

1876.

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BOROUGH OF CARDIFF.  
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THE
OFFICER OF HEALTH'S REPORT

ON

Sanitary Condition of Cardiff,

DURING THE YEAR 1875.

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CARDIFF:
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TO THE

CARDIFF LOCAL BOARD OF HEALTH.

Cardiff, June, 1876.

GENTLEMEN,

In bringing before your notice my Report on the Sanitary condition of Cardiff, with the collateral circumstances influencing it during the year 1875, it will be necessary to consider the recent enlargement of the District, by the operation of the Cardiff Extension Act.

CARDIFF URBAN SANITARY DISTRICT.

AREA AND BOUNDARY RECENTLY ENLARGED.

The Borough now comprises an area of 7,374 acres, exclusive of that portion covered by water. For Sanitary purposes it will be convenient to deal with the Wards in sub-divisions, as follows :—

Cardiff Proper	...	...	...	...	...	2,300 acres
Roath	..	...	...	...	...	3,500 „
Canton	..	...	...	...	...	1,574 „

The boundaries of the enlarged District may be described as follows :— On the South the Borough is bounded by the Bristol Channel ; on the East by the River Rumney at its mouth, where it empties itself into the Bristol Channel (to a point near Llyn-y-Grant Isaf) ; on the North by the parishes of Llanishen, Whitchurch, and part of Llandaff, by a line drawn from Llyn-y-Grant to Cefn Coed, the Weddal, Allen's Bank, Maindy Forge, Pont Ganna, the South side of Pencisely Lane, and Ely Bridge ; and on the West by the River Ely, from Ely Bridge to the Bristol Channel.

GEOLOGICAL CONFORMATION.

The Geological conformation of the superficial strata of the district must, necessarily, influence, to a considerable extent, the health of its inhabitants. These strata have been formed by the varying beds of the Rivers Taff and Ely ; also, to some extent, by the Rumney, at its Eastern boundary ; and by the tides of the Bristol Channel. We, therefore, find that on the West, South, and East a marine clay deposit

of variable thickness, occupies a considerable area. At the basin of the East Bute Docks, and probably all along the high water mark on the South East, the clay averages a depth of 45 feet; its thickness decreases as it recedes from the Channel inland, to near Pengam Farm House, Splot House, and a short distance from the top of the Bute Docks, where it joins a silty gravel, or forms but a thin stratum above it.

On the South West and Western portion of the Borough, there is a very large deposit of marine clay, extending along the boundary until it is intersected by the South Wales Railway. It occupies the whole of the surface between the rivers Ely and Rumney, as well as a small portion North of it, and forms the populated part of Canton, as far North as Sophia Gardens and Wellington Street. This clay is of a very plastic nature, and is quite impervious to water. The stratum which joins the clay along the boundary referred to, and which extends inland for some distance, following the whole line from the River Ely on the West in a Southerly direction to the Cardiff Docks, and afterwards in a South Easterly direction to within a short distance of the Rumney River, is composed of a mixture of silt, clay, and gravel; this is as nearly impervious to water as the marine clay itself. A large portion of the surface stratum of Canton, North of the South Wales Railway, consists of this silty gravel; the remaining portion, although much less extensive, is, nevertheless, capable of holding water, except here and there, where beds of porous gravel, situated at the North East of Canton, and extending backwards to Llandaff, exist. These same strata occupy a large area in the Northern portion of the District, from the Weddal, Tydraw, and Cemetery, on the North East, to Roath Castle on the South; and from Maindy, on the West, to Roath Mill on the East; as well as numerous beds of smaller dimensions intersecting the more porous gravel, and the upland clayey marl stratum. The low West lands in Roath, which formerly were part of the common, *e.g.*, Plasnewydd, Tyn-y-Coed, &c., have this class of subsoil.

A gravel subsoil of a more open character joins the silty gravel deposit, and, like it, extends almost from one end of the District to the other. This stratum, however, is far from being of an uniform nature, and is more or less intersected by beds of silty gravel and clayey marl; it occupies the portion lying between the silty gravel on the South, including the North portion of the Old Town, the North of Canton, and the South Eastern inhabited portion of Roath, Splotlands, Adamsdown, &c.

The surface stratum in the hilly part of the District at Peny-lan, as well as some smaller plots on the Crwys Farm, Park Place, and one extending from Plasnewydd, to the Drill Hall, is composed of a clayey ferruginous marl. The latter plots named agree very nearly in composition with the clayey marl of Penarth, being calcareous in its nature.

The subsoil is usually very plastic and retentive, so that little water can percolate into the substrata. It will, therefore, be apparent that the outlying districts of the Borough on the South, East, and West have a subsoil so retentive, close, and plastic that the only exit for water is surface drainage. Moreover, these districts are very low, much of the clay lands being under (tidal) high water level, while those on the silty gravel are but a few feet higher.

The foggy vapours which overhang these low levels in the winter, in addition to the miasmatic and damp atmosphere, generated by the continual evaporation of water from the surface, exercise an important influence, not only directly on those diseases usually referred to, as zymotic, but also collaterally on those grouped under the heading of constitutional. The high death-rate from Pthisis, which obtains in this district, fully bears out the conclusions of Dr. Buchanan, in his able report recently made to the Medical Officer of the Privy Council; on the excitant causes of that disease.

THE DRAINAGE.

CARDIFF SUBDISTRICT.

In a former report I described in detail the then existing sewerage of Cardiff Proper, which still continues to work in an efficient manner. This system comprises an outfall at the Eastern boundary of the District (as designed by Mr. Hawkshaw), which to admit of Dock Extension was subsequently discontinued, and a New Outfall was built still further East. Commencing at this Outfall, a sewer 10ft. diameter, with an inclination of 4ft. per mile, extends to the East end of Tyndall Street. At this point three main trunk sewers diverge, namely, No. 1, from Tyndall Street in a Northerly direction; thence through Newport Road, Crockherbtown, Queen Street, Angel Street, joining Sewer No. 2, with a rise varying from 8ft. 5in. to 16ft. 6in. per mile, and in size from 4ft. 0in. by 2ft. 9in. to 3ft. 0in. by 2ft. 0in. Sewer No. 2 passes through Tyndall Street, Herbert Street, Bute Street, Charles Street, under the Glamorgan-shire Canal to St. Mary Street, and through to Angel Street, joining Sewer No. 1. This Sewer from its commencement has a rise varying from 4ft. 0in. to 10ft. 0in. per mile, and also varies in size at its commencement from 4ft. 0in. by 2ft. 9in. to 3ft. 0in. by 2ft. 0in. at its termination. Sewer No. 3, with a size of 3ft. 0in. by 2ft. 0in., runs from Davies Street through Victoria Street, Adam Street, Bute Terrace, David Street, and Charlotte Street, to Crockherbtown, joining Sewer No. 1, with a rise from 4ft. 8in. to 7ft. 7in. per mile. Into these main trunk sewers all lateral sewers from the intermediate streets discharge; the Bute Town Main Sewer discharging into the Sewer No. 2 at Herbert Street. It comprises a Brick Sewer 3ft. 9in. by 3ft. 6in. to Loudoun Square, and from that point to Penarth Terrace, with a size of 3ft. 0in. by 2ft. 0in., with a rise of 3ft. 6in. to 4ft. 10in. per mile.

The additional Drainage since my last report are as follows:—

The Northern part of the District is provided by a Main Sewer running from Sewer No. 1 in Newport Road, at West Grove, passing through the Little Heath Estate, Upper George Street, Woodville Road, and Grange Terrace. Into this Sewer the sewerage of Castle Road and intermediate streets discharge. The dimensions of this sewer are 3ft. 3in. by 2ft. 0in. The back of Park Place and adjacent streets discharge their sewerage by a sewer 3ft. 3in. by 2ft. 0in. into Main Trunk No. 1.

In my last report I called your attention to the parts of your then District which were unprovided with main sewers, namely, Blackweir; the North Eastern part of the Borough, and Harrowby Street. The sewerage of the whole of these localities has been accomplished by a scheme devised and carried out, through and under the direction of Mr. Johnson, as follows:—

A Main Sewer has been extended from back of Park Place to Blackweir, 1,776 yards in length, having a gradient of 2 in 1,314 laid at an average depth of 14 feet; and the property situated along the route of the same has been efficiently drained.

