard of previous years; and that many painful recollections of the recent epidemic, will be lost in a grateful appreciation of increased health and comfort among the population."



How these opinions have been borne out, Mr. Westall's Tables will tell by comparing each year with that which precedes it, but most of all by comparing 1857 with the years which have been already analysed: the year 1858 has become an exceptional year, from causes to which I shall allude hereafter. It will be noticed in the table before you, that the death rate has been gradually diminishing since 1853, in a most regular manner, viz.—

	1853,	28·57
	1854,	26·52
	1855,	19·75
	1856,	16·70
	1857,	15·94
	1858,	18·75
1st Quarter,	1859,	15·33

The population has increased to nearly 28,170, contained in 4546 inhabited houses, and the number of deaths for the whole year was 437, (the registered births were 775,) being 109 deaths less than in the year 1848, when the population was 9000 less than in 1857; the death rate was reduced from 28·16 to 15·94, leaving a balance in favour of the town of 12 persons per 1000, or to put it more intelligibly, the sanitary improvements effected by the Local Board have caused a saving of life in one year alone of 342 persons; supposing that the mortality had continued as high as in 1848 and 1853, or even taking a mean of ten years, five before and five since the works have been in action, viz., 22·9, the undeniable saving of life has been 196. What a triumphant answer this must be to the rumour that the Croydon drainage has failed, and must all be taken up again! why if the old system had continued and the population had increased in a similar ratio, upwards of 1000 of those now living within this parish would have been numbered with the dead! This is a startling statement to make, but if there be any truth in figures it is undeniable; we have to thank our sanitary arrangements for at least 1000 of our present residents being now alive and in good health, without reckoning the many who might have been maimed by disease, and rendered totally or partially helpless for the rest of their lives! Then, again, the character of the disease which had been fatal is changed: 1848 and 1853 presented a long array of deaths from diarrhœa, scarlatina, measles, whooping-cough, and erysipelas; not so in 1857,—the death rate from fever dropped from 7·6 per



cent. to '02; it was nearly the same in 1856; and in the first half of 1858 Mr. Westall reported only one death from fever; and in November of 1857, (as reported in the local papers,) Mr. Thomas Farley, one of the members of your Board of Guardians, informed the Board that not a single case of fever appeared in either of the medical officers' relief books for that week. Mr. Westall has also favoured me with his account for the past quarter, and it shews a lower range than has ever before appeared. In 1857 ten deaths occurred from small-pox, all I believe among the unvaccinated, shewing that our poor are not yet fully alive to the benefits of vaccination. It would be a move in the proper direction, if every death from fever or small-pox could be investigated before a jury of non-resident persons, who should have the power of inflicting a heavy fine upon the parish in which the death took place, if any charge of neglect of public drainage or of parsimonious vaccination could be substantiated—a fine of £100 towards the county rate upon each death, would soon bring parishes to their senses; and as regards small-pox, make the vaccination fee sufficient to remunerate the operator.

It will be right to remark, that several out-lying districts included in Mr. Westall's Tables, are still destitute of drainage and good water supply, such as parts of Norwood, Shirley, Woodside, and Stroud Green; the deaths in these parts raise the whole mortality to a point higher than it would be if they could be excluded. Thus, 82 of the 437 deaths occurred in Norwood, 61 also occurred in the Union House, which is the poor-house for nearly a dozen other parishes, including the populous parish of Mitcham; if these figures be subtracted, it leaves 294 deaths only for the town and its suburbs.

