Parkes Pamphlet Collection: Volume 49

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ON DIFFICULTIES

WHICH EXIST

IN ADMINISTERING

SOME OF THE

SANITARY ACTS OF PARLIAMENT.

BY

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AUTHOR OF THE "SANITARY ACT, 1866," ETC., ETC.

LONDON:
HARRISON, BOOKSELLER TO THE QUEEN AND H.R.H. THE PRINCE OF WALES,
59, PALL MALL.

KNIGHT AND CO., 90, FLEET STREET,
Publishers by Authority to the Poor Law Board, and to the Home Office, for the purposes of the Local Government Act, 1858.

1860.

Bequeathed
by Dr. E. A. Parkes.

PREFACE.

In consulting some of the Acts of Parliament which form part of our Sanitary Code, I found so much that seemed to be perplexing that I was induced to examine them carefully. The notes which I made in the course of that examination I have put together in the shape of the annexed paper, "On Difficulties which exist in administering some of the Sanitary Acts of Parliament."

I found that the Legislature had not, in all cases, distinctly directed what Department or Departments should see that the several Acts were carried into proper execution. It seemed to me that if Departmental action on the part of the two principal offices concerned* (the Privy Council

* In the early part of November, 1868 (as reported in the local newspapers) correspondence was going on between the Medical Department of the Privy Council Office and the Croydon Board of Health as to the existence of nuisances in one part of Norwood, and correspondence was also going on between the Local Government Act Office and the same Local Board as to the existence of another nuisance of a similar description in another part of Norwood. In each case it was the fear that disease and sickness would result from the existence of the nuisance which induced the complainant to make application for Governmental interference.

Office and the Home Office) had been advisedly allotted by Parliament, and such division rigidly adhered to, much of the fragmentary legislation which has been one cause of the present intricate and perplexing state of the Sanitary Code would probably not have taken place; and, so long as the present want of a good system continues, there will be, it is feared, but little hope of sanitary matters being dealt with in the manner which their great importance to the country demands.

The annexed paper is not intended to be an exhaustive one, nor to set forth all the perplexities of the various sanitary enactments; but merely to call attention to some instances which give rise to the perplexities and doubts which surround much of the action of sanitary authorities, and to some omissions which would appear to have been made by the Legislature.

J. B. H.

Privy Council Office,
January 14, 1869.

On Difficulties which Exist in Administering some of the Sanitary Acts of Parliament.

In order to bring clearly into view the very intricate state in which the law is with reference to the powers of local authorities for the removal of nuisances, for the provision of proper drainage and water supply, and for the doing of other matters and things intimately connected with the public health, it is necessary that some account should be given of the earlier provisions of the legislature on these matters, as by that means, perhaps, a reader might be able to understand, with less difficulty, the various phases through which this part of sanitary legislation has, at different times, passed. How Parliament has, at one time, put the authority to remove nuisances into the hands of Vestries; how it has at another time taken it out of the hands of Vestries and placed it in the hands of Boards of Guardians and Local Boards of Health; and how it has again taken a portion of it out of the hands of Boards of Guardians and replaced it in the hands of Vestries, are matters which, to those unacquainted with the peculiar complication of the various Health Acts, must appear incredible. These may be taken

as illustrations of the confusion arising from the want of some definite guiding principle.

The first Act which was passed with the view of procuring the abatement of nuisances was in the year 1846. By that time it had become an acknowledged fact that many epidemic diseases were much aggravated, if not, in some instances, actually caused by a state of filth, such as was then, and even now is, constantly to be met with, and the absence of an efficient system for generally regulating the sanitary circumstances of places and persons. The reports of the various Commissions which had, in previous years, made inquiry into the sanitary and social conditions of numerous districts in this country may undoubtedly be assigned as one reason of the Legislature moving in this matter. But, probably, the action of Parliament was hastened by the fear of another visitation by that much dreaded pestilence, Asiatic Cholera. The fact to which people commonly had persisted in shutting their eyes was then seen, viz., that our best protection against cholera lay in the removal of filth. The consequence was, that the Government of that day prepared a measure which subsequently became the Act of Parliament, 9 and 10 Vict., cap. 96. The provisions of this Act were of temporary application only, but, before its expiration, a permanent Act, the Nuisances Removal Act of 1848 (11 and 12 Vict., cap. 123), was passed.

Previous to the passing of the 11 & 12 Vict.,

cap. 123, but in the same session of Parliament, another Act relating to health matters had been passed. This was the 11 & 12 Vict. cap. 63, well known as the Public Health Act, 1848. By this Act a new Department of the Government was established, having cognizance of matters relating to the public health. This Department was called the General Board of Health, and was invested with various powers, as the preamble to the Act says, "for improving the sanitary condition of towns and populous places in England and Wales," and for placing, as far as practicable, "the supply of water to such towns and places, and the sewerage, drainage, cleansing, and improving thereof, under one and the same local management and control." The powers of this Board were only of temporary duration, but they were periodically renewed, with various modifications, until the year 1858, when the Board was abolished, certain of its powers being vested in the Privy Council, and certain other powers being transferred to a new branch of the Home Office, which was called the Local Government Act Office.

This Local Government Act greatly extended the powers which Parliament had given to centres of populations to execute their own sanitary works; but, it left numerous other less populated places which were in equal need of the execution of sanitary works, without any provision for their wants. This was partly remedied by the Sewage Utilization Act, 1865, and the Sanitary Act, 1866,

though certain places were even then shut out from the advantages to be derived from being able to supply themselves with good drainage and good water. By the Sewage Utilization Act of 1867, however, these powers were extended in the fullest manner to every place in England, and now no place is without a Local Authority for sewers and water supply, as well as for the removal of nuisances.

It will not be necessary to consider the 11 and 12 Vict., cap. 123 ("The Nuisances Removal and Diseases Prevention Act, 1848") and its amending Act, 12 and 13 Vict., cap. 111, as both of these Acts, in so far as England was concerned, were repealed on the 14th August, 1855, by the 18 and 19 Vict., cap. 121, which last Act, with those which have since been passed, and with one which had passed both Houses of Parliament a short time previously (the 18 and 19 Vict., cap. 116*) are those which, at the present time, are in force for the objects of preventing disease and of procuring the removal of nuisances. The Acts are:—

"The Public Health Act, 1848" (11 and 12 Vict., cap. 63).

* It is a strange fact that the Act which repealed the old Nuisances Removal and Diseases Act was not passed until after a new Code of Regulations for a portion of those Acts (viz., for the prevention of disease) had received the sanction of Parlialiament, so that there were two Acts co-existent. However, no inconvenience resulted from this, as both Acts received the Royal assent on the same day (August 14, 1855).

"The Diseases Prevention Act, 1855" (18 and 19 Vict., cap. 116).

"The Nuisances Removal Act for England, 1855" (18 and 19 Vict., cap. 121).

"The Local Government Act, 1858" (21 and 22 Vict., cap. 98).

"The Nuisances Removal and Diseases Prevention Act Amendment Act, 1860" (23 and 24 Vict., cap. 77).

"The Local Government Act, 1861" (24 and 25 Vict., cap. 61).

"The Local Government Act Amendment Act, 1863" (26 Vict., cap. 17).

"The Sewage Utilization Act, 1865" (28 and 29 Vict., cap. 75).

"The Sanitary Act, 1866" (29 and 30 Vict., cap. 90).

"The Sewage Utilization Act, 1867" (30 and 31 Vict., cap. 113).

"The Sanitary Act, 1868" (31 and 32 Vict., cap. 115).

I purpose to treat briefly of some of the more important points which arise under these Acts, dividing the consideration of the subject into five parts, as follows:—

I.—Local Authorities, who they are.

II.—The Duties of Local Authorities.

III.—Examples of the Anomalous Effects of some of the Acts in their practical administration.

IV.—Want of Principle in the Allotment of Supervising Powers to Departments of the Government.

V.—Conclusion. Some points for consideration in future legislation.

I.—Local Authorities, who they are.

The body which had to deal with sanitary matters, either in the shape of the removal of nuisances or the provision of drainage, &c., in any place for which such powers are conferred, was called the "Local Authority," and there was but one such local body for all sanitary purposes, as contemplated by the Public Health Act, 1848. It is true that the Local Authority was not in some places endowed with so much power as was the Local Authority in other places; but still whatever powers could be exercised for sanitary purposes were exercised by one body only. The Sewage Utilization Act of 1865, however, following the precedent set by the Diseases Prevention Act of 1855 (a measure of only temporary application on particular occasions) divided the hitherto single responsibility by assigning the execution of one set of sanitary works in a locality to one Local Authority, called the "Sewer Authority," and leaving the execution of another set of sanitary works in the same locality to another Local Authority, the "Nuisance Authority;" and in most cases this

TABLE showing what Bodies have been, and now are, empowered by Law to execute the Nuisances Removal Acts, and the Sewage Utilization Acts; and also showing the Different Changes made, and the Years in which they have been made respectively.

	1846.	1848.	1849.	1855.	1860.	1865.	1866.	1867.	1868.
NUISANCES REMOVAL AUTHORITY *whose powers, now in some respects ill-defined, may be illustrated by an instance about which there has never been any doubt, the removal of sticking pigs.*	Any Town Council or other like Body, having jurisdiction within any Corporate Town, Borough, City, or Place; or any Trustees or Commissioners, or other like Officers acting under the provisions of any Act of Parliament, for the Drainage, Paving, or Cleansing, or managing or directing the Police in any Town, Borough, City, or Place, or for any of the above purposes; or in case there shall be no such Town Council or other like Body, or no such Trustees or Commissioners having jurisdiction or acting as aforesaid, in any Town, Borough, City, or Place, then the Guardians of the Poor, upon receiving a certificate in writing, signed by two duly qualified Medical Practitioners.	The Town Council, or any Trustees or Commissioners for the Drainage, Paving, Lighting, or Cleansing, or managing or directing the Police of any City, Town, Borough, or Place; or any other Body of a like nature; or any Commissioners of Sewers or Guardians of the Poor; on receipt of a notice in writing, signed by two or more inhabitant householders of the parish or place to which the notice relates.	The Guardians, Directors, Wardens, Governors, or Overseers of the Poor, or Parochial Board, or other like Officers having the management of the Poor, or acting under the authority of any local Act of Parliament for the Paving, Cleansing, Drainage, or Lighting any Town or Parish (*so far as prosecutions are concerned*).	In any place within which the Public Health Act is or shall be in force, the Local Board of Health. In any other place wherein a Council exists or shall exist, the Mayor, Aldermen, and Burgesses by the Council, except in the City of London and the liberties thereof, where the local authority shall be the Commissioners of Sewers for the time being; and except in the City of Oxford and Borough of Cambridge, where the local authority shall be the Commissioners acting in execution of the Local Improvement Acts in force respectively in the said city and borough. In any place in which there is no Local Board of Health or Council, and where there are or shall be Trustees or Commissioners under an Improvement Act, such Trustees or Commissioners. In any place within which there is no such Local Board of Health nor Council, body of Trustees or Commissioners, and where there is or shall be a Board for the repair of the highways of such place, that Board. In any place where there is no such Local Board of Health, Council, Body of Trustees, or Commissioners, nor Highway Board, a Committee for carrying this Act into execution, by the name of "The Nuisances Removal Committee," of which the Surveyor or Surveyors of Highways for the time being of such place shall be ex officio a member or members, may be annually chosen by the Vestry on the same day as the Overseers or Surveyors of Highways, and the first of such Committees may be chosen at a Vestry to be specially held for that purpose; And such Committee may consist of such number of members as the Vestry shall determine, not being more than twelve, exclusive of such Surveyor or Surveyors, and of such Committee three shall be a quorum. In any place wherein there is no such Local Board of Health, Council, Body of Trustees or Commissioners, Highway Board, or Committee appointed as aforesaid, and wherein there is or shall be a Board of Inspectors for Lighting and Watching under the Act 5 & 6 Wm. IV, c. 30, that Board with the Surveyors of Highways. In any place in which there is no such Local Board of Health, Council, Body of Trustees, or Commissioners, nor Highway Board, nor Committee appointed as aforesaid, nor Board of Inspectors for Lighting and Watching, the Guardians and Overseers of the Poor, and the Surveyors of the Highways in and for such place.	In any place within which the Public Health Act is or shall be in force, the Local Board of Health. In any other place wherein a Council exists or shall exist, the Mayor, Aldermen, and Burgesses by the Council, except in the City of London and the liberties thereof, where the local authority shall be the Commissioners of Sewers for the time being, and except in the City of Oxford and Borough of Cambridge, where the local authority shall be the Commissioners acting in execution of the Local Improvement Acts in force respectively in the said city and borough. In any place in which there is no Local Board of Health or Council, and where there are or shall be Trustees or Commissioners under an Improvement Act, such Trustees or Commissioners. In any place within which there is no such Local Board of Health, Council, Body of Trustees, or Commissioners, if there be a Board of Guardians of the Poor for such place, or for any Parish or Union within which such place is situate, such Board of Guardians; and if there be no such Board of Guardians, the Overseers of the Poor for such place, or for the Parish, of which such place forms part. In addition to the above Bodies, Highway Boards and Nuisances Removal Committees were empowered by section 3 of the statute 23 and 24 Vict., c. 77, to take action under the Nuisances Removal Acts. The section is as follows:— "That in any Place where a Highway Board or 'The Nuisances Removal Committee' chosen by the Vestry in pursuance of the said Act is subsisting, and at the time of the passing of this Act employs or joins with other Local Authorities in employing a Sanitary Inspector or Inspectors, such Highway Board or Nuisances Removal Committee may continue to act, and a like Committee may be annually chosen by the Vestry for such Place in the same manner as if this Act had not been passed; but in case in any year the Nuisances Removal Committee be not chosen for such Place in manner provided by the said Act, or if the Highway Board or Committee now subsisting or hereafter chosen fail for two months in any year to appoint or employ a Sanitary Inspector or Inspectors, the authority of such Highway Board or Committee shall cease, and no like Committee shall be chosen for such Place, and the same Body or Persons shall thenceforth be the Local Authority for the Place as if no such Highway Board or Committee had been appointed therein."	Same as in 1860	[The "Sanitary Act" passed in this year made an alteration in the local authorities for nuisance purposes. Section 17 of the Act directs that all powers vested in any Highway Board or "Nuisance Removal Committee" under the Nuisances Removal Acts shall determine. The effect was, that from and after August 7, 1866, Nuisance Removal Committees and Highway Boards ceased to be Nuisance Authorities, and the only Authorities having power under the Acts are as follows:—] In any place within which the Public Health Act is or shall be in force, the Local Board of Health. In any other place wherein a Council exists or shall exist, the Mayor, Aldermen, and Burgesses by the Council, except in the City of London and the Liberties thereof, where the local authority shall be the Commissioners of Sewers for the time being, and except in the City of Oxford and Borough of Cambridge, where the local authority shall be the Commissioners acting in execution of the Local Improvement Acts in force respectively in the said city and borough. In any place in which there is no Local Board of Health or Council, and where there are or shall be Trustees or Commissioners under an Improvement Act, such Trustees or Commissioners. In any place within which there is no such Local Board of Health, Council, Body of Trustees, or Commissioners, if there be a Board of Guardians of the Poor for such place, or for any Parish or Union within which such place is situate, such Board of Guardians; and if there be no such Board of Guardians, the Overseers of the Poor for such place, or for the Parish of which such place forms part.	Same as in 1866	Same as in 1866; and, for certain purposes, the "Local Authority" under the Sanitary Act, 1866.
SEWER AUTHORITY .. .. *whose functions, varying with each successive piece of legislation since the term was first used in 1815, may be illustrated by the typical power of sewer-construction.*	.. .. ..

TABLE showing what Bo e N I

NUISANCES REMOVAL AUTHORITY, *whose powers, now in some respects ill-defined, may be illustrated by an instance about which there has never been any doubt, the removal of stinking pigs.*	Any Towns, Wa having j of th Town, Bher li Trustees of th Officers y of ar any Act aving,
LOCAL AUTHORITY (*Under Sanitary Act of* 1868.)	

"Nuisance Authority" corresponded with the body which had previously had sole jurisdiction and responsibility.

"The Nuisances Removal Act for England, 1855" (18 and 19 Vict., cap. 121) introduced into the code of Sanitary Legislation the generic term "Local Authority." It spoke of the "Local Authority" as the authority for executing the provisions of that Act. The term Local Authority thus became familiar to all those having anything to do with sanitary matters. But though the public knew the term meant some authoritative body, they were quite at a loss to understand how, in one place, it applied to one body, and how, in other places, which seemed exactly the same, it applied to a different body, or how again, in a third place, the powers which would be exercised by a single body, would be divided between two or more bodies, though in each case the same powers only would be exercised.

It will be of assistance in the consideration of this paper, if some account be given of the different Local Authorities which are endowed with powers under the several Acts.

After various vicissitudes (as shown in the accompanying Table, which sets forth what bodies have at different times been Local Authorities for the purposes of the Nuisances Removal, and some other, Acts), the following will be found to be a pretty accurate statement of the various bodies which now

are Local Authorities under the several Acts relating to sanitary measures, and also of the different powers which these bodies possess under the Acts.

There are several Local Authorities. There is, in some places, one Local Authority for dealing with some nuisances, and there is another Local Authority for dealing with other nuisances; and again, in other places, there is but one Local Authority for dealing with all nuisances. There is a Local Authority for the execution of the Local Government Act; and this authority is a Sewer Authority, a Nuisance Authority, a Water Supply Authority, and a Hospital Authority. There is a Local Authority for the purposes of the Sewage Utilization Acts (such as providing sewers and a water supply), which authority is termed the "Sewer Authority." There is a Local Authority for the purposes of the Sanitary Act, 1866, which authority may be either a Local Authority for nuisance purposes or a Local Authority for sewerage purposes. And there is a "Local Authority" for the purposes of the Sanitary Act, 1868, which body must be either a "Local Board" or a "Sewer Authority."

By the Nuisances Removal Act of 1855 various bodies were constituted the Local Authorities for the removal of nuisances; but in 1860, by the 23rd and 24th Vict., cap. 77, fresh bodies were named who should see to the execution of the Act, and, with the exception of Nuisance Removal Committees and Highway Boards, which were abolished,

for the purposes of the Nuisances Removal Acts, by section 17 of the Sanitary Act, 1866, those bodies are, at the present time, the Local Authorities for the Act.

By an Act passed last Session (Vict. 31 and 32, cap. 115), a new authority, named the "Local Authority," was created for executing duties* analogous to some of those hitherto performed by the Nuisance Authority under the Nuisances Removal Act of 1860, but it must not be placed in the category of "Nuisance Authorities." Before the first-mentioned Act was passed the term "Local Authority" was understood to mean any body of persons charged with the local execution of general sanitary and such like measures. But this wide meaning must now, I suppose, be restricted in its application, for the Act in question has given an express definition to the term "Local Authority," and declared it to mean either a Sewer Authority or a Local Board, and not, for instance, a Board of Guardians, acting as a Nuisance Authority.

The Local Authorities are as follows:—

Under the Nuisances Removal Acts.

1. In the Metropolis,—the Vestries and District Boards, acting in execution of the Act for the better Local Management of the Metropolis.

* The duties here referred to are the provision of earth-closets instead of water-closets, and the making of regulations for their construction and use.

2. In places where the Public Health Act, 1848, is in force, or where the Local Government Act, 1858, has been adopted,—the Local Boards elected for the purposes of those Acts, respectively.

3. In Corporate Towns, except the City of London, Oxford, and Cambridge,—the Town Council.

4. In the City of London,—the Commissioners of Sewers.

5. In Oxford and Cambridge,—the Improvement Commissioners.

6. In places where Local Improvement Acts are in force,—the Commissioners or Trustees for the execution of such Acts.

7. In places where none of the above-mentioned authorities exist,—the Board of Guardians for the Union, or, if there be no such Board, the Overseers of the Poor.

Under the Diseases Prevention Act.

1. In the Metropolis,—the Vestries and District Boards acting in execution of the Act for the better Local Management of the Metropolis.

2. In all Extra-Metropolitan places,—the Boards of Guardians for the Unions, or, if there be no such Boards, the Overseers of the Poor.

Under the Public Health and Local Government Acts.

1. The Local Boards formed under the provisions of those Acts.

2. Any person appointed by the Secretary of State in pursuance of the 49th Section of the Sanitary Act, 1866, to perform the duties of a Local Board that has been guilty of a default, as therein mentioned, in the performance of such duty, and for the purposes thereof.

Under the Sewage Utilization Act, 1865.

(The Local Authority under this Act is termed the Sewer Authority).

1. In boroughs, with the exception of the boroughs of Oxford and Cambridge, not within the jurisdiction of a Local Board.	The Mayor, Aldermen, and Burgesses acting by the Council.
2. In the boroughs of Oxford and Cambridge, and in any town or place not included within the above descriptions, and under the jurisdiction of Commissioners, Trustees, or other persons intrusted by any Local Act with powers of improving, cleansing, lighting, or paving any town.	The Commissioners, Trustees, or other persons intrusted by any Local Act of Parliment with powers of improving, cleansing, lighting, or paving the town.
3. In parishes not within the jurisdiction of any sewer authority herein-before mentioned, and in which a rate is levied for the maintenance of the poor.	The Vestry, Select Vestry, or other body of persons acting by virtue of any Act of Parliament, prescription, custom, or otherwise, as or instead of a Vestry or Select Vestry.

N.B.—*The term "parish" includes any township or other place in which a separate rate is levied for the relief of the poor.*

4. Any Collegiate or other Corporate Body required or authorized by or in pursuance of an Act of Parliament to divert its sewers or drains from any river, or to construct new sewers.

5. Any Public Department of the Government.

6. Any person appointed by the Secretary of State in pursuance of the 49th Section of the Sanitary Act, 1866, to perform the duty of a Sewer Authority that has been guilty of a default as therein mentioned in the performance of such duty.

Under the Sanitary Act, 1866.

There are two classes of Local Authorities under this Act: (1) Nuisance Authorities; and (2) Sewer Authorities.

1. The Nuisance Authorities are those stated above for the Nuisances Removal Acts.
2. The Sewer Authorities are,
   - *a*. The same as stated above for the Sewage Utilization Act, 1865, and numbered 1, 2, and 3.
   - *b*. For the 37th Section of the Act,—Local Boards.

Under the Sewage Utilization Act, 1867.

1. The same as for the Sewage Utilization Act, 1865.
2. Local Boards.
3. Joint Sewerage Boards.

Under the Sanitary Act, 1868.

1. Local Boards.
2. Sewer Authorities.

It will thus be seen how perplexing it must be to any one who is not well versed in the various Sanitary Acts of Parliament to define for practical purposes the term "Local Authority."

II.—Duties of Local Authorities.

It is necessary next to speak of the duties of Local Authorities under the several Acts. These duties are now as follows:—

Under the Nuisances Removal Acts.

To see to the part prevention and removal of nuisances.

Under the Public Health and Local Government Acts.

To see to the removal of nuisances.

To the provision, maintenance and repair of sewers, drains, &c.

To provide a proper water supply.

Under the Sewage Utilization Act, 1865.

To provide, maintain and repair sewers.

To take proceedings for preventing water-courses being polluted.

Under the Sanitary Act, 1866.

There are two authorities under this Act: (1) the Nuisance Authority; and (2) the Sewer Authority.

1. The duties of the Nuisance Authority are:—

To make periodical inspection of its district for the purpose of taking proceedings for the removal of all nuisances.

To cause the disinfection of premises and things when infected by any dangerous disease.

To provide for the disinfection of clothing and bedding free of charge.

To provide carriages for the conveyance of infected persons between their houses and hospitals.

To provide for the removal to hospital of infected persons not properly housed.

To provide mortuaries and post-mortem houses.

To make regulations as to lodging-houses.

To provide for the periodical removal of manure from mews, &c.

And the Nuisance Authorities in the metropolis have, in addition to the above duties—

To provide hospital accommodation.

2. The duties of the Sewer Authorities are:—

To compel the draining of houses into sewers.

To provide proper water supply.

To provide hospital accommodation in extra metropolitan places.

Under the Sewage Utilization Act, 1867.

The duties under this Act are the same as those under the Sewage Utilization Act of 1865, but of a more widely extended application.

Under the Sanitary Act, 1868.

Under this Act there are three authorities concerned: (1), the "Local Authority," *i.e.*, Local Boards or Sewer Authorities; (2), the Sewer Authority; and (3), the Nuisance Authority in the Metropolis.

1. The duties of the "Local Authority" are:—

To see to the provision of earth-closets in certain cases.

To make regulations for the construction and use of earth-closets.

2. The duties of the Sewer Authority are:—

To see that new houses have a sufficient water-closet or privy and ash-pit.

To see that drains, water-closets, privies, and ash-pits within its district do not become a nuisance.

To see to the removal of house refuse from premises, to the cleansing of privies, ash-pits and cesspools, and, as far as these matters are concerned, to become the Nuisance Authority of the district.

To make provision for the temporary supply of

medicines and medical assistance for the poor in extra metropolitan places.

3. The duties of the Nuisance Authority in the metropolis are :—

To make provision for the temporary supply of medicines and medical assistance for the poor.

III.—Examples of the Anomalous Effects of some of the Acts in their Practical Administration.

In the Preface to my (second) Edition of the Sanitary Act 1866, I called attention, in the following words, to a duplication of authority which was given in several instances :—

"From the law, in its present state, it is quite possible (and, perhaps, probable), that considerable inconvenience may result with regard to the water supply and sewerage of those places which have adopted since June 29, 1865, or shall hereafter adopt, the Local Government Act. If that Act shall be adopted in its entirety, the local Board would have conferred upon it, by Sections 29, 30, and 31 of the Act, full powers as to sewerage, and by Sections 51, 52, and 53 of the Act, full powers as to water supply. But its jurisdiction in these matters would not be a sole jurisdiction, as the vestry of the parish within which the district is situated would, as the law stands, still retain its jurisdiction over the same matters.

"Should both those authorities choose to put into force the powers with which they are respectively endowed, and be determined to assert their powers antagonistically, there is no knowing to what serious consequences this dual empowerment might lead.

"If this duality of power is to be preserved, the only way in which it will be possible to avoid collision in these matters is, either to give to the Secretary of State, on the adoption of the Local Government Act by any place in which there is already a Sewer Authority under the Sewage Utilization Act, 1865, and the Sanitary Act, 1866, power to disallow the adoption of those sections of the Act which relate to sewerage and water supply,* or else to enact that, on the adoption of the Act by a place, all the powers, &c., of all Sewer Authorities within the district shall become vested in the Local Board."

This conflict of authority and jurisdiction was rendered still more perplexing by another Sewage Utilization Act passed in 1867, and, in my preface to a third and enlarged edition of the Sanitary and Sewage Utilization Acts, I pointed this out in the following words :—

* Another way in which this difficulty might, perhaps, be met, would be for Parliament, instead of giving power to the Secretary of State to disallow the adoption of certain parts of the Act, to enact that, in such places as I have referred to, those portions of the Act which relate to matters over which the Vestry as the primary Sewer Authority has had jurisdiction, shall not be put in force by the Local Board.

"By the Act of 1865 the duplication of authority might be brought about. But the new Act [The Sewage Utilization Act, 1867, 30 and 31 Vict., cap. 113], in making 'all Local Boards' into 'Sewer Authorities' will, in certain places, and under certain circumstances, establish two different governing Bodies, having actually the same designation of 'Sewer Authority,' and acting for the same purposes within the same area. For, if a parish, no part of which is under the Local Government Act (and in which, consequently, the Vestry is the Sewer Authority), should at a future time adopt the Local Government Act, there will then be two legally constituted and legally named Sewer Authorities—the Vestry and the Local Board*—for the Act does not direct that the powers of a Vestry, as a Sewer Authority, shall cease on the Local Government Act being adopted."

* I may give one illustration of the working of this. The Local Government Act, 1858, was, in the beginning of 1867, adopted by the ratepayers of the parish of Bromley in Kent, and came into operation in April of that year. A Local Board was accordingly elected, and now acts in the parish in all such matters as are provided for by that Statute, and is a "Sewer Authority." But immediately on the passing of the Sewage Utilization Act, 1865 (June 20, 1865), the Vestry of the parish had become the "Sewer Authority."

Here, then, we have two co-existing Sewer Authorities,—the Vestry of the parish, in virtue of the "Sewage Utilization Act, 1865," and the Local Board, in virtue of the "Sewage Utilization Act, 1867."

The state of things above described still exists.

But this is not all: for there arises another complication of the question, apart from the difficulty of saying what Body is the Sewer Authority. It being beyond doubt that, in some places, there are two Sewer Authorities, it has to be considered which of these two Sewer Authorities is the one which should exercise the particular powers required, or whether the two Authorities should not act conjointly in the matter. There can be no question as to the mischief of this state of the law, in furnishing excuses to people who are averse to sanitary works. It is certain that the opponents of sanitary works, wishing to do nothing and yet not to confess their inaction, would profess their anxiety to execute all necessary works, having all the time a full conviction that their duties could not be brought home to them. The Local Board would, in all probability, say the Vestry was the proper authority, as that Body was in existence before the Board; and the Vestry would assert that the Local Board was the proper authority, because it had been formed at a more recent date, and had, therefore, superseded the Vestry.

On the other hand, each body might assert its right to execute works, independently of the other, —a course of proceeding equally objectionable; and so a place might have two sewers running side by side (like the lines of opposition railways) and, it might happen, both bodies compelling their unfortunate constituents (perhaps in addition to

providing the money to execute the works) to cause their drains to run into each of these rival sewers; and it would be difficult to prove that such should not be the case, for each of these two bodies is created by Act of Parliament a Sewer Authority, and endowed with compulsory powers.

Then there is another difficulty. Supposing the Vestry is supine, and the Local Board carries into effect the provisions of the Sewage Utilization Acts, how are the expenses to be defrayed? One would naturally assume that the Board would be empowered to pay the amount out of its ordinary funds; but it is not clear that such is the case, for the funds authorized to be raised under the Local Government Act are directed by the Act to be expended only for certain objects contemplated by that Act, and not for the execution of any works under the authority of the Sewage Utilization Acts. But although it seems to be doubtful whether, in places where there is not this duplication of authority, a Local Board has any right to expend money in executing works under the Sewage Utilization Acts (there not being any direction in those Acts as to the fund out of which the expenses of a Local Board are to be defrayed, the Acts having simply enacted that Local Boards shall become Sewer Authorities), in places where it does exist, the Board would appear to be undoubtedly debarred from raising the money required.*

* The parish of Bromley, referred to in the foot note on page 22, is an illustration of the difficulty here adverted to.

Section 17 of the Sewage Utilization Act of 1867, directs that when the Sewer Authority of a district is a Vestry, the expenses of executing the Sewage Utilization Acts shall be met by a separate rate to be levied by the overseers, which rate shall be "deemed to be a rate levied for the relief of the poor." It seems, therefore, that, in cases where a Vestry has power under the Sewage Utilization Acts, the expenses incurred under these Acts must be met by a separate rate, which the Local Board does not appear to be empowered to levy: so that, whatever doubts may exist in other cases, it seems pretty clear that, in cases where a Vestry has power, under the Acts, the Vestry alone has power to levy a rate to defray the expenses of carrying the Acts into execution. This view is partly borne out too by the Sewage Utilization Act of 1865, which directed the expenses to be paid out of the poor rate; and by section 16 of the Act of 1867, which directs that the word "'parish,' in the schedule to the Sewage Utilization Act, 1865, shall include any township or other place in which a separate rate is levied for the relief of the poor." And this view would appear to be further strengthened by a reference to the 43rd section of the Sanitary Act, 1866, which empowers Local Boards to adopt the Act for the encouragement of the establishment of public baths and washhouses, and which, at the same time, directs out of what fund the expenses, incident to such adoption, are to be defrayed.