A 3ft. 3in. by 2ft. 0in. Main Sewer has also been laid from North West end of Flora Street, along Grange Terrace, through and along Whitchurch Road, and Allen's Bank Road, to opposite the New Barracks, with branches to Pen-y-wain Road and Allen's Bank Road. This sewer is 600 lineal yards in length, with a gradient of 1 in 66, at an average depth of 18 feet. Another sewer of like dimensions passes from Crwys Bychan Toll Gate along Whitchurch Road to Crwys Farm, joining the last mentioned sewer. This is 502 lineal yards in length, with a gradient of 1 in 220, and 1 in 6, respectively.

Lateral Sewers of 3ft. 3in. by 2ft. 0in. have been laid in Flora Street and Letty Street, Cathays, by the landowner (Col. Wood), to a length of 473 lineal yards, with a gradient of 1 in 200, at an average depth of 11 feet.

An Old Barrel Sewer, 2ft. in diameter, at George Street, Docks, from James Street to Stuart Street, has been taken up, and a 3ft. 3in. by 2ft. 0in. sewer has been substituted there, 240 lineal yards in length, with a gradient of 1 in 180, at an average depth of 14 feet.

A 2ft. Barrel Culvert has been laid down at the back of Harrowby Street, 320 lineal yards in length, with a gradient of 1 in 272, at an average depth of 11ft., into which the whole of the property in this locality is efficiently drained.

The flushing of the Cardiff Sewers is as follows:—That part of Bute Town bounded by Penarth Terrace, Bute Lane, and Mount Stuart Square, is flushed from a flushing shaft situate at the back of

the Channel at Penarth Terrace, but can only be utilized at extraordinary high tides, or at about 32 feet above the sill of East Bute Dock.

The Flushing Reservoir in Loudoun Square is supplied from the mains of the Cardiff Water Works Company. This Reservoir is utilized, when full, three times a week, and flushes the sewers situate within the part bounded by Canal Parade, Loudoun Square, Bute Street, and North Church Street. The streets laying between Mount Stuart Square and Loudoun Square are flushed by a hose pipe from the Water Works mains, but in addition there is an independent outlet from Mr. Hodge's Docks, which conveys the water from the same through Hannah Street to Bute Street; and there is also a 9in. pipe on the South side of Loudoun Square from Mr. Tamplin's Dock, emptying into Bute Lane.

Crichton Street, Crichton Place, and streets between the Bute Bridge and Great Western Railway are flushed by hose pipes from the Water Company direct.

The whole of the streets within the area bounded by Whitmore Lane, South end St. Mary Street, Havelock Street, Westgate Street, Castle Street, Crockherbtown, Charles Street, Nelson Terrace, Love Lane, Adam Street, and Davies Street, are flushed from a pond situate in the Castle grounds, supplied by a sluice from the feeder by a 2ft. culvert used daily for flushing purposes. The water obtained from the same can be turned in any direction within this area for flushing any distinct sewer. Provision is also made near the Cardiff Arms by a valve fixed upon the Water Company's mains. A 9in. hose pipe is fixed from this valve to the sewer. This is not often required. It has in fact only been used once within the last three years.

The Pendoylan Street, Thomas Street, William Street, Ellen Street, Tyndall Street, and adjacent streets receive and are flushed by the water from Messrs. Hill and Sons' Docks, which is let off several times a week.

Tredegarville, Castle Road, and streets East of the Rhymney Railway, and between Moira Place and Adamsdown Road, are flushed by hose pipes from hydrants upon the Company's Mains.

Temperance Town is flushed by flushing shafts at Wood Street and Park Street, which receive the water (as at Penarth Terrace) at high tides, but at other times it is flushed from the Company's mains.

The size of the sewers which has been adopted will permit the passage of a man through them, and the junctions and side entrances are so arranged as to afford all practicable facilities for the same purpose.

Ventilation is effected by means of vertical shafts direct from sewers and street surfaces, placed at distances of 100 yards on mains,

and 150 yards on branch sewers ; and a few flues have been connected with engine chimnies, with beneficial results. The most effective draughts are obtained at the Gas Works, which have a circular flue 18 inches in diameter, and a velocity of 1,025 feet per minute, and at Messrs. Hill and Sons', where there is a flue of 15 inches diameter, and a velocity of 430 feet per minute.

Deodorising Charcoal Chambers have been placed at the outlets in the streets most requiring them.

Great benefit has been derived from the catch pits and flushing doors in the sewers at Paradise Place, Charles Street, Ellen Street, and other places.

DRAINAGE ROATH SUBDISTRICT.

The sewerage of Roath, so far as it has been carried out, is in fair condition ; but the rapidity with which streets have been formed and built upon has necessarily made it a matter of extreme difficulty to keep pace with its requirements. The system of sewerage may be described as follows :—The streets on the Western side of the district, namely, Clive Street, Milton Street, Shakespeare Street, Vere Street, Oxford Street, the whole of Castle Road, about 100 yards of the Newport Road, covering an area of 15 acres, are sewered into the Cardiff sewers. These are flushed at a tank at the summit of this part of the district, fed from the Brook on the North end of Castle Road in winter, and from the Water Works Mains in summer. This, combined with a rapid fall, keeps them in good condition, the sewers being deep enough to drain all the cellars and underground floors. The remaining and longest sewers flow into an outfall sewer 3ft. 6in. diameter, which discharges itself into the sea at Splot Moors. This, however, is only a temporary arrangement. The sewers of this portion are flushed partially from a tank in Milton Street, and partly from tanks constructed at the upper ends of the respective sewers with water supplied by the Water Works Company. These sewers have good gradients, and are of a size sufficiently large to admit personal inspection, with the exception of some streets in the southern part of the district—namely, Eclipse Street, Comet Street, Planet Street, System Street, Platinum Street, and Zinc Street ; also some in the central part—viz : Wordsworth Street, Southey Street, Dryden Street, Partridge Road, and Oakfield Street. The sewers in these streets being of small dimensions are inaccessible, and contain in some cases a considerable amount of deposit. It will be necessary therefore for your Board to take into early consideration the question of substituting larger sewers for these, and also laying down a larger outfall, or providing an additional outfall. New sewers, 3ft. 0in. by 2ft. 0in., have recently been laid down, with a gradient of 1 in 200, in Pearl Street, Agate Street, Diamond Street, Topaz Street, Ruby Street, Sapphire Street, Emerald Street, Gold Street, Silver Street,

Metal Street, John Street, Green Lane, Broadway, Helen Street, Stacey Road, Harold Street, Partridge Road, Oakfield Street, Clive Place, Charles Street, Rose Street, Lily Street, St. James's Street, St. James's Place, and Thistle Street. These sewers average from 6ft. to 10ft. deep, and are in very good condition. The sewers are all supplied with ventilating shafts, placed in the middle of the streets, and the foul air being passed through layers of charcoal is deprived of its offensive gases.

Since the construction of the sewers, the level of the subsoil water has been gradually lowered, resulting in an imperceptible but effectual drying of the air, and a very approvable purification of the atmosphere:

A sunk reservoir is constructed at the sea outfall for the reception of storm waters, and any unusual flow in the sewers during the high water of spring tides, when the outfall doors are closed. This reservoir prevents the accumulation of back waters in the sewers, and the consequent forcing of foul air through the ventilators in the upper part of the district. At neap-tides the outfall is always free.

The sewerage of the Northern part of Roath, namely: the Merthyr Road, land East of Oakfield Street, and the Western part of the village of Roath, is now being provided for, by extending the West Grove 3ft. 0in. by 2ft. 0in. sewer along Richmond Road to Merthyr Road, with a gradient of 1 in 800, at an average depth of 24ft. The new sewer just laid down in Crwys Road also provides for the drainage of the houses and land East of Crwys Bychan Gate.

DRAINAGE OF CANTON SUBDISTRICT

The principal sewerage of Canton, so far as it has been carried out, consists of a 2ft. barrel sewer, diverging from the Cardiff Western sewer at the White House Bridge, following the Cowbridge Road to Canton Cross. This sewer varies in depth from 9ft. 6in. at the White House Bridge, to 5ft. at its termination; and its gradients vary from 1 in 783 to 1 in 1,196. The other main sewers laid down are those up Severn Road and Wellington Street, consisting of 2ft. 3in. by 1ft. 9in. brick sewers, having outlets into the last-mentioned sewers, laid at an average depth of 6ft., with an inclination of 1 in 369, and 1 in 189 respectively.

