

Dr. Thorne Thorne's report to the local government board on an epidemic of diphtheria at Llanhaiadr.

Contributors

Thorne, R. Thorne (Richard Thorne), Sir, 1841-1899.
London School of Hygiene and Tropical Medicine

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Dr. Thorne Thorne's Report to the Local Government Board on an Epidemic of Diphtheria at Llanrhaiadr.

EDWARD C. SEATON, M.D.,

Medical Department,

March 30, 1878.

The Local Government Board having been informed that diphtheria was epidemic in the parish of Llanrhaiadr, I received instructions to inquire into the circumstances under which the disease was prevailing, and I now beg to report as follows:—

Llanrhaiadr is a parish in the rural sanitary district of Ruthin, in Denbighshire. Spreading from the low-lying parts of the Vale of Clwyd up to and amongst the mountainous hills which bound the vale on the west, it covers in all 16,976 acres, and it had in 1871 a population of 1,700. The most populous part of the parish is the village of Llanrhaiadr, which consists of two hamlets, Pentre and Llan, lying about half a mile apart. They are both on the main road from Ruthin to Denbigh, and are mainly situated on the low-lying land of the Vale of Clwyd, immediately at the foot of the hills. According to information supplied to me by Mr. H. Davies, Inspector of Nuisances, Pentre and its vicinity contains 104, and Llan 66 inhabitants. These two hamlets were the principal seats of the epidemic, and to its prevalence in them I propose in the first instance to refer.

General History of the Outbreak.

1st. *At Pentre.*—The first clear case of diphtheria occurred at Pentre; it is referred to as Case No. 1 in the appended list of cases, the patient being a child two years and nine months old. The child sickened on August 12th, 1877, sudden prostration soon followed by dyspnoea being amongst the earlier symptoms; the breath also soon became foetid, and when the child was seen on August 14th by Dr. W. D. Jones, of Ruthin, the entire fauces were covered with a "thick mass of grey deposit." The child rapidly sank, and died on August 15th. As the result of often repeated inquiries as to the prior movements of this child, nothing could be ascertained which seemed in any way to connect its diphtheria with any prior case. The child was under the charge of its grandmother, with whom it lived, and I was confidently assured that the last time it left Pentre was when it went, one month prior to its illness, with its grandmother to Ruthin, where no sickness in any way resembling diphtheria is known to have occurred. In the next case, No. 2, which commenced on August 14th, there was a possibility, if not a strong probability, of communication with the house in which Case No. 1 occurred. Cases Nos. 3 and 4 occurred in the same house as No. 1, on August 17th and 19th, and in the case of No. 5 there was admittedly free communication with that house. Indeed, as far as the cases in and about Pentre are concerned, no interest attaches to the question of origin after Case No. 1, for there were then ample means for its diffusion. In all 16 cases, three of which were fatal, occurred in Pentre from August 12th to the end of October. This number includes one case of a second attack in the same patient. The first attack, (Case No. 11,) commenced on October 5th, and though a mild one, was marked by distinct diphtheritic deposit; it was apparently followed by complete recovery; the second attack, (Case No. 15,) commenced on October 27th; it was one of some severity, and when I saw the patient there was a considerable amount of grey deposit on both tonsils and the uvula. But some of the cases referred to would not have been looked upon as true diphtheria had it not been for the circumstances under which they occurred. Thus Cases Nos. 5 and 6 were, so far as general symptoms and throat appearance are concerned, cases in which simple sore throat was associated with the existence on the tonsils of one or two yellowish grey patches, and in Case No. 7 nothing beyond what is generally seen in "simple tonsillitis" could at any time be discovered. But the specific character of these and similar cases was clearly marked; not only did they occur synchronously with, or follow upon, well-marked cases of diphtheria in the same house, but they were a source of infection to others.