Mr. Simon says, in his remarks upon the paper of Dr. Headlam Greenhow before alluded to, that "the fact of a few deaths from fever occurring cannot be accepted as conclusive proof of sanitary neglect in a district, for unavoidable contagion may have been imported; even the fatal cases themselves may have come from the fever nest of some adjoining jurisdiction." A death now and then will occur most certainly, until the fever nests of the whole kingdom, and,—in these days of steam,—of the continent of Europe, are extirpated and rendered fever proof. Thus, I have had cases of fever under my care imported most undoubtedly from Marseilles, from the Mediterranean, and, if it could be, still more certainly from Ostend; but such



cases are easily made out, and as in the early part of 1858, there was a complete absence of fever in Croydon, it caused some surprise when a few cases presented themselves in different parts of the town, in the latter part of the year: a large establishment in Park Lane had to be dispersed by reason of its appearance among the inmates, which assisted to give rise to the most absurd rumours abroad, besides producing excessive alarm at home; every case of slight illness became magnified into fever of a most malignant type, and our profession reaped a harvest from the fears of our clients—that kind of complaint is very catching, and is the most fertile source of emolument that the medical profession possess. The year 1858 has passed over, and the first quarter of 1859 bids fair to be one of the least fatal ever known in Croydon, notwithstanding the high rate of mortality that has prevailed elsewhere. Taking Mr. Westall's Tables again as our guide, we will dissect them fairly, and see if there was any ground for the apprehension felt in September last, point out the cause, and recommend a remedy.

The total number of deaths for the year was 525, giving a death rate of 18·75; the births were 893. The first quarter had 125 deaths; the severe cold produced its effects upon lung diseases and aged persons, and raised the rate somewhat above the average of the preceding year; there was one death from fever and two from scarlatina; the highest mortality was in the eastern district, a part as yet only partially drained. The second quarter presented a mortality of 108; there was no death from fever or scarlatina registered; the death rate was 15·42, whilst that for the town districts of England was generally above 22·9; the eastern part still presented the highest range in Croydon. The third quarter shewed a rise in the mortality, the deaths being 134, including nine cases of fever and three of scarlatina; the east and north were the most unhealthy districts. In the fourth quarter the deaths rose to 158, shewing a death rate of 22·57, including eleven cases of fever and nine of scarlatina; the major part of the fever and scarlatina cases occurred in September and October, in the eastern and central districts, and a large per centage were female servants; the eastern district had a high rate, but the town itself highest of all; the severe weather of November made a marked increase in the cases of chest disease and old age, and would under any circumstances have raised the death rate for that quarter; but it is to the 32 cases of fever and scarlatina that I have principally to direct



your attention, as well as to the circumstance of the eastern part of the district all through having a high rate of mortality. This latter circumstance I refer to the fact of there having been scarcely any means of flushing provided for that part of the district which is drained; and this has continued to act rather adversely on all diseases, compared with the other parts of the town. It is true that the cases of fever after all are few, being only 22 for the entire year, but 19 of them occurred in September and October—occurred in two months, at a time when it was least expected, when we were exulting in the positive proof afforded by Mr. Westall's returns, that fever had been entirely banished—they were not, they could not be all imported cases, and they made a great noise in the world, for the number of persons wishing ill to Croydon, because they do not wish our system of sewers to prosper, is very great: probably in almost every town in the kingdom it was again reported that a black fever raged in Croydon, and at home the element of fear had fair play. I will not now stay to ask whether this slight return of fever could have been prevented, but I may remark that when, as occasionally has happened, a death has been supposed to have resulted from the negligence (presumed or otherwise) of a medical attendant, Croydon, like other towns, has shewn a due appreciation of the value of human life by raising a little tumult upon the subject. I should not wish to raise such a tumult now as would lead to enquiry, as to why 84 more persons died than there was reason to believe at the beginning of the year would die: probably some such instance was required to render us more alive to the possibility of danger, even in that which undoubtedly is a great blessing to the town; but blessings may, and do at times, become sources of danger, and it may be taken as a positive axiom, that the greater the blessing the greater the chance of danger arising from an abuse of that blessing. Such is the case with religion,—pervert its spirit, and what crimes, what miseries spring out of its now altered condition! the greatest blessing upon earth, in a perverted sense, is the ostensible cause of a very large part of the crime and misery which deform and debase human nature. Next in order to religion stand stimulants; wine and its allies, properly used, are blessings to man, but pervert their use—let them be abused—and they become a curse and a source of misery, sin, and wretchedness, only excelled by the cause previously mentioned. So again, every virtue has a corresponding vice, which putting on the guise of its



opposite, deceives many as to its real nature: thus it is with sanitary science,—trust to it implicitly, whilst you neglect its true spirit, and your blessing becomes a scourge—a viper which stings with deadly aim.