The lateral sewers consist only of 9in. and 12in. glazed socket pipes, laid at an average depth of 5ft., having gradients varying from 1 in 100 to 1 in 200, and emptying respectively into the Cowbridge Road and Wellington Street sewers; the only object these sewers can attain is to carry off the surface waters of streets, and are of little use for anything else; it is my opinion that as soon as the Main Trunk Sewers, now being laid, of 4ft. 0in. in diameter, with a gradient of 1 in 1,700, from Grangetown, are complete, sewers, of larger capacity and much better adapted to the growing wants, should be laid down throughout the entire Canton district.

In consequence of the smallness of these sewers, they are inaccessible for inspection ; and up to the present time no means of flushing has been resorted to.

The streets in Grangetown are provided with main sewers, laid down by the Trustees of Lord Windsor. The Main Truck Sewer commences at or near the mouth of the River Taff, extending in a North-westerly direction through Amherst Street and Knowle Street to Bromsgrove Street. The lateral sewers are laid down in Lower and Upper Grangetown, varying in size from 3ft. 9in. by 2ft. 6in. to 3ft. 3in. by 2ft. 3in., but no provision is made for the flushing of these sewers ; neither, up to the present time, has it been found necessary to make arrangements for this purpose, very little sediment being found there.

Provision is now being made for the deep drainage of Canton, by extending the Grangetown main outfall by a 4ft. barrel culvert towards the district of Canton, which will be completed to the West end of Cowbridge Road by the end of the summer.

THE WATER SUPPLY.

The water supply of Cardiff is obtained chiefly from the Water Works Company. In the sub-district of Cardiff very few wells exist. To Roath the same remark applies, water in this district being obtained from wells only at Crwys Bychan, and a few houses on the Southern side of Newport Road at the end of Green Lane, called Spring Gardens. The village of Roath, near the road leading to Penylan, obtains water from a spring of fair quality near the road-side. The sub-district of Canton, however, has many houses which are supplied from wells, and in these cases the water is highly impure in quality.

The Water Works Company obtains, as I have stated in a former report, the greatest portion of its supply from the Limestone district near Lisvane. The water derived from this source is of a very good quality, and free from organic impurities. It contains no nitrates or sulphates. The mineral ingredients consist almost entirely of carbonate of lime ; and, although this renders the water hard when used for domestic purposes, its effect on the animal economy is beneficial, except in individuals who possess what is termed calculous diathesis. When this diathesis exists, or when the ordinary use of the water is undesirable, the excess of lime can be got rid of by boiling, or if necessary by Clarke's process. The lands which constitute a part of the gathering grounds at Lisvane are not in a high state of cultivation, so that rain falling there does not pollute the water with nitrogenous substances or matter from manures. The Cardiff Water Company's supply is, therefore, free from any indication of sewage contamination, as well as from any compound which is likely to give rise to any disturbance of health, or to detract from its adaptability for a town supply.

The water from this district is received immediately into a reservoir, of the capacity of 100,000,000 gallons. The capacity of the reservoir has been considerably increased since my last report, and it can be again increased as necessity arises. There are also three other storage works, capable of holding 5,000,000 gallons, for the outlying districts near the town, namely, Penhill, Leckwith, and Landough.

1,800,000 gallons of water are delivered daily into the distributing conduits—a supply which is equal to 25 gallons per head of the combined population of Cardiff, Roath, Canton, and Penarth. Immediately on leaving the reservoir this water passes through extensive and very effective filter beds, and from thence direct into aqueducts leading to the distributing conduits. The latter are made of cast-iron pipes, so that the water cannot be contaminated before it enters the service pipes.

The water supply to large towns varies, but the following may be taken as examples:—

The London Companies give	21 to 34 gallons per head.
Southampton & Edinburgh	35 " "
Liverpool	30 " "
Sheffield	20 " "
Derby	14 " "

Dr. Parkes, in his valuable work on Practical Hygiene, states that the quantity of water which ought to be supplied to towns is about 21 gallons per head. This supply is divided into that necessary for domestic purposes, which equals 12 gallons, and the remainder is used for municipal and trade purposes. The water supply for municipal purposes at Cardiff is chiefly limited to watering streets, flushing courts, and only a section of the public sewers.

The water is supplied to the District on the constant principle, and the supply may be considered abundant.

I have obtained from Mr. Thomas, F.C.S., the very able Borough Analyst, an analysis of this water, made by him within the last month. This agrees practically with that furnished by Dr. Hassal, some three years ago, at your request.

Mr. Thomas' analysis is as follows:—

Total Solid Impurities	19·6 grains per gallon.
Albuminoid Ammonia	0·05 " "
Free Ammonia	0·01 " "
Nitrogen as Nitrates and Nitrites	none.
Previous Sewage Contamination	none.
Chlorine	·86 " "
Hardness { Temporary	7·1°
{ Permanent	9·1°
Total	16·2°

In the old Town of Cardiff, as well as in the newly amalgamated Districts of Roath and Canton, the wells which exist are shallow, and seldom exceed from 14ft. to 18ft. in depth. From these wells water is

still obtained for dietetic purposes. As I mentioned in the description of the Geological superficial strata of Cardiff, the surface strata are for the most part of recent formation, and were covered at a too remote period by the ever changing and receding beds of the Rivers Taff and Ely. They are chiefly composed of gravel, intermixed with sand and clay.

The strata underlying (as previously stated) the gravel are apparently a continuation of the Penarth formation, and the waters derived from these are free from nitrates and nitrites. It follows, therefore, that the presence of these compounds, (nitrates and nitrites) are the products of the oxidation of animal matter, which may be regarded as a measure of the pollution of the well waters in this district. The well waters of the three districts, Cardiff, Roath, and Canton, contain objectionable quantities of sulphates and magnesia; they moreover, shew every indication of sewage pollution, in spite of the filtration they undergo by percolation through the gravel subsoil. They are, consequently, utterly unfit for drinking purposes.

In consequence of cases of fever reported to me, in Ebenezer Court—one of which was fatal—I caused an analysis to be made of the water supplied to the three houses in this court. The occupiers of the houses complained of its quality, and in the specimens I obtained, I found worms and animalculæ.

The analysis of water in Ebenezer Court, made by Mr. Thomas:—

	grains per gallon.
Total of Solid Impurities	51·8
Organic Carbon and Organic Nitrogen yielding Ammonia	·0098
Ammonia	·0037
Nitrogen as Nitrates and Nitrites	2·505
Previous Sewage Contamination	25·000
Chlorine	3·88
Hardness { Temporary	4·29
{ Permanent	25·9
Total	30·8

This water was highly charged with mineral compounds, including sulphates of lime and magnesia, with an excessive amount of chloride of soda. Some of the living organisms were visible to the naked eye, being of considerable size; others were detected by microscopical examination. The water was also exceedingly hard, and, therefore, quite unfit for drinking or domestic purposes.

Samples of water were obtained from the well belonging to a house in St. Mary Street, and from a well supplying some houses in a court in Millicent Street—cases of fever being reported in both localities. An analysis gave similar results to that obtained from the well in Ebenezer Court.

Some severe cases of fever were reported to me in some houses near Crwys Bychan Gate, Roath District. On visiting the locality I

E R R A T A .

Page 12, Mr. Thomas' Analysis 1.—“Previous Sewage Contamination.”	For 25·900 read Twenty-five Thousand, whole numbers.
” 13,	For 13·146 read Thirteen Thousand One Hundred and Forty-Six, whole numbers.
” 18,	For 20·880 read Twenty Thousand Eight Hundred and Eighty, whole numbers.
” 14.	For 4·900 read Four Thousand Nine Hundred, whole numbers.

found the inhabitants of these houses obtained water from a well newly sunken there. I obtained samples from the well, (they smelt very strongly of sewage), and caused them to be analysed by Mr. Thomas, with the following remarkable results:—

Total Solid Impurities	100·9	grains per gallon
Organic Carbon and Organic Nitrogen	·042	" "
Yielding Ammonia	·149	" "
Ammonia	1·340	" "
Nitrogen as Nitrates and Nitrites... ..	13·146	" "
Previous Sewage Contamination	39·9	" "
Chlorine	13°0 or	" "
Hardness {	Temporary	18°5
	Permanent	31°5
Total	31°5	" "

The Sulphates were also excessive. The total solid impurities were very great; a portion of this impurity—the organic matter—was capable of yielding ·042 grain of albuminoid-ammonia, as well as ·149 grain of ammonia, which existed in the free state and as ammoniacal salts.