2nd. In Llan the first case which was recognised occurred on September 2nd, when a young girl aged 13 years, Case *c*, was attacked. This case was one of considerable severity, and it terminated fatally on September 12; it was also followed by six other cases, Cases *d*, *e*, *h*, *i*, *j*, and *k*, three of which were fatal, in the same house. The girl first attacked spent a part of every day in service at a house close by. Her mother is convinced that for some time prior to her illness she had not left Llan, and minute inquiry made at the time of her illness by Dr. Turnour, of Denbigh, failed to elicit any information with regard to infection by means of a prior case. The following history was, however, subsequently obtained with regard to the house in which this girl was in service. About the 5th of August one of the family, a little girl about five years of age, Case *a*, sickened with some throat affection. Her illness was deemed trivial and was not thought to require medical attendance. Owing, however, to swelling of the glands about the angles of the lower jaw, an embrocation and a flannel bandage were used. "A few days" after this child's attack, her brother, aged nine years, Case *b*, had "something the matter with his throat." This was also looked upon as of no importance, and it is stated soon to have passed off. On the 30th of October I had an opportunity of examining these children, and I found that in both of them the tonsils exhibited loss of tissue, that in the case of the little girl being considerable. There were two other young children in the house, but neither of these had been ill; a youth residing here is, however, believed to have suffered in a very similar manner during the previous winter, and both his tonsils have the appearance of having been deeply ulcerated. Every effort was made to ascertain if the two children who had ailed had in any way come into contact with any prior case of throat affection, but without result. The house in which they live is, however, an inn, a circumstance which increases the difficulty of obtaining definite information on such a point.

After Case *c* there was no difficulty in accounting for the spread of the disease in Llan by direct infection. Including the two attacks at the inn, 12 cases in all had occurred in the hamlet by the end of October; they included a few cases which appeared exceptionally trivial, but the majority were of great severity, and four of them were fatal.

Circumstances associated with the Origin of the Epidemic.

From the description which has been given as to the general circumstances of the epidemic, so far as it affected the two hamlets forming the village of Llanrhaiadr, it will already have been gathered that, as regards the earliest cases, nothing in the evidence obtained tended to connect them with *antecedent cases*. In this connexion it should, however, be stated that diphtheria had been fatally prevalent some 11 miles from Llanrhaiadr, in a valley in the Abergele sub-district, where 12 diphtheria deaths were registered in the first two months of 1877, and also that in Denbigh the same disease was fatally prevalent about the same time that it prevailed in Llanrhaiadr, as I have elsewhere reported. There is in addition the evidence of several medical men in and about the districts referred to, as also in remoter parts of the county of Denbigh, to the effect that "sore throats" had been specially prevalent during the autumn months.

No cases of *scarlet-fever* or *erysipelas* were known to have occurred in or near Llanrhaiadr prior to or during the epidemic.

The *milk-supply* amongst the affected families was from more than one source, and there had been no recent cases of disease in the dairy farms from which it was derived.

With regard to the influence of any *local circumstances* as affecting the origin of the disease, the only cases which present any interest are, in the order of date: 1st. The two cases of "sore throat," Cases *a* and *b*, which occurred at the inn in Llan; 2nd. The child first attacked at Pentre, Case No. 1; and, 3rd. The girl in service at the inn at Llan, Case *c*.

With regard to the first cases at Llan, it was noted that the inn occupies a low site, being sunk below the level of the adjoining road, and that it is immediately opposite and in close proximity to a churchyard, which, though still used for burial purposes, is stated to be much overcrowded. The water-supply to the house is subject to risk of pollution by soakage from this graveyard. The adjoining yard is stated to be often dirty by reason of the piggeries, &c. in it.

The house in which the first child at Pentre was attacked is, to a considerable extent, buried in the hill side into which it has been built, and immediately behind it and above the level of the ground floor ceiling is a large mill-dam. I found it difficult to ascertain the extent to which this mill-dam causes dampness in the house, owing to the



He accompanied Dr. Thorne's Report on Llanrhaidr.

SECTIONS ACROSS THE VALE OF CLWYD.