Another peculiarity of the Sewage Utilization Act of 1867 is, that it constitutes "any Public Department of the Government" a Sewer Authority. The effect of this is most extraordinary, for it converts into Sewer Authorities such Public Departments as the following:—the Civil Service Commissioners, the Charity Commissioners, the Mint, the Public Record Office, the Registrar of Friendly Societies, &c.; Departments which it is hardly possible to conceive could be expected, or be called upon, to undertake the provision of sewers and a water supply, seeing that their sanitary jurisdiction cannot extend beyond the limits of the premises which they respectively occupy. With such an example of the sweeping applicability (as is provided by Section 2 of the Sewage Utilization Act of 1867) of the term "Sewer Authority," it is perhaps scarcely to be considered a matter of surprise that, in the public mind, much doubt should exist as to what bodies are, and what bodies are not, Sewer Authorities.

Sewer Authorities have no power given to them to appoint officers, not even a Clerk, although the existence of such an officer is contemplated by section 7 of "The Sanitary Act, 1866," which Act enacts that "the production of a newspaper containing . . . a certificate under the hand *of the Clerk or other officer performing the duties of Clerk, for the time being, of the Sewer*

Authority which passed the resolution forming the district, shall be evidence of the formation of such district." It seems doubtful, also, whether a Vestry-clerk can act as Clerk to a Vestry in its capacity of Sewer Authority, or be called upon by the Sewer Authority to act as its Clerk; because the Act (13 and 14 Vict., cap. 57) which authorizes the appointment of Vestry-clerks, also enumerates the duties which they shall have to perform, and because they are to some extent under the jurisdiction of the Poor Law Board, as, for instance, in the matter of salary. The salary of the Vestry-clerk is payable out of the Poor Rate, whereas the salary of the Clerk to a Sewer Authority would not be payable out of the Poor Rate: and this alone would make it appear that the Vestry-clerk and the Clerk to the Sewer Authority must be different officers, though, if the Sewer Authority had power to make such an appointment, the two offices might be held by the same person.

The power of appointing and paying officers is specially given to Local Boards by the 37th section of the Public Health Act, 1848, and also to Vestries, as shown above. It would therefore seem that, for an Authority to have power to make appointments and to pay the appointees, it is necessary that express permission for these purposes should be given by the Legislature. If this is so, it is quite apparent that any moneys expended by Sewer Authorities in the shape of salaries to officers is not warranted by law, and is therefore illegal. And I assume that it

would be the duty of the Auditor to disallow any such payment which may have been made. It is very clear that such could not have been the intention of the Legislature, but, as the law now stands, there seems to be an absence of authority for such expenditure, and any person who should authorize such a payment to be made would be liable to be called upon to repay to the funds of the Sewer Authority the amount which he shall have authorized to be expended.

If it be considered that the power of appointing and paying officers is inherent in Sewer authorities, why should not the same power have been possessed by Local Boards and Vestries, and not have been expressly given to them by Act of Parliament?

But, perhaps, one of the strangest of the provisions which have been passed by Parliament with the intention of promoting the performance of sanitary works, and so securing to places a proper system of drainage and water supply, is a private Act passed in 1867, the 30 & 31 Vict., cap. 173, which makes a corporate company of a body of persons, under the style of "The Towns Drainage and Sewage Utilization Company," and empowers Sewage Authorities, Commissioners of Sewers, Local Boards, Corporations, Trustees, or other bodies having under any Act authority to carry out, promote, or make contracts for sanitary improvements or works, "to delegate or grant to the Com-

pany any of the powers and privileges, or property, given to or vested in them respectively by any Act of Parliament, provided that any such delegation or grant be made with the consent of the Inclosure Commissioners, and for such periods and subject to such conditions or restrictions as they may think fit;" and enacts that, "subject as aforesaid, the Company may use and execute all powers and privileges so delegated or granted as aforesaid, in the same manner and to the same extent and effect as the delegating or granting parties respectively could do of themselves, acting with their full powers and privileges." The effect of this statute would appear to be to enable Sewer and such like Authorities to shift to a private Company the responsibility of doing work which the Legislature has, by public Act, required them to perform.

This power given to Sanitary Authorities of delegating their functions to a private Company is likely, as is shown below, to act most adversely, both to the progress of sanitary improvement and to the interests of the public.

First, as affects the progress of sanitary improvement:—This Private Act would seem to relieve Local Authorities, who avail themselves of it, from the operation of section 49 of the Sanitary Act, 1866, and of the subsequent provisions for rendering more effectual the compulsory power of Government in requiring the execution of sanitary works. Suppose the following case, for instance:—

Complaint is made of the want of proper sewers in a place, the Sewer Authority of which has delegated its powers to this Private Company; the Sewer Authority is directed to execute the necessary works under threat of enforcement, by the Secretary of State, of the powers given under section 49 of the Sanitary Act, 1866: and the Sewer Authority pleads that, under section 20 of the Private Act, 30 & 31 Vict., cap. 173, it has delegated its functions to "The Towns Drainage and Sewage Utilization Company," which, by section 4 of an Amending Private Act passed in 1868, is empowered to "give all requisite notices, and take all necessary steps, for carrying out within the district or jurisdiction of such Sewer Authority the works which the said Sewer Authority is or may be empowered to execute under or by virtue of any Act of Parliament, law, custom, prescription or otherwise;" that its responsibility, therefore, ceases in the absence of express legislative enactment to the contrary,* it having, in this matter, complied with the provisions of an Act of Parliament authorizing the delegation of the authority, and that the Company is not liable to

* It is noteworthy that, though a similar delegatory power (to Committees) is given to certain Sewer Authorities by section 4 of the Sanitary Act, 1866, it is expressly provided that the delegated body shall only act as the agent of the Authority, and "the appointment of such Committee shall not relieve the Sewer Authority from any obligation imposed on it by Act of Parliament or otherwise."

the operation of section 49 of the Sanitary Act, 1866, because that section relates to the default of a Sewer Authority, as defined by the Sewage Utilization Act, 1865, which definition does not include "The Towns Drainage and Sewage Utilization Company," and because the arrangement between the Company and the Authority is subject to the control of the Inclosure Commissioners and not of the Secretary of State. In such a case as this it seems very doubtful whether the intervention of Government, under section 49 of the Sanitary Act, 1866, could be exercised: whether there is any other speedy method of compelling the execution of sanitary works under the circumstances described, is a question that it would be very difficult to answer satisfactorily.

Secondly, as affects the interests of the public:—The works of Local Boards and such like authorities under the public Acts are subject to the supervision and control of the Government, inasmuch as it is expressly enacted by Parliament that sanction shall be obtained before any such authority borrows money for the execution of works, and for the repayment of which the ratepayers are made liable; and authorities, in order to obtain this sanction, are required to specify in detail the works for which the sanction of expenditure is sought. Now there does not appear to be, in the private Acts referred to, any such supervising power over the expenditure of the Company; so that, unless the Inclosure Commissioners should see fit to exercise a power of this

kind, the Company would seem to be able to incur an expenditure both unlimited and unliable to audit. The delegating authority must pay; for the Towns Drainage and Sewage Utilization Act of 1867 says that such authorities shall from time to time, as occasion shall require, "levy any rates which they shall be empowered to levy for the purpose of promoting or carrying out any of the objects intended to be promoted by this Act, and which shall be required to enable them to pay to the Company such annual or other sums" as may be required.

In addition to the rates payable in ordinary cases (*i.e.*, where the authority borrows money and executes works) for the payment of interest and instalments on loans, there will be, as set forth in the printed "Prospectus" of the Company, in cases where the Company advances the money, and where the Company's officers superintend the execution of the works, an additional payment, in the shape of commission to the Company, of 5*l.* per cent. on the total outlay, and so an additional burden will be laid upon the ratepayers of the district. Thus, suppose 25,000*l.* are required, and the Company acts as contemplated above, there will be a charge of 1,250*l.* in addition to the charge which would have been made had the authority itself done the work.

The Nuisance Authority has power under certain sections of the Sanitary Act, 1866, to cause the

removal (on order of a Justice) to hospital of any person suffering from any dangerous, contagious, or infectious disorder, being improperly lodged, or on board any ship or vessel. It also has power to lay down rules, with the sanction of the Privy Council, for the removal to hospital of persons brought by ships; and, further, to provide carriages for the removal of persons to hospital. But while this is so, the duty of providing hospital accommodation in all places without the metropolis is imposed on the Sewer Authority, and not on the Nuisance Authority.

In the metropolis, however, it is the Nuisance Authority which has power to provide hospital accommodation; and thus, for the metropolis, there is, in this matter, no division of the Executive, like there is in places outside the metropolitan area.

Section 35 of the Sanitary Act, 1866, empowers the Nuisance Authority of certain places to make, with the approval of the Secretary of State, regulations for the prevention of overcrowding, and for the better ordering, registering, cleansing, ventilating, &c., of any "house, or part of a house, which is let in lodgings, or occupied by members of more than one family;" but there is no power given either to the Secretary of State or to the Nuisance Authority to rescind or amend any regulation which has once been passed. This power of amending and repealing bye-laws made under the

authority of Section 115 of the Public Health Act, 1848, is given by express statutory enactment to Local Boards, who make bye-laws of a like nature, though not perhaps with the same intent. And, if it was necessary to obtain authority from Parliament to enable Local Boards to repeal or amend their bye-laws, it seems but reasonable to suppose that, for the purpose of exercising a like power in the case of regulations (which are of a similar kind) under Section 35 of the Sanitary Act, 1866, the like Parliamentary authority is requisite. In many instances the operation of the regulations under this Section of the Sanitary Act has been limited to a period of twelve months; this is also a power which is not given by the Statute, and which, if necessary, should be provided for by statutory enactment.

Under Section 10 of the Sanitary Act of 1868, the Sewer Authority in extra-metropolitan places may, with the consent of the Privy Council, make provision for the temporary supply of medicine and medical assistance for the poorer inhabitants.

Now precisely similar power is given to Boards of Guardians (who can never be the Sewer Authority) under the Diseases Prevention Act, for the Act 18 and 19 Vict., cap. 116, authorizes the Privy Council to make regulations for the "dispensing of medicines . . . . . and for affording to persons afflicted by, or threatened with, any such epidemic, endemic, or contagious disease, such medical aid . . . . as may be required."

Here again is an instance of two different bodies having, under two different Acts, similar powers for the same object.*

The Sanitary Act of 1868 directs (section 4) that "where the Sewer Authority and the Nuisance Authority of a district are different bodies of men, the jurisdiction of the Nuisance Authority shall cease within such district in relation to all matters within the purview of sections 51 and 54 of the Public Health Act 1848."

But considerable doubt arises whether the intention of the Legislature to endow the Sewer authority with power under the 51st and 54th sections of the "Public Health Act, 1848," is not frustrated by the restriction placed upon the application of these sections; for the 4th section of 31 and 32 Vict., cap. 115, says that they shall only apply to the districts of those Sewer Authorities "in which there is no enactment of any public or private Act of Parliament to the like effect in force." Now the "Nuisances Removal Act" (18 and 19 Vict., cap. 121) is a "Public Act" which is always in force, and in which there is a provision to the "like

* There is this marked difference, however, between the *modus operandi* of the two Statutes. Under the Diseases Prevention Act of 1855 the Privy Council takes the initiative; whereas, under the Sanitary Act of 1868, the Sewer Authority is the body which moves first, and makes the regulations which must afterwards be sanctioned by the Privy Council.

effect" to the power given to Sewer Authorities by section 54 of the "Public Health Act, 1848." Section 7 of the first-mentioned Act empowers the local Nuisance Authority to deal with "any foul ditch, gutter, watercourse, privy, urinal, cesspool, drain, or ashpit, so foul as to be a nuisance or injurious to health;" and, though the Nuisances Removal Act does not particularize "watercloseets," a "privy" must be held to be the genus of which a "watercloset" is but one of the constituent species. Thus the Nuisances Removal Act, which, as stated before, is "an enactment to the like effect," and which is, *ipso facto*, in force everywhere, deals with the very matters with which it is sought to empower Sewer Authorities to deal. But it might be argued, with the view of reconciling these apparent discrepancies, that the Act is to be put in force by the Sewer Authority as a supervising power, and only so far as to see that those places "do not become a nuisance;" and that, should the Sewer Authority have neglected the supervision of them, and a state of nuisance have arisen, its action then ceases, and the action of the Nuisance Authority commences. If this is so, the confusion created is very great, and the result is that the growing nuisance and the existent nuisance (though it will be impracticable to draw the line of demarcation) are to be dealt with by two separate and distinct bodies in one and the same place. It, of course, in practice cannot be desirable that a state of things like this should

exist; for the real effect would be (provided, of course, that there were no legal difficulties or uncertainties in the case), to transfer this supervising portion of the duties of a Nuisance Authority from Boards of Guardians, who are often ignorant of their duties in this respect, to Vestries who are, if possible, more ignorant of, and unwilling to put in force, such powers as this Statute proposed to give to them.

With reference to section 51 of "The Public Health Act, 1848," the Nuisances Removal Act operates in the same way. For instance: if any Local Nuisance Authority is of opinion that a nuisance exists, or is likely to recur, it may take proceedings before Justices, who may by their order "require the person on whom it is made to provide sufficient privy accommodation, . . . or to do such other work or acts as are necessary to abate the nuisance complained of, in such manner and within such time as in such order shall be specified." Thus a Nuisance Authority has power (and without the intervention of a third person, as is required under section 54 of the Public Health Act) similar to that sought to be given by the Sanitary Act, 1868.

It will thus be seen that, in the words of the Act, there is an enactment of a public Act of Parliament to the like effect in force in every part of England, and therefore in the district of every Sewer Autho-

rity, and that, consequently, the 4th section of the Sanitary Act of 1868 is of no effect.

Another section (5) of the Sanitary Act, 1868, directs that "where the Sewer Authority and the Nuisance Authority are different bodies of men, the jurisdiction of the Nuisance Authority in such district shall cease in respect of all matters over which the Sewer Authority acquires power by this section," viz., the removal of house refuse from premises, and the cleansing of privies, ashpits, and cesspools.

With regard to the powers given to Sewer Authorities by the section of the Sanitary Act, 1868, now under consideration, though the difficulty above adverted to does not exist, there appears to be great doubt whether this newly-created minor Nuisance Authority, or, as the Act names it, the "Sewer Authority," has any power to cause the removal of the contents of privies, ashpits, and cesspools.

The clause of the Local Government Act referred to in this section of the Sanitary Act, 1868, relates only to the "cleansing of privies, ashpits, and cesspools," and does not empower the Local Authority (*i. e.*, the Sewer Authority of other Acts) to remove any of their contents, or to enter upon any premises for that object. Neither does the Act of 1868 give to the Sewer Authority power of entry. The

only power of entry given to Sewer Authorities is by section 5 of the Sewage Utilization Act, 1865 (28 and 29 Vict. cap. 75), which invests the Sewer Authority with the same power which Local Boards possess under section 143 of the Public Health Act, 1848, and which are "for the purpose of making plans, surveying, measuring, taking levels, examining works, ascertaining the course of sewers or drains, or ascertaining or fixing boundaries." Under these circumstances it appears that the only power conferred on the Sewer Authority, is an unenforceable power to require privies, ashpits, and cesspools to be cleansed, for there is no penalty or proceeding provided by the Act in cases of neglect to obey the requirements of the Sewer Authority in this behalf.

It is, then, almost without doubt that a Sewer Authority has no power of entry for the purposes of section 5 of the Sanitary Act, 1868, and without such a power it does not seem feasible for a Sewer Authority to undertake "the cleansing of privies, ashpits, and cesspools."

If this view of the law is correct the result is that, in places where there is a Sewer Authority which is a different body from the Nuisance Authority, the cleansing of privies, ashpits and cesspools cannot be accomplished at all; because, though the Act directs that the Sewer Authority shall do this work, it does not give to the Sewer Authority the necessary power; and because the Act directs

that, in such places, the jurisdiction of the Nuisance Authority in such matters shall cease.

There are two other matters to which it would, perhaps, be as well to direct attention.

First. Section 22 of the Sanitary Act, 1866, relates to the disinfection of houses and articles infected with any dangerous disease. It empowers the Nuisance Authority to require, by written notice, in certain cases, disinfection to be done, and it enacts that "if the person to whom notice is so given fail to comply therewith within the time specified in the notice, he shall be liable to a penalty of not less than 1*s*., and not exceeding 10*s*., for every day during which he continues to make default; and the Nuisance Authority shall cause such house or part thereof to be cleansed and disinfected, and may recover the expenses incurred from the owner or occupier in default in a summary manner." It must be observed that, though the Nuisance Authority, in cases where its notice is neglected to be obeyed, has power to cause the house to be disinfected, the Legislature has omitted to give the Authority power to deal with any articles of bedding, clothing, &c., which may be in such houses and require to be disinfected.

Secondly. The 11th section of the Sanitary Act, 1868, enacts that "in the construction of the first

part of the Sanitary Act, 1866, 'owner' shall have the same meaning as it has in the second part of the said Act. But as, in the second part of the Sanitary Act, 1866, there is no definition or meaning given to the word 'owner,' it is difficult to discover what is meant, or of what practical utility this section of the Sanitary Act, 1868, can be.

IV.—Want of Principle in the Allotment of Supervising Powers to Departments of the Government.

There is another matter connected with this subject which is worthy of notice, viz., the want of principle in allotting to various Departments of Government their functions in sanitary matters.

There are two Government Departments which, in ordinary cases, exercise a sort of supervision over Local Authorities in the execution of their sanitary duties, but there is a third Department* which exercises, in particular cases, a supervision over sanitary works. The next following paragraphs are devoted to the consideration of the functions of the two principal Departments which have habitual employment in the matter; while, on page 48,

* The Department referred to is the Inclosure Commissioners, who have in some instances a controlling power over the action of Local Authorities: how this arises, is explained on pp. 28 to 32.

reference is made to the supervision which, in certain contingencies, is exercised by the third Department.

The two Departments to which particular attention is now given are the Privy Council Office and the Home Office; and, broadly speaking, the line between the functions of the one Department and of the other Department might be supposed to be definable as follows:—The Privy Council Office, and its Medical Department, to exercise supervision over such functions as locally would fall under the cognizance of the local Medical Officer of Health and Sanitary Inspectors; the Home Office, and its Local Government Act Office, to exercise supervision over such functions as would belong to the Department of a Surveyor or Engineer to a Local Board.

For the sanitary operations of local authorities may (speaking in general terms) be divided into two classes, viz.:—Class I, those more directly relating to the prevention of disease,—such as the medical sanitary inspection of premises, the regulating of certain trades, the doing of disinfection, &c.; and Class II, those relating to territorial boundaries and public structural works, such as settling the boundaries of districts, building sewers, waterworks, &c., of which two classes of functions it will be observed that those of investigation most commonly precede those of structural works.

Now, as to the central supervision of local authorities in executing these two classes of duties, it is a fact that the former class of local duty, which is more directly concerned with matters of health, is supervised by the more purely Medical Department of Government, the Medical Department of the Privy Council Office; and that the latter surveying or constructive class of local duty is supervised by the Department of Government that has engineering officers at its disposal, the Local Government Act Office. The Medical Department of the Privy Council Office engages the services of Inspectors who have received a medical education and training; and this specially qualified assistance is quite necessary for a Department which has to advise as to the prevention of diseases. While the Local Government Act Office has, as stated above, a staff of Civil Engineers for its Inspectors.

But, though there are these two Departments of Government, with functions apparently so naturally distinguishable, it would seem that recent legislation has not always kept the distinction in view. Thus section 49 of the Sanitary Act, 1866, enacts that "where complaint is made to one of Her Majesty's Principal Secretaries of State that a Sewer Authority or Local Board of Health has made default in providing its district with *sufficient sewers* or in the maintenance of existing sewers, or in providing its district with a *supply of water in cases where danger arises to the health of the inhabitants from the insufficiency or unwholesomeness of the*

existing supply of water, and a proper supply can be got at a reasonable cost, or that a Nuisance Authority *has made default in enforcing the Provisions of the Nuisance Removal Acts*, or that a Local Board has made default in enforcing the provisions of the Local Government Act, the said Secretary of State, if satisfied after due inquiry made by him that the authority has been guilty of the alleged default, shall make an order limiting a time for the performance of its duty in the matter of such complaint."

The words in italics qualify the authority given in this section, and point to the Department which, in the absence of express direction to the contrary, would take action under it. It would appear that such a Department as the Privy Council Office, which has a medical adviser and staff, would be the proper one to inquire whether sufficient sewers existed; it will not be questioned that "sufficient" means "sufficient for health"—sufficient not only in quantity but also in particularity—for sewers in a place may, as an engineering work, be sufficient, and yet, in a health point of view, be totally insufficient and unadapted to the requirements of the place. The question of drainage (and the consequent reduction of the humidity of the atmosphere and wetness of the subsoil, and the thorough removal of excreta and their products), as it affects the localization of certain diseases, is one for the solving of which medical knowledge is required. This appears to be the proper definition of the term "sufficient

sewers." And with regard to the water-supply portion of the inquiries by the Home Secretary, that has especial reference to *cases where danger arises to the public health either on account of the insufficiency or unwholesomeness of the existing supply*. This also appears to be a matter especially requiring medical knowledge; for the unwholesomeness of water is, in many instances, only ascertainable by chemical treatment—the brightest to the eye, and most pleasant to the taste, often being that most hurtful in its effects upon the public health. So also as to the neglect of a Nuisance Authority. It is not sufficient, I take it, to the putting in force of the power given under this section that the Authority shall have allowed nuisances to exist in its district, but the nuisances must be such as are likely to militate against the health of the district; for the authority must make "default in enforcing the provisions of the Nuisances Removal Acts," and these Acts deal only with such nuisances as are "injurious to health." This would also seem to indicate the necessity for medical inquiry. It thus appears that the Privy Council Office (which is the guardian of the public health under the Public Health Act, 1858) would be pre-eminently the Department to make these inquiries, if it were not expressly directed in the Statute that the Home Office should undertake this particular duty.

It is under this section that the Secretary of State is empowered to make inquiries as to the default of

local authorities, and if satisfied that default is made, to take proceedings for compelling them to obey the law. The power hereby given to the Home Secretary of instituting these inquiries has made it very difficult to state positively where the inspectorial functions of the Home Secretary and of the Privy Council respectively commence and stop; and this uncertainty has, doubtless, helped to create in the public mind, much confusion on the subject. In certain matters, such as inquiry into the outbreak of disease and the prevalence of epidemics, there can be no doubt as to which Department should put its power into operation; nor can there be any doubt, in matters relating to the building of sewers and other structural works, which Department should exercise supervision; but in many other matters, such as cleansing filthy ponds, removal of stinking pigs, &c., there may be doubt as to which Department should exercise its functions.

It will thus be seen that there are, so to speak, two kinds of official sanitary inquiries: (1) those made under the authority of the Public Health Act, 1858; and (2) those made under the authority of section 49 of the Sanitary Act, 1866; and so, at times, there arises a confusion as to which of these two sets of sanitary inquiries is referred to. The public have begun to use the term as applying to the work of both Departments,* and without realiz-

* While this Paper is passing through the press I observe the following paragraph in the "Lancet" of November 28:—

ing the fact that the inquiries made by the Privy Council, under the Public Health Act, 1858, should be looked upon as "primary" sanitary inquiries—as being made with the view to ascertain the causes of the declension of health in a locality; while the inquiries made by the Home Secretary, under the Sanitary Act, 1866, should be looked upon as "secondary" sanitary inquiries—as being made with the view to the execution of such works as may be necessary for removing any pre-ascertained causes of such declension.

Though most educated men are ready to admit that injury to health may result from defective local conditions, such is not the case with the poor and ignorant part of the population. And there can be but little doubt that more weight would attach to proceedings as to matters of health, and as to causes of sickness and death, taken by a Department whose Chief and Inspectors are members of the medical profession, than to proceedings taken by a Department whose Chief has

"Mr. Arnold Taylor, the Government Inspector, will open on Wednesday next, at Falmouth, an inquiry into the sanitary condition of that town, the unhealthiness of which has been already noticed." Mr. Taylor is one of the Engineering Inspectors of the Local Government Act Office. This illustrates the confusion which exists in the public mind as to the nature of the inquiries made by the Privy Council Office and the Local Government Act Office. for Mr. Taylor's inquiry had reference to matters of drainage only.

no medical knowledge, and whose Inspectors' qualification has reference to civil engineering.

Again, by some strange accident, the supervision of regulations for lodging-houses under Section 35 of the Sanitary Act, 1866, is left in the hands of the Local Government Act Office, when the regulations have only to do with the conditions necessary to health, and do not relate to works or questions requiring practical or theoretical engineering knowledge and skill.

There is, as I have already said, another Department of the Government which may, in some cases, exercise a sort of supervision over the doings of local authorities; this Department is the Inclosure Commissioners. By a private Act passed in 1867 (The Towns Drainage and Sewage Utilization Act, 1867), certain Local Authorities are, as before stated, authorized to delegate to "The Towns Drainage and Sewage Utilization Company," any of the powers which such Authorities possess for sanitary purposes; but the delegation must be made with the consent of the Inclosure Commissioners. It is thus possible that one set of works in a place will be sanctioned and supervised by the Local Government Act Office, while another set of works of a similar kind will be sanctioned and supervised by the Inclosure Commissioners. In short, if a Local Board itself executes any works, the consent of the Local Government Act Office will have to be obtained;

whereas if a Local Board delegates the execution of any works to this Company, the consent of the Inclosure Commissioners will have to be obtained. Here is another complication of jurisdiction which it is very desirable should be done away with as soon as possible.

V.—Conclusion. Some Points for Consideration in future Legislation.

In this Paper some points have been raised which would appear to be deserving of consideration in future legislation with a view to render more easy the local performance and central supervision of sanitary works; to remove much of the confusion which at present exists as to the authority whose duty it is to carry into force the various Sanitary Acts of Parliament; and to the adoption of some settled scheme whereby Governmental supervision of, and advice to, Local Authorities may be made on some definite plan, and thus the present undecided course of proceeding in such matters be avoided. The principal points are as follows:—

1. That, unless a new Sanitary Department be created, the supervision of, and the giving of advice to, Local Authorities on all sanitary matters be confined to the Privy Council Office (the Medical Department) and the Home Office

(the Local Government Act Office); and that a division of departmental responsibility in these matters be made on some such principle as follows:—

a. The matters referred to in Class I, page 42 of this Paper, being dealt with by the Medical Department of the Privy Council Office; and

b. The matters referred to in Class II, page 42 of this Paper, being dealt with by the Local Government Act Office.

2. That the Medical Department of the Privy Council Office conduct the preliminary inquiries necessary to the putting in force of section 49 of the Sanitary Act 1866, and that the Home Secretary take action under that section, on the report to, and motion of, the Privy Council, and without further inquiry, other than as to how the particular kind of works, which it may be requisite to carry out, shall be executed. The necessity, or not, for the execution of sanitary works, to be a matter for the decision of the Privy Council.*

* In most instances, the prevalence, or the fear of the outbreak, of some disease is the reason for putting in force section 49 of the Sanitary Act; and this being so, it would seem reasonable that the necessary preliminary inquiries should be made by the Privy Council and its Medical Inspectors, and not by the Home Office and its Engineering Inspectors. There is not, in the first instance, any question as to the manner of the execution of works; but only whether works are necessary or not. This is a plain matter of fact, and one which does not,

3. That in each place there be one Local Authority, and one only, for all sanitary purposes; and that the present (in some cases, very limited) areas of

of necessity, require the investigator to be possessed of any engineering knowledge. The adoption of such a plan of proceeding would simplify matters much, for then there would be but one inquiry, and that by the Department authorized by Parliament to make inquiries in any matter concerning the public health. If the Privy Council, on the report thus made, should consider it necessary for works to be done, the Council could then move the Home Secretary to take action, and to decide the manner of executing the works; and, if the Local Authority neglected the requirements of the Secretary of State, the Local Government Act Office could then appoint some one to carry out the requisite works. In some cases inquiry is now made by both the Departments; as, for instance, last year at Terling, where there was an epidemic of fever. The fact was reported to the Privy Council, and inquiry was directed to be made into the circumstances of the outbreak, when it was discovered that the Local Authorities had neglected their duties as to the removal of nuisances, and the provision of water and drainage. Upon this discovery, and upon the ascertainment that the Local Authority was not inclined to obey the law, the Secretary of State was moved to take action under section 49 of the Sanitary Act, 1866, and it became necessary for the Home Office also to make inquiry, in accordance with the provisions of that Statute. There evidently was not any non-legal necessity for the second inquiry, as the fact of neglect had already been ascertained. (For fuller particulars of this case, see Tenth Report of the Medical Officer of the Privy Council.)

If some such plan as that now proposed be adopted, and the law be altered, the necessity for the second inquiry, and its consequent delay and expense, will be avoided.

sanitary districts be much extended.* This alteration might, in the consequent details, be made to cover the other points hereafter referred to, and this course appears to be quite as practicable as the alternative, which is—

4. That the conflict of authority under the several Acts of Parliament† now in force relating to sanitary matters be at once removed; and express power given to Sewer Authorities to appoint and pay officers.

November 1868.

* The division which might, perhaps, be most conveniently made, would be to take the several counties of England, subdividing only the largest. There are obvious advantages derivable from this concentration of Local Authority, by improving the class of persons who would take action in sanitary matters, and by procuring the best professional assistance, with economy of offices, staff, &c. And, on the other hand, the objection that a whole county might be rated for the benefit of particular places, is scarcely worth discussing. For it would, of course, be proper that any enactment which imposed upon County Local Authorities, powers of rating for sanitary purposes, should also endow them with the power of making separate rates in particular places for merely local improvements from which other places could derive no benefit.

† A list of the principal Acts of Parliament is given on pages 8 and 9. But, in the event of such an arrangement as that proposed in No. 3 being ultimately carried into effect, other Acts would probably have to be added to the list.

PRINTED BY HARRISON & SONS, ST. MARTIN'S LANE.

With the Author's Respects

ON

CARBOLIC OR PHENIC ACID

AND ITS PROPERTIES,

BY DR. F. CRACE CALVERT, F.R.S., &C.

(*Reprinted from the "Journal of the Society of Arts" of Oct. 23, 1867.*)

LONDON:
J. H. DUTTON, "CHEMICAL NEWS" OFFICE,
BOY COURT, LUDGATE HILL, E.C.

1868.

CARBOLIC OR PHENIC ACID.

The following lecture was delivered in French, a few months since, by Dr. Crace Calvert, F.R.S., F.C.S., &c., before the Society for the Encouragement of National Industry in France :—

Gentlemen.—I have readily accepted the friendly invitation of your illustrious president, M. Dumas, to submit to your notice some facts relative to carbolic acid. But before doing so, allow me to express publicly the feelings of gratitude which I owe to France for having opened to me the way to the profession which I pursue with such pleasure. In truth, it is to the sympathy of scientific men of this country, to the friendly assistance of one of your scientific celebrities, M. Chevreul, and to the liberality of your institutions, that I owe the knowledge I have acquired, the elements of which I gained at the Gobelins, and at the Museum of Natural History during the stay I made there. After these remarks I will proceed with the subject of my lecture.

No doubt most persons present are aware that when coals are submitted to the action of a dull red heat, in a retort, products are obtained which may be grouped into four classes.

1st. Gaseous products, commonly called coal gas, and which are now employed in so general a manner as means of illumination, sources of heat, and motive power.

2nd. Water containing ammonia and ammoniacal salts, substances which chemistry purifies, modifies, and which are then utilised in agriculture, manufactures, and medicine.

3rd. There distils with the above products a black, sticky substance, of an unpleasant odour, called tar.

4th. There remains in the retort a solid, porous body, which is known to us all as coke.

When the above-mentioned product called tar is submitted to distillation, water first comes over, then there distil jointly with this fluid, liquid carburetted hydrogens, which, being lighter, float on it, and are therefore called *light oils of tar*; and, lastly, compounds heavier than water are collected which bear the name of *heavy oils*.