It will not therefore do for us to sit down quietly, saying, “We have finished our work;”—a watch after a time wants cleaning, a room close shut up will require dusting, so our sewers require periodical washing and careful cleansing. They did not have that cleansing in 1858 to the same extent that they had in 1857; the consumption of water averaged 22,000,000 gallons less in one half year, whilst on account of the dry and very hot season, it should have been more; the rain fall was several inches less than the average; the gravel through which the pipes were laid was very dry, and probably absorbed a great deal of water from the pipes themselves,—in fact, the water passed in a contrary direction to that which it did in 1853, as was then shewn in evidence by Messrs. Grainger, Austen, and Page,—whilst vaporization from the great heat and dryness carried off a large part of that which was really supplied, and in many cases, as I had ocular proof, the water traps of the drains themselves became useless from that cause. There was also another source of evil from the absence of rain: the roads never became dirty, they were therefore unscrapped; the dust was laid by watering, and much of the water actually used went in this manner; for many weeks the sides of the roads and the gully holes of the town were necessarily loaded with dust containing much animal exuviae, whilst the house extremities of our sewers were furred up with decomposing deposit, like so many chimnies that required sweeping. At the end of August we had some very hot moist days, with heavy showers sufficient to stir up the deposits and to increase the fermentation going on, but not sufficient to carry them away. Here then was a cause for the illness which arose—a cause which could scarcely have been expected by people generally, and which having occurred, will most likely never be allowed to occur again—for if it did, those who neglected to remove the cause, would surely commit a criminal act; and the experience earned will not be dearly bought. The illness subsided in a marked manner, at least the fever part of it, after the sewers had been thoroughly flushed by the officers of the Local Board.

The remarks I have made upon the condition of our streets, apply to every town in the kingdom, which does not have a complete system of scavenging; foul gas arises



in abundance from the gully holes and road drains, and fever arose in most of the towns and villages around us, more even than it did here; and it is a fact which ought to be known far and wide, that by flushing and cleansing our sewers, we did prevent a large amount of illness, which otherwise might have become as famous as that which arose in the royal town of Windsor from a similar cause. Ought we not to determine that such a cause should not again arise? ought we not to determine that the sewers should be always regularly flushed by an experienced officer, who would be able to do the most good with the smallest quantity of water, so that unnecessary waste should not occur? I do not hesitate most emphatically to condemn those who do use it uselessly or without any object; but such matters ought not to be left in the hands of private persons—the necessity for private flushing beyond that which is prudent for every house, ought never to arise.\*

Some of my neighbours have remarked that a few cases of fever occurring here is really nothing; fever has occurred elsewhere, as at Windsor, and almost everywhere, more or less. Undoubtedly it has, but the remark always brings to my mind a portion of Mr. Simon's report upon the epidemic of 1852, when replying to the same observation. He said, "If sanitary improvement means anything, it means that epidemic disease shall make its difference in favour of the improved locality; that however much fever may elsewhere rage, yet here where preventive medicine has done its work the hurtful influence shall become comparatively inoperative;" and further on he asked why Croydon had not obtained "that immunity from fever which is the foremost promise of sanitary improvers." This immunity Mr. Westall shews that we possessed up to September, 1858, and since November we have also enjoyed the same privilege. Mr. Farley, who has given me an account of the state of the poor, writes, "I have examined Messrs. Roper and Johnson's books, and am happy in being able to inform you that no case of fever is to be found existing at the present time, and but one of scarlatina, and in fact the register of illness in both books appears to me to be very slight; I also examined the master's report book of the Union-house, and found no fever cases there."

Fever is now absent, and it ought never again to rear its

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\* Since this lecture was delivered, the Local Board have ordered a general and regular system of flushing.



crest in Croydon (except as imported cases), and it never will, if the inhabitants take care that proper means are continued for its prevention,—which means are, a continuous supply of perfectly pure water, the rapid removal of foul matter from our sewers, and a proper system of ventilation, whilst our streets ought to be attended to by a general system of scavenging.