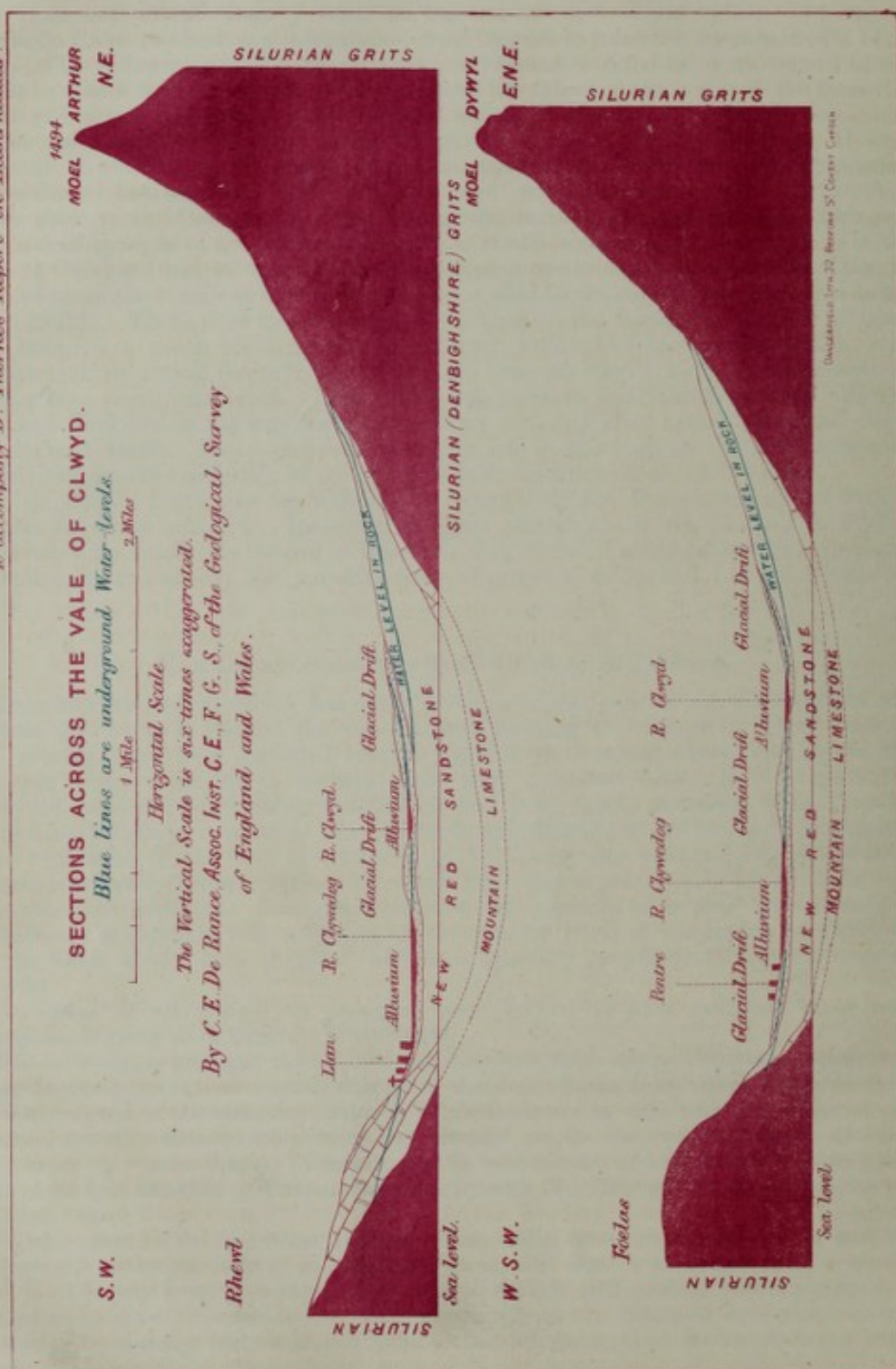
Blue lines are underground. Water levels.

2 Miles

1 Mile
Horizontal Scale

The Vertical Scale is six times exaggerated.

By C. E. De Rance, Assoc. Inst. C. E., F. G. S., of the Geological Survey of England and Wales.



fact that a large oven of a bakery was in use there at the time of my visit; but close by the house is a wall which for the purpose under consideration fairly corresponds with the house walls, and it was quite wet. Within six feet of the house was a heap of dung, and situated at one side of it and at a considerable height above the ground floor was a privy-with-pit, and also a pigstye from which liquid refuse trickled down towards the house door. [Since writing the above I learn that a fatal case of enteric fever has occurred in this house. The disease was not ascertained to have been imported.]

In the third case it is not possible to state whether the girl contracted her illness whilst at the inn, or at her own home. The latter is, however, a house built into the hill side, the loose soil being in immediate contact with the back and side walls. In addition to this a privy having a large pit, the contents of which were freely soaking into the surrounding soil, was found situated at a high level immediately behind the house. A fatal case of diphtheria occurred in this house in 1861.