It is these heavy oils which were the first tar products utilised in manufacture. Their consumption made such rapid progress in England, that special manufactories were established for their preparation, and these works were, for a long period, the only ones in which tar products were produced. Most of them were established between 1837 and 47, for the production chiefly of coal naphtha, used for many purposes, and heavy oils, employed for the preservation of railway sleepers, by a process discovered by Mr. John Bethell, by means of which they are preserved twelve or fifteen years; whilst without it they decay after three or four years. I have much pleasure, whilst on this subject, in calling your attention to a very remarkable and very complete work upon the creosoting of wood, by M. Forestier, chief engineer of the department of La Vendée, assisted by M. Marin. These gentlemen have made numerous experiments, the result of which is that wood thus treated is preserved from decay in water as well as under ground, and, what is important, wood is no longer destroyed by that very destructive insect the *teredo*.

Lastly, there remains in the still (after the heavy oils and some semi-solid substances have distilled off) a product, which is fluid at the high temperature at which this operation is conducted, but which, when exposed to the natural temperature of the atmosphere, becomes hard and brittle, and is known under the name of *pitch*. This product, as you are aware, is largely employed in Paris under the name of asphalte, bitumen, &c., to make the foot pavements and public walks, as well as for the manufacture of a sort of concrete, called in England patent fuel.

After this rapid sketch of the products given off during the distillation of coal and tar, allow me to call your attention to *carbolic* or *phenic acid*, also called carbolic or phenic *alcohol*; in fact the latter is the most appropriate name for this substance, as its properties are not those of an acid, but that of an alcohol.

It is now twenty years since Laurent, the eminent chemist, first pointed out an easy method of extracting carbolic acid from coal tar. It consisted in submitting the light oils to a fractional distillation, and then treating with a concentrated solution of potash, those products which had distilled at a temperature between 160 and 200 degrees, separating the alkaline solution from the hydrocarbons which floated on it, and then neutrallising the alkali by an acid which liberated the carbolic acid.

Such was Laurent's method of preparing carbolic or phenic acid, but pure carbolic acid was only there in a very small proportion; it was, in fact, a mixture composed chiefly of different liquids similar in properties and composition to carbolic acid, and though Laurent succeeded in obtaining solid carbolic acid, still the process devised

by him was too expensive to answer on a manufacturing scale; and besides, his method of operating was too complicated.

In 1847, Mansfield, and towards 1856, M. Boboeuf, made known processes which, in fact, were only a modification of Laurent's, for they consisted principally in employing caustic soda instead of potash, and in treating the whole of the light oils instead of a special portion of them, as Laurent had done; still, by these processes, a very impure acid was obtained, from which it was very difficult, as experience has shown us, to extract pure carbolic acid; however, in a commercial point of view, the process of these gentlemen was a step in the right direction. This method was followed by Mr. Clifts in manufacturing some carbolic acid for me about the year 1847; and it was this impure acid which was employed by several chemists who, like myself, studied the properties of this substance, and who were endeavouring to apply it usefully; and I succeeded at about that time in applying it to the production of picric acid, or in preventing the transformation of tannic acid into gallic acid, in tanning substances, or, finally, in the preservation of subjects for the dissecting-room. M. Boboeuf also made use of it in preserving organic bodies from putrefaction, a property which has received of late very important applications.

In 1859, M. Marnas, of the firm of Guinon, Marnas, and Bonnet, of Lyons, came to Manchester, and asked me to furnish him with a purer carbolic acid than had been as yet manufactured. He showed me a white and crystalline product, which he gave as a specimen. It was then necessary to make new experiments, and we (F. C. Calvert and Co.) discovered that the best mode of preparation was not by treating light or heavy oils of tar with concentrated alkalies, but, on the contrary, by treating the impure benzines of commerce or naphthas with weak alkaline solutions. By this means a semi-fluid, blackish product was obtained, a little heavier than water, of a density of 1·06, and which contained fifty per cent of real carbolic acid, which acid we managed to separate in part by careful distillation; and it was this product which was employed by Messrs. Guinon, Marnas, and Bonnet, and others, till 1861, for the manufacture of colours derived from carbolic acid. At this period the colours obtained from aniline were so fine and brilliant that, to keep up a comparison with them, it was found necessary to improve those derived from carbolic acid. To effect this it was necessary to improve the quality of the carbolic acid then manufactured, and, after some trials, we produced carbolic acid in white detached crystals, melting at between 26 and 27 degrees, and this is the product which is now generally employed in commerce and industry, as witness the specimens which are to be seen of it at the present Universal Exhibition. In 1863 this relative purity was insufficient, and the same firm which had required the improvements which I

have before named asked us to try and make it still purer. We again set to work, and produced commercially Laurent's phenic alcohol, or carbolic acid; that is to say, a substance melting at 34 degrees Centigrade, and boiling exactly at 186 degrees. This became a very important commercial product for us, and we delivered large quantities monthly.

From this time I made many efforts to draw the attention of the medical profession to the really remarkable therapeutic properties of carbolic acid, but the tarry and sulphuretted odour which it still possessed was a serious obstacle to its application. I soon succeeded in overcoming this difficulty, and towards the end of the year 1864 our firm was in a position to deliver in considerable quantities carbolic acid deprived of sulphuretted compounds, and therefore fit for all medicinal uses. But I am glad to say that the series of improvements in the manufacture of pure carbolic acid, or phenic alcohol, did not stop there, for towards the end of last year I discovered a process which now enables me to show you a product completely deprived of all disagreeable odour and tarry flavour, and, in fact, as pure, though extracted from tar, as if it had been produced artificially by the help of the reactions recently discovered by Messrs. Wurtz and Kékulé, based upon the direct transformation of benzine into carbolic acid, or by the well-known changes by which it may be obtained from salicylic acid or nitrobenzoic. This new phenic or carbolic acid is distinguished from Laurent's in being soluble in 20 parts of water, whereas the latter requires 33. It is fusible at 41, instead of 34, and boils at 182 degrees, instead of 186, but it gives, like Laurent's, the blue colour described by M. Berthelot when mixed with ammonia, and to the solution is added a small quantity of a hypochlorite; the same effect is also produced when you expose to the vapours of hydrochloric acid a chip of deal soaked in this pure carbolic acid.

It was supposed that, as Laurent's phenic acid had a constant boiling and crystallisation point, it was a pure and definite substance. Now, the production of our new acid shows it is nothing of the kind, the product of Laurent being only a combination of *our pure carbolic acid* and a liquid homologue; for when to the acid of Laurent is added a certain proportion of water, and the mixture is exposed to a temperature of four degrees Centigrade, it deposits a crystalline substance in large octahedrons, which is a hydrate of carbolic or phenic alcohol, that is to say, carbolic acid combined with an equivalent of water of crystallisation. This fact is important in a chemico-theoretical point of view, for it exhibits the only example known of an alcohol which, combining with water, forms a crystallised hydrate. By removing from this hydrate the equivalent of water which it contains, carbolic or phenic acid is obtained in its purest state.

We will now rapidly glance at the applications which have been made of this remarkable substance for sanitary purposes, in medicine, agriculture, and manufactures.

The *disinfecting* or rather antiseptic properties of carbolic acid are very remarkable. The beautiful researches and discoveries of M. Pasteur* have shown that all fermentation and putrefaction is due to the presence of microscopical vegetables or animals, which during their vitality, decompose or change the organic substances, so as to produce the effects which we witness, and as carbolic acid exercises a most powerful destructive action upon these microscopic and primitive sources of life, carbolic acid, therefore, is an antiseptic and disinfectant much more active and much more rational than those generally in use.

It is necessary that I should here make a few remarks, explanatory of the distinctions between *deodorizers*, *disinfectants*, and *antiseptics*:—

Deodorizers.—All substances merely acting as such are neither disinfectants nor antiseptics, as they simply remove the noxious gases emitted from organic matters whilst in a state of decay or putrefaction, without having the property of arresting decomposition or fermentation, for it has been proved that the source of infection or contagion is not due to noxious gases or bad smells (being merely indicators of its probable existence), but, as we shall see presently, to microscopic spores floating in the atmosphere, and which by their ulterior development and propagation, are believed to be the true source of contagion.

Disinfectants.—Under this head may be classed bleaching powder or chloride of lime, sulphurous acid and permanganate of potash; they first act as deodorizers, and then as disinfectants, but they must be employed in large quantities to thoroughly oxidize or act upon organic matters, so as to prevent them from again entering into decomposition, but still it is known that if the organic substances so acted upon are exposed to the atmosphere, they will again experience decay and putrefaction; they are, in fact, more destructive agents than disinfectants, and they are never antiseptics.

Antiseptics.—Antiseptics, such as corrosive sublimate, arsenious acids, essential oils, carbolic acid, &c., act as such by destroying all source of decay and decomposition, that is to say, they destroy or prevent the formation of the germs of putrefaction and fermentation, without acting upon the mineral or vegetable matters present. The advantage of their use is, therefore, that they act, when used in small quantities, upon the primary source of all organic matters in a state of decay; further, they are deodorizers,

* See "Comptes Rendus de l'Académie des Sciences" for several years past, and my lecture at the Society of Arts, 1863-65.

for they prevent the formation of offensive odours, and consequently they are antiseptics, disinfectants, and deodorizers. The great advantages which carbolic acid possesses over all other antiseptics are, that it cannot be used for any illegal purpose, as arsenic and corrosive sublimate.

And allow me further to add that disinfectants, such as chlorine, permanganate of potash, or Condy-fluid, operate by oxidising not only the gaseous products given off by putrefaction, but all organic matters with which they may come in contact; whilst carbolic acid, on the contrary, merely destroys the causes of putrefaction, without acting on the organic substances. The great difference which therefore distinguishes them, is, that the former deals with the effects, the latter with the causes. Again, these small microscopic ferments are always in small quantities as compared to the substances on which they act, consequently a very small quantity of carbolic acid is necessary to prevent the decomposition of substances; therefore, its employment is both efficacious and economical.* Moreover, carbolic acid is volatile; it meets with and destroys, as Dr. Jules Lemaire says,† the germs or sporules which float in the atmosphere, and vitiate it, but this cannot be the case with Condy's fluid, chloride of zinc or iron, which are not volatile, and which act only when in solution, and are mere deodorizers. This is why carbolic acid was used with such marked success, and therefore so largely, in England, Belgium, and Holland, during the prevalence of cholera and of the cattle plague.‡ Mr. W. Crookes, F.R.S., not only states:—"I have not yet met with a single instance in which the plague has spread on a farm where the acid has been freely used;" but he has also proved, by a most interesting series of experiments, that the gases exhaled from the lungs of the diseased cattle contained the germs or sporules of the microscopic animals discovered by Mr. Beale in the blood of such animals; for Mr. Crookes having condensed on cotton wool these germs, and having inoculated the blood of healthy cattle with them, they were at once attacked with the disease. As to the value of carbolic acid for preventing the spread of cholera, among many instances which I could cite, allow me to mention two special instances: First, Dr. Ellis, of Bangor, says: I have in many instances allowed whole families to return to cottages in which persons had died from cholera, after having had the cottages well washed and cleansed with carbolic acid, and in no case were any of the persons so allowed to enter such purified dwellings attacked with the disease. My friend, Professor Chandelon, of Liège, has stated to me that out of 135 nurses who were

* See remarks at the end of lecture.
† See "Comptes Rendus," 1867.
‡ See the third report of the Royal Commissioners on the cattle plague, and especially the valuable report of Mr. W. Crookes, F.R.S.

employed to attend upon the cholera patients—and they must have been numerous, for 2,000 died—only one nurse died, but the nurses were washed over and their clothing sprinkled with carbolic acid. In fact the antiseptic properties of carbolic acid are so powerful that 1-1000th, and even 1-5000th, will prevent the decomposition, fermentation, or putrefaction for months of urine, blood, glue solution, flour, paste, fœces, &c., &c.;* and its vapour alone is sufficient to preserve meat in confined spaces for weeks, and even a little vapour of this useful substance will preserve meat for several days in ordinary atmosphere, and prevent its being fly-blown; lastly, 1-10,000th has been found sufficient to keep sewage sweet, for Dr. Letheby states, in a letter addressed to me, that through the use of such a quantity of carbolic acid in the sewers of London during the existence of cholera last year, the sewers of the City were nearly deodorized. And I am proud to say that the British Government have decided to use exclusively our carbolic acid (as an antiseptic and disinfectant), not only on board Her Majesty's ships, but in other Government departments; and that no other deodorant or disinfectant, such as chlorides of zinc or iron, permanganate of potash, or any disinfecting powder, shall in future be used for such purposes. Although questions of public health are the province of medicine, still permit me to say a few words on the medicinal properties of carbolic acid. This question deserves to be treated thoroughly, for phenic acid is susceptible of so many applications in this direction; its properties are so marked, so evident, and so remarkable, that they cannot be made too public, and it is rendering a service to mankind to make known some of the employments of so valuable a therapeutic agent.

I wish all who were listening to me were medical men, for I could show, by numerous and undeniable facts, the advantage they might derive from *pure* carbolic or phenic acid; and if my testimony was not sufficient to convince them, I would invoke the authority of men justly esteemed amongst you. I would recall to you the words of the good and learned Gratiolet and those of Dr. Lemaire, showing that carbolic acid is the most powerful acknowledged means of contending with contagious and pestilential diseases, such as cholera, typhus fever, small pox, &c.† Maladies of this order are very numerous, but in carbolic acid we find one of the most powerful agents for their prevention, for besides many instances which have been cited to me, I may add that I have often used it in a family in which there were eight or ten children, and that none of the family have suffered from those diseases except those who were attacked previously to the em-

* See private reports made by Dr. Allen Miller, F.R.S., and Mr. Crookes, to Messrs. F. C. Calvert and Co.
† See Dr. Lemaire's work on Phenic Acid. Paris, 1865.

ployment of carbolic acid about the dwellings in which such diseases existed. Besides its antiseptic action, the caustic properties of carbolic acid are found useful, for I may say most beneficial effects are obtained from it in the treatment of very dangerous and sometimes mortal complaints, such as carbuncle, quinsy, diphtheria, &c., as shown by Dr. T. Turner, of Manchester, and also in less severe affections, such as hæmorrhoids, internal and external fistulas, and other similar complaints. But what deserves to be especially mentioned in the employment of carbolic acid is its power to preserve in a healthy state certain purulent sores, and prevent the repulsive odour which comes off from them, an odour which is the symptom of a change in the tissues, and which often presents the greatest danger to the patient. The services which carbolic acid renders to surgery can be judged of by reading several most interesting papers on compound fractures, ulcers, &c., &c., lately published in the *Lancet* by J. Lister, Esq., F.R.S.; and allow me to draw your special attention to the following paragraphs which are to be found in his paper published in that journal of the 25th September, 1867:—"The material which I have employed is carbolic or phenic acid, a volatile organic compound, which appears to exercise a peculiarly destructive influence upon low forms of life, and hence is the most powerful antiseptic with which we are at present acquainted. The first class of cases to which I applied it was that of compound fractures, in which the effects of decomposition in the injured part were especially striking and pernicious. The results have been such as to establish conclusively the great principle that *all the local inflammatory mischief and general febrile disturbance which follow severe injuries are due to the irritating and poisoning influence of decomposing blood or sloughs.* These evils are entirely avoided by the antiseptic treatment, so that limbs which otherwise would be unhesitatingly condemned to amputation may be retained with confidence of the best results. Since the antiseptic treatment has been brought into full operation, and wounds and abscesses no longer poison the atmosphere with putrid exhalations, my wards, though in other respects under precisely the same circumstances as before, have completely changed their character; so that during the last nine months not a single instance of pyæmia, hospital gangrene, or erysipelas, has occurred in them." My hearers can also witness the same remarkable results by visiting the two sick wards of Dr. Maisonneuve, at the Hotel Dieu. Further, I must not overlook the valuable application made of it to gangrene in hospitals by the eminent physician, James Paget, Esq.; and lastly, it has been used by many of the most eminent medical men with marked success in those scourges of humanity, phthisis and syphilis.

Agriculture.—Our firm has stimulated the employment of the carbolic acid for the cure of certain diseases very common to sheep—scab, for example. The method of treatment customary in similar cases was very imperfect as well as dangerous, whilst with carbolic acid this malady is cured, and without danger to the animal, by dipping it for a minute, often only for some seconds, in water containing a small quantity of carbolic acid. For this purpose pure acid would be too expensive, and is not used, nor concentrated acid, which ignorant men who have the care of sheep would not know how to use, but by the help of soap an emulsion of carbolic and cresylic acids is made. After having shorn the sheep it is dipped in this mixture; a single immersion in a bath containing 1-60th of it is sufficient to effect a cure. After scab, foot-rot is one of the worst and most frequent complaints. Carbolic acid is also for that an efficacious remedy. For this a mixture is made of the acid and an adherent and greasy substance, capable of forming a plaster, which is made to adhere to the animal's foot for two or three days, preventing the contact of the air, allowing thereby time for the application to produce its effect. But if the flock be numerous, it would take a long time to dress the four feet of each animal one after another; so, to make it more easy, a shallow tray is made of stone, a sort of trough; this is filled with the medicated mixture, and the sheep made to pass through it; their feet being thus impregnated with the required substance. Permit me also to state that cattle cease to be annoyed with flies, &c, if washed with this solution, or a weak solution of carbolic acid; and a first-rate salve can be prepared by adding 10 per cent of carbolic acid to butter, or any other fatty matters used for such purpose.

Manufacturers have not yet availed themselves of one tithe of the valuable properties of carbolic acid, and in this direction a new field is open to its employment; still I may cite a few instances. The preservation of wood has been already referred to, and, thanks to carbolic acid, the great trade in skins and bones from Australia, Monte Video, Buenos Ayres, &c., will ultimately be benefited, for, as you are aware, wild animals live there in herds and are slaughtered by thousands. Formerly the refuse of cattle, especially the bones, came to us in a bad state, half-putrid, emitting an insupportable odour, and only fit for manure; in this state their price was not more than 150 francs the 1,000 kilogrammes, now, with carbolic acid treatment, they arrive perfectly preserved; they can be employed for all the uses to which green or raw bones are usually applied, and the value of bones is raised as much as from 250 to 300 francs. Hides also often arrive putrid, although they have been dried rapidly in the sun, or salted, which latter process, as you are aware, necessitates long and costly manipulations; whilst it is only necessary to immerse them for twenty-four hours in a solution of two per cent of carbolic

acid, and dry them in the air, to secure their preservation. It is probable that in a short time the blood, intestines, and other parts of these animals will be, by means of carbolic or phenic acid, converted into manure, and imported into this country. In England carbolic acid is used in the preservation of guts at the gut works, for keeping anatomical preparations, and the preservation of all animal matter. Carbolic acid is also utilised in preventing the decomposition of the various albumen, flour, and starch thickeners used in calico printing, as well as gelatine or bone size, employed for sizing fustians and other cotton goods.

One of the most interesting chapters in the history of carbolic acid is certainly that which relates to the production of colouring materials from it; they alone enter into comparison with those derived from aniline, and often enter into successful rivalry with them. Amongst the colouring matters derived from carbolic acid, the most important is, without fear of contradiction, *Picric acid*.

The discovery of this acid dates back to a distant period; it was studied by Welter, and was called Welter's bitter. But it was my illustrious master, M. Chevreul, who, in 1807, discovered the real chemical composition of picric acid, and who demonstrated that picric acid was often produced when organic matters were acted upon by nitric acid. Further, M. Chevreul discovered in the products of the oxidation of organic substances through nitric acid two different compounds, which he called *amer au minima* and *amer au maxima*, the latter being picric acid. This acid was again examined by Laurent in 1841, when he demonstrated that the true generator of picric acid was phenic acid; that in the action of nitric acid on the latter it formed three nitrogenated compounds, mononitrophenic acid, binitrophenic acid, trinitrophenic acid, the latter being also picric acid.

These interesting results of Laurent would perhaps have remained for a long time without any commercial value if picric acid had not been applied to dyeing, in 1847, by M. Guinon, senior, of Lyons. Since then the use of this acid, producing magnificent yellows, has been much extended, and what has contributed to its employment is that, conjointly with indigo, it gives ordinary greens, or of *vert Lamiere* with Prussian blue, so that its consumption may be valued at from 80 to 100,000 lbs. annually; our firm alone produces more than 300 lbs. weekly; and when it is considered that 1 lb. of picric acid dyes to an intense shade 70 to 100 lbs. of silk, or 40 to 50 lbs. of wool, the enormous quantity of textile materials dyed by this single product may be appreciated.

The processes followed for the preparation of picric acid are still those which Laurent indicated in 1841; but instead of using carbolic acid, loaded with the heavy oils of tar, as M. Guinon had done, I

sought to diminish the quantity of nitric acid, employed in mere waste, on the heavy oils of tar, which were then mixed with carbolic acid, and I am glad to say that I succeeded in doing so in 1849, by employing carbolic acid, containing only some of its liquid homologues. In 1856, M. Bobœuf took out a patent in France, for the manufacture also of picric acid from carbolic acid. But picric acid was still at a high price, and it is only since our firm has manufactured cheap carbolic acid that picric acid can be produced free of resinous materials which prevent its purification and its being sold at a low price; in fact, owing to our pure carbolic acid, picric acid is now obtained chemically pure; this product, which was sold some years since at 15s. to 20s. per lb., is now sold at the rate of 3s. Further, I may add that to apply it in a quick and economical manner it is desirable to add to the dye bath a small proportion of sulphuric acid; this method of manipulation, which is not generally known, is very important, for it is only in this way that the textile materials can be readily dyed, and the baths exhausted.

I shall now have the pleasure of calling your attention to the production of two new colouring substances derived from picric acid:—

1st. *Picramic* acid was, in the first instance, obtained by Wœhler; by making sulphate of iron act upon picric acid, and neutralising with caustic barytes, when a deep brown salt was produced, from which he separated the baryta by the help of sulphuric acid, and thus obtained an acid, to which he gave the name of nitrohæmatic acid; but it is to M. Aimé Girard that we owe the practical process by means of which we are able to manufacture large quantities of picramic acid, viz., through the action of hydro-sulphate of ammonia on picric acid. Picramic acid imparts to silk a beautiful series of brown tints, similar to those obtained from catechu.

2nd. *Isopurpurate of ammonia*. It is with much pleasure that I noticed, at the exhibition, in M. Casthelaz's case, a coloured substance known in the trade by the name of soluble garnet, and which, I am informed, is used especially by M. Chalamel, of Puteaux; this substance is particularly remarkable, owing to its being isomeric with the *purpurate of ammonia or murexide*. Although the preparation of this colouring substance was first pointed out by M. Carey, still it is really due to a previous observation by Hlasiwitz, who was the first to call attention to the reaction of cyanide of potassium upon picric acid, and thereby gave us the knowledge of manufacturing the isopurpurate for industrial purposes.

Before taking leave of picric acid it may not be without interest that I should state a curious application which has been made of the explosive property of its salts. During these last few years the picrate of potassium has been employed by Mr. J. Whitworth, for charging the shells used in destroying the iron plating of ships.

When the projectiles thus prepared strike the iron masses, the enormous propelling force with which they are expelled from the gun is instantaneously converted into heat, and to such an extent that the shot becomes red hot, and the heat thus generated decomposes the picrate of potash, and a violent explosion ensues, owing to the enormous quantities of vapours and gases which are thus produced in an an instant of time. Whilst the alkaline picrates are endowed with such formidable properties, they also possess others which are useful for the alleviation of human misery. Picric acid being an efficacious remedy in intermittent fevers. Persons affected with such types of fever, and upon whom quinine has lost all its beneficial effects by continuous usage of it (this is the case with some of our soldiers who return from India), derive, I am glad to say, wonderful benefit from the use of picric acid and picrates, as Dr. Aspland has proved to be the case at the military hospital at Dukinfield. The knowledge of this fact may be useful in districts in which poor populations exist, for it affords them a cheap febrifuge; and, moreover, picric acid is not dangerous, as arsenical preparations are, nor does it derange the stomach like quinine.

To return to the colours derived from carbolic acid, allow me to remind you that when, in 1834, Runge discovered phenic acid amongst the products of coal tar, he observed at the same time the existence of two colouring substances, to which he gave the name of *rosolic acid* and *brunolic acid*.

I will not detail here the processes by which Runge extracted these substances from the residue of coal tar by means of lime, nor the method adopted by Messrs. Smith, Dussart, and Jourdin for producing these substances by direct oxidation of phenic or carbolic acid, but will describe rapidly the process which we now use to manufacture *rosolic acid*, which, by the bye, should not be attributed, as is generally done, to M. Kolbe, the method being due to M. Jules Persoz, the son of the celebrated Professor of tinctorial chemistry in the Conservatoire des Arts-et-Métiers. His process consists in making oxalic acid act upon sulphophenic acid at a temperature of about 160 degrees, which gives rise to a product which has the bronze-green appearance of cantharides. To render it suitable for employment in dyeing it is only necessary to wash it so as to separate from it all the sulphuric acid with which it is contaminated, and then it is sold under the name of *Yellow Coralline* or *Aurine*. It was our firm who first, in 1863, discovered that rosolic acid thus prepared could be employed directly as a dye, and introduced it to dyers under the name of aurine, and to printers to produce upon silk and albumenised cotton magnificent orange colours, like those of basic chromate of lead or of turmeric. In 1860 M. Persoz, junior, discovered also that if rosolic acid was

heated under pressure with ammonia it gave rise to a red substance, which he called *Péonine*. Messrs. Guinon, Marnas, and Bonnet perfected the manufacture of péonine, and gave it the name of *Red Coralline*. This colouring substance imparts to silk and worsted a flame-coloured tint and brilliant scarlets. This firm were also the first to produce and introduce, towards the end of 1860, a blue dye, derived from carbolic acid, or, more so, rosolic acid, which they called *Azuline*, which is prepared by heating for several hours, at the temperature of about 180 degrees, a mixture of rosolic acid and aniline, and which is purified by repeated treatment with sulphuric acid and benzine, constituting, when dry, a red mass having gold-coloured tints. Azuline, although discovered before the *Aniline blues*, which have since become formidable rivals to it, is still, notwithstanding, manufactured in competition with them.

To Messrs. Guinon, Marnas, and Bonnet is also due the first production of a green derived from coal tar products. It was manufactured in 1863, therefore some months before the appearance of an aniline green, known as *Vert d' Usèbe*, which, however, with the exception of the iodine greens, is the only one now employed in dyeing. *Viridine* was obtained by this firm from a mixture of aniline, benzoic, and rosolic acids.

Phenicienne, discovered in 1863, by M. Roth, is another colouring matter derived from phenic acid; it produces fast colours, from a deep garnet red to a golden buff. Phenicienne is produced by the action of nitrosulphuric upon carbolic acid.

I cannot conclude this retrospective review without calling your attention to a fact which seems to have escaped the attention of my colleagues; it is that the majority of the beautiful colours obtained from phenic or carbolic alcohol, or from aniline, are due to the industrial application of a discovery made by your illustrious president, M. Dumas, more than thirty years ago. I mean the principle, so rich and fruitful, and to which he gave the name of "the law of substitutions;" a law which has thrown, as you are aware, such bright beams of light on modern chemistry, and which has prepared the way for such brilliant achievements, and which, I say, has also been the foundation of the production of those beautiful colouring substances which are derived from tar products, and which we all so much admire. Thus, in order to obtain aniline blues, violets, and greens, produced by the methods devised by the illustrious chemist, Dr. Hofmann, we substitute for a certain proportion of the hydrogen of rosaniline an equivalent quantity of the alcoholic radicals, called phenyl, ethyl, methyl, and amyl. Further, this celebrated chemist has also shown that the blues obtained by Messrs. Girard and Delaire are also due to the same laws.

I am far, I regret to say, gentlemen, from having named all the remarkable properties and applications of carbolic or phenic alcohol; but I trust I have succeeded in making you share my enthusiasm for this valuable agent, which, after having rendered important services to most of the world's industries, still offers to chemists and to manufacturers a wide field for new applications."

* Owing to the inducements which have been held out by some traders, large quantities of a fictitious mixture have been sold to the public as carbolic acid. To enable purchasers to protect themselves from fraud, the following test is supplied on the authority of Mr. W. Crookes, F.R.S. :—"Commercial carbolic acid is soluble in from 25 to 70 parts of water, or in twice its bulk of a solution of caustic soda, while oil of tar is nearly insoluble. To apply these tests :—1. Put a teaspoonful of the carbolic acid in a bottle; pour on it half a pint of warm water; shake the bottle at intervals for half an hour, when the amount of oily residue will show the impurity. 2. Dissolve one part of caustic soda in ten parts of warm water, and shake it up with five parts of the carbolic acid. As before, the residue will indicate the amount of impurity. These tests are not given as having any pretension to scientific accuracy, but as affording persons who are desirous of using carbolic acid a rough and a ready means of seeing whether or not they possess the right article."

QUARANTINE

AND

CHOLERA.

Reprinted from the "Calcutta Review."

Calcutta:

1869.

QUARANTINE AND CHOLERA.

THE question of quarantine in cholera, which now engages the attention of authority in India, could not have presented itself at a time more favorable for full discussion and just estimation of its merits. The doctrines which formerly prevailed as to the necessity and efficacy of the measure were asserted in a time of excitement and terror. The credulity of nations, threatened with pestilence, rose accordingly as promise of immunity under quarantine was more or less boldly put forth by its advocates and blindly accepted by authority. There was not leisure or tranquillity for calm enquiry. The natural consequence of extravagant hopes was disappointment; and the denunciations of quarantine, which followed and formed the current doctrine of England for many years subsequently to the epidemic of 1832, had little more of substantial ground to rest on than the credulity which had preceded them. Disproof of the efficacy of quarantine soon gave way to denial of the possibility of communication of cholera from man to man, and it must lie under suspicion, therefore, of having furthered whatever extension of disease may from time to time have followed the non-recognition of this principle.

There have existed, no doubt, reasons, many and strong, why the scientific investigation of quarantine should have been impeded. With regard to cholera, the disease has prevailed in Europe in epidemic form at long intervals only; and with the disappearance of each outbreak the public care for preventive measures has ceased. Not only have science and public health been concerned in the solution of the difficulty, but great questions of commerce and politics have arisen, and the magnitude and variety of interests involved have been fatal to all singleness of purpose and patient enquiry: indeed it may well be doubted whether, in later days, quarantine has not been borne down in England more by a national sense of its being a ruinous alternative than by deep-rooted conviction of the difficulty of enforcing it, or of its intrinsic uselessness.

But consistent and resolute antagonism has been almost peculiar to England. Other countries have clung with greater or less tenacity to the belief that contagious disease is kept

from their shores by quarantine. Some of our own dependencies are, to this day, unable to shake themselves free from the practice; while, for international reasons, there is still kept up a semblance of quarantine against yellow fever in certain parts of the mother country, which are in direct communication with her West Indian possessions.

Continental policy has derived strong confirmation from the conclusions of the Cholera Conference of Constantinople. With the knowledge of the direction which these were likely to take, it was natural to expect that the epidemic of 1865, 1866, and 1867, would be met by restrictive measures of the fullest extent and rigour. It was so met, and in consequence the capabilities of quarantine have been developed and tested to the full, with results which are day by day becoming more accurately known than they were, when the reports were drawn up on which the judgment of the national delegates was pronounced.

It is with quarantine solely as a measure of practical hygiene that we are now concerned. We seek to do no more than contribute to a solution of the question whether it can be usefully introduced when nations or communities are threatened with disease from without, either through ports and sea-board places, or between adjacent districts of continental land ; and to enquire whether the better insight, which the experience of the past three years has given us, into the nature and attributes of cholera, is in accord with the broad results which have attended the international enforcement of quarantine during the recent epidemic in the west.