I have now only to consider the subject of ventilation. In a tubular system of impervious sewers, it may now and then happen that a stoppage occurs: all drains will stop up if they are not taken care of; a pipe may break, a foreign body may pass into them, either by accident or design, and when such stoppage does occur, all sewerage passing into the sewer above the stoppage remains in the tube, displacing as much foul air as equals the volume of the sullage. Now if there be no arrangement for ventilation, this displaced air must pass into the house, but if an outlet be provided external to the building, it will escape outside, under ordinary circumstances; thus, in many instances, the Local Board have protected the town, by inserting ventilating pipes into very many of their main sewers. The late surveyor was fully alive to the necessity for this, from the fact having been brought fully into notice by Mr. Page, in 1853. It appears that under the first plan carried out, no arrangements were made for ventilation,—a most dangerous fault, but one that has been remedied as far as the public sewers are concerned: but we ought not to be dependent upon public ventilating shafts,—every house ought to have its own ventilator, which should be placed at the very highest point of the sewer, just below the trap. If this were carried out in every house, it would not be possible, with well constructed house-work, for foul air to find an entrance into the house at all, and a neighbour's misfortune could not affect us. It has been supposed by many, that if the syphon taps be properly charged with water, no gas will pass through: this is a fallacy,—sewer gas will pass through water in abundance at common temperatures, and in greater quantities if the water be warm, and more especially if it be at all under pressure. Thus, in the diagram before you,\* let the main become stopped up, with no means for ventilation near the extremity, the air in the pipe will expand in an equal ratio with the atmosphere every time the barometer falls; (and the sewer gases will expand to an enormous extent;) a large part of the excess must pass through the water, and must be given off into

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\* Refers to diagram exhibited at the Lecture.



the chamber above the trap,—this is the reason why drains smell most just before a fall of rain: when the water in the trap becomes charged with the sewer gases, of which sulphuretted hydrogen and hydrosulphuret of ammonia, are the most notorious, they are rapidly given off at the inner surface, and conveyed safely into the house,—safely as regards the gas, very unsafely as regards the inmates; every pint of warm water going in the contrary direction, has a similar effect to a fall of the barometer, for the universal law of diffusion of gases will come into play, as well as a known law of hydrostatics, that the pressure upon fluids is equal in every direction. By means of this latter law, a ventilating shaft at fifty feet distance is not sufficient to protect a water valve from pressure, for the pressure at the surface of the water will be the same as it is at the mouth of the ventilating shaft, and some gas will pass into the water before the pressure is altogether taken off, especially as it will be found in almost every case that there is a current from below upwards—that air is continually rushing from the outlet towards the house extremities of the drains, to fill the vacuum occasioned by a constant expansion and condensation;—the house extremities must be warmer than the lower end, and warm air will rise. Thus, then,

1. The law relating to the diffusion of gases;
2. The law of pressure upon fluids being equal in every direction;
3. The law of convection, or the rising of hot air;

all come into play in every system of sewerage, and their effects must be guarded against by a ventilating system, which will allow all foul gases when they are generated to pass out of the house, not into it; and you may take it as a positive fact, that whenever foul air does ascend into your houses, either the house sewers are unventilated, or the house-work is imperfect, allowing the collection of sewerage and the entrance of danger. If house drains and sewers be well flushed, no real sewer gases will be present, for there will be nothing to produce them; but as this is not often the case, as some dirty matter will stick, it behoves us to diminish danger to the least possible amount, by a careful ventilation and daily cleansing. It would be wisdom therefore on the part of every builder to look to this; and it becomes the duty of every one taking a house, not to inhabit it until he feels satisfied that there are means for ventilating the sewers, as well as a public regulation for their flushing. It is



supposed by many, that a little stream of water will not do anything towards this object: this however is a fallacy, for a small stream is better than none, especially if it be as pure as that supplied to us—a small stream constantly running will absorb all gases likely to be produced in a common house drain from the small collection of solid matter that may accidentally remain there; thus, if a pipe has a cubic foot of water per hour passing through it, it will absorb all the foul gas given off by the lump B,—but by far the most safe and expeditious plan is to remove B altogether.\* I would just remark with reference to this point, that the great sewers of London and other towns with brick culverts, are only dangerous to the sewer men, when these latter find their way into some part in which there is stagnant water, or which is positively dry and unventilated; there, gas in a concentrated form, fearfully violent in its effects upon the human frame, is found, and the men occasionally drop dead in a moment.