It will thus be seen with regard to these three premises that besides presenting certain gross nuisances fouling their sites, they were all specially characterised by *dampness of site*, a circumstance which leads me to consider somewhat in detail the physical features of the site which Llanrhaiadr occupies, and the general meteorological conditions of the district.

Site and Soil.—The Vale of Clwyd in which Llanrhaiadr is situated commences at Llanfair Chapel, about seven miles south of Pentre, and gradually widening in its course opens at Rhyl on the north coast of Flintshire. The vale consists mainly of a flat level plain between two ranges of hills; it is about 16 miles in length and is traversed by the Clwyd and its tributaries.

According to information supplied to me by C. E. De Rance, Esq., of Her Majesty's Geological Survey, the Vale is entirely excavated in impermeable Silurian Rocks, which rise to a considerable elevation on either side, and pass under the newer rocks occupying the bottom of the valley, thus forming a water-tight basin through which the Clwyd and its tributaries flow. These newer rocks consist of Old Red Sandstone and of Mountain Limestone flanking the sides, and of the Triassic Lower Mottled Sandstone occupying the bottom of the valley. These are all permeable strata, and would absorb a large amount of the rainfall of the district, were it not that they are covered by a thick envelope of impervious glacial drift, which appears originally to have filled up the valley to a height of 500 feet or 600 feet above the sea level, and to have been subsequently to a great extent carried away by post-glacial fluvial denudation, which has re-excavated the valley and re-assorted the materials which filled it up, so as to distribute them in an alluvial plain, and in older alluvial terraces which fringe the valley at successive heights. From the area occupied by the rocks flanking the sides of the Vale, and from the Silurian rocks in the upland tract above, the rainfall, to no noteworthy degree lessened by absorption, is thrown off into the valley, the permanent water-level of which appears to be very little below the ordinary top-water level of the Clwyd. (See diagrams annexed showing sections across the Vale of Clwyd.) For a space of between two and three miles in the neighbourhood of Llanrhaiadr the drift, which consists of loamy clay charged with stones closely packed together, is stated to be "wholly impermeable." "Flourishing oak trees, the growth of rushes, dark-coloured grass, deep and full ditches, all attest the clayey nature of the soil and its non-absorbent qualities." A large portion of this area is also beneath the level of the floods, which often cover the fields and the roads around.

Rainfall.—No meteorological records are kept at Llanrhaiadr; but from those of various observers in the neighbourhood which have been supplied to me, and especially from those recorded by Lieut.-Colonel Humberstone, of Glan-y-wern, a place situated in the Vale of Clwyd, about two miles east of Llanrhaiadr, I have been able to gather the following points as to rainfall. The average fall of rain in this part of the Vale for the months of July and August has for a series of years been 2.3 in. and 2.2 in. respectively. In July 1877 it was 2.9 in., and in August it reached 5.24 in. In the month of July nearly two inches of rain fell on the three days 13th-15th, and somewhat over an inch fell again on the 24th and 25th. This, however, under the peculiar physical conditions already named, led, I am informed, to some flooding of the Vale in the vicinity of Llanrhaiadr, towards the end of July. How far the floods subsided I cannot learn; but they were much increased by the exceptional rainfall which, commencing on the 3rd of August, was maintained almost throughout the month.

The wetness thus induced was moreover a foul wetness, for the sewage of Llan is held back for many months of the year in streamlets the level of which is below the ordinary level of the river Clwydog, a tributary of the Clwyd; but when these rivers overflow

their banks, as they frequently do on heavy rainfall, the accumulated sewage mingles with the flood waters spread over the valley. It is to this circumstance, as also to the large amount of decomposing vegetation in the valley, that must in all probability be attributed the offensiveness which at times characterises the valley during and subsequent to periods of flood, and which I am informed is at times specially noticeable during the night.

Circumstances associated with the spread of the Disease.

Infection unquestionably played a large part in the spread of the diphtheria. To some extent it is believed to have operated in connexion with *school attendance*. But the disease broke out at a time when the village school was closed, and though the school reopened on the 9th of September, it was again closed on the 9th of October at the suggestion of the Medical Officer of Health; circumstances which, taken together with irregularity of attendance owing to the prevalence of the disease, prevented any definite information being obtained on this point.