The medical officer to the Privy Council, after careful survey of the facts and arguments adduced by advocates and opponents of restrictive measures, has stated his belief that if quarantine could be carried out with the accuracy of a chemical experiment, it must keep cholera from the shores of any country where the very difficult conditions can be fulfilled. This will be open to no doubt if only it can, and in so far as it can, be made clear that epidemic diffusion of cholera depends on direct communication from infected persons. Recent observation, however, has shewn that whatever influence this may have in determining the first cases, or the beginning of the disease in a place, it is certainly not the only, and probably not the principal, medium of propagation ; and that efficient systems of quarantine are not practicable on a scale adequate to the requirements of nations.

It is a very prominent point in the history of the Western epidemic, that the countries in which quarantine was practised with the utmost rigour suffered most severely from cholera. Of this, Spain and the Papal States were notable examples ; and at the opposite end of the list lay England with its unrestricted freedom of intercourse and comparative immunity from disease. On the other hand, it is said (on what evidence we shall presently enquire) that in two infected localities mechanical investment seems to have been absolutely perfect, and extension of disease to have been prevented. These places were Sicily and Dominica,—places so circumstanced that the success of their policy, if it be established, can afford no guide for its adoption on a larger scale ; no disturbance of the general conclusion, that quarantine, with the most perfect organization of which it is susceptible, fails in its object when applied to much frequented sea-boards, crowded ports, or to the investment of inland places ; and leaves its supporters without a weapon of defence against the charge of causing great collateral evils.

Evidently this is the direction which opinion has now taken in England on the subject ; not indeed in the mere pursuit of controversial bias, nor in the manner of obstinate adhesion to the earlier policy of the nation which realizes, in their greatest intensity, the evils attending impeded commerce and the interrupted intercourse of colonies ; but as the conclusion of scientific men, many of them masters of sober reasoning, committed to no previous doctrine whatever, and judging simply from observation of facts now brought before them on a scale of novel magnitude. This opinion has found expression in a memorial which was presented to the President of the Privy Council, in March last, in which it was proposed to take advantage of the opportunity now afforded of testing, through a Royal Commission, the practicability and efficacy of quarantine by recent events, and of pronouncing finally whether the good to be expected from it is such that the great attendant evils should be accepted for the sake of it. Among the subscribers of this memorial are found the names of all in England who have been prominently before the world of late, in connexion with sanitary advancement ; and its language plainly sets forth the distrust of quarantine, which has led to its presentation.

The results of quarantine are now, as we have said, fairly before the world. With every advantage of locality, organization, and unlimited resources, it has not kept cholera from

the ports of the nations which have trusted it, nor hindered its inland spread. As a matter of observed and recorded fact, the failure is open to no dispute ; and as the policy has had for the time the support or the patient tolerance of all the nations of Europe, it is difficult to suppose that failure has been due to any defect of means or power which may hereafter be remedied. It becomes necessary, therefore, to seek elsewhere for the cause of the ill success. It is clear that the main conditions of the spread of the disease have not been met, and that no mechanical impediment which is practicable has prevailed against them. It is probable that they vary with circumstances which are not yet accurately known ; that the exacter knowledge which is growing up of the material agents involved in the phenomena of cholera, while it tends on the one hand to prove the possibility of preventing its extension in some small degree, will shew, on the other, that such limited prevention can only appropriately be attempted by operating on cases in detail, and not by broad measures addressed to the supposed infective power of masses of men ; and thus that research in demonstrating, if it be so, the existence of human communication, will at the same time define the real limits of its actions.

It must not be forgotten that fallacy may at all times attend conclusions based on observation of a single outbreak, in the case of a disease which has appeared, at different times and places, to vary greatly in its attendant phenomena. But there are many considerations which help to liberate from this source of error arguments drawn from the last great epidemic. By its extent and duration there came into view all the many phases and characters of the disease which in local epidemics have shown perplexing variety, and which belong to peculiarties of geographical position, of climate, and season, and soil. These characters have been scrutinized with the utmost minuteness. The freshest resources of science have been called into requisition, and applied throughout the whole Western world by the most competent hands ; and there has resulted an accumulation of exact knowledge on questions of fact, which clears the subject of much confusing speculation, and brings out conclusions which are at once available for useful application in preventive work.

And it is in virtue of this exact knowledge, so far as it has advanced, that the teaching of the past two years has an all-important bearing on the question at issue. It is only by the

precision with which the medium of cholera infection of man by man is known, that the possibility of interrupting infection can be measured ; and it is only in so far as this process of transmission can be shewn to influence the course of epidemics, that restriction on intercourse can point the hopes even of enthusiastic persons. There are many examples of the spread of cholera from place to place where no personal communication can be traced : there are also many reasons of a positive kind for believing that infection is carried by the air, as the only element known to pervade all infected places, the agent being either itself a vapour, or taking some form that air or vapour may convey. How far such cases are examples of the general law of epidemic cholera, and how far they are exceptions to it, is the question of main importance, and very difficult of solution in the existing conflict of opinion and testimony. But if the process which they indicate be admitted in extenuation of the failure of restrictive measures, it must be with the effect of shewing that failure is irremediable ; for air-borne contagia must, in the nature of things, overleap all obstacles of quarantine, and prove them to be as useless as the controllable media of personal infection would prove them to be needless.

From the weight which naturally attaches to the deliberations of so learned a body of men as the delegates who met at Constantinople ; from the fact already mentioned, that their views strengthen in a very high degree the position of those countries which have never relinquished their belief in quarantine ; and especially from their conclusions having been suffered to guide hitherto the counsels of the Government of India, we can devise no better method of enquiring into the soundness of their conclusions than by following this Conference through the evidence they have collected ; examining it internally as far as the record permits, and supplementing it, where we are able to do so, with information gathered from independent sources. To do this completely and in a such manner as to escape suspicion of selecting facts for a purpose, it will be necessary to pass in review all the events which have been recorded by the delegates in illustration of the spread of cholera, in the special report prepared by the Committee, and finally adopted by the Conference ; though this will involve the risk of re-producing many wearisome details.

For the present, and for the sake of the argument, we shall admit the principle of transmissibility, passing without criticism the reasoning on which it is supported in the proceedings.

At the outset it seems desirable to draw a broad distinction between the efficacy and the practicability of complete isolation; but in arguing on facts, it is not always possible to maintain the separation, for in every instance of failure we are liable to be met by the assertion that failure has been due to remediable defects of practice, and does not, therefore, affect the principle advocated; and it is of course impossible to prove, on the bare evidence of present facts, whether other consequences would or would not have followed other antecedents. It is however none the less useful to examine the actual facts on which the Conference has founded its judgment.

It is alleged that in certain instances immunity from disease has resulted from the observance of quarantine, and to these instances we shall first direct attention. They are very few, scattered through an overwhelming list of failures, and in nearly, if not quite, all of them the conclusion is open to objections which forbid its ready acceptance. Greece, Sicily and some ports of the Black Sea and the Levant, comprise the whole with New York, which last is set forth as "confirming "in the most conclusive manner the efficacy of quarantine judi- "ciously applied against the propagation of the choleraic "scourge." The selection of New York as a typical case was unfortunate. It is true that in 1865 quarantine was very rigorously maintained against very limited sources of infection, and that the city, *in common with other ports of the United States, of whose practice we are not told,* escaped. But in the following year quarantine remained in full vigour and fuller prestige, and New York was ravaged by the disease. There is, therefore, no evidence to be found here as to the efficacy of quarantine, but a strong caution against confidence in its continued practicability.

The ship *Atlanta*, between Havre and New York, reported sixty cases of cholera and fifteen deaths. Two deaths occurred in the port. No arrangements having been in readiness for rigorous isolation, the vessel was sent to the lower bay and isolated there. Forty-two cases were subsequently sent from the ship to the Marine Hospital, of which six only died. New York escaped, as well it might when the state of things was such that six cases only out of forty-two landed were fatal. Cholera had arrived—that is, cases of the disease had moved westward in advance of the conditions which constitute and carry an epidemic, and alone their importation was powerless to determine epidemic spread.

Ships are well known to suffer under the conditions which foster the extension of cholera. It is a matter of common experience to find that at times, when the disease is only of occasional or sporadic occurrence in Calcutta, emigrant ships leaving the port are the scenes of severe outbreaks, but unaided they do not carry the disease into their places of destination. The *Atlanta* obeyed the same law. Her freight of men was heavily visited on board; but no sooner were the sick landed, than they felt the influence of a place where no epidemic state prevailed, and nearly all recovered.

Two other infected vessels arrived, the *Virginia* and the *England*, with similar events. If anything more be needed to prove that the epidemic conditions had not yet reached America, it may be found in the following paragraph from the proceedings of the Conference. Personal communication did its worst. "The *England* furnishes us with the "following cases of transmission, devoid of interpretation and "duly certified. The Pilot who took the vessel into Halifax "was attacked by cholera and returned to Portuguese Cove, "nineteen or twenty kilometres distant, where his family lived. "Five of his children had cholera one after the other, and two "died. Another Pilot of the same ship, who also returned to "Portuguese Cove, fell slightly ill, and his sister very seriously "after him. The Sanitary Officer of the Port of Halifax, who "had attended upon the passengers by the *England*, sank "under an attack of cholera."

On the voyage there had been fifty deaths in a company of 138 persons, and a very slight outbreak in the town of Halifax. Here the sick return from the ship to their families, and nothing of an epidemic kind is heard of.

In the case of Greece the question of practicability must be conceded, in so far at least as Greece proved herself able to hold all her external relations in suspension. Commercial nations will, we fear, at the best, look upon this as a very barren triumph of a principle. On the escape of this country from cholera, the Conference lays strong emphasis. The system adopted for the southern shores required all ships approaching to perform quarantine at Delos,—an island at a distance of seventy miles from the nearest point of the mainland,—with several islands interspersed. There is, therefore, no inference of arrest by quarantine in any form possible to the world at large; no illustration of efficacy which can serve the purposes of other countries.

The northern quarantine station was the Island of Sciathos. Here we are in close proximity to the town of Volo, which, as we shall presently show, escaped from other causes than quarantine; and there was at the same time exposure of this frontier inland from infected places in Thessaly, so that no protective action can be ascribed to seclusion in Sciathos. It is unfortunate that in the most signal instances of apparent protection, the information obtained by the Committee should be wanting in precision. It is stated in general terms that the country of Greece was saved from invasion, and this result is attributed to the stringency of her quarantine system; but none of the occurrences at the several ports are recorded, as has been done in most other cases, and it would seem that, from Greece, Sicily, and Samos, the general condition only of the countries as to the epidemic has been reported. This vagueness is fatal to exact comparison. It is worthy of remark that in 1854-55, Greece and Thessaly shared the same fate, and that in 1865 there were isolated outbreaks of the disease in Thessaly without the character of a wide-spread epidemic. Indeed, as we shall presently see, several importations of cholera took place in various parts of Thessaly with the result of proving that the country was, in an epidemic sense, insusceptible. From previous history, and from their being portions of the same mainland, it would be reasonable to conclude that Greece was similarly conditioned with Thessaly in 1865. In the absence of information, this is no more than a natural conjecture, throwing doubt on the protective agency of the quarantine system.

With regard to Sicily, it is equally difficult to believe that the very rigorous quarantine laws were effectual in practice, for we have it on the authority of a Return to an order of the House of Commons "for information on the laws of quarantine "obtained by the Board of Trade, dated 18th August 1860, "as a well known fact that while a strict quarantine was often "imposed by Sicily or Malta, smuggling was going on all the "while." Dr. John Davy was the author of this passage in "the Return."

Of the events in Samos we are only told that the island was saved by the adoption of the same system as that of Greece, and was surrounded by choleraic foci.

We desire to write in no spirit of controversy, but it is obvious that deficiencies of the records are responsible for the doubt from which at present it is not possible to escape, and

that to establish the fact of exception to so general a law as the failure of quarantine has proved to be, requires evidence the most minute and exact. The only specific information furnished relates to the deaths from cholera in the Greek quarantine stations. It shews that they were numerous in them; neither were the objections due to concentration of disease wanting here, nor was any immunity secured to those who had come from infected places. There is moreover, some little confusion of dates tending further to impair confidence in the reports of these countries, which, though belonging strictly to the accounts from Volo and Larissa, is of importance with regard to the alleged escape of Greece. After details of the events at the former place, including the infection of villages in its neighbourhood in August and September, it is stated in the proceedings that Larissa, *as well as all Thessaly*, had "en-"joyed perfect health until the end of November."

Concerning the town of Volo, for which credit of exemption by quarantine is claimed, the facts are these. Ships arrived with foul bills of health. From two of them alone 1,649 passengers underwent quarantine in tents. Sixty-two cases of cholera occurred in the lazaret. The doctor of the lazaret being attacked, fled into the town, but no result followed, and a writer in the Health Office was attacked beyond the limit of the lazaret. Forty-two days later, disease was again imported into Volo from the adjacent villages, where there had been 32 deaths in a population of 1,051 inhabitants, but there was no extension of it. It began and ended with the one man who came sick into the place. Similarly, from the Parliamentary Report, we learn of Volo that "between April 1855 and April 1859, twenty-three cases of "cholera were admitted into the lazaret; no other case of sick-"ness or death occurred, nor any instance of the spreading of "disease."

It seems difficult to draw from these facts any inference other than that the conditions necessary for the reception of epidemic cholera did not exist in Volo at the time. To infer that quarantine was protective when not only was it violated by a public officer who carried the disease into the town, but when actual importation took place also from another source without leading to infection, is scarcely reasonable.

A similar train of events occurred in Thessaly close at hand. Some two months later, there came into Larissa, from the Province of Monastir, where cholera existed, between

three and four hundred Bulgarians. "Cholera," says the report, "appeared at Larissa simultaneously with their arrival. "From the 5th to the 15th of December there were 18 cases, "seven of which ended in death. The Bulgarians came from "an infected country, and they furnished the greater number "of cases; the others were persons inhabiting the same quar- "ter and living in houses close by the dwellings of the Bul- "garians. The disease ceased with the departure of these "foreigners, who took to flight." Surely there was the same want of receptivity here as in Volo; the same disproof of immunity after previous exposure.

In summing up the evidence, and commenting on the mischievous effects of misconstructed and misplaced lazarets, the Committee find that the case of Salonica is opposed to their general conclusion, as, notwithstanding its prominent defects, the town escaped infection. They say:—"We note a "circumstance, however, in the case of Salonica, where the "lazaretto, before the construction of the huts, labored under "even still more unfavorable conditions than those men- "tioned above. The over-crowding was greater, and the "number of cholera patients more considerable here than "elsewhere. Yet the town was spared. *Might not this be "one of those cases of local immunity observed in all epidemics, "though their true cause is inexplicable?* What tends to make "one think so is that cholera penetrated into some villages "of the interior, such as Galatzita, where it prevailed abund- "antly without touching the town, which was greatly more "exposed to the focus alongside it. The three cases observed "in the town, the persons attacked having come out of the laza- "retto, support this hypothesis." It is not surprising after this that the Conference should have been charged, as they have been with forcing their facts into accordance with foregone conclusions. At Volo and at Salonica trains of events are seen which are the exact counterpart the one of the other; even accident conspires to enforce the identity, for the same number of infected cases appear in the protected places, three in each. In the one case the quarantine adopted is the approved process of the Conference, and the escape of the town is its accepted consequence; in the other the system is bad and, the result being the same as before, it is conjectured to have arisen out of local causes.

The cases of Rhodes and Crete come next as examples of quarantine success. At Rhodes 2,618 persons were detained

in the course of two months. They were, for the most part, under canvas in favorable circumstances. One of the people in the quarantine station, who had landed the day before from an Egyptian ship from Alexandria, which had had no cholera on board, fell sick of cholera and died the same day. The other passengers by this ship, 86 in number, were removed elsewhere under tents, and completed ten days of quarantine without accident. It was the only case of cholera observed at Rhodes during the period of quarantine, according to the Conference; but, in the Appendix to the 8th Report of the Medical Officer to the Privy Council, Dr. Radcliffe states, on the authority of H. M.'s Consul, that "a suspected case was re- "ported in the town, the patient having arrived from Alexandria "a month previously." How far these facts tend to prove the local origin of the cases, as distinguished from their importation, we are not now concerned to enquire; but they shew clearly that town and lazaret were similarly situated as to non-receptivity, a position greatly strengthened by the previous history of the island. In the Parliamentary Return already quoted, dated 1830, we read: "Since 1838, when Rhodes was erected into "a Central Health Office, no disease, for which quarantine is "liable to be imposed, has occurred in the island." "And again, "during the five years, 1854 to 1858, 1,755 persons were re- "ceived into the lazaret from fear of plague or cholera. "Among the entire number received, not a single instance of "fresh sickness occurred."

Crete received one hundred and three ships, with foul bills of health, coming from Egypt, Smyrna, and Constantinople. The crews were 843 in number, the passengers 972. Of these 184 performed quarantine on board, and 788 on three islets, where huts had been erected and encampments prepared. The supervision was strict. No communication was allowed between the islets, which were situated "at a certain distance" from each other. Two ships only brought cholera cases with them. Three others had cases on board during the voyage, "*but without any ulterior results.*" Among the passengers of the first two, cholera developed itself during the quarantine: there were altogether thirteen cases only, and nine deaths. The Conference remark—"What deserves special mention here is the fact that "not only did cholera not penetrate into the Island of Crete, but "that no case occurred among any batches of passengers other "than those of the two ships which had brought cholera patients "with them. The reason of this is that the passengers of the

"two vessels underwent quarantine separately in two islets in "the Gulf of the Suda, the two islets being very distant from "each other, and having no communication with each other or "with the main island. The Cretans knew how to profit by "the experience which had saved their country in previous "epidemics."

The cases of Rhodes and Crete are held by the Conference in proof that assemblage in lazaret of persons from an infected place does not tend to extend the disease among those so confined, and thus to get rid of a leading objection to quarantine. For this purpose they are completely overpowered by a multitude of instances of an opposite kind, if the bare facts of disease and no disease in the lazarets are isolated from their attendant circumstances and regarded as evidence. The conclusion to which under careful analysis these cases appear to point is this, that groups of persons arrived at places enjoying at the time, from local or other causes, the conditions of immunity, and this immunity they shared with the people of the place. Lazarets were so contrived as to admit of their sharing this advantage, and their inmates neither acquired nor transmitted the epidemic. It was otherwise at Salonica. Local immunity was there, but the state of the lazaret effectually thwarted its action. The arrivals contracted disease freely from their infected members for the lazaret was crowded and insalubrious; but they did not transmit it to the neighbourhood which was insusceptible, though they sent some cases to the town. Regarded by the Conference as illustrations of importation checked by quarantine, Salonica and the islands are in a direct antagonism. Regarded as illustrating the results of local conditions, they are pointedly concurrent. That the towns did not owe their exemption to wholesale isolation is clear, as the quarantine stations were, in an epidemic sense, exempt, without such isolation in Rhodes and Crete; and the towns of Volo and Salonica were exempt where isolation was violated. So long as the general conditions of receptivity were wanting, it would seem that the only useful element of quarantine acted with full effect; that is, where the person infected was watched and prevented from infecting his neighbours, all went with the mass. But though adopted in some quarantine stations, this practice is not peculiar to them, nor does it render their existence necessary or desirable. Dr. Radcliffe tells us that the same thing was done in the town of Salonica—(Report to Privy Council.) He says:—"Her Majesty's Consul reports that a Turk,

"after being detained fourteen days in quarantine, was attacked "with cholera in his own house, and died. His wife, who had "attended him during his illness, and had not been in the "lazaretto, was also seized with the disease, and died. A third "person living in the same house was likewise attacked. "The house was isolated, the inmates removed into other "houses, and the malady did not spread further." Here are the circumstances of the Cretan quarantine station repeated in a town, and the results are the same. Similar practice was adopted in other lazarets and other towns. The case of Porto, after choleraic arrival from Elvas on the Spanish frontier, and those of several towns in Northern Italy, may be cited.

The course of events at Samsoun and Bourgas, the other instances of alleged exemption under quarantine, was the same; but we should scarcely have expected to find the name of Bourgas in the list, as the quarantine there was of a character elsewhere condemned by the Conference as insufficient. It lasted only three days. Moreover, one man died in the town after being admitted to pratique, yet cholera did not spread.

At Benghazi one case was landed. None occurred in the lazaret or town.

At Mitylene two cases occurred on board the ships in quarantine; none in lazaret or town. We obtain from the Parliamentary Return of 1860, some insight into the previous history of Mitylene:—"Since 1854, when cholera was in the "Levant, no arrivals have been quarantined. About August "1850, four persons, who had just returned from Asia Minor, "were attacked with cholera in the village of Sanmarino, about "five miles from the town. One died with all the symptoms "of Asiatic cholera; the three recovered. It is generally "believed that in 1853 there was one case of cholera in this "town." So much for the receptivity of Mitylene.

The cases of Valona and La Cavalla were the same. Sinope and Batoum, Varna and Scio, are also named in the proceedings as exempted places, but unfortunately without particulars. Of Scio we gather from the Parliamentay Return of 1860 some previous details:—"Although during the last 25 years "numerous vessels have arrived here with cholera on board, "and the sick have been landed at the lazaret, no case, either "of that or any other contagious disease, has ever occurred "among the population."

In estimating the bearing of the cases of minor ports on the *practicability* of maritime quarantine, it is necessary to draw

a broad distinction between those at which vessels merely touch in passing, and those which are ports of final destination; for it is clear that in the former class the inducements to the evasion of quarantine laws will not exist as in the latter. These inducements are obviously entitled to the prominence given to them in the Privy Council Reports, as dominant influences against the possibility of quarantine on a large scale, or in places of large commercial intercourse; and it is unreasonable to infer, from any apparent success of quarantine at mere ports of call, that it can be carried out in places differentiy circumstanced. This point, notwithstanding its manifest importance, does not seem to have attracted the notice of the Conference.

We have in the foregoing paragraphs, carefully transcribed from the published proceedings of the Conference, every example of alleged protection by quarantine, and, examining them by the internal evidence of the record itself, and of other authorities of equal value, have found ourselves driven from the conclusion arrived at by the Conference as to the efficacy of isolation. Argument of contagion from negative results alone, in such a case as this, must be open to objection as soon as it becomes clear that two factors at least are necessary to ensure a positive issue, either of which may have been absent or inoperative when the event is wanting. External evidence becomes indispensable to shew which of the two is in abeyance, and such evidence is plentiful in the case before us. Granting the transmissibility of cholera, the imparting agency has been forthcoming; but there has not been epidemic transmission. A condition of non-receptivity is thus made evident. We do not pretend to define this condition, nor even to indicate the whole of its component elements; but we cannot, even at this stage of the enquiry, conceive it possible to doubt its existence, or its influence in determining whether the disease imported into a place shall take the form of a deadly epidemic, or shall be kept within the narrow limits which ordinary care may impose on the action of personal contagia.

It is evident that in the result of non-reception, as above exemplified, isolation has had no part; for where it was, and where it was not effected, the result was the same. Where lazarets were well-placed and well-designed and managed, infected arrivals participated in the exemption which the neighbourhood enjoyed; where they were otherwise, infection spread within, but not beyond them. Some, therefore, of the conditions

of infection and escape are demonstrable, though not all. Sanitary management in places visited by cholera has not always been successful, nor has the neglect of it been everywhere deadly. Infected arrivals favorably situated in quarantine have been precisely in the position now familiar to Indian experience, in the practice of *camping out* troops and prisoners where barracks and jails are infected,—a practice often, but by no means uniformly, successful. Whether the result depends in this case also on the presence or absence of epidemic influence, is a great question for future enquiry, on which the events of 1867 in Northern India, may throw no small light.

So far, then, as we have yet advanced, the facts on record sustain no inference either of reduced liability to disease among those who have come from infected places, or of the efficacy of quarantine. Arranged to support these doctrines, they are irreconcileable with each other, and exceptions at once appear to the law which it is sought to establish. Under the conclusion now indicated, there is nothing that needs to be reconciled about them, but in every case the same cause and effect cling closely and consistently together.

Having thus been inductively led up through a limited class of cases to an hypothesis of local preservation against disease by causes other than isolation, we are in a position to try if it be a law, by applying it to the much larger number of instances in which the epidemics of 1865 did extend from place to place. Having regard to the great importance of this law, and to the consideration that, ifestablished, it is subversive of the position of the Conference, we shall be careful to omit mention of no place which is brought foward in their Report to support their view, for the purpose, as before, of guarding against suspicion of overlooking cases adverse to the conclusion: and we shall again adduce from other public records whatever facts and opinions appear to assist the enquiry.

To establish our position, it is necessary to shew that where choleraic arrivals have appeared to impart an epidemic to the place of arrival, they have themselves suffered in a similar manner; as we have alredy seen that their escape has accompanied the escape of the several exempted ports. The relative numbers of cases in the lazarets and towns will be the data of calculation, wherever they are obtainable; and inasmuch as the populations of the lazarets fluctuate from day to day, the same inmates remaining only for a few days, they can be rightly compared with

the fixed populations of towns only by ascertaining the mean daily numbers present in the lazaret as the base of the proportion. In the Report which forms the annexure to the Ninth Minute of the Conference, but is published in India separately from the volume of proceedings, a numerical comparison of cases of cholera in towns and lazarets is instituted for the purpose of proving the exemption of persons previously exposed to infection; but it is so conducted as to be fallacious. The gross numbers of persons who passed through certain lazarets are taken, and the toal number of cases of cholera which occurred within their walls. These are brought into relation, and the resultant figure is called the percentage of cholera cases in the lazaret, and is used for comparison with the rate reckoned on the fixed population of the adjoining town, notwithstanding that many of the persons remained in lazaret only five days, none of them more than ten, and all as they passed out contributed to swell the population of the town. The erroneousness of this method is too obvious to require demonstration, but as it is made the basis of a prominent argument it is necessary to notice it here.

The circumstances of the several ports vary so much in their details, that no figures can be even approximately true, which do not in some degree represent these differences. Each case must therefore be separately examined before its figures can be accepted, or the totals will be mere aggregates with nothing of totality in their nature, and the ratios mere fictions. With the utmost care an appoximation is the best result that can be hoped for from the records as yet published. A mean daily number is absolutely exact as the basis of ratio, where the contingency to be calculated is due to causes arising within the place itself, and not imported from without. By every case of imported disease accuracy is in some degree impaired; and to clear the present reckoning to the utmost from fallacy, those cases of disease only should be taken into consideration which arise within the lazaret. With this precaution there will still remain a source of error in the influence of imported cases on the residents, which cannot be eliminated; but error will be reduced to a minimum.

Starting from Alexandria as the centre from which the epidemic spread westward, the Conference first notice the invasion of Constantinople, which introduces no question of quarantine, and then proceed to the case of *Dardanelles*.

There is no daily record of events in the lazarets from which alone a perfect estimate of mean numbers could be made, but

we are told that the numbr of persons who performed quarantine at Dardanelles, between 29th June and 15th September, was 3,058. This number, multiplied by the average, number of days passed by persons in the place (the mean, that is, of 5 and 10 or 7·5), will yield a figure representing the total number of persons present for one day, which again divided by the total number of days will give an approximate daily mean. Calculating in this manner, we arrive at 8 per cent. as the proportion of seizures in quarantine, there having been 22 cases of cholera in the lazaret. In the town of Dardanelles, again, containing 8,000 souls, there were 550 attacks, or 7 per cent. But from this population it is said that there were 2,000 fugitives. At what period the flight took place we do not know; but if the whole number be deducted from the first day, the ratio will only rise to 9 per cent. It is more accurate to avoid this deduction, as in the population of the lazaret there are included the crews of the ships who performed quarantine on board. The inclusion of fugitives in the town, therefore, improves the parallel.

The events at Dardanelles are thus described in Dr. Radcliffe's Report to the Privy Council:—"Aggravated mortality in the "lazaret itself, and propagation of disease beyond the walls."

At *Enos* a small group of cases occurred, but there was no ground whatever for concluding that they were in any way connected with the shipping in quarantine, among which no sickness had occurred; nor is any such conclusion intimated by the Conference. There is, therefore, no question of quarantine raised.

La Cavalla is one of the towns mentioned as illustrating the value of quarantine restrictions, but the events appear to lead to an opposite conclusion. There was no spread of disease from sick to healthy in the lazaret, nor in the town. The quarantine arrangements were such that persons landing without sickness might continue without sickness; and in common with the neighbourhood, they did so. But the fact which converts the arguments from the form given to it by the Conference, is, that the town was at the same time exposed to infection from a place in inland communication with it at six miles distance, where there were local conditions of disease; for 52 persons died of cholera in a population of 2,500.

Salonica and *Volo* have already been mentioned in speaking of the question of exemption. In the former case, no extension of disease took place to the town, notwithstanding the passing into it of three cases of cholera; but there was heavy

mortality in the crowded unhealthy lazarets. The local conditions of the lazarets frustrated those of the neighbourhood, and the history of Salonica presents no exception to the law which has governed other cases.

Larissa.—Here also the events have already received notice. They offer no illustration of the present question.

Of *Smyrna* there is sufficient information to shew that the town and lazaret suffered alike. From 23rd June to 24th October, 1,701 persons passed through the lazaret. The period of detention is not laid down, and a mean daily number cannot therefore be deduced, but it must clearly be very small. Nevertheless the Conference enumerate 19 cases and 11 deaths (the first statement in the Section of 14 cases and 9 deaths seems due to an oversight) among them. In the town it is said that about 5 per cent. of the population were seized. This population, however, as estimated with a close insight into its component classes by Dr. Radcliffe, would yield a smaller proportion, by 50 per cent. than that recorded by the Conference.

Mitylene, *Rhodes*, *Crete*, and *Benghazi* having escaped the epidemic, have no bearing on the present question. They have been already examined.

Cyprus.—Calculation made as in the case of Dardanelles yields a rate of seizures of 4·5 per cent. in the lazaret, and 5·5 in the town of Larnaca. In the latter the population was reduced by flight from 12,000 to 4,000, according to the Committee. The mean, or 8,000, has been taken.

Mersina was infected from an inland source. There were no cases on board the ships or in the lazaret. The infection was partial in the town, in an "unhealthy quarter under "very unfavorable hygienic conditions." No numbers are given.

Alexandretta.—Two cases were landed in the lazaret: no others occurred in quarantine or in town, connected with this importation. The town, it is said, was subsequently infected from an inland source.

At *Beyrout* there arrived from Alexandria, between 17th and 25th July, 3,600 passengers and 950 sailors, in 50 ships: in all 4,550 persons. Thirty attacks of cholera took place in quarantine, or 3·5 per cent. on the mean daily number detained. In the town, with a mean population of 50,000, there were 1,500 seizures, or 3 per cent. nearly. The lazaret is described as "isolated and well ventilated, but crowded, and consequently communication took place between the different classes of persons in quarantine."

Aleppo, *Jerusalem*, *Damascus*, and *Mesopotamia* come next in order in the Report. They afford no evidence on quarantine.

The town of *Samsoun* escaped with only two doubtful cases. There were 56 vessels in quarantine, with 3,170 passengers and 1,960 sailors. From eight of these sick men and corpses were landed. The ships had been severely visited before arrival. It would seem that at this place, the number of vessels subjected only to short quarantine was so greatly in excess that a mean number of days would lead to error. Fortunately, the highest number in the lazaret at one time is stated at 853; but notwithstanding that 18 cases of cholera and 12 corpses were landed, there occurred only six seizures subsequently. The sick were removed to a cholera hospital at a distance, but a portion of the lazaret was "a few yards from the Government House." None of the employés about the lazaret were affected, nor was the town, except as above stated.

From *Trebizand* we have not sufficient particulars for comparison. The general facts are, that a crowded lazaret, situated close to a town, exhibited high mortality among its inmates; and though the town population is not given, it would seem, from the small number of cholera cases mentioned (46) that the death-rate fell far short of that in the lazaret. In a report from Mr. Consul Stevens, dated 2nd August, we find that "among the Circassians, about 1,200 in "number, encamped close to the suburbs, 50 deaths daily "had been occasioned by the disease for ten days back." Although the report of the Conference extends over the period included in this note, it makes no allusion to this heavy mortality.