This water showed a previous sewage contamination, equal to the presence of thirteen thousand one hundred and forty-six grains of average filtered London sewage. The chlorine was excessively high, as also the free and albuminoid ammonia, indicating that this water contained a vast quantity of undecomposed sewage matter. It was also, doubtless, highly polluted with urine, which caused it to emit an abominable odour. The water was to the last degree dangerous to persons drinking it.

The sample of water obtained from a well in Spring Gardens, Roath, was analysed by Mr. Thomas, with the following results:—

Total Solid Impurities	24·4	grains per gallon
Organic Carbon	·18	" "
Organic Nitrogen	·049	" "
Ammonia	none	" "
Nitrogen as Nitrates and Nitrites	2·12	" "
Total combined Nitrogen	2·17	" "
Previous Sewage Contamination	20·850	" "
Chlorine	5·4	" "
Hardness {	Temporary	6°0 or
	Permanent	12°8
Total	18°8	" "

This water shows much previous sewage contamination, in addition to a considerable quantity of organic matter and chlorine, and was highly dangerous for drinking purposes.

In Canton there are at this moment 282 houses supplied with water from wells.

Much of Canton is in a water-logged condition, due to the circumstance that it is entirely bounded on the south by a marine clay deposit, which is very thick, and offers a complete resistance to the outflow of any but surface water. The wells are shallow and sunk in the

porous subsoil of sandy gravel, which abuts on the marine clay. It is, therefore, very retentive of water. Cesspools are closely adjacent. The sewage matter from these cesspools overflowing with water, finds its way into the wells in an undecomposed state, and in sufficient quantity to cause the water obtained from the wells to emit a nauseous and offensive odour. The inmates of houses so supplied frequently call my attention to the fact, and attribute derangement of health to this cause. The following is an analysis of the water made by Mr. Thomas, and it may be taken as a fair specimen of the quality of that drawn from various wells throughout the district.

Analysis of water obtained from a well supplying 15 houses at Railway Terrace, Canton, made by Mr. Thomas.

Total Solid Impurities	...	...	28.0	grains per gallon
Organic Ammonia	...	...	0.18	" "
Free Ammonia	...	...	0.20	" "
Nitrogen as Nitrates and Nitrites	...	...	5.07	" "
Previous Sewage Contamination	...	...	4.900	" "
Chlorine	...	...	3.4	" "
Hardness	{	Temporary	...	2.98	or
		Permanent	...	11.99	" "
Total	...	...	14.97	" "

This sample is highly contaminated with sewage matter in an undecomposed state, and is, therefore, very dangerous for drinking purposes. In every sample obtained from wells in Canton, Sewage contamination existed to a greater or less degree, especially in the wells at Canton Square, Wellington Street, Severn Road, and Llandaff Road.

METEOROLOGY.

The Meteorological indications of the year were as follows:—

The Rainfall at Cardiff during the year 1875, and four preceding years, as observed by Mr. W. ADAMS, C.E. & F.G.S., at his residence, is given in the subjoined table:—

	1871.	1872.	1873.	1874.	1875.
	Inches.	Inches.	Inches.	Inches.	Inches.
January ...	2.555	7.79	4.76	4.630	5.872
February ...	2.653	4.24	1.17	2.910	2.080
March ...	1.753	3.16	3.60	2.035	1.667
April ...	5.135	1.83	0.39	1.670	2.651
May ...	0.885	2.11	2.72	0.676	2.930
June ...	1.577	3.71	1.93	1.710	5.340
July ...	5.112	4.67	4.03	1.786	6.279
August ...	2.885	3.12	3.66	4.575	3.825
September ...	6.670	3.67	2.75	5.457	4.055
October ...	4.162	4.45	4.42	4.837	7.800
November ...	1.367	5.56	2.29	2.711	7.780
December ...	2.260	6.05	1.16	4.355	1.746
	37.014	50.36	32.88	37.352	52.025

The total rainfall in 1875 was 11 inches above the average of the five years.

The month of January was very gloomy, with fogs and great moisture. The barometer was low and unsteady, and fluctuated through a wide range. The highest temperature in the shade was 55deg. on the 15th, the lowest 21deg. on the 1st, and the range 34deg. The mean temperature was 45.5, which is fully 8deg. above the average. The winds were Westerly, and very boisterous. The rainfall reached the total of 5.87 inches, and fell on 26 days. The month was unhealthy.

February was much drier and colder. The barometer was high and steady, and with a more limited range. The highest temperature in the shade was 53deg. on the 12th, the lowest 27deg. on the 5th, and the range 26deg. The mean temperature was 37.6deg., which is less than the average by 1deg. Easterly winds prevailed. The rainfall was light, only 2.08, and it fell on 15 days.

March was a fine dry month. The barometer was high and steady, with a range of less than one inch. The highest temperature was 60deg. on the 31st, the lowest, 28deg., on the 21st, and the range 32deg. The mean temperature was 42.4deg., which is rather above the average. The winds were generally North-East, the air dry, and rainfall moderate, being 1.67 ; it fell on 8 days.

April was fine, with a high steady barometer. The maximum temperature of 72deg. was on the 20th, the minimum, 32deg., on the 2nd ; the range was 48deg., which is rather above the average. Easterly winds prevailed. The rainfall was light, 2.65 inches ; rain fell on 11 days.

May was a very genial month, with a moderately high and steady barometer. The highest temperature was 75deg. on the 14th, and the lowest, 43deg., on the 28th and 31st. The mean temperature was 56deg., which is well above the average. The rainfall was 2.93, and fell in refreshing showers on 16 days. North and Westerly winds prevailed.

June was singularly wet and stormy. The barometer was low and unsteady. The temperature was very variable. The highest, 80deg., occurred on the 3rd, and the lowest, 43deg., on the 11th and 19th ; the range being 37deg. The mean temperature was 57deg., which is 2deg. below the average. The prevailing winds were South Westerly. The rainfall was 5.34in., which is much above the average ; it fell on 21 days.

July was remarkably wet and stormy. The barometer was low and fluctuating. The highest temperature was 78deg. on the 4th, and the lowest, 45deg., on the 26th ; the range being 33deg. The mean temperature was 61deg., which is near the usual value. The Easterly

and Westerly winds were nearly equal, but the North exceeded the South. The rainfall was extremely heavy, and measured 6·28in. It fell on 17 days. Thunderstorms and floods prevailed. On the 14th 3·74 inches fell in 24 hours.

During August terrific thunderstorms and floods occurred. The barometer was high and the disturbances electric. The highest temperature was 79deg. on the 16th, and the lowest, 46deg., on the 21st; the range being 33deg. The mean temperature was 62·9deg., which is rather in excess of the usual value. The prevailing winds were N. W. The rainfall was 3·82in.; it fell on 16 days.

September was fine and hot during the first half of the month, but afterwards wet. The barometer was high and steady on the whole. The temperature was highest, 78deg., on the 11th, and lowest, 42deg., on the 29th; the range was 36deg. The mean temperature, was 59·6deg., which is above the average. The prevailing winds were S. W. The rainfall was 4·06in., and fell on 15 days.

October was a month of storms, and incessant rains. The barometer was low and unsteady. The highest temperature was 68deg. on the 1st, the lowest, 35deg., on the 14th; the range being 33deg. The mean temperature was 47·7deg., which is below the usual mean. The prevailing winds were S. E. The rainfall was 7·80in, and it fell on 26 days.

November was very wet up to the 10th, afterwards fine and frosty. The barometer was below 30in. on 16 days. The highest temperature was 62deg. on the 3rd, the lowest, 26deg., on the 27th; the range was 37deg. The mean temperature was 44·1deg., which is above the average. The prevailing winds were N. E. The rainfall was 7·78in.; and it fell on 28 days.

December was fine and frosty during the first half of the month, then wet and mild. The barometer was high. The highest temperature was 54deg. on the 21st, the lowest, 28deg., on the 4th; the range being 26deg. The mean temperature was 40·5deg. Westerly winds prevailed. The rainfall was 1·74in.; it fell on 15 days.