Age also appears largely to have influenced the spread of the disease. The total number of persons residing in the village at the commencement of the epidemic is stated to have been 180. Only five of these appear to have been under 3 years of age; of these two suffered from diphtheria; 52 were found to be from 3 years to 15 years old, and of these as many as 23 or 44·2 per cent. were attacked; and of the remaining 123 persons, all over 15 years of age, only three were attacked, and two of these were only 16 years of age.

After the description already given as to *site, soil, and dampness* in speaking of the origin of the disease, it is only necessary to add that the conditions of dampness existing in the Vale at the commencement of the outbreak were to a great extent maintained during the course of the epidemic, and that the rainfall in September and October, viz., 3·38 in. and 3·09 in., respectively sufficed to maintain a certain amount of flood during the whole of those months. With regard also to this question of dampness I would further note that a large proportion of the persons attacked with diphtheria in Llanrhaidr lived in very damp dwellings, the dampness being almost invariably due to the houses being partly built into the surrounding rising ground, and the floors, as a rule slabs of slate, being laid immediately upon the soil beneath. In several marked instances the wetness about the houses was added to by the soakage from undrained piggeries and from privy-pits.

In the *outlying portions of the parish of Llanrhaidr* and in the adjoining parish of *Llanynys* several cases of well-marked diphtheria were also met with. The occurrence of most of these could be explained as the result of personal infection, but this was not so in all the cases. The circumstances of two of these exceptional instances are of interest.

The first of these cases occurred in an isolated house in the parish of Llanrhaidr, occupying an elevated position in the Vale of Clwyd on a small table-land stated to consist of drift gravel overlying new red sandstone. The foundations of the house are particularly dry, and beyond the existence of a glazed pipe drain, in dangerous proximity to a somewhat deep well, and of certain defects in a partially ventilated system of house drains, the establishment seemed to be free from any ordinary sanitary defects. The household consisted of 14 adults and of five children, varying in age from 1 year to 12 years. On Sunday, September 23rd, five adults, and two children aged 2 years and 11 years, drove to Llanrhaidr Church, and on the 27th the child aged 11 years, Case D, complained of sore throat. This being, however, a very common ailment with her, the complaint was all but disregarded. On the 30th, however, serious symptoms set in, and the case rapidly became one of great severity; the entire fauces were covered with a thick and characteristic exudation, and the recovery was a protracted one. This child was strictly isolated on and after September 30th, and no other member of the family was attacked. Every possible source of infection in this case was most carefully investigated by Dr. Turnour, of Denbigh, at the date of the illness, and a few weeks later by myself, and it appears evident that the family had no relations with any of the earlier cases scattered about the district, and that if it was in any way due to an antecedent case, the disease can only have been contracted during the visit to Llanrhaidr on September 23rd. The child's movements on that day are, however, for special reasons, distinctly remembered by several members of her family, and I am positively assured that it is quite impossible that she can have come into contact with any of the villagers in any other way than by being seated with them in the same church, and even there she occupied a separate pew belonging to the family. In point of time the attack in this case might be related to this visit to Llanrhaidr; but if the

circumstances recorded in this case are in every detail correct, any infection so contracted must have been strangely diffused. It should, however, be noted that in December 1874 an isolated but fatal case of diphtheria in a child occurred in this same house, and that the case is not known to have been due to direct infection.

The second case occurred under the following circumstances. In an outlying part of the parish of Llanynys, and standing on one of the somewhat precipitous and thickly-wooded sides of a narrow, gorge-like valley of the impervious Denbighshire Flags, is an isolated house, occupied by a family consisting of two adults, and five children varying in age from 4 years to 16 years. The house, which all but overhangs a stream, is built almost immediately on the slate rocks; but owing to the rapid slope of the surface, it is somewhat embedded in the rock and in surface soil behind and at the two sides; and with a view of intercepting the rain which falls on the hill side, a trench, containing a drain pipe, has been constructed round the house. It is, however, quite certain that this arrangement failed to carry off the surface water in the manner described, and also that the house is rendered damp both by reason of its immediate site and of its surroundings. Nuisances from piggeries are rife around the house. The water-supply, derived from a small mountain stream, is apparently wholesome. On the 16th of October the youngest child, a boy aged four years, Case β , fell ill, complaining of pain in the throat and of difficulty in swallowing, and when medical attendance was procured it was found that he had a characteristic deposit on both tonsils and on the uvula. The subsequent general symptoms, including high febrile disturbance, delirium, and prostration, were also of marked severity. Efforts were made to isolate the child, and the other members of the family had, I was informed, not suffered. Both the parents of this child are confident that for several months prior to its illness it had not quitted the immediate vicinity of its home, and that no member of the family had either visited Llanrhaiadr or Denbigh, where cases of diphtheria had occurred, or received a visit from anyone residing in either of those places, since the commencement of the epidemic. Only one other case of the disease, Case γ , could be heard of anywhere in the neighbourhood, and this occurred several weeks later, and was imported from Denbigh. In short, no history of infection could, as the result of repeated inquiries both by the Medical Officer of Health and by myself, be elicited. It is, however, worthy of note that sore throats are stated to be common in the household, that the child above referred to had a severe "ulcerated throat" in the winter of 1875-76, that the tonsils of one of the other children exhibited at the time of my visit marked loss of tissue, and that in two others the fauces had all the appearances of recent inflammatory action.