At *Erzeroum* nothing occurred which bears on quarantine. Of *Sinope*, *Batoum*, and *Varna*, we have no particulars, although the first is placed by the Conference among proofs of the efficacy of quarantine. *Bourgas* received 186 vessels with 1,718 sailors, and three cases of cholera. The quarantine lasted for only three clear days. It was, therefore, of a character elsewhere condemned by the Conference. Yet it is brought forward in support of the efficacy of isolation. One thousand and ninety-six persons underwent quarantine. Only two cases of cholera arose in the lazaret: one man died in the town after being admitted to pratique, and some cases of "cholerine" took place. The occurrences in town and lazaret were identical.

At *Kustenjie* we are unable to draw comparison of town and lazaret. From the facts recorded we are left to conclude that quarantine, which lasted only three days, had come to an end before the town was infected.

Sulina.—Here 387 vessels arrived, carrying 865 passengers and 7,983 sailors. Thirty cases of cholera were said to have occurred on broad. No disease appeared on shore, either in quarantine or elsewhere until after the arrival of a Turkish war steamer on 30th July, the *Esseri Jedid*, from Constantinople. Among her crew, five cases out of twelve ended fatally on 30th and 31st July. The greatest number of persons present together in the lazaret was 73. Even admitting this as a mean number, the percentage was very high, fully equal to that which prevailed in the town, from whence it is traced by the Committee to the neighbouring villages. The authority on which this statement rests is not given, and we cannot avoid contrasting with it the authenticated narrative furnished by Mr. Radcliffe to the Privy Council, which runs thus: "Dr. "Jellinck, the Medical Officer in charge of the Navigation "Hospital, in a report to Major Stokes, the British Commis- "sioner on the Danube, dated 17th October 1865, states that "on the 30th July, a Turkish Steam Transport arrived in the "road-stead of Sulina from Constantinople, having on board a "crew for one of the iron-plated gun-boats in that harbour. "The transport had lost two men from cholera on the passage. "The men disembarked were immediately quartered in an "isolated house. On 1st August, Dr. Jellinck was invited by "the Quarantine Doctor to visit these men, and among them he "recognised two incontestable cases of cholera, both of which "ended fatally the following night. On the morning of the "2nd August, he observed among a group of workmen *who "were encamped on the opposite side of the town*, about a mile "from the lazaretto, a man affected with all the symptoms "of cholera. During the afternoon of the same day another "case was discovered, the patient being a man employed in "the Lieutenant-Governor's Office. These cases also proved "fatal. From this date the epidemic spread rapidly. The "manner in which the epidemic showed itself," writes Dr. Jellinck, "as described above, shews pretty clearly the useless- "ness of the quarantine against its extension. * * * Never- "theless we were obliged to endure the inconvenience of a "complete exclusion; commerce was checked; the navigation "suffered enormously; every ship was taxed to no inconsider-

"able extent for guards, &c. The same scene was repeated with "the same want of success at Tultcha, Galatz, and Ibralia, "whilst the epidemic advanced constantly, and attacked places "situated in the interior of the river-bordering countries."

Dr. Jellinck admits that the arrival of the Turkish steamer was the signal for the outbreak, but specially notices the fact of its appearing at a distance from the quarantine station, and among persons who "had come from Galatz to Sulina, and "who, it was well known, had not been in contact with the "cases in quarantine."

At *Toultcha* we are merely told by the Conference that the sailors performing quarantine in the river suffered heavily as did the towns-people. No figures are given.

At *Roustchouk* the disease is represented as having been received overland from Kustendji. No question of quarantine arises.

At *Vidin* similarly, no comparison can be drawn, the quarantine being nominal.

At *Valona* twenty-two ships arrived from infected places. On board one of them, twelve passengers had died during the voyage; 416 were landed, of whom five were sick; one of them died the next day. All were advantageously situated on shore during a quarantine of ten days. The sick recovered; the town escaped. One case only occurred among the détenûs on the day when pratique was granted.

Gallipoli, Echelle, Neuve, Chio, Adalia, Akaya, and *Durazzo,* are next mentioned as exempt, notwithstanding the arrival of many vessels from infected places, of which, however, it is added, "the greater number came from Constantinople, "Smyrna, and Alexandria, places essentially compromised; "but no cases of choleraic disease occurred on board either "on arrival or during the voyage." Mr. Radcliffe tells us that Gallipoli was included among infected places, but no particulars are given.

The town of *Odessa,* according to the Conference, "felt the "first attacks of the epidemic which was prevailing at Con- "stantinople towards the middle of July. From 14th to 17th "of this month, four cases of sporadic cholera were observed "here, one of them ending in death. It was not till between "the 11th and 16th, that fresh germs of the disease were im- "ported by two ships from Constantinople." There is probably some confusion of dates here, or typographical error. Four cases of disease distributed over a period which includes the

alleged date of importation of the epidemic, would scarcely be distinguished as "sporadic," unless it were desired to establish the fact of importation by ignoring the previous existence of epidemic elements. From the official reports of the Russian Government we learn that "*at the commencement of May* "(on the 2nd, 3rd, 4th, and 5th days), four cases of sporadic "cholera occurred in Odessa, of which one died. From 29th "July, cases presenting all the symptoms of epidemic cholera "were received into the lazaret of that port from vessels of "different kinds which arrived from Constantinople. On 6th "August the first case of epidemic cholera was recognized in "the city."

There are discrepancies, also, of minor importance, in the dates of the subsequent cases. No numbers are furnished of persons in the lazaret, but we gather from the Russian source that 16 persons were attacked in the lazaret, and 236 in the city and hospital, the latter being situated at a distance. This points to the fact that town and lazaret fared alike, and the narratives are mutually corroborative in this respect, which is the immediate issue; but, considered in their relation to the question of importation, the pointed statements of the Russian reports concerning the unusual previous mortality in Odessa, and of the appearance of cholera in May, are full of significance.

The case of *Greece*, the next in the list, has been already noticed.

Trieste was but slightly visited, and a few cases occurred in quarantine; but it does not appear whether the disease is to be regarded as received overland or by sea, though the Conference feel justified in concluding that the dates of occurrence, inexact as they are, connect the disease with the vessels.

Italy.—Here the first case on record occurred at Ancona, but the manner in which the disease was imported, if imported at all, is left undefined. The Conference state that no one had been attacked in the lazaret, and they accept a rumour, without giving the evidence on which it rests, that the first case occurred in the person of a washerwoman who had removed some clothes belonging to passengers from Egypt. The date of this is said to have been the 7th July, after arrival of the steamer *Principe Carignano*—how long after, we are not told; but we learn from the Privy Council report that this vessel arrived on the 17th June, all on board having enjoyed good health; and that she had been put in quarantine, as a

passenger came on board at Messina, who had suffered from a choleraic attack in the lazaret there. Mr. Radcliffe quotes the following additional fact from a letter of H. M.'s Chargé d'Affaires at Florence, dated 15th July 1865: "A woman who "arrived at Ancona from Alexandria on the 3rd instant, re-"mained at the lazaretto of that place, in conformity with "quarantine regulations, for the space of six days. She left the "lazaretto on the 9th, was taken ill on the 10th, while travelling "towards Pistoja, where she died on the following day with all "the known symptoms of Asiatic cholera." And from a note by Dr. Webster, F. R. S., "two persons who had come from "Egypt were affected with cholera in the lazaretto of Ancona, "but recovered; while it is further said that other cases of the "malady had occurred near, but outside the lazaretto, which "were, however, considered as sporadic and exceptional."

"It is proper to add," says Mr. Radcliffe, from whose report the foregoing passages are extracted, "that Professor Ghinozzi, "who made an official investigation of the outbreak, believes "that it would have occurred even if no communication with "Alexandria had taken place."

With this conflicting testimony, it is not easy to draw a conclusion of the manner in which Ancona became infected. There is no information as to the previous state of public health in the place, to throw light on the question of importation having taken place in the manner intimated by the Conference; and as we are equally uninformed of the situation, construction, and population of the lazaret, we are unable to compare its condition with that of the town. Indeed, it is not clear whether the lazaret was inhabited at all after the disease commenced. The woman mentioned above had completed her quarantine and been discharged.

The history of the subsequent spread of cholera in Italy is full of important evidence on the results of arrest by the care of individual cases and small groups; by measures, that is, which are in the category of sanitary and medical treatment; although perhaps the practice of isolating cases and houses in towns may be claimed by the advocates of quarantine and lazarets as a part and illustration of their system. "Thus" say the Conference, "the first case imported into Milan was followed by no consequences." The same thing happened at Pistoja and Ravenna. "At Bologna the germ was imported on several occasions, but *receded before measures applied with tenacity and perseverance by the Sanitary authorities*." The tale

was repeated at Modena, and Acqui, and other places in Piedmont, according to Dr. Milroy, who observes: "Nowhere in the Northern Provinces did the disease become fairly epidemic; whereas in numerous towns in the Provinces of Capitanata, Terra di Bari, and Otranto to the south, it raged with great violence, although there was very much less intercourse with Ancona in this direction than towards the more busy and populous towns in the north of the Peninsula.

Marseilles.—From France we can gather little that bears on the question of quarantine. It is clear that the disease, whether of local origin or imported from Alexandria, preceded by some time all official recognition of an epidemic. Its commencement is traced back as far as the 9th June. Infected vessels are said to have arrived from Alexandria, which port they had left on 1st June. No figures are given for comparison of events in lazaret and town.

Spain.—It is to be regretted that in a country where quarantine restrictions are carried out with the utmost severity, there should be difficulty in obtaining historical information. Yet this peculiarity has been recorded of Spain from the time when questions of public health first attracted attention; and it appears to be in some degree the characteristic of all countries in which an exclusionist policy is maintained. Concerning the introduction of cholera into Valencia, the Conference afford no information, but that it was imported by one Honorè Teissier, a French merchant, who had come from Alexandria *viâ* Marseilles. Even this seems conjectural only, for it is added: "We are all the more justified in supposing that "cholera was imported by him or his baggage, that the victims "who were carried off in succession all inhabited the same house. "Of the lazaretto we learn only that Valencia having no la- "zaret, one was improvised when the quarantine regulations "were strictly observed." The only conclusion supported by this imperfect record is that quarantine was ineffectual.

With the other towns of Spain, there is similar absence of details relating to quarantine. Of Palma it is recorded that "the disease spread to all the other localities in the environs of "the town, in spite of the establishment of sanitary cordons." Carthagena and Murcia, Seville, Barcelona, and Madrid, yield no information. The Conference remark generally of the practice adopted, that "the quarantine for choleraic arrivals "lasted from three to five days in those towns of Spain where "temporary lazarets had been improvised, but a strict quaran-

"tine was observed, according to the Spanish law, in the ports "of Vigo, Cadiz, and Mahon, which were provided with suitable "establishments. The proper measures, however, were not "strictly observed everywhere." The latter supposition is well suited to the explanation of the failure of quarantine, but at variance with the characters of the system in Spain, well known as they are, and often brought unfavorably into notice, on account of their severity, by Dr. Milroy. The entire account of the choleraic invasion of Spain, as given by the Conference, is composed of loose, indefinite, or doubtful statements, shewing that they succeeded no further than former enquirers, in eliciting exact information from that country.

Portugal was invaded through its Spanish frontier. No question of quarantine was illustrated, as in Northern Italy, unless the arrest of disease by isolation of houses and cases be held to uphold the credit of general quarantine.

Malta.—Here the Conference make no attempt to define the manner of introduction with precision. They show that suspicious arrivals preceded the official recognition of the disease, but that it did not shew itself until six days after quarantine had been enforced. They ignore the previous state of public health in the island, and make no mention of the character of the buildings in which cholera first appeared; nor do they give any statistics of mortality in the lazaret.

We are fortunately provided from other sources with the fullest details regarding both Malta and Gibraltar. In the report of Surgeons Adams and Welch of H. M.'s 22nd Regiment, quoted by Dr. Milroy, we read: "Between 14th June, the date "of the establishment of quarantine, and 5th July, upwards of "1,500 persons from Alexandria were landed and confined in "the lazaret, which, besides being badly ventilated and infested "with offensive smells, was the scene of much crowding, dis- "comfort, and wretchedness. The first cases of actual cholera "in this building occurred on 28th June, and were received "from the *Wyvern*, just arrived from Alexandria; but prior to "that date, several cases of choleraic diarrhœa had taken place "among the inmates. Already, however, the disease had "broken out unmistakeably in the immediate neighbourhood, but "outside of the lazaret, and about two hundred yards distant "from it, in a number of small houses that were formerly used "as a plague hospital, and were at the time inhabited by "soldiers' wives and their families. The atmosphere of this "confined locality was most offensive, and the people had

"frequently complained of the great unwholesomeness of the place. "The lazaret, too, was no better; for there, as far back as May "20th, several of the military, who then occupied the building, "had been attacked with severe diarrhœa, which the patients "themselves attributed to the disgusting effluvia from the "latrines."

From the valuable report of Dr. Sutherland (presented to both Houses of Parliament, 1867), we learn that there occurred in the lazaret 23 cases of cholera and 14 deaths, and of diarrhœa 17 cases. During forty-eight days there were admitted into the lazaret 2,031 passengers. Allowing a detention of seven days to each, a mean daily number of 296 is obtained, and a rate of cholera seizures of 7·6 per cent. Of the cities within the garrison, the population was 53,316, and the cases 979, or 1·8 per cent. Of the towns and villages outside the garrison, the population was 64,019, and the cases 1,280, or 2 per cent. very nearly. The attacks among soldiers were 2 per cent of their number, of their wives 9 per cent., of their children 3 per cent. Here was excessive mortality in the lazaret again as at Salonica, corresponding with the known conditions of insalubrity. Dr. Sutherland fully confirms Dr. Milroy's description of the quarantine buildings, and says "there are within them local causes suffi- "cient to have brought the disease into existence among suscep- "tible persons, quite apart from any question of importation."

The same writer investigates with extreme care and penetration the state of public health in Malta prior to the appearance of the epidemic,—a topic untouched by the Conference. He alludes to the belief in personal communication of cholera existing among influential persons in the island, as an obstacle to sanitary improvement and criticizes the evidence advanced in support of the belief in Malta and Gozo. "The first "important fact is," he says, "that when compared with the "whole number of instances in which cholera appeared with- "out even suspected communication, the whole number of "alleged cases of communication would scarcely make a frac- "tional difference in the history of the epidemic; and if they "were all expunged, they would make no difference in the law "of progress of the disease, as shewn by the statistical facts "already given." And though not professing to carry his argument against quarantine beyond the strict scope of his report, which was to shew that the prospect of escaping epidemics in Malta lay in sanitary improvment, and not in restricted intercourse, he adduces abundant ground for the opinion which he does not conceal, that the cholera of 1865 was of indigenous origin in Malta, and that through the same year "quarantine did not arrest the progress of cholera over Europe."

Were it our purpose here to discuss the communicability of the disease and the manner of its spread, it would be easy to shew the close accord which exists between Dr. Sutherland's position and the fact now abundantly demonstrated, that the inmates of quarantine stations have met with a fate determined by the conditions of the place at which they landed. Moreover, with regard to the great argument of importation drawn from the dates of infected arrivals, finding that in those places where the most exact knowledge is afforded from other sources, evidence is brought forward tending strongly against the assertions of the Conference, it would be at least pardonable to hesitate before accepting their accounts of places of which they are our only informants.

Gozo.—The outbreak at Gozo again, illustrates no question of quarantine. It did not commence until a month after Malta had been infected. It is traced to communication through the person of Michael Cilia, who arrived from Malta, by boat, suffering from diarrhœa, on 21st July. Not a word is said of the filthy house into which he came, nor of the fact that between the 20th June and 21st July, some 220 boats and 800 passengers had passed between Malta and Gozo without any result. The several cases, as they occurred in succession, are put forward by the Conference in such manner as to indicate the agency of communication. Dr. Sutherland, however, recording all the events with singular minuteness, after visiting every room of every house involved, shews that "out of four simul- "taneous cases which constituted the first outbreak of the "disease, one took place a long way from the house supposed "to have been the focus, and without any communication, "and that one-half of the 16 cases had no communication "with Cilia's case, or with any other;" and with a closely consistent argument he connects the outbreak here, as in Malta, with the crowded insalubrious dwelling of the place.

Gibraltar.—Here the facts allow no comparison of quarantine station and town. On the authority of Inspector-General Rutherford, the disease is traced to the arrival of the 2nd Battalion, 22nd Foot, from Malta, on 10th July. The men, however, had had nothing approaching to cholera among them

previously to departure, and their good health remained unbroken up to the 18th, except by a single case of slight diarrhœa. On the 18th a soldier fell ill of cholera and died. The wing to which he belonged *embarked on board the "Star of India," and reached Mauritius without accident.* The other wing remained in health till 31st July, having been removed to a great distance from the first camp. On the 31st a fatal case occurred, followed immediately by another. The wing embarked at once, and also *reached Mauritius without accident.* But the disease remained and spread in Gibraltar.

It would seem difficult to arrange facts more pointedly for proof that the cause of disease was on shore, and not brought there by the troops; yet the Conference arguing, it must be supposed, on the evidence of dates, are satisfied of its importation. They apparently anticipate objection from the fact of the Battalion having been in perfect health before and after leaving Malta, for it is added: "On the 5th and 6th July, "the day of embarkation, cholera was raging at Malta, in "an outer fort close to the place of embarkation;" and they stated that the troops on arrival were encamped on a very healthy spot named North Front, between the north of the Rock and Spanish territory. Both of these statements, which compose the entire evidence of importation of cholera, are overthrown by Dr. Sutherland (Report to Parliament). Of the events before embarkation at Malta he writes: "The regiment "moved from Pembroke Camp on the 5th July. It marched "through Floriana without passing near any locality where "there was cholera, and embarked on board the *Orontis*, which "was lying off the Hay wharf in the quarantine harbour It "was at one time thought that possibly the regiment might "have become infected from having been embarked near a "place where there was cholera, or from a drain proceeding "from the counterguard, which enters the harbour 200 "yards or more from the place where the ship was moored. "There had, no doubt, been cholera in the counterguard, but "there had been no cases for three days before the regiment "embarked; and, moreover, it never was near the counterguard. Again. "The first case of cholera in Pembroke Camp, where "the 2nd Battalion, 22nd Foot, had been stationed, took place "in a woman, on the 20th July. The first case in a soldier "was on the 27th. It will be seen that the regiment had "left Malta a fortnight and three weeks before these occur"rences."

And of the north front, speaking of the spot where the first cases occurred, Dr. Sutherland shews that it would be difficult to imagine a place more abounding in deadly nuisances.

The Conference do not notice that the other passengers on board the *Orontes*, soldiers' families, who proceeded to England after landing the 22nd regiment, reached their destination without a casualty.

Guadeloupe.—Here, if importation of cholera be accepted, it must be admitted to be possible from a vessel thirty-six days after quitting an infected place, although there had been no sign of sickness on board. Indeed, the point which receives most prominent illustration in the epidemic of Guadeloupe is the fact that persons from infected places may make long voyages without indication of sickness until after they reach their place of destination, and still be charged with the importation of sickness. There were similar examples in Europe.

Having thus traced the epidemic to its extreme western limits, the Conference proceed to follow its course inland from various places which they designate "secondary foci," and in doing this, touch on no questions of quarantine.

We have now to deal with the question of inland quarantine by means of *cordons*. This portion of the subject is in more immediate relation with the measures which have recently been proposed by the Sanitary authorities for adoption in this country. Following the conclusions of the Conference as to the position of Indian pilgrim assemblies as original foci of the disease, and as to the general utility of quarantine, the advisers of the Government of India appeared to accept without demur the policy of restriction laid down by the delegates. It is therefore of special importance that the history of sanitary cordons should be followed as minutely as possible, and their efficacy examined, with which view we shall re-produce from every source at our command such records of fact as they contain, making no omission or selections, in order that our readers may be in the same position as ourselves in forming judgment on the evidence.

From the language in which the Conference recommend the adoption of cordons, it would appear that there was in the minds of the delegates themselves but little confidence in the position they had taken up. They are (*see* Proceedings, p. 881) of opinion, that "sanitary cordons, when established "in thickly populated countries, produce an uncertain and often

"a dangerous result; that on the contrary, when established "in thinly populated and confined countries, such as those of "Asia, thay *may be* of the greatest use against the propaga- "tion of the malady." This is little more than saying that where cordons are most necessary, they will be found uncertain and dangerous; where other conditions are such as to render them superfluous, they may be successful. It is a position which appears to concede all that the opponents of quarantine need desire, and would render even investigation needless as far as this authority is concerned, were it not that in India such weight has been attached to the very qualified recommendation of cordons that their adoption has been seriously contemplated. We shall presently shew that if the opinion of the Conference in their favor were fully sustained by facts instead of being a mere speculation, Indian pilgrim assemblies would, on their own shewing, be the very last occasion for the use of cordons; meanwhile, as in the case of maritime quarantine, we transcribe the evidence which is before us, of their efficiency and expediency.

The examples adduced by the Conference in support of their view are derived almost exclusively from Russia. They are passed, however, with little more than allusion, and without detail of fact. Some stress is laid on the events of the year 1830-31; but in a previous paragraph it had been said, in extenuation of the failure of these very cordons: "It is even "probable that the cordons contributed to disseminate the evil "against which they were intended to act. Between 1847 and "1850, Sweden made a still more sustained effort than the other "States of Northern Europe in order to save herself; but on "this occasion too cholera passed the very costly barrier "erected against its progress. Such systems, powerless to stop "cholera in its invading march, brought discredit upon quaran- "tines," &c., and the summary conclusion is thus worded :— "The Committee, therefore, are of opinion that the lessons to be "drawn from the experience of this primary period of quaran- "tines have no conclusive value." We must conclude that on the fact of the success of cordons in these countries having been greatly out-weighed by their failure, the conclusion with regard to them in populous places was based. The most important statement, because it is the most particular, is the following :—"It appears from a statistical paper, submitted to "the Russian Ministry of the interior by Dr. Rosenberger, "that from 1847 to 1849 the deaths from cholera in the Rus-

"sian Empire exceeded the number of one million, and that "the number of towns attacked was 471. Now, at that time the "communications between infected and healthy places were "open. On the other hand, in the first invasion, from 1829 "to 1835, when the progress of cholera was interrupted by "sanitary cordons, the number of deaths did not exceed "290,000, and there were only 336 towns attacked. Does "not this difference (the epidemic on both occasions being "equally violent) seem to be explained by the action of "restrictive measures and cordons?" Nothing further is said. What the evidence of equal violence may have been, we are left to conjecture if we can. It is to be feared that impartial persons will scarcely regard the difference between 471 and 336 as proof of the efficacy of cordons.

The following examples are all that we have found in the proceedings in favor of the argument for thinly peopled countries:—"Lately (1866), the small town of Tiberiad, in Pales- "tine, was tried by the epidemic. It lost more than a hundred "out of 3,000 inhabitants. Being situated in conditions ren- "dering isolation easy, it was encircled by cordons, and the "cholera died away there without spreading to any other place "in Syria. Almost at the same time cholera raged at Nejef and "Kerbela. One of the eight small forts existing on the skirts "of the desert, to restrain the incursions of the Bedouins, was "infected. It was isolated and guarded. The disease died "out in it without touching any of the other fortlets, which "were only an hour's journey distant from each other." The Conference have elsewhere brought to notice the marked influence of desert land in arresting cholera, and have shewn how the disease dies out in caravans returning from Mecca.

Prominent mention is made of the use of cordons in Mecklenburg Schwerin in 1859. In the course of the discussion on the report, M. Muhlig, contending for a broad distinction between cordons for the defence of untainted localities, and for investment of infected regions, observes that, "during the epidemic in the Grand-Duchy of Mecklenburg Schwerin in 1859, about ninety or one hundred uncontaminated localities were isolated by cordons, and maintained themselves uninfected. Only nine or ten of them were attacked in spite of this measure. It must be added, nevertheless, that many places remained untainted, notwithstanding their frequent communication with infected places."

"From Palma," the Conference tell us, "the disease spread "to all the localities in the environs of the town, in spite "of the establishment of sanitary cordons." From other sources we gather the following facts :—

"In 1831," Dr. Williams says, "the cholera broke out at "Suez and Coffier a few days after the arrival of the fugitives "from Mecca. A hurried cordon of the Bedouin Arabs was "thrown across the road between Cairo and Alexandria, but "unsuccessfully ; for on 21st August, many soldiers were at- "tacked in the second line." Speaking of the action of the Russian Government in 1831, the same author remarks : "They "attempted to stop the progress of the disease by establish- "ing an extensive military cordon along their frontier, and also "by enforcing a strict quarantine ;" and he proceeds to show in a detail of facts the utter fruitlessness of the measure. A second cordon was instituted for the protection of Moscow with similar results. The disease then spread to St. Petersburg, "notwithstanding another strong military cordon." The succeeding events were these :—"The Governments of Austria and Prussia established a triple cordon of troops along their respective frontiers, and submitted all persons passing them to quarantine—precautions equally futile on this as on every other occasion."

"The city of Naples is a remarkable instance of the inuti- "lity of precautionary measures in preventing the introduc- "tion of cholera. The Neapolitan Government, alarmed at its "approach, surrounded the city with military cordons and "adopted the severest system of quarantine. The city never- "theless was infected."

Dr. Williams, summarising the evidence of the accumulated facts which his book contains, thus states the conclusion at which he arrives : "It will be only necessary now to add that every "preventive means founded on the principle of contagion has to- "tally failed. In Moscow many persons provided themselves "with a stock of provisions, shut up, lived in chambers filled "with chlorine gas, yet were seized with the disease. Respect- "ing cordons and quarantine regulations, Russia tried them am- "ply and in vain. In Austria, the cordons round Vienna nearly "occasioned a civil war. The King of Prussia, in a procla- "mation dated Charlothenburg, September 6, complains that the "Asiatic cholera had penetrated into his dominions, in spite of "measures the most vigorous, precautions the most active, and vi- "gilance the most sustained ; and he adds : "The vigorous mea-

"sures of isolation by cordons established on the frontiers and in "the interior of the country have hitherto acted unfavorably on "the industrious habits of my people, and threaten, if they be "maintained much longer, to destroy the comforts of families, and, "in short to become more ruinous than this malady itself. The "experience at Naples was equally unfortunate. It is remarkable "that Hanover, which early abandoned, or did not adopt this "system of quarantine, almost entirely escaped the disease.

Dr. Milroy, writing of the events of 1865 in Spain, says : "On 24th August, a military cordon was drawn right across "the neutral ground by Spain so as to cut off all communication "with Gibraltar. The amount of distress it occasioned to the "neighbouring Spanish villages, as well as to Gibraltar, was "very great, and the destitution that ensued upon so many of "the people being thrown out of employment inevitably aggra- "vated the severity of the visitation on both sides of the cordon. "On this as on former occasions, this measure of rigour failed "in its object." (*Brit. and For. Med. Chir. Rev.*, XII., 178.)

The same author describes the occurrence at Dominica, which has assumed great importance from its having been brought forward by Mr. Simon as one of the two instances which he acknowledges of successful isolaton. Dr. Milroy's narrative runs thus :—"In the second or third week of November, five "men from Marie Galante landed at Dominica ; two were ill "with cholera at the time, and one of these men died ten hours "after landing, the other after twenty. A strict isolation of the "place where the men abode was maintained, and no other cases "occurred. None of the other West India Islands (the case of "Guadeloupe had been previously recorded), nor any place "throughout the whole Mexican Gulf, manifested any traces of "infection in 1865. It was not till the following year that "any extension of the disease in this region of the world "occurred."

Mr. Simon's account (8th Report, Medical Officer, Privy Council), taken from a public despatch of the Lieutenant-Governor of Dominica, states :—"When news arrived that the disease "was spreading through the island of Guadeloupe, the whole of "the island and its dependencies were placed in quarantine. "Despite this precaution, a boat from Marie Galante, filled "with persons, some still healthy, and some sick with cholera, "succeeded in reaching Dominica. A street guard was placed "by the Lieutenant-Governor in the village at which these "persons had landed, and for the future health guards with

" loaded muskets were stationed at every place round the island " where landing was possible, to prevent persons from Guade- " loupe from setting foot on the island. These measures of " precaution were entirely successful, and, so far as I can " gather from the despatch, only two persons died of cholera " in Dominica; and these were two boatmen who landed from " the boat mentioned above, and died on the beach close to the " village which was subsequently isolated." This case has received exceptional notice, but the facts bring it at once into the same category with Salonica, Volo, Porto, and many towns of Northern Italy. The disease is imported, but public attention is aroused, care is taken, and it does not extend even among those in communication with the sick. The epidemic state does not prevail; the island, in common with other West India Islands, escapes, and quarantine is credited with the result. Had infection of numbers taken place within the circle invested by street guards, while all beyond it escaped, the argument would have had a very different appearance. As it is, isolation does not appear to have been even put upon its trial, for disease could not be arrested in its passage where it did not attempt to pass.

From the Board of Trade Returns, already quoted, we derive much useful information respecting cordons. The following is taken from the Consular Report on Egypt and Barbary :—" With " respect to quarantine measures by land, several cordons have " been established since 1831, to prevent the spreading of the " plague and the cholera; but they were unsuccessful. Last " year, when the plague appeared at Bengazi, the Sanitary Board " here attempted to establish a military cordon from Aboukir to " the Libyan desert, and around the city. Numerous infrac- " tions of the cordon took place, especially by smugglers. The " pestilence did not reach to Egypt; the exemption was due " more to the remoteness of the infected localities than to " the operation of the cordon. The caravans from the desert " preferred to return from whence they came, rather than sub- " mit to the quarantine which would have been imposed upon " them."

Of Tripoli it is said on the same authority:—" In 1858, a " cordon was placed on the eastern frontier of the province of " Tripoli, to prevent the introduction of the plague from Ben- " gazi. The organization of the cordon was so imperfect that " no inference can be drawn from it. Happily the province " was preserved from the pestilence.

In Portugal, " while the cholera in 1855 was marching on " along the course of the river Tagus towards Lisbon, a sani- " tary cordon was established to prevent all persons having any " ailment whatever, and coming from an infected place, from " entering the city. The cholera made its appearance notwith- " standing."

At Porto Rico, " during the cholera of 1856, sanitary cordons " were established in various parts of the island with the most " signal want of success."

At Teneriffe, Consul Murray says : " Sanitary cordons by " land have been adopted on several occasions here, and are " considered as decidedly advisable."

Of Spain, " formerly," says Mr. Consul Brackenbury, " sanitary cordons were adopted in such parts of the road as " were deemed expedient, to impede the introduction of epi- " demics by land; but, doubtless in consequence of the im- " possibility of obtaining any results by such means, the " employment of cordons was ultimately abandoned as being " vexatious to traffic and to the communications in the inte- " rior, without producing the desired object. In September " 1855, when the cholera re-appeared partially in the neigh- " bourhood of Vigo the spread of the disease was believed to " have been arrested by isolating the infected houses, and " burning such articles as were susceptible of contagion, and had " been used by the cholera patients."

With respect to quarantine measures by land, Mr. Consul Mark observes :—" On the outbreak of cholera in 1854 and " 1855, sanitary cordons were established in the outskirts of " Malaga to intercept communication with the infected places. " They were discountenanced by the Government from the " commencement, and they do not appear to have had the " slightest effect in checking the extension of the disease."

" At Carthagena, when any pestilential disease has been " declared in the district, a sanitary cordon is established " against the introduction of the same. In 1854 and 1855, " this plan was adopted against the cholera; but, whether it " was from the cordon or from any other cause, only one case " of the disease was publicly declared to have occurred in " this city." Mr. Consul Turner adds, that " during the " sanitary cordon, the Municipal authorities were known to " leave the town and return to the same without being placed " under observation, such being strictly against all rules and " regulations."