VITAL AND SANITARY STATISTICS.

The estimated population of the Cardiff Urban Sanitary District for the year 1875 is 72,760, namely:—

The subdistrict of Cardiff, including seamen	...	...	43,118
Roath	...	...	16,500
Canton and Grangetown	...	...	13,142
			72,760

In making an estimate of the population of Cardiff a considerable difficulty exists, which precludes the possibility of calculating it by the ordinary rules regulating the increase of a Town population,

This may be recognized by the ever-varying returns of the censuses since 1801. Thus—

Census of ...	1801	...	1,870
	1811	...	2,577
	1821	...	3,521
	1831	...	6,187
	1841	...	10,077
	1851	...	18,351
	1861	...	32,054
	1871	...	39,536
Estimated population 1875	...	...	72,760

The estimated population of 1875 includes the recently amalgamated districts of Roath and Canton, which were first included under the Cardiff Extension Act of 1875. The census returns of 1861 and 1871, shewed the average number of inmates to exceed 6·5 per house. This unusually large number of inmates, is due to the circumstance that nearly the whole of the houses occupied by the working classes are built on leasehold property, at a comparatively high rate of ground rent; hence they are large, as compared with the same tenements in other towns. The rents paid for these vary from 5s. to 8s. 6d. per week, and as a consequence each house gives accommodation for two or more families. Since 1871 houses have considerably increased in number, much in excess of any former period. This obtains not only in the subdistrict of Cardiff, but especially in that of Roath, and, although not to the same extent in Canton, yet very largely in that subdistrict. The respective number of houses in each district, relatively, during these periods being—

	1871.	1875.	increase since	1871.
Cardiff ...	5,339	6,019	" "	680
Roath ...	1,213	2,581	" "	1,318
Canton ...	1,583	2,071	" "	488
	<u>8,135</u>	<u>10,671</u>		<u>2,536</u>

The return for 1875 was obtained by a careful survey of the several districts, made during the month of January of the present year, by the Sanitary Inspectors, every house in course of erection or unoccupied being excluded. The ascertained number of inmates of each house indicated that the average of 1871 is maintained.

The estimate of the number of seamen constantly in the port is taken as the same as that given by the census return of 1871, but it should be noted, that, according to the following return furnished by the kindness of Mr. T. S. Miller, H.M. Collector of Customs at this Port, that, although the number of vessels entered at the Customs House since 1871 is somewhat less, there is a considerable increase

in the average tonnage of each vessel. The latter circumstance suggests that probably vessels remain longer in the port for discharging and reloading, and would increase the average number of seamen constantly in the port. The average tonnage of each vessel (including foreign and coastwise trade) in 1871 was 199; in 1875 it was 239.

YEARS.	No. of Vessels Inwards.		Total No. of Vessels Foreign and Coastwise.	TONNAGE.		Total Tonnage, Foreign and Coastwise, Inwards.
	Foreign.	Coastwise.		Foreign.	Coastwise.	
1871	4,234	6,919	11,153	1,637,725	588,011	2,225,736
1872	4,942	6,994	11,836	1,951,897	600,865	2,552,762
1873	4,694	6,674	11,368	1,920,410	640,089	2,560,499
1874	4,966	6,210	11,176	2,113,987	545,692	2,659,679
1875	4,645	5,541	10,186	1,947,265	493,818	2,441,083

The births registered in the Cardiff Urban Sanitary District during 1875 were 2,716, sub-divided as follows:—

St. John, Cardiff	...	...	459
St. Mary, Cardiff	...	...	1054
Roath	...	...	700
Canton	...	...	359
Grangetown	...	...	144
			2716

The birth-rate in Cardiff was 37·1 per 1,000; that of all England 35·5. In making this comparison it is also to be borne in mind that it is calculated on the estimated population, which includes 4,000 seamen constantly in the port, whose families are non-residents, and do not contribute to the birth-rate.

The deaths registered in Cardiff during 1875 were 1547; and occurred at the following periods:—

Winter Quarter, ending March 31	...	...	404	
Spring	"	June 30	...	342
Summer	"	Sept. 30	...	371
Autumn	"	Dec. 31	...	430
			1547	

The comparative death-rate of Cardiff, all England, and London being:—

	Cardiff, Total Deaths.	Rate per 1000.	England, Rate per 1000.	London, Rate per 1000.
Winter Quarter	... 404	22·1	27·5	27·2
Spring	... 342	18·8	21·9	21·9
Summer	... 371	20·3	20·1	21·5
Autumn	... 430	23·6	21·3	24·3

The death-rate on the year was :—

Cardiff	...	...	21.2
England	...	..	22.8
London	...	...	23.7

The death-rate on the year being 1.6 per 100⁰ less in Cardiff than that ruling all England, and 2.5 less than that of London.

The deaths in relation to the sexes were :—

Males	...	...	838
Females	...	...	709
			1,547

The table of the births and deaths registered in Cardiff during 29 consecutive years is interesting, as demonstrating very forcibly the results of Sanitary Improvement.

	Births.	Deaths.	Majority of Deaths.	Majority of Births.	
1847	331	484	153	...	
1848	428	579	151	...	
1849	486	864	395	...	Cholera epidemic, 350 deaths registered.
1850	504	485	...	19	Supervision of lodging houses, and re- moval of house refuse.
1851	575	525	...	50	
1852	696	620	...	76	
1853	865	644	...	221	
1854	950	925	...	25	Cholera epidemic, 175 deaths registered.
1855	1079	641	...	438	The first portion of new sewers were made available.
1856	1227	772	...	455	
1857	1367	883	...	484	The first main of new water supply laid on.
1858	1356	753	...	602	
1859	1336	826	...	510	
1860	1246	662	...	584	
1861	1223	837	...	386	
1862	1268	695	...	573	
1863	1302	862	...	440	
1864	1399	932	...	467	
1865	1382	867	...	515	
1866	1332	882	...	449	Cholera epidemic, 47 deaths registered.
1867	1397	870	...	527	
1868	1387	843	...	544	
1869	1419	1005	...	414	
1870	1406	903	...	506	
1871	1391	891	...	500	
1872	1358	916	...	442	
1873	1430	885	...	545	
1874	1551	995	...	556	
1875	2716	1547	...	1169	Cardiff district absorbed Roath & Canton.

The Sanitary history of Cardiff may be thus described:—In 1849 an alarming outbreak of cholera occurred, and caused an investigation to be made into the Sanitary condition of Cardiff. The Inspector of the Board of Health reported that an examination of the registry of births and deaths, extending over a period of 10 years, revealed the fact that the total number of deaths exceeded the births, and that the yearly average rate of mortality was 30 per 1000. The town was then in a deplorable condition. Beyond a partial means of carrying away surface water and house slops, no provision for drainage existed. The supply of water was utterly inadequate, and impure in the poorer districts of the town. There were no pumps, and the dwellings of the working classes were overcrowded. Immediately after this report, namely, in 1850, the Local Authorities commenced their attempts at Sanitary reform. These were necessarily at first limited to house inspection and removal of house impurities and other refuse matter. In 1855 the first portion of the new sewers was made available in that portion of the district occupied by the labouring classes, and in 1857 the first main of the new water supply was laid on. A reference to the table above shews that the years 1850, 1854, and 1857, were important epochs in the sanitary history of Cardiff.

The following table gives the total births, deaths, and marriages during the year 1875, with those of the preceding 10 years; also the estimated population in each year, with the proportionate rate per 1,000 of births and deaths.

	Estimated population.	Marriages	Births.	Birth rate per 1,000 population.	Deaths	Death rate per 1,000 population.
1865 ...	35,588	560	1372	38·5	867	24·0
1866 ...	36,246	539	1331	36·8	882	24·3
1867 ...	36,904	601	1397	37·8	870	23·5
1868 ...	37,562	586	1387	36·8	843	22·5
1869 ...	38,220	585	1414	39·2	1,005	26·2
1870 ...	38,878	578	1406	36·1	903	23·2
1871 ...	39,536	558	1391	35·6	891	22·5
1872 ...	40,431	658	1358	33·5	916	22·6
1873 ...	41,326	741	1430	34·1	995	21·3
1874 ...	42,221	812	1551	36·7	885	23·5
1875 ...	72,760	841	2716	37·3	1,547	21·2

The estimated average population of Cardiff during the 10 years ending December, 1874, is 38,691, and the average death-rate 23·3 per 1,000. Comparing this death-rate with that of the 10 years preceding 1855, which was 30 per 1,000, there has been an annual saving of life of 232, or a total of 2,320 on the

10 years. The average estimated population of Cardiff during the decennial period ending 1864 was 28,714, and the death rate 23·9 per 1,000. On these 10 years, therefore, there was a saving of 1,684 lives, making a total saving of life during the 20 years of 4,004. In other words, 4,004 persons are now living who, but for the sanitary provisions carried out in this district since 1855, would have been dead.