Reference has several times been made in this Report to the circumstance that sore throats, which, so far as their physical symptoms are concerned, appeared to be of a simple and trivial character, were frequently met with in conjunction with cases of well-marked diphtheria. To this must be added the fact that I found in outlying and isolated portions of Llanrhaiadr and of adjoining parishes, at times in remote localities among the hill and mountains, numerous instances of the same description, but altogether unconnected with cases of definite diphtheria. In some such cases nothing beyond what appeared to be simple tonsillitis was noticed; at others it was ascertained that during some stage of the ailment patches of a yellow or grey deposit, often most insignificant in point of size, had been detected. The general symptoms in these cases, except in so far as they were in some instances associated with a great amount of physical prostration, were not remarkable. But owing to the neighbouring epidemic they received special attention, and strict inquiry was made as to all the circumstances under which they occurred. The result was that as regards throat appearance and general symptoms it was impossible to distinguish them from those milder cases occurring in Pentre and Llan, in which there was no doubt as to their diphtheritic nature. But unlike these latter, some of the cases now under consideration, 1° had undoubtedly arisen without communication with any prior case of throat disease; 2°, in none of them could any origin from antecedent diphtheria be made out; and 3°, no cases of fully developed diphtheria had been seen to result from intercourse with them.

Summary.

The points elicited during the course of my inquiry may be summed up as follows:—

- 1st. The prevailing disease has been genuine diphtheria, but it has been associated with numerous cases of a mild throat affection, in which the special local characteristics of diphtheria were either very trivial and ill-marked, or, so far as could be ascertained by frequent examination of the fauces, altogether absent.

- 2nd. In some of these mild cases, as also in cases indistinguishable from true diphtheria, no amount of personal inquiry led to the conclusion that they were the result of immediate infection.
- 3rd. By far the majority of the cases occurred in localities which were, owing to physical and special circumstances, characterised by dampness of site, a condition which throughout the affected district had been aggravated by recent heavy rainfall.
- 4th. A large number of the houses affected were further characterised by conditions of filth, resulting mainly from ill-kept and ill-constructed privies and piggeries.

General Sanitary Administration.

The following points with reference to the general sanitary administration of Llanrhaiadr require notice.

The *water supply* of the most populous parts of the parish is inadequate to the requirements of the population, and in some instances it is subject to the risk of pollution. In both Pentre and Llan there is no efficient *means of sewerage and drainage*, and nuisance is occasioned at the outfall of the very faulty system obtaining at Llan. Considerable nuisance and danger to health arises in both the above places from the *privy-pits* and from the ill-kept and undrained *piggeries*. The *dampness of dwellings*, which arises mainly from their being so often partly buried in the surrounding soil, is a condition calculated seriously to affect health. It has in some few instances been successfully remedied by excavating the soil so as to form a dry area round the houses. Although certain measures of disinfection have during the epidemic been carried out under the supervision of the officers of the Sanitary Authority, and although certain recommendations as to the isolation of the patients have been made by the Medical Officers of Health, yet since the Authority has neither provided *means of isolation* nor efficient *means of disinfection*, such partial efforts in these directions have, as might have been expected, not been attended with any appreciable results.

R. THORNE THORNE.

Local Government Board,
February, 1878.