Mr. Consul Barrie writes from Alicante of cholera in 1834 and 1854:—"Though many of the towns in the province and "particularly on the coast, adopted measures to prevent com- "munication, few of them escaped. Among the latter was "Carthagena, where very rigorous measures, both by sea and "land, were enforced. This is the only instance in Spain, of "which I am aware, where sanitary isolation proved effec- "tual."

An important comment on the case of Carthagena is furnished in the special report from that place by Dr. Dalgairns:— "In 1854 and 1855, when the disease was raging in other "parts of Spain, a cordon was formed round the town, and no "persons were allowed to enter until they had performed a "longer or shorter quarantine. Corn-meal and poultry were "admitted without trouble, but letters and newspapers, af- "ter being pierced in various places, had to be dipped in salt "water or vinegar before they could be received. Three "cases only, in persons who had come from Murcia, all fatal, "occurred: one within the town, one in the suburbs, and the "third in a village three miles off. *Outside the cordon, in the "suburbs and neighbouring villages, persons were in the habit "of coming from infected districts, without bringing infection.*" The events of Salonica and the others, therefore, were repeated at Carthagena. From Trinidad it is written:—"In former "times some abortive attempts were made to prevent the intro- "duction or spread of pestilential disease by quarantine mea- "sures on land."

Dr. Milroy, in an article in the "British and Foreign Medical Chirurgical Review," No. LXXXIII., tells us that "in 1867, "military cordons were drawn round the infected districts in "Montenegro, and persons who dared to cross them were "shot. The horrors of famine were thus added to those of "pestilence."

Mr. Redcliffe, in the 8th Report of the Medical Officer of the "Privy Council, says, that the malady appeared in the town of "Filurina, and on the disease being recognized, a *cordon sani- "taire* was drawn around Filurina, and the epidemic does not "appear to have extended beyond the limits of the town." What its extension was within the town limits we are not told, and have therefore no data for judgment on the operation of the cordon.

Again, says the same writer:—"At Orsova, the frontier town "of Austria on the Danube, the quarantine, established for a

"short time, was removed upon the earnest remonstrances of "my Austrian colleague, on the commission. Although the "cholera visited every Turkish town where the quarantine "was strictly enforced, to within a few miles of Orsova, that "place remained quite free from the disease. The passenger "traffic through Orsova, between the East and Vienna, is very "considerable, and yet no instance occurred of cholera being "imported from the many pest-stricken towns."

Dr. Sutherland, in his Report on Gibraltar, thus writes of the cordon:—"The Spanish cordon was established on the "24th of August, five days after the first case of cholera "among the civil population of Gibraltar; and we learn from "the 'Gibraltar Chronicle' of September 12, that cholera sud- "denly appeared at St. Roque, four or five miles behind the "cordon, and proved fatal to six persons in one day. At a "later period (October 9), the disease entered a solitary "house between St. Roque and Algesiras, away from all "communication with affected localities, and attacked the "inmates. It is perfectly certain that these events took place "in spite of the cordon."

It must be stated that this case is intended to illustrate rather the absurdity of establishing a cordon at such a time than the inefficacy of the proceeding; for cholera "had already esta- "blished itself over a third part of the area of the country."

Of the foregoing examples, which include all that we have been able to meet with of the institution of cordons without omission or selection, no reasoning or analysis is needed to shew which way the testimony points.

To strengthen their advocacy of the principle of quarantine, the Conference endeavour to overthrow the leading objec- tions—sanitary and commercial—to which it has been found liable in practice, the objections, that is to say, of a posi- tive kind which are the intensification of disease by confinement of compromised persons in lazarets, and the great cost to na- tions from interrupted commerce. On the first point it is contended in the report that no such intensification exists, but that on the contrary there is evidence of a certain im- munity attaching to persons who have come from infected places,—an inference based on the fact that infected arrivals have often passed through quarantine stations without suffer- ing material injury. Such an opinion is at variance with the entire mass of evidence adduced in support of the transmis- sibility of cholera; for, when arguing to this conclusion, the

authorities are at considerable pains to prove that at the several points of arrival the disease appeared first among the new comers and this in several instances where there had been no sign of previous infection of the group. And if all the cases adduced be examined in their bearing on this particular question, while no pretension is made to set aside such proof of communication as may be deducible from dates, it will be placed beyond doubt that in no instance could such exemption be established. That the arrivals often escaped disease is absolutely true; but they escaped only where favorably situated on landing, and in common with the residents of the place; equally in common with these, they suffered when the conditions of suffering were locally present, and they suffered in much higher degree where the state of the quarantine station was such as to expose them to exceptional risk. The element of disease which they introduced depended for its subsequent diffusion, not on any condition which accompanied it, but on the conditions into which it was imported; and if it be contended that the arrest of cholera in good lazarets, which is herein admitted, is a strong argument on the side of the Conference, we reply that the results destroy at a blow all the pretensions of lazarets and quarantine, for they have followed on the same details of management in towns and places, where no such establishments existed; and they are of constant occurrence in the experience of every Indian Officer, who records from year to year a few isolated cases of cholera in his barrack, or his jail, or his hospital.

The grounds on which the opinion of the Conference is based respecting the loss and injury sustained in commerce from quarantine are less obvious. The opinion is thus stated in the proceedings:—"Restrictive measures, made known generally beforehand and properly applied, are much less "prejudicial to commerce and international relations than the "disturbance occasioned to industry and commercial transactions by an invasion of cholera." This follows as a conclusion on arguments stated in general terms. No attempt is made to introduce the evidence of facts, unless the following passage be regarded in this light:—"Honorable merchants "have remarked to the Committee that, directly the quarantine "is raised, commerce re-commences with an activity which may "compensate for the loss sustained during its imposition;" which is probably true enough in the interest of capitalists, and

large mercantile firms well able to bear temporary suspension of business, but very open to question if said of the trading community generally. No doubt the difficulty in the way of a comparative estimate of losses under quarantine, and losses under epidemic invasion by emigration from towns and other causes is very great if exactness be sought for; but there are nevertheless records of the financial effects of quarantine, which tell heavily against it as they stand. The Board of Trade Returns give copious details of quarantine dues at the several ports, and shew how great an influence the power to levy them exercises in leading to the enforcement of quarantine on grounds vexatiously trivial. Dr. Sutherland also has touched upon the question in such a manner as to prove that great pecuniary loss is inseparable from a quarantine system. In his Report on Malta he remarks—"When we examine what has been "the result of the various quarantines enforced since cholera "declined in Malta, the question may fairly be asked, whether "the loss to commerce has not vastly exceeded any hypothe-"tical gain to health. We learn from the tables that between "the 1st August 1865 and the 31st December 1866, no fewer "than 1,008 vessels entered Malta in quarantine. The aggre-"gate tonnage of these vessels was 508,507 tons; their crews "amounted to 28,622 men, and they had 1,663 passengers on "board. If all the vessels had ridden out their quarantine, "no less than 1,944,504 tons of shipping would have been de-"tained for a day, and 101,632 men with 15,734 passengers "would also have been detained for a day;" and of Gibraltar he writes—"The total tonnage arrested was 323,409 tons: "240 vessels rode out their quarantine, and 395 vessels arrived "and sailed in quarantine. The practical result of this great "sacrifice, so far as concerns public health, was simply *nil*; "for in spite of it all, Gibraltar was visited by one of the most "fatal epidemics on record. So far as regards commerce, the "small population of Gibraltar is almost entirely dependent "on commerce for its support; and one of the inhabitants said "to me—'If we have such another quarantine as we have gone "through, it will be our ruin.'"

Dr. Milroy *(Brit. and For. Med. Chir. Review,)* says—"The "pecuniary losses are incalculable. Dr. (now Sir John) "Bowring, speaking in the House of Commons in 1841, stated "his belief that the losses from quarantine in the Mediterra-"nean alone were not less than two or there millions sterling "a year." We learn from Dr. Burrell's able and very instructive

report on the plague of Malta in 1813, which he considered—and we think justly—of indigenous origin, that it entailed *(sic)* by the rigid cruel measures enforced to confine it, a cost of £232,531.

By adopting Dr. Sutherland's method, it would dave been easy for the Conference to arrive, approximately at least, at the cost to the shipping at the several quarantine ports. To do it in this place would take us far from the scope of this article, and for a purpose with which we in India are very little concerned. It is sufficient, therefore, to say that the argument of comparative loss by quarantine and invasion proceeds entirely on the hypothesis that restriction is both necessary and efficacious against cholera: and it ceases, therefore, to be an argument if it be shewn that neither character belongs to it.

Another objection to quarantine in cholera, which transpires under examination of its history, is the fact that there always have been, and as far as can yet be seen, always must be, instances where epidemic progress outstrips official intelligence, establishing the disease in a place before in can be recognised, or restrictive measures applied. The facts of 1865, which set forth this point, are numerous and definite. They may be used, indeed, as arguments against the whole doctrine of personal conveyance of epidemic cholera, and so may bear a significance much wider than is now claimed for them, but in their narrowest interpretation they can exhibit no less than a serious and abiding source of failure in quarantine The appearance of the first case of cholera at Alexandria, long in advance of the arrival of the pilgrims from Mecca; the circumstances so fully detailed by Dr. Sutherland, as preceding the outbreak at Malta; the *sporadic* cases at Odessa and Ancona; and a large number of less definite statements of fact and opinion, scattered through the several records we have examined, point to the great caution with which we should receive evidence even so apparently conclusive as that adduced, to prove the personal conveyance of cholera from Alexandria in 1865. Although in the great majority of instances, no counter-testimony of facts has yet been published, it is allowable to remark that in the few places of which we have the most exact information from other sources, the facts are at variance with those furnished to the Conference. It is no more than prudent, therefore, to accept at present, with suspended judgment, the great argument of communication derived from dates of arrival.

Summarising the evidence which we have now brought forward, and stating for convenience of application the conclusions to which we have been led, we arrive at the following propositions:—

1. *Quarantine being a mechanical measure, and addressed only to the prevention of personal communication can, in the nature of things, operate only so far as this process contributes to the diffusion of disease.*

2. *The particular elements of quarantine practice, to which it has owed its success, can be, and have been, applied with full effect in places other than quarantine stations, without any of the attendant evils of such stations; and that, therefore, where the success of quarantine is apparent, it affords no argument for the maintenance of the system.*

3. *Whether personal communication contribute much or little to the spread of cholera, there are wider agencies at work in determining epidemic diffusion, which, though they are not yet definable, are certainly of such a nature that no process of personal restriction can counteract them; and although such agencies are beyond those comprising the known conditions of insalubrity, there is no room to doubt that, within the limits of insalubrious places, crowding and mismanagement may give to the results of importation the proportions of an epidemic.*

4. *Whatever truth there may be in the doctrine that cholera is communicable from man to man, this property, though it may determine the occurrence of first cases in a place, has little or no further share in producing an epidemic. It is inoperative in the presence of good sanitary management, and may be effectually opposed by measures applied to cases of actual disease. It does not, therefore, support the policy of quarantine, nor extended restriction of intercourse.*

5. *Bodies of men arriving from infected places, whether there have or have not been among them evidence of infection, have suffered after arrival, in more or less degree, exactly as the sanitary condition of the place of arrival would render probable.*

6. *Where this condition has been favorable to immunity disease has been arrested; where it has favored its increase, it has increased and spread, whether the cases of imported disease have been many or few, severe or mild.*

7. *The same circumstances have determined the degree of infection of towns and neighbourhoods after choleraic arrivals, whether general isolation has been completely or incompletely enforced, or has not at all been attempted.*

8. *From the foregoing propositions a general law becomes evident, that groups of persons arriving from infected places share the fate of the residents and neighbours of the place of arrival, with regard to the risk they incur from communication with actual cases of cholera. The few exceptions to this law, which, as matters of fact, are on record,* viz., *the instances in which arrivals have suffered severely after landing without spreading infection, are those and only those in which they have been themselves unfavorably situated, in the neighbourhood of more favored places; and where towns have been severely visited without corresponding intensity of disease in quarantine stations, it has been shown that there was special care of sanitary matters in the latter.*

9. *In a large majority of the examples in which the efficacy of isolation is affirmed, it is clearly provable that isolation cannot have had any influence on the events, and in no single instance has its necessity or usefulness been demonstrated.*

10. *Upon the general question of communicability of cholera from person to person, the conclusions set forth by the Conference must, for the present, be received with the utmost caution, for they rest mainly on the relative dates of imperfectly known events; and in those cases in which we are in possession of detailed information from other sources, the records of the Conference are contravened in points very material to the issue.*

It is to inland restrictions on intercourse that the attention of authority in India is for the most part directed. Cordons have been suggested to prevent the dispersion of large assemblies, and to divert travellers from ordinary lines of road, with regular establishments of quarantine stations, or lazarets in the environs to towns and jails. It is, therefore, by the experience of this class of measures that the prospect of good results in India, from restriction, must be estimated.

There can be little doubt that, in respect of probable efficacy, a broad distinction must be drawn between cordons established for the confinement of infected masses, and those which are intended to protect from infection places hitherto healthy. The distinction was discussed by the Conference, and it calls for the fullest consideration in India. It would be unreasonable, for instance, to refrain from hindering the admissions to a healthy jail, when its neighbourhood had become infected, merely because it had been found impossible or dangerous to restrain the rush of terror-stricken millions from Hurdwar; equally unreasonable to deny that an infected pilgrim crowd might be diverted from a station or a town with advantage,

because all efforts had failed to prevent their leaving the focus of disease. Without acknowledging any difference of principle, or affecting to believe that any such mechanical obstacle will stay the course of an epidemic it is clear that the merits of the several processes of quarantine are not identical, for the simple reason that one procedure is open to the charge of mechanical impossibility, while another may involve no practical difficulty whatever. Each class, therefore, must be judged by itself, and each has now become the subject of recorded experience in a Report on the epidemic in Northern India in 1867, recently issued by the Sanitary Commissioner with the Government of India.

The report enters fully into the distribution of the disease over the vast tract of country infected. Regarding the Hurdwar Fair as the point of departure, the march of returning pilgrims is traced, and its influence on the health of the several districts pointed out, with, of course, especial reference to the question of communication. The evidence adduced is of the same general character as that of the Western epidemic of 1865. There is the same prominent notice of dates of arrival of pilgrims as the main proof; but there is the broad distinction that the epidemic only spread in certain directions, and did not attend the return of pilgrims in others. To examine this portion of the Report at length, would carry us too far from our immediate purpose, and unduly extend the length of this article; we shall, therefore, do no more than allude to the facts which tend to shew that personal contagion has an influence as limited and partial in India as elsewhere, with the object of proving, as far as is yet possible, that there is no principle at work here to render quarantine more necessary or more rational than it has proved to be elsewhere.

The influence of local peculiarities overbearing all liability to personal infection, is seen in the general exemption of the jails and of certain stations; in the greater immunity of Native than European troops, the latter being certainly less exposed to external contagion, while an internal possible source of disease is shewn among them; the relative mortality of cavalry, artillery, and infantry; the special infection of the small female jail at Lahore, while the extensive male wards escaped; and the very remarkable case of the village of Singhawara. We find the same conflicting testimony of observers as to communication; the same impossibility of tracing it in places; the same convictions of independent origin, the last in much

greater proportion than in Europe; the same extravagant hypotheses to supply the missing links in the chain where the doctrine of contagion is the sole pursuit; and even the same admixture of conclusions demonstrably fallacious.

We must content ourselves with this hasty indication of the general tenor of the epidemic history, and pass on to the third section of the Report, which treats of "The preventive measures adopted, and the results of the epidemic."

It is clear that there was no neglect of any sanitary precaution *which could be adopted on a sudden emergency*. It is equally clear that precautions so adopted, including quarantine, did not prevent wide diffusion of cholera. "Cordons of police were posted to divert the stream of returning pilgrims "from the larger towns. Quarantine camps were established, "in which the pilgrims were detained in some places for 48 "hours, in others as long as five days. * * * In the "districts which lie nearer to Hurdwar especially, quarantine, "sanitary cordons, cholera hospitals, and general sanitary "supervision, were had recourse to. The opinions of the "Civil Surgeons are generally to the effect that much good "resulted from them;" and from these opinions several extracts follow. They are unfortunately recorded as mere opinions, and stated in general terms, without the particulars which alone could make them useful evidence in trying the question. At Ferozepore "very marked success is reported;" at Kurnaul "tolerable success;" the town of Sirsa is said "to have enjoyed entire immunity; this, doubtless, is owing "to the sanitary and precautionary arrangements having "been strictly enforced." The Commissioner of Umballa reports that "the sanitary cordon was most effective." From Jullunder, Dr. Verchere reports—"It is worthy of record that "none of the principal towns or villages became attacked with "cholera to *any considerable extent*. To all these places orders "had been sent by the Deputy Commissioners, that quarantine should be established for the returning pilgrims, and the "orders were more or less strictly carried out." At Hissar it is said—"The disease would have prevailed more, and perhaps assumed a violent type, had not timely precautions been "employed." Further opinions of similar character are given and allusion is made to doubts entertained by other observers respecting the efficacy of the work that was done.

This work, it must be observed, includes not only quarantine, but all the measures enjoined on the district officers to meet

the emergency. The Commissioner thus briefly comments on the opinions cited:—"To determine how far the preventive measures and the slight prevalence of the disease in certain places "stand in the relation of cause and effect, is a question of very "great difficulty. There is a natural tendency in the human "mind to attribute successful results to the efforts which have "been made to attain them; and especially in regard to such a "disease as cholera, whose erratic fitful course is so proverbial, "it is extremely difficult, if not impossible, in the present state "of our knowledge, to say with any accuracy what effect any "preventive measures have had upon its progress." And again —"In considering the nature of cholera and the manner of its "spread, the opinions of the medical officers and others, which "have been quoted on this question, cannot be received "as evidence, however interesting they are in themselves." The grounds of rejection are not stated, but it is natural to infer that the several reports did not set forth conclusive facts in support of the opinions they conveyed, and therefore that these opinions have not contributed to form the conclusions of the Commissioner which we shall presently examine. But although opinions thus stated cannot be evidence on the entire position they advocate, they imply the prevalence of facts which bear very pointedly on a main issue of your enquiry. It is observable that *partial success* is the base of favorable judgment throughout. This can only mean that the places reported on were partially infected; and it is certain that where this took place, seclusion of quarantine was not effectual. We are not in possession of sufficient details to prove, as in the case of Salonica, the means by which diffusion of cholera was prevented after importation; but the fact of importation is valid against the efficacy of seclusion, while the other proceedings appear in such favorable light as is thrown upon them by limited spread of disease. It appears to us open to no denial that every instance of introduction without diffusion becomes an example of non-receptivity, whatever may be the condition which determines it.

The subject of quarantine is more specifically treated in the succeeding paragraphs on *preventive measures in jails*. The practice is thus described:—"A modified quarantine has been "imposed on all new prisoners. The system is confessedly im"perfect, because a perfect quarantine is almost impossible, and, "also, because suitable buildings have not yet been provided for "carrying it out. But imperfect as it is, most excellent

" results have attended its institution, and several instances have " occurred in which jails have escaped epidemic visitations for " the first time in the course of several years, by preventing " the introductions of contagious disease. When cholera was " known to be abroad, particular attention was devoted to render- " ing quarantine as stringent as the imperfect means which " existed would allow." Subsequently, in a section on general conclusions, the Sanitary Commissioner reiterates this opinion of the results, in such manner as to leave no doubt that it must have been based on the experience of the epidemic of 1867. " Practical results," he says, " are of much greater value than " mere theoretical opinions, and the introduction of even such an " imperfect quarantine as has been practicable in the jails of the " Upper Provinces, has been attended with most excellent re- " sults." For special testimony we turn again to the third section of the Report, where we find the following statement :— " In " only one instance during the late epidemic has a genuine case " of cholera occurred in the quarantine ward of a jail. This " was at Umballa. The man had just been received from " Simla ; he was immediately isolated, and proper means of dis- " infection used. In the Lahore Jail two cases of choleraic " diarrhœa were discovered in the quarantine quarter : and, if " recent opinions are correcct, a person suffering from choleraic " diarrhœa is as dangerous on arrival as a person suffering from " cholera. The Inspector-General of Prisons in the Punjab " is of opinion that the benefit of isolation as a preventive " to the extension of the disease amongst the prisoners has " been instanced in cases of the jails generally throughout " the Province, and remarkably in the central jail at Lahore. " We must not suppose that this question has been treated otherwise than seriously by the high authority from which the report emanates ; yet we can scarcely ask, with becoming gravity, wherein the protective action of quarantine lay, when only one case of cholera occurred in the quarantine ward of a jail ; or why, if the central jail of Lahore is held up as a remarkable instance of success, the female wards should have been infected, and eight per cent. of their inmates attacked.

That isolation was useful need not be questioned now, as it includes the separate treatment of the individual, which is in practice carried out in every hospital in all points which affect the alleged media of cholera transmission, and has been so with the same results as are now attributed to quarantine, ever since hospital organization and management became

entitled to their name. Year after year there come into the wards of Calcutta institutions case after case of cholera, without infecting a single inmate ; but no one thinks of personal seclusion. In the face of this, can it be said, or seriously thought, that if the above cases had been received at once into the jail hospitals, any different result would have followed ? or into the wards of the jail itself ?—for of late years the jails of India have been the great centres of sanitary improvement, as from their impassable limits, facility of command, and internal resources, the means of making them so have been the most complete in existence : and that it is by the sanitary condition of the jails that their fate in 1867 was determined, is indicated alike by the general fact of the exemption which was seen in Bengal where there was no quarantine, as well as in the North-West and Punjab, where it was practised, and the special occurrences recorded by the Sanitary Commissioner. " Considering, " writes Major Malleson, " the extent to which the disease prevailed " among the free population, the comparative immunity which " the prisoners enjoyed is very remarkable. In the North- " Western Provinces, out of thirty six jails, only eleven were " attacked, and of those only two, Allahabad and Shahjehan- " pore, suffered with any severity. In four others, out of the " eleven, only one solitary case occurred in each. No less than " twenty-five escaped entirely, and many of these, such as Mee- " rut, Benares, and others, were large prisons in the centre of an " infected population. In the Punjab, out of twenty-nine jails, " eight were attacked ; but in two of these, the disease was " trifling ; twenty-one escaped entirely. Out of eleven jails, " in Oude, six suffered ; but, excepting at Seetapore, the cases " in each were few."

If quarantine is to be involved in these results, it must be admitted to have utterly failed in twenty-five cases out of a total of seventy-six, for in that number disease was imported ; whereas if the results were due to internal arrangements, there were but nine instances of failure throughout, *viz* ; the cases in which infection was considerable in the three Provinces. It may be contended that importation was due to servants and others who were not subjected to quarantine ; but the argument of no diffusion is not weakened thereby, nor is it easy to see how " suitable buildings" or any other mechanical perfections of quarantine could have prevented it.

The measures adopted with troops for prevention of cholera

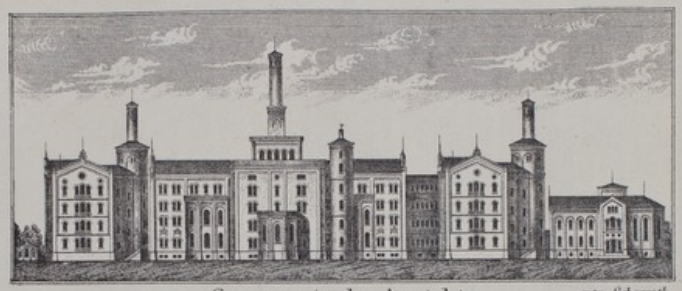
in 1867 include no process of quarantine, and therefore call for no examination. If the cantonments derived any protection from restricted intercourse, it could only have been through the agency adopted for towns and stations generally, while the great immunity of the cavalry, the relative infection of artillery and infantry, and, above all, the smaller mortality of Natives than of Europeans, point forcibly to internal differences of cause, and not to any general agency which would affect them in equal degree.

Bringing thus the conclusions drawn from the great epidemic of 1865 to the examination of the last Indian outbreak, we find nothing in the latter that is not strongly confirmatory of them: nothing which can be held to shew that the system which has so signally failed in all other parts of the world, has any better prospect here. Complete restriction of intercourse is as impossible here as there; nor is there any reason to suppose that, if possible, it would be advisable or successful. On the contrary, the Report before us contains evidence of the highest value, of the action of wider agencies than personal contagion in creating an epidemic,—agencies which can be reached by no such measures; while here, as before, is seen abundant proof that such transmission as is due to contagion may be easily and more rationally controlled without quarantine; and that the system is here, even in the comparatively innocent forms which it has been suffered to take, productive of very serious evils.

The Sanitary Commissioner last year had stated that he "had no hesitation in coming to the conclusion that quarantine "should be established." This referred to a general quarantine, and the framing of special rules was deferred until full reports had been received of the outbreak at Hurdwar. In the present Report a modified opinion is given, based upon the conflicting evidence recorded, the now-acknowledged difficulties of the task, and the growing opposition to quarantine in England. "The question," we quote from the Report, "is one of "very great difficulty: were sanitary considerations alone to be "kept in view, it could be easily answered. In my letter to "the Government of India, in the Military Department, No. 312, "dated 29th May 1867, an opinion was expressed that quarantine should be established. Regarding the matter merely in "a sanitary light, that opinion remains unaltered; but a careful "consideration of the many important points involved, leads to "the conclusion that any general attempt to enforce this measure is undesirable.

"The difficulties attending any general enforcement of quarantine are practically very great, and it would certainly be "attended with much hardship and oppression to the pilgrims. "Quarantine was attempted in nearly every district in the Punjab and the upper part of the North-Western Provinces, and "the results are generally spoken of as having been very successful. It is very doubtful, however, how far the two things "can be regarded as cause and effect. The Civil Surgeon of "Umritsur mentions in his report that the pilgrims complained "bitterly of the treatment they had received near ———, "being driven off the regular road, and forced to walk during "the heat of the day for miles through heavy sand without "food or water. In fact they attributed a great many of the "deaths to this cause. No system of strict quarantine can be "carried out without great suffering to those concerned."

The use of the words "sanitary considerations" in the above connexion would seem to imply that the Commissioner adheres to the belief that cholera may be arrested by quarantine, but yields to the pressure of practical difficulties. Seeing, however, the great disposition herein evinced, to bend conclusions to the testimony of facts, and to advance with the advance of opinion elsewhere, may we not reasonably hope that, before further necessity arises, sanitary considerations will have urged the Commissioner in the same direction in which questions of general expediency have urged him now, and that for the sake of the revenue of the country, and in the cause of sound sanitation, all "suitable buildings" and other appliances of quarantine will long continue, as they are at present, unprovided; unless, indeed, they are to involve no more than the course of humane and judicious treatment which is daily seen to lead to no spread of cholera in the wards of Indian hospitals?—"*Calcutta Review.*")



Geometrische Ansicht. entw. Scharrath.

Beispiel

der Krankheits- und dem neuen Barlowschen Krankenhause der neuen Ventilation durch die Sonne-Ventilation gegenüber:

1, Der Fall 28 der Tabelle resp. der Personen, ist mit Inbegriff des Aufenthaltsraumes für einen einzigen Raum zu groß, indem die selbstverständlich größere Anzahl Krankenfälle, bei der Kranken die Hoffnung auf Genesung vermindert.

2, Die Heizvorrichtungen haben durch die ungleichmäßige Luftbewegung von den Kranken, auch ungleichmäßige Temperatur für die Letzteren.

3, Die Heizvorrichtungen hindern durch ihren Brand in der Mittellinie des Saales den Verkehr der Aerzte, und verbrauchen durch den Brand verhältnismäßig viele Luft.

4, Die 2 Fenster an je einem Pfeiler sind nur 2½ Fuß von einander entfernt also zu nah, und äußerlich ohne Zierden, die Ventilations-Ventilatoren.

5, Die Ventilation durch die gegenüber stehenden Fenster giebt schädlichen Zug.

6 Die über Mannshöhe am meisten verdorbene, giftige Luft bei gleichzeitiger Fensterventilation von einem Saale aus dem andern.

7, Die Kranken können von ihren Betten nur nach der Himmel sehen, wodurch die nachtheilige

wöchentliche Langeweile verschaffen und vermehrt
wird.

8, ein Theil der Kranken bekommt bei der
gegebenen Lichtstellung durch die gegenüber be-
findlichen Fenster die Sonne ins Gesicht.

9, die angebrachte Ventilation findet nicht
das Aufsteigen der Athemluft an den Wänden.

10, die neue Luftheizung ist bei kalter Zeit
entweder nicht genügend temperirt, oder nicht
gleichmässig.

11, die Abtritte und Pissoirs sind nicht genügend
isolirt, sondern sie nur durch eine Mauer
vom Krankenraume getrennt.

12, die Treppen sind zu unbequem und zu wenig
breit, sondern jeder Treppenarm 16 Stufen
ohne Podestunterbrechung hat.

13, der Plätzen ist in seinem Inneren von
den letzten Betten ca 10 Fuss entfernt,
also zu weit

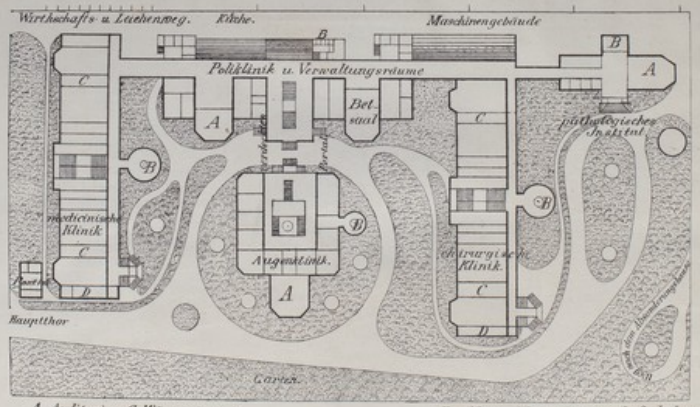
14, der Luftraum ist für die Normalbetten bei
stehenden Betten nur mit dem Risico
der Lufterneuerung einrichtbar.

15, im Sommer ist die Ventilation der
stehenden Luft zu gross, weil keine gleichmässige
Luftabsaugung vorhanden.

16, die Heizleitungen für Wasser, Gas, Closets,
Spülwasser und dgl. werden durch die Zer-
störung der Röhre zu lang, wodurch allmälig
das Terrain mit stehendem Schmutzwasser inficirt
wird.

17, der Transport der Kranken ist durch die grossen
Entfernungen

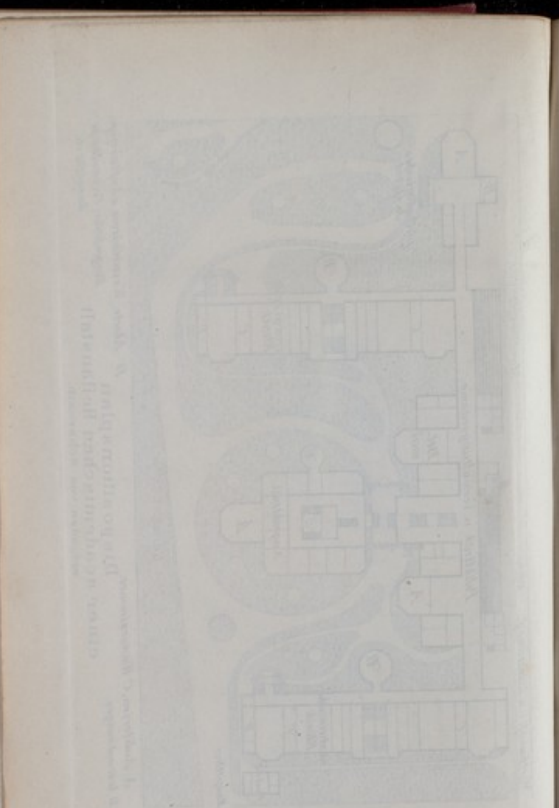
Festsetzungen unter seinem Zimmer sehr ar-
beitsam.
18, Das Krankenhaus ist von der östlich liegenden
Kranken festbar, also für dieselben ruhig
gelegen einwirkend.
19, Die Türen sind durch die richtige Heiz-
vorrichtung regulierbar einfach und säu-
berlich.
20, Die Wärterinnen können bei schönem
Wetter nur einstündlich mit ihren Kranken
an die Sonne ins Freie gebracht werden.
21, Die großen Verwaltungs-, Haus- und Re-
gulierräume betragen einen vierfachen
Luftwechsel gegenüber das Doppelte.