The pecuniary value of this saving of life may be estimated as follows :—Dr. Farr, the eminent statistical authority of the kingdom, estimates the money value of a productive male life as £300, this being considered moderate, and the productive value of a female life at half that sum.

Taking 4,004 as the total saving, and estimating half these as males, and that four-tenths are productive lives

The gain to the District will be 300 by 800	...	...	£240,000
And the productive females at half the value	..	...	120,000
			<hr/> £360,000

As a diminished death-rate also means an improvement in the health of a population, to this sum should be added the value of the productive industry of those who, but for improved health, would have been altogether lost to the community.

The following is a classification of causes of death, as registered in Cardiff during 1875, with the rate of mortality from each class, compared with that ruling the kingdom during the decennial period ending 1873. The report for that year being the last published by the Registrar General :—

Class	Total deaths from each class in Cardiff, 1875.	Rate per 1000.	Rate per 1000, all England, during decennial period ending 1873.
1 Zymotic diseases ...	377	5·181	5·035
2 Constitutional diseases ...	378	5·195	4·169
3 Local ...	491	6·746	8·781
4 Developmental ...	182	2·505	3·584
5 Violent ...	60	0·853	0·783
Not specified or ill defined.	59	0·810	0·149
	1546	21·200	22·500

A detailed analysis of the causes of death from each disease, with comparative rate of mortality, will be found in tables Nos. 1 and 2, appended.

The ages at death in each case are as follows :—

Class.	Causes of Death.	AGE												Total under 5 years	Total	
		0 to 1	1 to 2	2 to 5	5 to 15	15 to 25	25 to 35	35 to 45	45 to 55	55 to 65	65 to 75	75 to 85	85 to 95			95 and upwards
1	Zymotic diseases	110	50	98	45	13	26	13	10	10	1	1	..	..	258	377
2	Constitutional .	04	26	17	24	46	69	48	49	15	13	7	..	..	107	378
3	Local	141	35	26	33	21	32	34	55	56	35	25	..	..	102	491
4	Developmental..	115	6	11	..	..	4	1	1	4	22	21	6	2	122	182
5	Violent	1	3	4	5	12	10	12	6	4	2	1	..	..	8	69
	Not specified or ill defined	11	3	1	5	4	12	7	4	6	4	2	..	..	15	59
		442	172	147	112	96	151	115	125	96	77	57	6	2	712	1547

A detailed analysis of deaths at age from each disease will be found in table appended.

The subjoined table shews the mortality from the seven principal Zymotic diseases, in the 10 years, in Cardiff (1865 to 1874), as, also, that of 1875, with proportionate rate of deaths. The comparative rate observed in England for the 10 years, 1864 to 1873, is likewise given ; it is, however, to be remembered that in 1875, scarlatina and diarrhœa prevailed with unusual severity, not only in Cardiff, but also throughout the kingdom. In the above table these Zymotic diseases are included in Cardiff, causing a considerable increase under those headings ; but no reports for 1875 of the Zymotic deaths in England having as yet been published, the proportionate rate in Cardiff for 1875 appears unfavorable.

Disease.	1865.	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	Annual Average of 10 years, 1865 to 1874.	Proportion of Deaths to 10.0 Deaths in Cardiff 1875.	Proportion of Deaths to 1000 Deaths in Cardiff 1875.
Smallpox	44	2	0	4	4	0	13	55	8	2	13.2	12.4	6
Measles	14	4	14	11	17	5	4	69	2	52	19.2	18.3	2.4
Scarlatina	21	23	16	21	50	26	90	15	4	13	27.9	26.3	84.4
Diphtheria	7	4	0	2	11	2	1	2	6	6	4.1	4.8	7.
Whooping Cough.....	17	15	23	10	33	29	1	20	19	12	17.9	16.9	22.8
Fever.....	42	65	32	29	25	40	28	38	27	33	35.9	33.9	22.8
Diarrhoea	15	78	28	30	15	31	21	35	37	36	32.6	30.7	42.
Cardiff Total	160	191	113	107	155	133	153	234	103	154	150.8	143.3	182.0
London	14,272	14,760	11,660	14,925	17,413	16,476	19,455	12,690	11,376	11,230	14625.	196.4	169.1
All England	720,050	82,692	72,587	97,362	91,339	100,257	103,801	91,743	70,402	...	86947.	153.2	...

* No return issued by Registrar-General.

The zymotic diseases comprise a class with which Sanitary provisions are intimately associated; and, although these diseases cannot be entirely prevented, as in the case of the infantile epidemics, such as measles, scarlatina, and whooping cough, there can be no question, that the more perfectly Sanitary regulations are carried out, the greater is the diminution in the death rate. Under these circumstances, it is necessary I should bring these diseases more prominently before your notice.

Smallpox was fatal only in one case during 1875. This was a female adult resident in Roath, who, in perfect health, visited her family in Bristol, then suffering from smallpox; she remained there a few days, and returned home complaining of sickness. In two or three days an eruption appeared; and the poor woman was removed to a detached building at the Union. Isolation was strictly observed, and every means taken by Dr. Sheen, the medical officer, to prevent extension of the disease amongst the other inmates, with perfect success. The house at Roath was also thoroughly cleaned and disinfected, and kept for some time under observation. No other case occurred either in it or in the neighbourhood, nor was any other case of sickness from smallpox reported to me during the year.

The prevalence of smallpox during the years 1871 and 1872, caused considerable attention to be directed to this disease by the authorities, and a more effective system of vaccination to be observed. A public vaccinator for the Town district was appointed. That gentleman, Mr. E. Hier Evans, discharged the duties with great care and activity, and the results which ensued were most satisfactory.

Measles was fatal only in four cases. Scarlatina prevailed more extensively and fatally than in any year since the epidemic of 1869, 1870, and 1871. Its progress in this district was as follows:—

	Quarters ending				Total.
	March.	June.	September.	December.	
Cardiff ...	5 ...	5 ...	14 ...	48 ...	72
Roath ...	3 ...	2 ...	— ...	8 ...	13
Canton ...	7 ...	4 ...	3 ...	28 ...	47
					132

Epidemic scarlatina prevailed very extensively throughout the kingdom, more especially during the Autumn quarter. In the Spring quarter the Registrar General reports, among other places, that scarlatina prevailed severely at Neath and Cowbridge, in this County. In the Summer quarter it gave indications of assuming a severe form in this district, when twenty-two deaths were registered, and in the following, or last quarter of 1875, seventy-four deaths are recorded.

Scarlatina is a disease which presents the greatest obstacle to the proper enforcement of Sanitary regulations, partly owing to the subtle nature of the *materies morbi*, and partly to the facility with which it

is conveyed by individuals visiting the sick chamber. There is also great difficulty in effecting isolation, owing to the limited house accommodation which exists among the industrial classes, and the impossibility of preventing the visitation of friends and relations to infected houses, in spite of the strong and urgent appeals made by the medical attendant; coupled with this danger is the careless practice of sending children from these infected houses to day schools. I endeavoured to prevent this by serving a notice on every occupier of the house, or head of the family, among whom scarlatina existed, forbidding this practice. I also gave information to the masters of the schools, urging them to refuse to receive scholars from an infected house, and I am enabled to report that I received every assistance from the masters. Another practice, attended by the greatest danger, prevailed among the Irish, of holding "wakes" over the bodies of those who have died from this disease. I, at first, experienced considerable opposition, owing to the tenacity with which this class clung to national customs, but I received very valuable aid and co-operation from the Catholic clergy upon this, as upon all previous occasions, whenever I have appealed to them.

I am also under considerable obligations to my professional brethren, who gave me information of cases of scarlatina coming under their observation. This enabled me to place the Sanitary Inspectors at their disposal, to superintend and carry out effectively the process of disinfection of houses or clothing.