I have observed that it is only at times that sewer gas produces injury, in the diluted form in which it is presented to us; and at no time does the supposed law of the smaller the dose the greater the power, derive support from the law of the diffusion of gases. Usually the very dilute gases escaping from sewers have no effect in the production of disease, unless some epidemic influence be at work; thus, filth may be always present, but not always fever—an epidemic influence may be present, but if filth be absent and good water supplied, fever will not come. Two things are therefore required to evolve a fever poison,—one generated by man himself or his allies, the other an action or influence beyond our conception, and beyond our control; the one is filth, the other may be some meteoric or magnetic influence of the earth itself, or, as some now allege, the absence of ozone in the atmosphere. If filth be absent, you will be free from fever, cholera will not touch you, scarlatina will have lost its sting, and diphtheria will not come nigh your dwelling, sudden death will be less frequent, and all disease will be more under the control of our remedies, because the air we breathe is not polluted by miasms that are themselves the producers of evil, and which counteract the efforts of the physician in a most serious and embarrassing manner: let us hope that our town will ever for the future be spared these evils.

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\* Refers to diagram.



Croydon\* is at this moment healthier than any town or village in the kingdom; with a lower death rate than is found elsewhere, and with a complete absence of epidemic disease, which is almost beyond precedent: we must feel our advantages, and having felt them, let us hope no circumstances will be allowed to exist that may jeopardize them, and destroy that which next to a healthy mind is beyond price, viz., a healthy body;—it is now ours; it is our own fault if we lose it. Mr. Westall's Tables will always shew us when anything is wrong: let the town call for enquiry and have it righted, ere a giant evil arise which may again render us a byword; be not deceived by fair words when those tables say otherwise, and you will be safe. We have escaped diphtheria, which has carried dismay into many a household in neighbouring towns; we have escaped many ills which have seriously affected other places: let us be thankful that the cloud which obscured our sun, and appeared as if it would overwhelm us, has departed, and shewed its silver lining; giving us another proof of the goodness of the Almighty, in bringing blessings upon us out of the evils which threatened to annihilate our very existence.

\* Mr. Westall has published in the 'Croydon Chronicle,' a comparison of our present mortality with that of all England, the data for the latter being furnished by the Registrar General's returns for the last quarter. The figures will suffice to prove the assertion made above.

	Average of Ten years.	1859.
Town Districts of England.....	26·47	26·09
Country Districts .....	22·18	23·54
All England .....	24·55	25·12
Croydon—five years before and five since intro- duction of Health of Towns' Act .....	23·01	15·33

**J F P S.**



The first of these is the fact that the United States is a young nation, and that its history is a history of growth and expansion. The second is the fact that the United States is a nation of immigrants, and that its history is a history of the struggle for the rights of these immigrants. The third is the fact that the United States is a nation of free men, and that its history is a history of the struggle for the rights of these free men. The fourth is the fact that the United States is a nation of law, and that its history is a history of the struggle for the rights of these laws. The fifth is the fact that the United States is a nation of peace, and that its history is a history of the struggle for the rights of these peace.

The sixth is the fact that the United States is a nation of progress, and that its history is a history of the struggle for the rights of these progress. The seventh is the fact that the United States is a nation of justice, and that its history is a history of the struggle for the rights of these justice. The eighth is the fact that the United States is a nation of liberty, and that its history is a history of the struggle for the rights of these liberty. The ninth is the fact that the United States is a nation of equality, and that its history is a history of the struggle for the rights of these equality. The tenth is the fact that the United States is a nation of unity, and that its history is a history of the struggle for the rights of these unity.