A Auditorien. C Wärterzimmer. B Aborte, Wasserthürme, u. Luftabzüge.
D Arztwohnungen Etagenbäder, Verbandküche Ausgüsse etc.

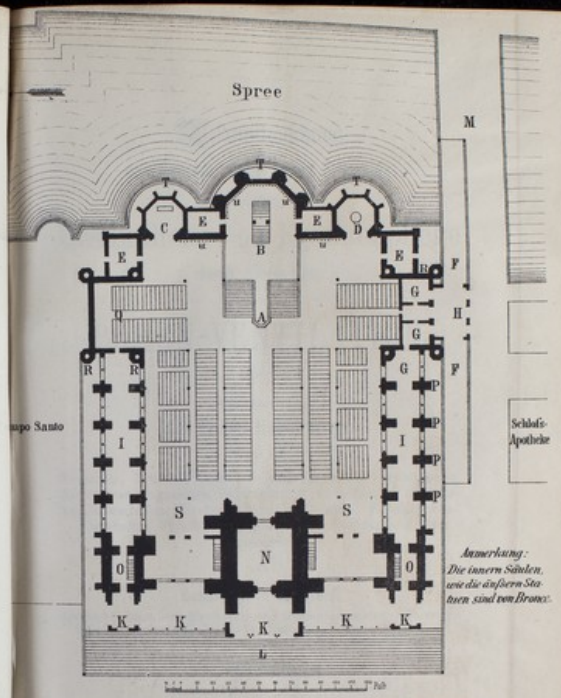
Dispositionsplan einer academischen Heilanstalt

erfunden von Scharrath.



Geometrische Ansicht eines Domes

Concurrenz-Entwurf für Berlin von Scharrath.



Grundriss nach gegebenen Grenzlinien und Spree-Fundamenten mit Anwendung der Poren-Ventilation.

…ge sande Luft tritt von der Chorseite zu u. durch die Thürme ab u. erhöht dadurch zugleich die Akustik.

…kanzel, darüber Kronleuchter u. zugleich Schalldecket
…Hochaltar mit Durchsicht
…Sacraments-Capelle.
…Taufe Capelle.
…Sacristeien u. Nebenräume
…Loge für das Königliche Haus
…Sacristeien des Königlichen Hauses
…Vorhalle des Königlichen Hauses
…Seitenhallen
…Haupt-Vorhalle.
L *Freitreppe*
M *Dombrücke*
N *Glocken u. Uhrthurm*
O *Treppenthürme u. Thürmer-Wohnung*
P *Fundamente für die Reiterstandbilder der Glaubenshelden*
Q *Orgel Empore*
R *Emporen Treppenthürme*
S *West Empore*
T *Gallerie*
u *Poren*

Bekanntmachung

der Vorzüge einer neuen Erfindung

zur Erhöhung der

Gesundheits- und Krankenpflege

durch Anwendung

der

POREN-VENTILATION.

Zur Beachtung

der hohen Regierungen

sowie der

Mediciner, Marine-, Casernen- und Lazareth-Verwaltungen, Architekten, Ingenieure, Sitzungspräsidenten, Rheder von Auswandererschiffen, Kirchen-, Schul-, Theater-, Krankenhaus-, Eisenbahn-, Fabrik-, Gefängniss- und Landwirthschafts-Vorstände.

von

Scharrath in Bielefeld.

Architekt, Ingenieur, Maschinen- und Mühlenbaumeister, Inhaber der Erfindungspatente für Poren-Ventilation in Frankreich, England und in den vereinigten Staaten von Nordamerika.

Mit zwei Abbildungen.

Halle.
Verlag von G. Knapp.
1869.

Einleitung.

Es konnte auf der letzten Versammlung der Naturforscher nicht ausbleiben, bei den Verhandlungen über Gesundheitspflege auch der gesunden Lebensluft die Aufmerksamkeit zugewendet zu sehen und dabei die deutschen Technicker, wenn auch nicht gerade allein der Luft-Verbesserung wegen, dem Auslande gegenüber zur Verantwortung zu ziehen.

Es würde jedoch vielleicht fruchtbringend gewesen sein, die Regierungen ebenfalls mit zur Verantwortung zu ziehen.

Der Verfasser hat z. B. schon vor ca. einem Jahre allen einflussreichen Regierungen die Mittheilung gemacht, dass es durch Anwendung der Poren-Ventilation möglich sei: den Gefängnissen, Fabriken, Schreibstuben, Schulen, Theatern, Schiffs-Cajüten, Eisenbahn- und Post-Coupees reichlich frische Luft zuzuführen, ohne Zug zu erzeugen; zugleich hat er darauf hingewiesen, da es früher nicht gelungen: *a.* von den Wänden der Krankenzimmer die Miasmen, *b.* von den Umgebungen der ansteckenden Krankenanstalten die Dünste und *c.* von den Eisenbahn- und Post-Coupees den ungesunden Staub abzuhalten, diese Uebelstände durch genannte Ventilation beseitigen zu können.

Auch hatte sich der Verfasser bereit erklärt, da er schon einen Proberaum vollendet und im Gebrauch hatte, die Richtigkeit vor einer wissenschaftlichen Commission durch Zeichnungen und Rechnungen zu beweisen. Schliesslich hatte derselbe sich noch auf die Autorität des Professors von Langenbeck, indem dieser der Neuheit eine grosse Tragweite für Gesundheits- und Krankenpflege verheissen, berufen.

Nur wenige Regierungen haben dieser Neuheit Beachtung geschenkt, im Auslande aber nur die Russische; andere Regierungen haben den Verfasser zur Patentirung veranlasst, wahrscheinlich weil sie dadurch noch Geld dazu zu gewinnen Aussicht hatten.

Allerdings sind durch solche Verfahrungsweisen seit jener Zeit, und durch die fortgesetzten Verhandlungen, namentlich mit Sachkennern, die Constructionen für die Anwendung der Erfindung bereichert worden, und ist es Zweck der folgenden Zeilen, die Vorzüge dieser Erfindung den jetzigen besten Bauwerken gegenüber spezieller hervorzuheben; zunächst aber den Stand der bisherigen Gesundheits- und Krankenpflege, soweit die Behörden und Bautechnicker dabei betheiligt sind, zu erörtern.

Wie weit sich einzelne Landesherren, Regierungen, Universitäten, Vereine, Militär- und Bau-Behörden sowie Fabrikbesitzer u. a. dieser Erfindung angenommen, wird durch mehrere beigedruckte Zuschriften, welche, auf eine besonders verfasste Abhandlung erfolgt (letztere jedoch der Patentbedingungen wegen nicht im Buchhandel erscheinen durfte), das allgemeine Interesse erkennen lassen.

Welche Stellung das Patentwesen im Interesse der bessern

Gesundheitspflege bei dem hoffentlich baldigen Umsturz des jetzigen Patentgesetzes im Reichstage einnehmen dürfte, ist am Schlusse angedeutet.

Die Veröffentlichung der gesammten Constructionszeichnungen mit den dazu gehörigen Erläuterungen kann selbstredend erst dann stattfinden, wenn der Verfasser nicht mehr an die mit mehreren Regierungen begonnenen Verhandlungen über die Abtretung des Erfindungsrechts gebunden ist. Die speziellen Anordnungen für Schulräume sind ihrer Dringlichkeit wegen schon im Nachtrage hervorgehoben, und ausserdem noch einige andere bisher nicht überall bekannte Neuerungen.

Von einer Zahl Männer, die der Erfindung des Verfassers ihr Interesse zugesagt und sich durch Einsicht der Zeichnungen von der Einfachheit der Erfindung je nach dem Fache überzeugt, dürften folgende zum Theil den meisten Lesern bekannt und deren Autorität zureichend sein.

Geh. Ober-Medicinalrath Prof. Herr Dr. von Langenbeck in Berlin.

Königlicher Baurath Herr Hase in Hannover.

Generalarzt und Director des Friedrich-Wilhelms-Instituts Herr Dr. Löffler in Berlin.

Eisenbahn-Betriebs-Director Herr Baurath König in Berlin.

Königl. Bau-Rath, Architekt der Universität Herr Diekhoff in Bonn.

Universitätskrankenhausarzt Herr Dr. Imans in Utrecht.

Professor und Hofbaurath Herr Strack in Berlin.

Corvetten-Capitän und Depot-Director Herr Olberg in Geestemünde.

Marine-Ingenieur Herr Brix in Geestemünde.

Bandirector Herr Schröder in Bremen.

Ingenieur und Professor der Künste und Gewerbe Herr Armengaud in Paris.

Ministerialreferent und Dr. med. Herr Kappeyne van de Capello in Haag.

Ingenieur Newton in London.

Dombaumeister Herr Güldenpfennig in Paderborn.

Geheimer Medicinalrath Professor Dr. Herr von Gräfe in Berlin.

Geheimer Regierungsrath, Verwaltungs-Director der Charité und der Thierarzneischule Herr Dr. Esse in Berlin.

Leibarzt des Königs Wilhelm, Geheimer Sanitätsrath, Generals- und Corps-Arzt Herr Professor Dr. von Lauer in Berlin.

Oberbaurath Herr Laughaus in Berlin.

Schiffsbaumeister und Königlicher Marine-Ingenieur Herr Hildebrand in Danzig.

Die folgenden Auseinandersetzungen mögen also dazu beitragen, dass die Menschenleben, welche uns durch die Instrumente des Krieges und ungesunde Räume verloren, mittels Werke der Gesundheits- und Krankenpflege wieder gewonnen werden.

Bielefeld, den 15. November 1868.

Vergeblich würde es sein, jene Zeit speziell zu beleuchten, wo Maschinenkunde und Naturwissenschaften bei dem Studium der Architektur nur dem Namen nach bekannt, das wirkliche Erlernen derselben aber Ausnahmen waren; jene Zeit, die auch das Reisen nach den mehr in der Technik kultivirten Ländern so ausserordentlich erschwerte, um vielleicht aus vielen kleinen zerstreut ausgeführten verkörperten Ideen Werke zu combiniren, welche für die Gesundheits- und Krankenpflege wirksamer gewesen. Ferner, wo Fabriken zur Herstellung von Arbeitsmaschinen für Ziegelsteine, Tafelglas, Gummi-Asphaltfabrikate, Wasser- und Luftbewegung nur unvollkommen vorhanden, und die so wichtige Dampfmaschine noch der Entwickelung gehörte, als sie für die in Rede stehenden Zwecke zur Benutzung zu wagen. Schliesslich die Verkehrsmittel, um die zur Erzeugung der Wärme resp. zum Betriebe der Maschinen nothwendigen Brennmaterialien preiswürdig zu beschaffen, fehlten.

Wären aber auch wirklich in jener Zeit alle die genannten Mittel vorhanden gewesen, so fehlte doch noch das in Bezug auf Krankenpflege in neuerer Zeit so sehr gehobene Humanitätsgefühl: für Menschenleben wesentliche Opfer zu bringen. Arbeitskräfte fehlten weniger, und hatte also auch die Erhaltung der menschlichen Arbeitskraft weniger Werth.

Jeder war damals froh, wenn er nur die nothwendigsten Bedürfnisse befriedigen und sicher wohnen konnte. Auch schien es, als wenn man damals besorgte, dass die Bevölkerung und damit die Nahrungsnoth zu gross würde, also nur Jeder auf seine eigene Erhaltung bedacht blieb. In den Kämpfen mit dem Feinde wurde ebenfalls auf die Menschen wenig Werth gelegt, indem man die verwundeten Krieger kaum der Cur würdigte. Die letzten Kriege zeigten ja noch Beispiele, dass die Mittel, um die Verwundeten einer Schlacht nach Möglichkeit zu erhalten, lange nicht zureichend waren, indem ja die Zahl der Verwundeten mit dem Umfange der Schlachten im ungünstigen Verhältniss zugenommen. Es würde, ohne scharfe Berechnungen anzustellen, in den jetzigen Kriegen nicht zu viel sein, wenn es die Taktik irgend erlaubte, die Krankenträger und Arztzahl womöglich doppelt so gross als bisher zu nehmen. Dieser letzte Wunsch wird hoffentlich durch die Genfer Conferenzen erledigt, und mögen die Krim, Italien und Böhmen die letzten Versäumnisse gezeigt haben.

Seit jener anfangs angedeuteten Zeitperiode, nach den Freiheits-Kriegen, hat freilich die Gesundheits- und Krankenpflege wenig Neues durch die Bautechniker erhalten, obgleich es wohl möglich gewesen, mehr darin zu schaffen.

Auf den technischen Lehranstalten entwickelte sich bekanntlich der Unterricht für alle die Fächer, welche hierfür nothwendig, immer mehr: Statik, Mechanik, Maschinen- und Bau-Construction, Chemie, Physik wurden von damals aufstrebenden Talenten in einer Weise gelehrt, dass der Studirende, welcher sich den Bauten für Gesundheits- und Krankenpflege widmen wollte, wohl dem Ziele näher kommen konnte; zumal die

Gefühle für unsere Humanitäts-Anstalten immer reger, und die Geldmittel dafür immer reichlicher wurden.

Gleichzeitig entwickelten sich ja auch die oben genannten Fabriken in riesigen Dimensionen, und die grossen Welt-Ausstellungen gestatteten Studien in den kultivirtesten Städten, von denen immer mehr mittelst Eisenbahnen von Jahr zu Jahr erreichbarer wurden, also ein Gedeihen der Gesundheitsbauten in jeder Beziehung erwartet werden durfte. Leider trat aber in dieser uns noch nicht fernstehenden Zeit an fast allen technischen Hochschulen das sogenannte Vielwissensollen auf, wovon sich jeder Leser, der die Bedingungen für das Examen eines Architekten kennen gelernt, überzeugt haben wird; nur das Kapitel der Gesundheits- und Krankenpflege war, man möchte sagen, überschen worden. Wenn nun einestheils solcher Wissensballast keinem Architekten gestattete, seine schwere Studienzeit auf andere Sachen als auf die zum Examen nothwendigen zu verwenden, trat auch anderntheils die Entwickelung des Eisenbahn- und Strassenbaues so in den Vordergrund, dass die Förderung der Technik für Gesundheitspflege noch immer zurückblieb.

Ausserdem hatte aber auch diese Sucht des Vielwissens noch schädliche Folgen dadurch, dass die Männer solcher Studien oft in Selbsttäuschung geriethen, namentlich wenn sie Glück in ihrem Examen gehabt. Unmöglich konnten diese Bedingungen als erfüllt anzusehen sein, weil ein blosses Präpariren auf die möglichen vielerlei Fragen nicht Wissen heissen kann. Ein solcher Zustand des Bauwesens hatte auch so lange, als es sich blos um Eisenbahn-, Chaussee-, Verwaltungsgebäude- und selbst Kirchen-Ausführungen handelte, keine anscheinend übelen

Folgen, indem Alles nach gewissen Vorbildern ausgeführt werden durfte. Derselbe wurde dann erst nachtheiliger, als derartige Männer zu Stellungen verwandt werden mussten, wo sie Einfluss auf die Gesundheits- und Krankenpflege hatten. Schulen, Krankenhäuser, Sitzungssäle, Kasernen, Irrenanstalten, Gefängnisse und auch Stallgebäude verfielen leider denselben Grundsätzen, wie die vorhin genannten Bauten; die oft bessern Vorschläge der Mediciner, Lehrer, Krankenhausverwalter und sonstiger erfahrenen Personen wurden oft als laienhaft betrachtet; und amtirte ein solcher Architekt in der Residenz, erklärte er sie oft kurz für provinziell.

Nur Aenderungen, die von den manchmal nicht viel mehr wissenden Vorgesetzten befohlen wurden, befolgte ein solcher Mann; auch Verbesserungen, die recht weit her, am liebsten aus Frankreich oder England stammten, imponirten. Gehörten jedoch zur Einführung solcher Verbesserungen, wie z. B. zu denen aus den französischen Heilanstalten; Kenntnisse von Maschinen und dergleichen, wurden sie wie so Vieles, was maassgebende Personen nicht kennen, als zu complicirt leider derart verworfen, dass ein späteres Erkennen des Irrthums einem Ehrenverlust ähnlich gewesen wäre. Es muss in der That noch heute ein trauriges Leben für solchen Mann sein, wo er selbst dann, wenn sein Irrthum ihm klar geworden, noch immer in dieser jämmerlichen Consequenz vielleicht bis an sein Lebensende verharrt.

Einen Hemmschuh gegen die künstliche Zuführung der gesunden Luft bildeten auch solche Männer, sogar hochgestellte, die kategorisch erklärten: die beste Ventilation sei das Oeffnen der Fenster; ohne dass ihnen eingefallen: dass

dieses Oeffnen der Fenster, namentlich in Heilanstalten, in der Winterzeit Rückfälle befürchten lasse. Nur durch kolossale Räume und Luft-Vorräthe konnten sich derartige Leute helfen; aber zuletzt stagnirte die Luft dennoch, Miasmen verdarben die Wände und eine grosse Zahl Krankheiten erhielten dadurch ihren Namen. Lazarethfieber, Kerkerfieber, ansteckende Augen-Entzündungen, Kindbettfieber, Schifftyphus und dergleichen sind noch heute nur die Folgen einer mangelhaften Ventilation. Eine andere Zahl Leiden der Menschen fanden ihren Grund durch den Aufenthalt in ungesunden Schulräumen. Ferner die Beamten, welche sich in ihren Büreaus die bleichen Gesichter holen, die Chemiker, die Fabrikarbeiter u. a. zeigen, dass nur die reine Luft die Menschen gesund erhalten kann. Jedem, der des Morgens einen Schlafsal, einen Schiffsraum, ein Eisenbahn-Coupee betreten, muss es klar geworden sein, dass der Mensch namentlich während des Schlafens viel reine Luft nöthig hat; die aber, wenn keine Erkältungen entstehen sollen, aus keinem sogenannten Zug bestehen darf. Gleiche Temperatur von allen Seiten, selbst wenn sie auch niedrig ist, wird einem gesunden Menschen, wenn er in Bewegung bleibt, selten schaden; während eine Temperatur-Verschiedenheit des Körpers, welche durch Zug entsteht, den Tod fürchten lässt.

Die Haupt-Aufgabe für Architekten bleibt also: den Aufenthalt für den Menschen so einzurichten, dass derselbe stets reichlich reine Luft athmen kann, ohne einer Zugluft ausgesetzt zu sein. Es ist ein ernstes Bestreben für dieses Ziel wichtiger, als die technische Kraft auf eine verlockende Zeichnung mit zarten Linien, welche höchstens nur die Bauherren verführen

kann, zu verwenden. Die schönsten Putzornamente verwittern und die Thürmchen, Zinnen und Dachkrempen machen das Bauwerk feucht und ungesund. Auch Behörden, welche etwa Preis-Concurrenzen für Gebäude der Gesundheits- und Krankenpflege ausschreiben, würden klüger handeln, das Nachdenken mehr auf gesunde Luft zu lenken, als die Zeit durch Zeichnungen in einem grossen Maasstabe verschwenden zu lassen.

Hoffentlich ist schon jetzt die Zeit gekommen, wo alle diese Vorbedingungen erkannt und das von den Naturforschern in Dresden erwähnte Versäumniss nachgeholt werden wird, zumal die Versammlung der eigenen Fachgenossen in Hamburg ja in bedauernswerther Weise gezeigt, dass die vor 4 Jahren in Wien gegründete Sektion für Heizung und Ventilation kein neues Material für die weitere Entwickelung brachte.

Wirklich ist es nach solchen Erfahrungen ein schönes Zugeständniss, dass auch jetzt die Hauptstadt von Norddeutschland einen bessern Standpunkt ergriffen und für die Examinanden des Baufaches die Kenntnisse der Heizung und Ventilation vorgeschrieben; und unsere Staatsregierung unter dem Drucke des Strebens für Gewerbefreiheit auch eingesehen: wenn die Staatsbeamten mit gutem Beispiel den Civiltechnikern vorangehen sollen, dass sie für erstere einen Theil des Vielwissensollens aufgeben müsse. Es sind desshalb von jetzt ab für diejenigen, welche sich der Richtung, wo die Gesundheits- und Krankenpflege gefördert wird, widmen, für die parallelgehende Richtung schon die nothdürftigen Kenntnisse ausreichend.

Inzwischen hat ja auch der Direktor der Königlichen Bau-Akademie, der Geheime Oberbaurath Grund öffentlich aus-

gesprochen: dass diejenigen, welche sich ausser der Staatsbeamten-Carrière der Architektur widmen wollen, nicht mehr für Examen und Titel, sondern für's Leben studiren möchten. Möge dieses von so einflussreicher Stelle gekommene Wort an allen technischen Lehranstalten Deutschlands freudigen Widerhall finden, und wir werden das Ausland auch bald auf diesem Gebiete erreichen.

Namentlich wird es möglich sein, dass strebsame Talente, denen die Mittel fehlen, in der Liste der Studirenden auf der Akademie zu figuriren, bisher also nur als Rathgeber benutzt, sich jetzt angespornt fühlen werden, ihre Leistungsfähigkeit auch für die Gesundheits- und Krankenpflege zum Ausdruck zu bringen. Nur derjenige Architekt wird noch am meisten geschätzt sein, der trockene Wände, dichte Dächer, engschliessende, reinliche Fussböden, sanft gehende Thüren, zugfreie Fenster, bequeme, gefahrlose Treppen, rauchfreie Küchen, geruchlose Abtritte und da das Problem der Wasserleitungen und Erleuchtungen, soweit es auf die Gesundheits- und Krankenpflege Einfluss hat, schon gelöst ist; kühle Räume im Sommer und warme im Winter, und vor Allem eine gesunde Heizung und zugfreie Ventilation zu schaffen weiss.

Der deutsche Stil wird durch diese Solidität nicht leiden, indem Architekten von solchen Grundsätzen nicht Putzbau als Hausteinbau erscheinen lassen; und den Backsteinrohbau der rothen Farbe wegen weder verachten noch bevorzugen; vielmehr jedes Bauwerk durch freundliche Farben verschönern und zu schützen suchen werden. Das Copiren der antiken und mittelalterlichen Ornamente wird nicht mehr als der Höhepunkt der Architektur betrachtet, sondern nur dort erlaubt

werden, wo Construction, Material und Klima damit in Harmonie zu bringen sind.

Welche Vorzüge allein durch die Anwendung der Poren-Ventilation den bisherigen besten Ausführungen gegenüber entstehen, ist aus folgenden Punkten zu entnehmen.

1) In gewölbten, namentlich gothischen Kirchen, wird die Luft gesunder und die Akustik erhöht.
2) Schulräume erhalten eine reine, zugfreie, im Winter erwärmte, im heissen Sommer gekühlte Luft.
3) Heilanstalten gewähren durch die eben bezeichnete Luftbeschaffenheit eine schnellere Heilung, gestatten weniger oder gar nicht das Ansetzen der Miasmen und verhüten die Ansteckung durch letztere.
4) Die Theater, Sitzungssäle, Auditorien und dergleichen gestatten Jedem bequeme, beliebig temperirte und ventilirte Plätze.
5) Gesellschaftsräume bieten zu jeder Jahreszeit einen zugfreien und dennoch luftreinen, angenehmen, erquickenden Aufenthalt.
6) Von den Eisenbahn-Coupees wird der lästige Staub und der ungesunde, einseitige Zug abgehalten.
7) Die Räume in Kriegs- und Personenschiffen gewähren selbst dann noch eine gesunde, zugfreie Luft, wenn alle Luken wegen Sturmwetter geschlossen werden müssen, ohne dass der eng bemessene Raum beeinträchtigt, und womöglich das Holzwerk noch besser conservirt wird.
8) Gefängnisse gewähren trotz des eng bemessenen Raumes nicht mehr den für die Zukunft nachtheiligen Aufenthalt.

9) Arbeitssäle, Laboratorien, Schreibstuben bleiben weniger durch die Ausdünstungen der verschiedenen Stoffe, als z. B.: Tabak, Säuren, Papier und dgl. ungesund.
10) In Stallgebäuden wird ebenfalls das Holz besser conservirt, hauptsächlich aber das Erkranken der Thiere, namentlich der Pferde und Schafe wesentlich verhütet.
11) Gewächshäuser gestatten das Gedeihen der Pflanzen in höherem Maasse.
12) Krankheiten, als: Kerkerfieber, Hospitalbrand, Lazarethfieber, Kindbettfieber, Schiffstyphus, ansteckende Augenentzündungen und dgl. mehr, werden wesentlich vermindert, wahrscheinlich ausgerottet.
13) Die Krankenpflege im Kriege gewinnt wesentlich, indem der Transport der Verwundeten weniger ungesund ist; und alle Kasernen, Lazarethe, Schulen, Kirchen und dergleichen dafür zu benutzenden Gebäude gewähren durch reichliche, zugfreie, temperirte Luft, selbst bei starker Belegung, einen bessern Heilraum.
14) Ausführungen von Kasernen, Lazarethen, Waisenhäusern, Arbeiterwohnungen, Gefängnissen gewähren schliesslich insofern die Ersparnisse bedeutender Summen, als sich für ein und dasselbe Baukapital fast der doppelte Zweck erzielen lässt; indem die grossen Luftvorräthe unnöthig, also die Räume kleiner werden dürfen.

Vorausgesetzt wird nach diesen Grundsätzen, dass keine Abtrittgruben die gute Luft verderben dürfen, zumal sie durch das Tonnensystem entbehrlich gemacht werden können. Für Epidemienhäuser genügen solche Wagen noch nicht,

desshalb müssen deren Ausleerungen durch die Dampfkesselfeuerung unschädlich gemacht oder desinficirt werden.

Bei Bauwerken, mit diesen und anderen sich ergebenden Vorzügen, ist eine zweckmässigere Raum-Disposition möglich, und wie die beigefügten Abbildungen eines neu entworfenen akademischen Krankenhauses zeigen, auch die bisher übliche. Es versteht sich von selbst, dass, abgesehen von dieser neuen Luftverbesserung, in Zukunft keine Krankenhaus-Direktion mehr Closets und Verbandküchen zwischen je zwei Krankensäle, und das Wasserreservoir auf den Dachboden, wie es bisher leider so oft geschehen, legen wird, indem dadurch sowohl die Luft, als das Gebäude leidet und der beliebten Südseite durch solches Arrangement auch kostbarer Raum für Krankenbetten geraubt wird. Rationell wird es also stets bleiben, wenn, wie die Abbildungen andeuten: Etagenbäder, Closets, Uriniranstalt, Ausguss, Verbandsküche in einem isolirten Thurme, um den in seiner Mitte befindlichen gemeinschaftlichen Rauch- und Luftabzug placirt; und in jeder Etage durch einen Vorplatz mit dem Haupt-Corridor verbunden werden. In dem Dachraume eines solchen Thurmes lassen sich auch die Wasserreservoire, welche im Winter in Folge des Abzuges der warmen Rauchluft dort nicht einfrieren, für erwünschten Wasserdruck aufstellen. Damit durch die Vereinigung aller dieser, die üblichen Constructionen verderbenden Stoffe, ein solcher Thurm nicht so leicht vergehen kann, darf derselbe nur aus Steinmaterial bestehen.

Von grosser Wichtigkeit sind diese hohen aus den Thürmen wachsenden Luftabzüge für die Reinheit der die Heilanstalt umgebenden Luft, indem, wenn alle ungesunden Dünste der Krankensäle nur durch diese hohen Abzüge abgeführt werden, sich dieselben möglichst vertheilen und wohl gar nichts von denselben in das Bereich der Heilanstalt zurückkehren kann. Namentlich ist solche Disposition für die Umgebung der Epidemienhäuser von Bedeutung, schon weil die Furcht davor sehr vermindert wird. Will man diese abziehende Luft der Epidemienhäuser ganz unschädlich machen, so braucht man nur in der Röhre des Luftabzuges ein Feuer anzubringen, welches alle ansteckenden Keime in der Luft vernichtet, zugleich aber noch die Zugkraft des Schornsteins wesentlich vermehrt. Es kann keinen grössern Uebelstand der Heilanstalt geben, als der des Ventilirens durch die Fenster, welcher im Sommer oft noch verderblicher werden kann als im Winter. Wenn nämlich nicht zufällig im Sommer ein frischer Wind weht, stagnirt die Luft in der ganzen Umgebung pestartig und tritt dieselbe mit der neuen Luft vermischt, zum offenen Fenster wieder zurück. Aus diesem Grunde ist auch die Heilung in den Krankenzelten und Krankenbaracken in der Jahreszeit, wo keine Windbewegung stattfindet, jammervoll; ja in der That um so mehr, als gerade in solcher Zeit, wo Baracken und Zelte der äussern Temperatur wegen zulässig, die Luftbewegung am schwächsten ist, abgesehen von der oft kaum erträglichen Hitze durch die Dächer und dem so leichten Festsetzen der Miasmen an die Gewebeflächen.

Wo man natürlich die Krankenbaracken zum Heizen einrichtet, repräsentiren sie auch weiter nichts als eine Art Fachwerkgebäude mit dünnen Wänden, welche jedoch eine grosse Menge von Brennmaterial durch die Abkühlung der Wände verbrauchen. Die vermehrte Feuersgefahr dieser Con-

structionen konnte sich bisher noch nicht geltend machen, da ja erst wenige von diesen Hütten vorhanden sind. Bisher blieb aber nur die Wahl zwischen zwei Uebeln: entweder die Kranken in den schlecht ventilirten Steinbauten, deren Wände von Jahr zu Jahr mehr mit Miasmen gesättigt werden, einer fraglichen Heilung zu unterwerfen, oder sie in die Baracken zu legen. So lange man also nichts Besseres hat, sind sie schon allein bei stark belegten Häusern, als Aushülfe des Raumes willkommen; namentlich bieten sie den Vortheil: die Krankenhäuser mittlerweile gründlich zu lüften.

Bei bemessenem Terrain, wie so oft in grossen Städten der Fall, wird die Aufstellung von Baracken kaum möglich, indem sie sich nur auf Unkosten ihres Zweckes in mehreren Etagen ausführen lassen. Leider gibt es Heilanstalten, welche diese Baracken nicht entbehren können, und einen grossen Theil ihrer Resultate dadurch erzielen, dass die Zimmer viel leer stehen. Nur durch Subvention können solche Heilanstalten noch eine preiswürdige Heilung ermöglichen und bleiben dieselben für eine regelrechte Rechnungsaufstellung: für eine gewisse Summe eine bestimmte Zahl Betten zu unterhalten, nicht maassgebend.

Wenn also, wie oben gesagt, eine Heilanstalt in der Umgebung die Luft so rein behalten will, wie sie überhaupt das Terrain bietet, darf die verdorbene Luft keinen andern Ausweg finden, als durch einen möglichst hohen Luftabzug, mit dem man selbstverständlich die Rauchabzüge der Küchen-, Zimmer-, Maschinen- und anderen Heizungen vereinigt. Diese also möglichst rein erhaltene Luft wird durch die Poren-Ventilation als die natürlichste, dem Kranken ohne Zug zugeführt:

stets in reichlichem Maasse, und von der Temperatur und dem Wassergehalt, wie der Arzt verordnet. Dadurch nun, dass diese Poren-Ventilation ohne Unterbrechung Tag und Nacht, wie ein erquickender Frühlingshauch die Krankenzimmer durchdringt, werden solche Bauwerke nicht dem Vorwurfe, dem unsere bisher nach den alten Grundsätzen mit den Luftvorräthen erbauten Heilanstalten, selbst sogar noch im Bau begriffenen entgegengehen, verfallen.