I have also caused a constant inspection of all houses in infected localities to be made.

Eleven deaths were registered from diphtheria; namely, eight in Cardiff, and three in the Roath subdistrict. These are in excess of the ordinary average; but it must be borne in mind that these deaths were registered during the prevalence of scarlatina. In the absence of the eruption there is a great difficulty in distinguishing a case of scarlatina anginosa from diphtheria, and, probably, this difficulty occasioned some of the deaths to be registered as diphtheria, which were really due to scarlatina. I form this opinion on the fact that I occasionally found that in a family where scarlatina had been fatal, the first recorded death was certified as from diphtheria.

Next to scarlatina, diarrhœa was the most fatal zymotic disease in Cardiff. During the year 70 deaths were registered from this epidemic, and they occurred in the following order:—4 were registered in the quarter ending March; 7 in the quarter ending June; 41 in that of September; and 18 in the early part of the December quarter.

Diarrhœa is a disease very prevalent during the autumnal or fruit season, but this year an unusually large mortality occurred in the

very early period of infant life, when fruit forms no portion of diet. Thus, of the 70 deaths registered from diarrhoea, 54 were under the age of one year; 7 under two years; 3 under five years; and only 6 were adults. Concurrently with this disease, a severe affection of the throat prevailed, somewhat analogous to diphtheria, but not resulting in the high proportionate death-rate of that disease. The sloughing was less extensive, and there was an absence of the albuminoid exudation peculiar to diphtheria. The ulceration of the throat and mouth partook of a vesicular and aphthous character. I also met with several cases of skin disease, which assumed the form of pemphigus. At this time foot and mouth disease prevailed among cattle, and largely among dairy cows. With the active assistance of Mr. Moir, veterinary surgeon of this town, and cattle inspector for the district, and of Mr. Thomas, the Borough analyst, we made daily examinations of samples of milk offered for sale, obtained by Mr. James, the inspector of nuisances. We detected in a very considerable majority of these samples that the milk was in a diseased state, and taken from cows labouring under foot and mouth disease. I then called the attention of the public and my professional brethren to the fact. The sale of diseased milk was immediately checked, and in all cases coming under my observation, the concentrated Swiss milk was recommended as a substitute, with considerable advantage to the public health.

The deaths at age were as follows :—

	Under 1 year	...	...	...	...	...	...	442
1 and	under 2 years	...	...	...	...	...	...	122
2	" 5 "	...	...	...	...	...	...	147
5	" 15 "	...	...	...	...	...	...	112
15	" 25 "	...	...	...	...	...	...	96
25	" 35 "	...	...	...	...	...	...	151
35	" 45 "	...	...	...	...	...	...	115
45	" 55 "	...	...	...	...	...	...	125
55	" 65 "	...	...	...	...	...	...	95
65	" 75 "	...	...	...	...	...	...	77
75	" 85 "	...	...	...	...	...	...	57
85	" 95 "	...	...	...	...	...	...	6
95 and upwards	"	...	...	...	...	...	...	2
							Total...	1547

According to the above table, in 1875 the total deaths registered in Cardiff under the age of one year were 442, or at the rate of 162 in every 1,000 registered births; that of the 18 typical large towns enumerated by the Registrar General during the same period being 177.

The infantile death-rate of Cardiff, therefore, contrasts very favourably with that of the kingdom, even in a year when this district suffered very seriously from epidemic, scarlatina, and infantile diarrhoea.

Deaths at Institutions during 1875.

Cardiff Infirmary	34
Hamadryad Seamen's Hospital ..	8
Cardiff Union Workhouse...	108.
Gaol	1
	<hr/>
	151

DISEASED MILK.

(Foot and Mouth Disease.)

I annex a description of the result of an examination of diseased milk, furnished by Mr. Thomas, and which may be taken as a typical illustration.

Analysis of milk furnished by Mr. Thomas.

OCULAR EXAMINATION.—In the first stage of the disease little or no difference is observed, with the exception that small particles of solid matter (fat) of a star-like form are seen. As the disease advances these star-like masses become larger and larger. This is especially the case if the milk has remained for some time in the udder. When the disease has attained its height, and the milk glands, either from sympathy, fever, or other local cause, become attacked, the milk generally gives a strongly acid reaction, while the *casein* is at the same time uncoagulated. Doubtless the *casein* then exists in a modified form, several such samples having withstood the action of strong acids for some time before coagulating. Again, if the milk, while in this state, be slightly agitated for a short time, masses of fat rise to the surface, and from a pint of milk it is easy to obtain a mass of butter, weighing no less than 1 or 1½ ounce.

Healthy milk, if shaken for twice the time, will give no such reaction. Moreover, the colour of the milk when much diseased is yellowish brown, of strong odour, and of such consistency as to be easily distinguished from healthy milk. If water be added to it when freshly drawn from the cow, the colour and consistency are, of course, reduced, but the fatty masses are not dissolved, and are easily recognised.

MICROSCOPICAL EXAMINATION.—In the first stage the milk appears moderately healthy. Masses of fat of small size are visible, and membranous and other matter are mostly present. Mucous and a striated membranous tissue, and sometimes pus corpuscles, are more often observed during the first and latter stages of the disease than even in its most virulent form. The fat globules are also much more minute in these stages. Several samples of milk in the first stage were very poor. As the disease advances the milk becomes much richer (containing often as much as 24 per cent. of solids). The fat globules also attain a much larger size, and the extreme richness of

the milk is very apparent under the microscope. The fatty masses now often cover the whole "field" (of the microscope), and sometimes 3 or 4 times the "field" (power 240 diameters). These masses give a strong iridescence by sunlight and fluorescence by diffused daylight. A network of fibres is sometimes observed in combination with the fatty masses, as well as a quantity of colouring matter, resembling hematine.

Epithelium is scarcely ever absent, and is often seen in very marked scales. A peculiar fibrous cell-like membrane colored red is almost invariably present, but I have not, however, been able to identify it. The most marked and constant indication of this disease is the affinity which the apparently healthy fat globules have of congregating in masses and leaving the greater portion of the field unoccupied. This is readily observed during every stage of the disease, and is often noticeable for some considerable time after the animal is apparently convalescent. When the fat globules have agglomerated their shape changes from round to oval, hexagonal, and broken-down forms, and the masses of fat globules are often so dense as to present a black appearance under the microscope. This can be attributed to the *casein* existing in a modified form—the caseous envelopes surrounding the fat globules being so thin and so weak as to allow them to congregate, and even unite in the manner in which they are to be seen in the milk.

The *casein* is sufficiently glutinous as it were, and of sufficient consistency in healthy milk to envelope and compel the fat globules to remain equally distributed throughout the field of the microscope.

SANITARY WORKS EXECUTED DURING THE YEAR 1875.

These have been very onerous, and have required constant and vigilant activity on the part of those to whom these duties have been entrusted. They consist in a frequent supervision of the whole of the district, as to surface nuisances near houses, defective house drainage, and offensive cess-pools, over-crowded and unwholesome condition of houses, impure and insufficient water supply, the disinfection of houses after infectious diseases, removal of infectious cases of sickness from crowded localities into the fever hospital, the collecting and disinfecting of clothes and bedding of patients who have suffered from infectious diseases, and the removal of animals kept near to inhabited houses, so as to cause noxious effluvia. The extent to which these duties have been carried out may be summarized as follows :—

11,575 night and day visits were made to houses supposed to be over-crowded or in an improper state; of these 242 were found to be over-crowded, and were served with notices to reduce number of inmates; 89 were summoned for non-compliance; of these 79 were fined from 10s. to £3 and costs; 10 being admonished and discharged.

569 houses and premises were cleansed, repaired, and limewashed.

108 houses were disinfected after infectious diseases.

125 house drains were cleansed and repaired.

173 privies and water closets were repaired and cleansed.

122 accumulations of dung, stagnant water, animal and other refuse matter were removed.

39 animals improperly kept near houses were removed.

Six boxes of clothing, and one bag belonging to seamen dying on passage to this country, from infectious diseases, were received from Customs House authorities, and disinfected by means of heated air.

15 seizures of meat, weighing 2 tons 15 cwt. 64 lbs. ; one cask of pickled pork, and one cask of pickled tongues.