Postscript.—Since writing this Report I learn from the Medical Officer of Health for the Ruthin rural sanitary district that no fresh cases of diphtheria occurred during November 1877. In December, however, there were four cases; two of these occurred in Llanrhaiadr, and two in an adjoining parish; they all terminated fatally. In one instance a boy who worked at a farmhouse in Llanrhaiadr where, on October 19th, an apparently trivial case (Case 1) had occurred, sickened on December 1st. In consequence of his illness he returned to his home in another part of the parish, where he died on December 10th, having in the meantime communicated the disease to a brother who died on December 14th. Two other fatal cases have occurred this year in an outlying part of the district, the disease in the second case having evidently been contracted during a visit to the house in which the first case had occurred. The visit was for one night only, and took place a few days after the burial of the first patient.

These examples, pointing as they do to the manner in which the poison of diphtheria is retained in and about premises where previous cases have occurred, call for energetic measures on the part of the Sanitary Authority thoroughly to disinfect infected premises, and either efficiently to disinfect or to destroy all infected bedding, clothes, &c.

R. T. T.

APPENDIX.

LIST OF ATTACKS FROM DIPHTHERIA IN LLANRHAIDR AND THE VICINITY.

Case.	Sex.	Age.	Residence.	Probable Date of Attack.	Result.
A. At Llan.					
a.	Female -	5 years	Llan -	August 5th (?) 1877.	Recovered } Doubtful cases.
b.	Male -	9 "	Llan -	" 9th (?) "	Recovered }
c.	Female -	13 "	Llan -	September 2nd "	Died, September 12th.
d.	Female -	9 "	Llan -	" 12th "	Recovered.
e.	Female -	6 "	Llan -	" 14th "	Recovered.
f.	Male -	9 "	Llan -	" 14th "	Recovered.
g.	Male -	5 "	Llan -	" 20th "	Recovered.
h.	Female -	8 "	Llan -	" 29th "	Died, October 10th.
i.	Female -	16 "	Llan -	October 7th "	Died, October 15th.
j.	Female -	10 "	Llan -	" 11th "	Died, October 18th.
k.	Female -	50 "	Llan -	" 13th "	Recovered.
l.	Female -	14 "	Llan -	" 19th "	Recovered.
B. At Pentre.					
1	Male -	2 ys. 9 ms.	Pentre	August 12th, 1877.	Died, August 15th.
2	Female -	5 years	Pentre	" 14th "	Died, August 20th.
3	Male -	4 "	Pentre	" 17th "	Recovered.
4	Male -	7 "	Pentre	" 19th "	Recovered.
5	Male -	10 "	Pentre	" 20th "	Recovered.
6	Male -	16 "	Pentre	" 20th "	Recovered.
7	Female -	7 "	Pentre	" 21st "	Recovered.
8	Female -	3 "	Pentre	" 21st "	Recovered.
9	Male -	8 "	Pentre	October 4th "	Recovered.
10	Male -	7 "	Pentre	" 4th "	Recovered.
11	Male -	12 "	Pentre	" 5th "	Recovered.
12	Female -	14 "	Pentre	" 8th "	Died, October 15th.
13	Female -	13 "	Pentre	" 11th "	Recovered.
14	Male -	2 "	Pentre	" 15th "	Recovered.
15	Male -	12 "	Pentre	" 27th "	Recovered.
16	Male -	4 "	Pentre	" 30th "	Recovered.
C. In Outlying Parts of Llanrhaiadr.					
A.	Male -	5 years	Llanrhaiadr -	August 16th, 1877.	Died, August 24th.
B.	Female -	13 "	Llanrhaiadr -	September 12th "	Recovered.
C.	Male -	17 "	Llanrhaiadr -	" 27th "	Died, October 2nd.
D.	Female -	11 "	Llanrhaiadr -	" 27th "	Recovered.
E.	Male -	17 "	Llanrhaiadr -	October 1st "	Recovered.
F.	Female -	54 "	Llanrhaiadr -	" 8th "	Recovered.
G.	Female -	13 "	Llanrhaiadr -	" 9th "	Recovered.
H.	Female -	28 "	Llanrhaiadr -	" 13th "	Recovered.
D. At Llanyys.					
α.	Female -	26 years	Llanyys -	October 11th, 1877.	Died, October 19th.
β.	Male -	4 "	Llanyys -	" 16th "	Recovered.
γ.	Female -	20 "	Llanyys -	" 21st "	Recovered.

APPENDIX

LIST OF ARTISTS FROM ILLUSTRATIONS AND THE VOLUME

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A. H. H. H.

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