Also, 30 boxes and two trucks' full of mackerel, and 30 ducks ; these were all ordered by magistrates to be destroyed, and the owners fined from 10s. to £5 and costs.

In carrying out these important duties, I can but speak again, as I have done before, of the zeal and activity displayed by Mr. James, the Inspector of Nuisances, and the fearless manner in which he dealt with cases of infectious diseases.

I have the honor to be, Gentlemen,

Your obedient Servant,

H. J. PAINE, M.D.,

Medical Officer of Health.

TABLE No. 2.

The following Table illustrates the proportionate death-rate to every 1,000 living in Cardiff compared with that of all England.

			Proportionate rate to every 1,000 living:	
			Cardiff.	England on decennial period Registrar General's last Report.
Class I.	ZYMOTIC DISEASES ...	377	5.181	5.035
Class II.	CONSTITUTIONAL DIS-EASES ...	378	5.195	4.169
Class III.	LOCAL DISEASES ...	491	6.746	8.781
Class IV.	DEVELOPEMENTAL DIS-EASES ...	182	2.5 5	3.584
Class V.	VIOLENT DEATHS... Not specified or ill defined ...	60 69	.880 .810	.783 ...
	Total... ..	1547	21.124	22.504
Class I.	ZYMOTIC DISEASES— Order 1, Miasmatic.			
	Smallpox	1	0.073.7	0.279
	Measles... ..	4	0.054	0.406
	Scarlet Fever (Scarlatina) ...	132	1.708	0.890
	Diphtheria	11	0.150	0.204
	Quinsy	2	0.027	0.013
	Croup	20	3.274	0.255
	Whooping Cough	38	0.520	0.526
	Typhus Fever	5	0.068	0.522
	Enteric or Typhoid Fever ...	24	0.328	
	Simple continued Fever ...	9	0.123	
	Erysipelas	15	0.205	0.085
	Puerperal Fever Metria ...	17	0.232	0.055
	Carbuncle ... ..	...	...	...
	Influenza ... ..	...	...	...
	Dysentery	1	0.013.7	0.052
	Diarrhoea	70	0.959	0.871
	Cholera... ..	...	...	...
	Ague ... ..	...	...	...
	Remittent Fever	1	0.013.7	0.008
	Rheumatism	6	0.082	0.111
	OTHER ZYMOTIC DISEASES Order 2, Euthetic.			
	Syphilis	11	0.150	0.073
	Stricture of Urethra ... ..	...	...	...
	Hydrophobia ... ..	...	...	...
	Glanders ... ..	...	...	...
	Order 3, Dietic.			
	Privation ... ..	...	...	...
	Want of Breast Milk ... ..	...	...	...
	Purpura and Scurvy	1	0.013.7	0.060
	ALCOHOLISM—			
	Demerita	4	0.041	0.02.9
	Opium	5	0.068	0.017
	Total... ..	377	5.154	5.035
Class II.	CONSTITUTIONAL— Order 1, Diathetic.			
	Gout	1	0.013.7	0.045
	Dropsy	42	0.575	0.348
	Cancer	36	0.493	0.388
	Cancerum oris	1	0.013	0.007
	Mortification	5	0.068	0.064
	Order 2, Tubercular.			
	Scrofula	6	0.012	0.148
	Tabes Mesenterica	65	0.890	0.293
	Phthisis	179	2.424	2.547
	Hydrocephalus... ..	45	0.616	0.357
	Total... ..	378	5.195	4.169
Class III.	LOCAL— Order 1, Diseases of Nervous System.			
	Cephalitis	10	0.137	0.193
	Apoplexy	20	0.274	0.481
	Paralysis	19	0.260	0.499
	Insanity ... ..	...	...	0.029
	Chorea ... ..	...	...	0.003
	Epilepsy	9	0.123	0.118
	Convulsions	109	1.423	1.261
	Brain Diseases	26	0.221	0.253
	Order 2, Diseases of Circulation			
	Pericarditis	1	0.013.7	0.028
	Aneurism	6	0.082	0.022
	Heart Disease, &c.	36	0.463	0.973
	Order 3, Diseases of Respiratory Organs.			
	Laryngitis	2	0.027	0.068
	Bronchitis	101	1.383	1.148
	Pleurisy	2	0.027	0.042
	Pneumonia	65	0.890	1.136
	Asthma... ..	15	0.205	0.186
	Lung Diseases	12	0.164	0.231
	Order 4, Diseases of Digestive Organs.			
	Gastritis	3	0.041	0.037
	Enteritis	3	0.041	0.149
	Peritonitis	2	0.027	0.077
	Ulceration of Intestines ...	1	0.013.7	0.042
	Hernia ... ..	...	...	0.042
	Ileus ... ..	...	...	0.056
	Intus Susception ... ..	...	...	0.013
	Stricture of Intestines ...	1	0.013.7	0.013
	Fistula ... ..	...	...	0.004
	Stomach Diseases, &c. ...	3	0.041	0.137
	Jaundice	4	0.054	0.069
	Liver Disease, &c.	12	0.164	0.251
	Spleen Disease, &c. ... ..	...	...	0.003
	Order 5, Diseases of Urinary Organs.			
	Nephritis ... ..	...	...	0.018
	Ischuria ... ..	...	...	0.305
	Bright's Disease (Niphria) ...	0	0.123	0.089
	Diabetes	2	0.027	0.030
	Calculus (Stone) ... ..	...	...	0.009
	Cystitis... ..	3	0.041	0.018
	Kidney Diseases	5	0.068	0.124
	Order 6, Diseases of Organs of Generation.			
	Ovarian Disease	2	0.027	0.011
	Uterus Diseases, &c. ... ..	...	...	0.047
	Order 7, Diseases of Organs of Locomotion			
	Synovitis ... ..	...	...	0.003
	Joints Diseases... ..	2	0.024	0.079
	Order 8, Diseases of Integumentary Organs.			
	Phlegmon	5	0.068	0.023
	Ulcer ... ..	...	...	0.019
	Skin Diseases	2	0.027	0.016
	Total... ..	491	6.746	8.781
Class IV.	DEVELOPEMENTAL— Order 1, Diseases of Children.			
	Premature Birth	33	0.452	0.404
	Cyanosis	1	0.013.7	0.022
	Spina Bifida	6	0.082	0.019
	Other Malformations	1	0.013.7	0.921
	Teething	15	0.205	0.200
	Order 2, Diseases of Adults.			
	Paramenia ... ..	...	...	0.004
	Childbirth (see Metria) ...	5	0.068	0.111
	Order 3, Diseases of Old People.			
	Old Age	51	0.698	1.352
	Order 4, Diseases of Nutrition.			
	Atrophy and Debility... ..	70	0.959	1.447
	Total... ..			
Class V.	VIOLENT— Order 1, Accidents or Negligence.			
	Fractures and Contusions ...	30	0.411	0.298
	Wounds { Gun-shot	1	0.013.7	0.005
	{ Stabs	3	0.031	0.004
	Burns and Scalds	3	0.041	0.134
	Poison ... ..	...	...	0.012
	Drowning	18	0.246	0.126
	Suffocation ... ..	...	...	0.058
	Otherwise	1	0.013.7	0.046
	Order 2.			
	Homicide	1	0.013.7	0.019
	Suicide... ..	...	...	...
	Total... ..	60	0.823	0.783
	Causes ill defined or not specified	59	0.810	0.149

TABLE No. 3.

Table shewing the Mortality from certain classes of Diseases, and proportions to Population, and to 1,000 Deaths, 1875.

	Total Deaths.	Deaths per 1,000 of Population.	Proportion of Deaths to 1,000 Deaths.
1. Seven Principal Zymotic Diseases	294	4.04	190
2. Pulmonary Diseases (other than Phthisis)	197	2.70	127
3. Tubercular Diseases... ..	240	3.40	160
4. Wasting Diseases of Infants..	103	1.41	66.5
5. Convulsive Diseases of Infants	179	2.46	108

NOTES.

1. Includes Smallpox, Measles, Scarlet Fever, Diphtheria, Whooping Cough, Fever, and Diarrhoea.

2. Includes Phthisis, Scrofula, Rickets, and Tabes.

3. Includes Marasmus, Atrophy, Debility, want of Breast Milk, and Premature Birth.

4. Includes Hydrocephalus, Infantile Meningitis, Convulsions, and Teething.