Es konnte desshalb nicht fehlen, dass diese Grundsätze des Verfassers, wo sie durch seine frühere Abhandlung einsichtigen Männern zur Kenntniss kamen, von diesen mit Freuden ergriffen, und wenn sich Gelegenheit zur Anwendung bot, sofort als maassgebend angenommen wurden. Demnach werden schon im Jahre 1869 Bauwerke, theils Heilanstalten, theils Schulen in den Städten: Dortmund, Hannover, Kiel, Osnabrück, Stuttgart, Marienwerder u. a. O. nach diesen Grundsätzen unternommen.

Sicher wird auch jeder Andere, der sich auf dem Höhepunkt des Wissens der Jetztzeit fühlt, zumal wenn er Gelegenheit für die Anwendung weiss, keine Mühe scheuen, diese Wohlthat seinen Nebenmenschen zu verschaffen, da, wie schon gesagt, bei Neubauten zugleich bedeutende Ersparnisse entstehen. Von Interesse wird es auch für die Leser, die für unsere Marine gern das Beste wünschen, sein, zu erfahren, dass alle Marine-Ingenieure und Commandeure, die diese Neuheit kennen gelernt, für die baldige Einführung streben, wodurch unsere Marine hoffentlich in Beziehung auf Gesundheits- und Krankenpflege das Ausland übertreffen wird. Keinenfalls werden aber auch die Regierungen von Frankreich, England, Russland und

Amerika, wo die Erfindung in Folge der Patent-Verleihung ebenfalls zur Kenntniss gekommen, lange säumen, und demnach das Ziel immer näher rücken: die Menschen, welche in jene engen Räume buchstäblich bisher eingepfercht waren, bald von dem Gifte der ungesunden Schiffsluft erlöst zu sehen.

Jeder Sachkenner wird sich freuen, dass dieser Erfindung im Interesse der Gesundheits- und Krankenpflege jene Phasen, die in andern Bereichen oft so hoffnungslos gewesen, hierbei erspart worden sind.

Um nun den Gang der erwähnten Verhandlungen mit den Regierungen zur Verhütung von Missdeutungen nicht unbesprochen zu lassen, namentlich da ja auch unsere als intelligent bekannte preussische Regierung zu den ersten Reflectanten gehörte, ist zu erwähnen, dass letztere die Erfindung noch zu neu eingreifend gefunden, als sie schon jetzt für die Einführung empfehlen zu dürfen; obgleich alle Bauten, selbst am Sitze derselben, sie augenscheinlich davon überzeugen müssen, dass die bisherigen Ventilationen, als: in Bethanien, in der Charité, im Elisabeth-Siechenhause, im König-Wilhelms-Gymnasium, im erweiterten Abgeordnetenhause, ferner im katholischen und jüdischen Krankenhause etc., nicht nur die Gesundheits- und Krankenpflege wenig fördern, öfters sie sogar schädigen. Die übrigen in dieser Beziehung unvollkommenen Werke des Staates, als: Gefängnisse, Kasernen, Lazarethe, Verwaltungsgebäude, Schulen, Kirchen, Kriegsschiffe, Eisenbahnwagen u. a. namhaft aufzuführen, würde den Lesern langweilig werden; des oft zu wahrer Pein sich steigernden Aufenthalts in den königlichen Theatern sowohl, als in den ersten Gesellschaftssälen kaum zu gedenken; weil von dort Jeder, der

solche Luft nicht zu ertragen im Stande ist, fortbleiben darf. Selbst das neue, von der Stadt Berlin projektirte Krankenhaus für 600 Betten wird, obgleich der Magistrat die Erfindung der Ventilation schon seit einem Jahre wusste, wahrscheinlich auf diese Verbesserung verzichten; sonach der Charité, Bethanien und den anderen Berliner Heilanstalten keine Concurrenz bereiten.

Die Heilanstalten in andern grossen Städten der Erde sind, wie viele Leser wissen werden, nicht viel besser, doch zeichnen sich einige durch die Anwendung der Dampfmaschine für die Luftbewegung aus, und ist es in der That zu wünschen, dass die Furcht vor den Dampfmaschinen-Anlagen, namentlich für Krankenhäuser, immer mehr schwinden möge. In Gefängnissen genügt die reichlich vorhandene Kraft der Gefangenen zum Bewegen der Ventilatoren.

Das stattliche Hospital La Riboisière in Paris hat z. B. sogar Reserve-Ventilatoren, und bleibt doch zu beklagen, dass die Wirkung derselben den nahe liegenden Kranken zu viel Zug verursacht, also auch dort die Luft keinen niedrigen Prozentsatz Todesfälle bewirkt. Die natürliche Ventilation durch die Fenster ist dort kaum möglich, weil unvermeidlich ein Theil der verdorbenen abziehenden Luft den nächsten Flügel treffen würde. Viel besser wird auch nicht das noch im Bau begriffene St. Thomas-Hospital in London, wenn dort nicht noch nachträglich die Einführung der Poren-Ventilation, die ja auch schon in England in Folge der Patentirung verbreitet ist, zur Berücksichtigung kommt. Auch das neue Siechenhaus in Haag hat die Fehler von Bethanien in Berlin nachgeahmt, und das neue Hospital in New-York beruht leider auf ähn-

lichen Grundsätzen, obgleich gerade Amerika durch die erste Anwendung der Kranken-Baracken den Luft-Verbesserungen für Heilanstalten am nächsten gestanden hat. Aus diesen einzelnen Beispielen geht zweifellos hervor, dass die maassgebenden Personen bei solchen Bauten sich durch ihre Vorgänger an andern Orten haben beirren lassen, da bekanntlich jede Krankenhaus-Verwaltung ihre Anlage lobt, ja am liebsten für die beste erklären möchte. Wir wollen hoffen, dass sich das bisher übliche Protectionswesen in einer so wichtigen Sache mehr auf das Sinnen nach Verbesserungen lenke, und dadurch die Gesundheits- und Krankenpflege von den Forschungen in der Mechanik, Statik, Luft- und Wärmelehre mehr als bisher profitire.

So weit nun die Erfindungen in dem Gebiete der Gesundheits- und Krankenpflege mit der nächstens zu berathenden neuen Patentgesetzgebung für Deutschland in Verbindung stehen, glaubt der Verfasser nach seinen in dieser Beziehung gemachten Erfahrungen allen Interessenten in Erwägung zu geben: ob nicht auf den Ausschluss der Erfindungen im Gebiete der Gesundheits- und Krankenpflege hinzuwirken sei, und diese so wichtigen geistigen Erzeugnisse durch die Staats-Mittel je nach dem Werthe belohnt und demnächst überall bekannt gemacht werden sollen.

Durch die bisherigen Geheimhaltungen von Seiten der Erfinder sowohl, als auch von den Mitgliedern der Patent-Commission, können oft sehr wichtige Erfindungen lange vor der Oeffentlichkeit verschwiegen bleiben. So war z. B., als der Verfasser die Patentirung in Preussen auf jene in den 14 Punkten entwickelten Verbesserungen begehrte, indem nach

dem jetzigen Patentgesetz §. 3 jede Sache Gegenstand der Patentirung werden kann, wenn sie nur neu, oder reell verbessert, oder auch nur zuerst im Lande eingeführt ist, der königlichen technischen Deputation für Gewerbe in Berlin die Erfindung weder im Prinzip noch in der Ausführung neu, allerdings ohne bisher einen Beweis des Früherwissens geliefert zu haben. Denn so weit die Forschungen unseres landesüblichen Wissens gedrungen sind und wie auch schon die am Sitze dieser hohen königlichen technischen Deputation für Gewerbe namhaft gemachten Bauten in Berlin schlagend beweisen, ist weder in Preussen, noch in Deutschland, und wie weiter die Unterhandlungen mit der russischen Regierung ferner die Erfindungs-Patente in Frankreich, England und Amerika richtig beweisen, auch in den cultivirtesten Staaten des Auslandes kein Werk, weder ein erbautes, noch geschriebenes bekannt, wonach jene Bedingungen zu erfüllen im Stande seien.

Auch die neuesten Mittheilungen über Ventilation aller Zeitschriften, in englischer, französischer und deutscher Sprache, selbst nicht die der Zeitschrift für Bauwesen, welche in dem Ministerium für Handel, Gewerbe und öffentliche Arbeiten zu Berlin, also in demselben Ministerium, unter welchem die hohe technische Deputation für Gewerbe steht; haben bisher nicht einmal den Gedanken gezeigt, dass man durch die Poren-Ventilation grosse Hospitäler, Sitzungssäle, Schulen, Theater, Gefängnisse, Schiffe u. s. w. ohne Zug und zugleich mit reiner Luft zu ventiliren, in den Krankenanstalten die Miasmen von den Wänden, und von den Eisenbahn-Coupees den Staub abhalten könne.

Es mag leider wahrscheinlich zum Amtsgeheimniss gehören, dass die hohe königliche technische Deputation zu Berlin ihr Wissen, selbst wenn es die segensreichsten Folgen brächte, nicht äussern darf; sonst würde schon allein diese eine Sache einen grössern Nutzen derjenigen Menschheit, die jene wichtige Neuheit für die Gesundheits- und Krankenpflege nicht kannte, gebracht haben, als das bedeutende Gehalt der hohen technischen Deputation seit ihrem Bestehen beträgt.

Schon allein der preussische Staat hätte bei seinen Anschaffungen von Kriegsschiffen, Kasernen, Lazarethen, Cavallerie-Pferdeställe Unberechenbares gewonnen, ohne der vielen Menschen zu gedenken, die in den letzten Kriegen durch eine reichliche, zugfreie, gesunde Luft in den Militär-Heilanstalten dem Tode entgangen sein würden. Selbst die Mitglieder des Abgeordnetenhauses würden sicher sehr dankbar gewesen sein, wenn der Sitzungssal durch diese Neuheit zugfrei geworden und trotzdem auch mit reichlicher Luft versehen worden wäre.

Also alle auf die Gesundheits- und Krankenpflege Bezug habenden Verbesserungen dürfte in Zukunft keine Patent-Commission verschweigen, zumal sich bei letzterer das Wissen des Neuen am meisten zusammenhäufen muss. Und sollte z. B. die Königliche technische Deputation für Gewerbe in Berlin auch noch andere Verbesserungen in diesem Bereiche wissen, wolle der Reichstag seinen Einfluss dahin geltend machen, dass die hohe Deputation, wenn sie diese ehrenvolle Anstellung behalten will, ein solches Mehrwissen offenbare.

Nachtrag

von neuen, noch nicht überall bekannten Verbesserungen, im Interesse der Gesundheits- und Krankenpflege.

1. Schulräume.

1. Bei einem länglichen Zimmer müssen die Fenster stets an der Langseite angebracht werden, weil dann die Beleuchtung am sichersten ist.
2. Die Fenster dürfen nur an einer Seite des Zimmers vorhanden sein, damit das Licht nicht störend wird, und kein Zug entsteht.
3. Die Fenster müssen an der ganzen Längenseite mit möglichst wenig Unterbrechung, ähnlich wie in einem Gewächshause angeordnet werden, damit an keinem Platze das Licht fehlt.
4. Alle Fenster müssen Doppelfenster sein, damit im Winter die Kälte und im Sommer die Wärme abgehalten wird und die Nahesitzenden keinen Zug zu erdulden haben.
5. Den Schülern muss das Licht auf die linke Hand fallen.
6. Vorzugsweise an der Seite, wo während des Unterrichts die Sonne belästigt, müssen statt der reparaturbehafteten Vorhänge Binnenläden aus eichenen Rahmen mit gefirnisstem

weitmaschigem Leinen überzogen sein, welches bei Temperaturen, wo die Fenster geöffnet sein dürfen, zugleich den Zug und das störende Sehen nach draussen verhindern.

7. Sämmtliche Fenster müssen Schiebefenster sein, damit die Oeffnung sowohl oben als auch unten geschaffen werden kann und die Binnenläden nicht incommodiren. Falls Gegengewichte angebracht werden, dürfen dieselben vorkommender Reparaturen wegen nicht versteckt liegen.
8. Der Lehrer muss dem Gesagten gemäss bei länglichem Zimmer an der schmalen Seite seinen Sitz haben, damit er beim Ueberblicken nicht den Kopf drehen braucht und der Schall beim Vortrag sämmtliche Schüler trifft.
9. Die Erwärmung im Winter muss von der ganzen Längenwand kommen, am besten von der Fensterseite, damit die Kühlung der Fenster möglichst ausgeglichen wird.
10. Die neue Lebensluft muss gleichzeitig von der Fensterseite, im Winter erwärmt in das Zimmer treten. Die Brustlambris eignen sich vorzugsweise dazu, und können in der Zeit, wo es draussen warm ist, mit der Aussenluft in Communication gebracht werden.
11. Die verdorbene resp. verbrauchte Luft muss durch die Deckenfläche und demnächst vermittelst der Canäle, die zwischen je zwei Balken vorhanden sind, abziehen. Bei grossen Schulen durch den Ventilationsschornstein.
12. Die Kohlensäure muss in der ganzen Länge des Zimmers, der Lufteinströmung gegenüber, durch einen Spalt in der Nähe des Fussbodens abziehen.

13. Wo einzelne Oefen angewandt werden, muss jeder Ofen seine Wärme hinter der Nr. 9 erwähnten Lambriwand ausstrahlen, wodurch die Wärme gleichmässig vertheilt wird.
14. Die inneren Treppen müssen, damit die Schüler nie hoch fallen können, vier Abtheilungen resp. drei Prodeste haben; gewundene Treppen und durchbrochene Geländer dürfen nicht erlaubt werden.
15. Die obere Begrenzung der Fenster muss des nothwendigen Lichtes wegen mindestens $^2/_3$ der Zimmer-Tiefe von der Fensterwand ab gerechnet, betragen.
16. Keine Bank darf mehr wie zwei Schüler fassen, damit der Lehrer zu jedem Schüler gelangen kann, die Schüler besser hinein und heraus können und dieselben zugleich gesunder sitzen. Frei-Gänge sind daher überflüssig und nur unmittelbar am Lehrerpult anwendbar.
17. Der Corridor muss dort, wo keine Turnhalle an das Schulgebäude schiesst, als Spielplatz bei schlechtem Wetter zureichend, desshalb möglichst gross sein.
18. Hohe Gebäude müssen in jeder Etage Abtritte und Urinirorte haben, damit sich einentheils die Kinder nicht zu sehr concentriren, und nicht veranlasst werden, der Entfernung wegen ihre Bedürfnisse zu unterdrücken.
19. Die Uriniranstalt muss, damit die Reinlichkeit erhöht wird, für Stadt-Schulen mit gegossenem Glase bekleidet sein.

2. Dampfmaschinen.

Zum Treiben der vielen Hülfsmaschinen, als: Wasserpumpen, Ventilatoren, Waschmaschinen, Trockenmaschinen,

Wäsche-Mangeln, Kartoffel-Schälmaschinen, Winden, Paternostertreppen, Holzsägen und dergleichen, wie sie in jeder grossen Haushaltung und Anstalt fast unentbehrlich geworden, gehört eine Kraftmaschine. Die sehr bewährte Dampfmaschine, welche solche Hülfsmaschinen sparsamer betreibt, wurde bisher häufig der Kesselexplosionen wegen gefürchtet und desshalb auf jene Bequemlichkeiten verzichtet. Es muss desshalb an dieser Stelle hervorgehoben werden, dass ein richtig geformter Dampfkessel mit einem hohen Wasserstand oberhalb der Feuerzüge und richtigem Federsicherheitsventil nie explodirt, und alle Furcht davor gleich der Gespensterfurcht aus Unwissenheit entspringt. Es werden in Folge dessen vielfach bei den betreffenden Anstalten die Kosten für eine solche der Gesundheit dienenden Maschine auf verwitternde Verzierungen verschwendet und oft die Kunst mehr geschändet als gefördert.

Schliesslich dient eine Dampfmaschine für eine Schule zugleich als vorzügliches Lehrmittel in mehreren wesentlichen Theilen der Naturwissenschaften.

3. Atmosphärische Kraftmaschine mit Gasbenutzung.

Wünscht der Reflectant für Kraftmaschinen, trotz der eben behaupteten Sicherheit der Dampfmaschine, eine einfachere und billige Kraftmaschine, so ist an Orten, wo Gasanstalten vorhanden, diejenige zu empfehlen, wo durch das Gas unterhalb eines Kolbens eine Luftleere geschaffen wird, demnächst die Atmosphäre den Kolben niederdrückt und auf diese Weise die Kraft erzeugt.

4. Paternoster-Treppen.

Das Steigen der Treppen in Krankenhäusern, Hôtels, Fabriken, Gefängnissen und dergleichen Bauten erschwert die Leistungen des Amtspersonals ausserodentlich. Es sind desshalb verschiedene Mechanismen in Anwendung gekommen, diesen Uebelstand der hohen Treppen zu vermindern und haben besonders die Einrichtungen auf der Welt-Ausstellung 1867 Aufsehen erregt. Allgemein fand man aber in dem langen Warten, der grossen Raumeinnahme und den nicht unbedeutenden Kosten ein wesentliches Hinderniss in der Nachahmung derselben. Der Verfasser glaubt desshalb auf die Paternostertreppe, welche ununterbrochen Personen auf und nieder befördert und dabei nur wenig Flächenraum in Anspruch nimmt, aufmerksam machen zu müssen. Für Bergleute gewinnt dieses Paternosterprinzip allerdings grössere Bedeutung.

5. Strahlenöfen.

Obgleich in jedem Semester der physikalischen Vorträge seit 50 Jahren und länger wiederholt wurde, dass die rauhen Oefen mehr Wärme ausstrahlen, als die geschliffenen, so führte doch erst eine englische Erfindung hauptsächlich auf der Weltausstellung eine Verkörperung jener Lehre vor die Augen, indem die betreffenden eisernen Oefen strahlenartige Rippen am Umfange zeigten. Solche Oefen sind in ihrem Werthe von grossem Einflusse auf unser Heizverfahren, indem dieselben die alten verrufenen Luftheizungen auf einfache Weise zu Ehren bringen. Es ist hierbei keine durch Glühen verdorbene Luft, kein Reinigen der Röhren von Russ, sowie überhaupt

keine undichte Rohrleitung zu fürchten; dieser Strahlenofen erwärmt die Luft in der mildesten Weise und führt dem Menschen zum Wohlbehagen die rein erwärmte Luft in reichlichem Maasse zu.

6. Waschmaschinen.

Die Reinlichkeit und Gesundheit durch Wäsche ist so wichtig, dass die Waschmaschinen nie genug zur Empfehlung gelangen können und wird desshalb zur Erleichterung der Waschmaschinen-Arbeit hervorgehoben, dass das Waschen nur während des Kochens der Wäsche vorzunehmen ist, weil in jenem Stadium der Schmutz sich am leichtesten entfernen lässt. Zugleich wird der Wasserkessel erspart.

7. Glas-Uriniranstalten.

Auch diese spielen in Anbetracht ihrer vorzüglichen Reinlichkeit für die Gesundheit eine hervorragende Rolle; es war nur bisher nicht gelungen, die Sprünge des dazu verwendeten Glases zu verhüten. Der Verfasser empfiehlt desshalb dafür: die Glastafeln nach den Grundsätzen des Quaderverbandes zu ritzen, damit die Sprünge nur den vorgezeichneten Ritzen folgen und weniger schädlich werden. Das Dichten der einzelnen Glastafeln geschieht durch Zusammenschleifen vermittelst scharfen Sandes. Solche geruchlose und zugleich dauerhafte Pissoire empfehlen sich namentlich für Stadtschulen, Bahnhöfe, Börsen, Bierwirthschaften, Kasernen und dergleichen.

8. Wagen für Excremente.

Die Bedeutung derselben ist schon bei Erwähnung des Tonnensystems betont, desshalb nur zu bemerken, dass dieselben

im Innern eine Filtrirschicht zur Erleichterung der Abfahrt haben müssen. Das Prinzip des Sturzkarrens und die Form des Zuckerhuts werden das bisher erschwerte Entleeren des Wagens erleichtern.

Bei dieser Gelegenheit muss auch der „Pulver-Closets“ nach Müller-Schür'schem System Erwähnung gethan werden, welche bei richtiger Anordnung die Water-Closets übertreffen, indem bei denselben kein Einfrieren, ferner kein Verfaulen des umgebenden Holzes nebst den damit verknüpften Reparaturen zu befürchten ist. Wenn vielleicht irgend wo durch mangelhafte Arbeit der Ruf derselben geschmälert worden, so ist das kein Grund gegen ein System, welches bei richtiger Durchführung keinen Geruch verbreiten lässt und die Abfuhr am billigsten gestattet.

Bemerkung

betreffs der in der Einleitung erwähnten Zuschriften von Interessenten für Gesundheits- u. Krankenpflege, sowie Andeutung der mündlichen Aeusserungen.

Um die Zuschriften nicht in zu grosser Zahl beizufügen, da sie ja doch alle auf die Dringlichkeit der Luftverbesserung in geschlossenen Räumen hinweisen, wurde bei der Auswahl nur auf die verschiedenartigen Gesichtspunkte der Absender zu dieser Erfindung Gewicht gelegt.

Auch die mündlichen Aeusserungen der in dieser Richtung erfahrenen Medicinern, Baubeamten und Architekten werden den Lesern insofern von Interesse sein, als sie alle darin übereinstimmen, dass allein der Gedanke: gesunde Luft ohne Zug durch Poren, und nicht wie bisher durch messbare Oeffnungen auf den Menschen wirken zu lassen, wichtig sei; da ja die Construction bei unserer reichlichen Materialien-Auswahl für jeden intelligenten Techniker kein Hinderniss bereiten kann.

In der Annahme, dass jede neue Leistung unter Verwerthung des Vorhandenen nur eine Abtragung der Schuld an seine Zeit ist, wird auch jeder Leser diese Mittheilungen im Interesse einer so ernsten Sache als zugehörig betrachten und demnächst in diesem Geiste für die Mitwelt weiter zu wirken suchen.

. . . . , den 5. August 1867.

Auf Euer Wohlgeboren gefälliges Schreiben vom 23. vorigen Monats, theile ich Ihnen ergebenst mit, dass es allerdings im hohen Grade erwünscht ist, eine zugfreie, regelmässige Ventilation auf Schiffen herbeizuführen und besonders auf den in neuerer Zeit allgemein zur Verwendung kommenden Panzerschiffen, welche keine Seitenlichter besitzen, und daher nur durch die Decksöffnungen mit Hülfe von Windsäcken und Metallventilatoren ventilirt werden können. Andererseits theile ich Ihnen ergebenst mit, dass sowohl in Frankreich wie in England mannigfache Apparate zur Schiffsventilation erfunden worden sind, dass aber auch diese bisher nicht vollkommen den gewünschten und versprochenen Erfolg aufzuweisen haben. Es bleibt der Technik jedenfalls noch die Aufgabe, dieses nicht leicht zu lösende Problem zu verwirklichen, und es kann nur erwünscht sein, auch deutsche Ingenieure zur Verwirklichung dieser schweren und für die Gesundheitsverhältnisse der Schiffe gewichtigen Aufgabe anzuregen.

Der General-Arzt der Marine.

. . . .

An
den Architekt und Ingenieur
Herrn Scharrath,
Wohlgeboren
zu
Bielefeld.

. . . . . , den 5. Oktober 1868.

Geehrter Herr!

Mit freundlichem Danke für die gütige Uebersendung Ihrer Broschüre über Poren-Ventilation in 12 Exemplaren gestatte ich mir, Ihnen die gleichfalls übersendeten drei Constructionszeichnungen wieder zugehen zu lassen. Im nächsten Sommer wird sich voraussichtlich Gelegenheit finden, das neue Prinzip versuchsweise zur Anwendung zu bringen. Indem ich hoffe, dass dieser Versuch die Anwendbarkeit herausstellt, wie ich nicht zweifle, habe ich für eine passende Vertheilung der Broschüre inzwischen Ihrem Wunsche gemäss Sorge getragen.

Hochachtungsvoll

. . . .
Oberbauinspector.

Ew. Wohlgeboren!

Die Broschüre, die Sie die Güte hatten, mir zu übersenden, verdient ihres wichtigen Gegenstandes halber das allgemeinste Interesse. Sobald meine Zeit es gestattet, werde ich mich mit derselben beschäftigen. Einstweilen genehmigen Sie meinen freundlichen Dank und die Versicherungen der Hochachtung

Ihres ergebenen

Hans v. Liebieg.

Wien, den 6. Oktober 1868.

Anmerk. Fabrikbesitzer in Reichenberg.

. . . . , den 5. Oktober 1868.

Auf Euer Wohlgeboren sehr gefällige Zuschrift vom 23. v. M., mittelst welcher Sie uns Ihre, die Poren-Ventilation betreffende Abhandlung haben zugehen lassen, theilen wir Ihnen ergebenst mit, dass wir von derselben mit grossem Interesse Kenntniss genommen haben, jedoch zur nähern Beurtheilung der Sache — falls solches angängig — um die betreffenden Pläne nebst Erläuterungen, zur Einsicht bitten.

Königl. Regierung, Abtheilung des Innern

. . . . .

An
den Architekten und Ingenieur
Herrn Scharrath
Wohlgeboren
zu
Bielefeld.

Celle (Prov. Hannover), 2. X. 68.

Ew. Wohlgeboren

statte ich hierdurch für die Uebersendung Ihrer Schrift über Poren-Ventilation meinen verbindlichsten Dank ab. Ich habe dieselbe mit grossem Interesse gelesen und zweifle nicht, dass diese Art der Ventilation in allen geschlossenen Räumen die beste ist. Sie würden mich zu grossem Danke verpflichten, wenn Sie mir, so weit es thunlich ist, Näheres mittheilten, damit ich eventuell die Poren-Ventilation empfehlen kann.

Hochachtungsvoll

Dr. . . . . .

Wildbad, den 26. September 1868.

Ew. Wohlgeboren

danke ich verbindlichst für die gefällige Zusendung Ihrer Schrift über Poren-Ventilation, und wünsche aufrichtig, dass es gelingen möge, die der praktischen Anwendung anscheinend entgegenstehenden Schwierigkeiten zu besiegen.

ergebenst

v. Moltke,
General.

Euer Wohlgeboren!

Seine Excellenz Herr Kriegsminister Freiherr von . . . . haben von Ihrer Schrift über Poren-Ventilation mit jenem hohen Interesse Kenntniss genommen, welches eine so gemeinnützige Idee allenthalben zu erregen nicht verfehlen kann, und beehrten mich mit dem hohen Auftrage, Euer Wohlgeboren für die gefällige Zusendung derselben den verbindlichsten Dank hiermit auszudrücken.

Mit Hochachtung

ergebenster

Dr. . . . . .
Stabsarzt.

. . . . . , den 13. November 1868.

. . . . . , den 15. Juli 1868.

Hochgeehrter Herr!

Von einer kleinen Reise zurückgekehrt, finde ich Ihr schätzenswerthes Werk über Poren-Ventilation. Dass der Gegenstand schon an und für sich hochwichtig ist, bedarf keiner Erörterung.

Im September gehen die Ferien des med.-aetiologischen Vereins für Erforschung und Vernichtung von Krankheitsursachen zu Ende und werde ich dann Ihr Werk dem Verein vorlegen.

Mit ganz besonderer Hochachtung

Ihr ergebenster

. . . . .

Vorsitzender des med.-aetiologischen Vereins.

Ew. Wohlgeboren

beehre ich mich im Auftrage des Vorstandes der polytechnischen Gesellschaft für die freundliche Zuschrift vom 27. v. M., in welcher Sie uns Mittheilungen über eine neue Methode der Ventilation von Krankenhäusern machen, unsern verbindlichsten Dank auszusprechen. Sie waren dabei so gütig, sich bereit zu erklären, uns, falls es der Gesellschaft erwünscht sein sollte, Zeichnungen zuzusenden, um die verschiedenartigen Constructionen ersehen zu können. Bei dem grossen Interesse, welches diese wichtige Sache gewährt, würden wir es mit dem grössten Danke anerkennen, wenn Sie Ihrem freundlichen Anerbieten gütigst nachkommen wollten. Es versteht sich von selbst, dass wir Ihnen die Zeichnungen ganz nach Ihrer desfallsigen Bestimmung zurücksenden werden.

Mit der vollkommensten Hochachtung unterzeichnet

Berlin, den 30. September 1868.

Der Secretär der polytechnischen Gesellschaft

Dr. Michaelis.

. . . . . , den 10. Juni 1868.

Ew. Wohlgeboren beehren wir uns die mittelst gefälligen Schreibens vom 9. April c. uns übersandten Zeichnungen und Beschreibung der von Ihnen erfundenen Poren-Ventilation, nachdem wir davon mit Interesse Kenntniss genommen, mit ergebenstem Danke hierbei zu remittiren.

Rector und Senat h. Königl. Universität.

. . . .

An
den Architekten und Ingenieur
Herrn W. Scharrath
Wohlgeboren
zu
Bielefeld.

Karlsruhe, den 8. Juni 1866.

Sehr geehrter Herr!

Indem ich für Uebersendung Ihrer Schrift über „Poren-Ventilation" bestens danke, verkenne ich durchaus nicht, dass schon die ernste Absicht, Menschen und Thieren „reichliche und reine Luft (die wahre Lebensspeise) ohne Zug" und mit Temperatur-Angemessenheit zu gewähren, alle Anerkennung verdient; dass aber diese Anerkennung zu einem grossen Verdienst, sowohl in moralischer als in materieller Hinsicht sich erheben wird, wenn der Ausführung keine erheblichen Schwierigkeiten entgegenstehen sollten. Denn zahlreiche Menschen und Thiere fallen der Mephitis, oder den ungeschickten Laren, welche vor der Rache jener zu schützen berufen sind zum Opfer.

Hochachtungsvoll

E. J. Fuchs,
Med.-Rath u. Prof.

Hochgeehrter Herr!

Seine Königliche Hoheit der Grossherzog von . . . . hat Ihre Zuschrift vom 13. ds. erhalten, womit Sie Höchstdemselben die als Manuscript gedruckte Beschreibung Ihrer patentirten Erfindung der „Poren-Ventilation“ übersenden. Seine Königliche Hoheit haben mit besonderem Interesse von dem Inhalt Ihrer Schrift Kenntniss genommen und geruhen mich zu beauftragen, Euer Hochwohlgeboren der Höchsten Anerkennung bezüglich dieser so bedeutungsvollen Erfindung zu versichern, sowie den verbindlichsten Dank des Grossherzogs für die Uebersendung Ihres Buches auszusprechen.

Indem ich durch diese Mittheilung dem mir gewordenen höchsten Auftrage nachkomme, bitte ich Sie, hochgeehrter Herr, die Versicherung der ausgezeichneten Hochachtung zu genehmigen, womit ich die Ehre habe zu verharren

Euer Hochwohlgeboren

ergebener Diener
Der Vorstand des Geheimen Cabinets S. K. Hoheit des Grossherzogs

. . . . . .

. . . . , den 16. Juni 1868.

Seiner Hochwohlgeboren
dem Herrn Architekten und Ingenieur
Scharrath
in
Bielefeld.

Seine Majestät der König haben Ihre Schrift über eine von Ihnen erfundene Ventilations-Methode, von welcher Sie Allerhöchst demselben ein Exemplar zu übersenden die Güte gehabt haben, mit vielem Interesse entgegengenommen, und bei der Wichtigkeit des in derselben behandelten Gegenstandes beschlossen, diese Schrift an das Ministerium des Innern abgeben zu lassen. Indem das Ministerium des Königlichen Hauses Sie hiervon in Kenntniss setzt, entledigt es sich zugleich des erhaltenen Auftrags, Ihnen für die Mittheilung der gedachten Schrift den aufrichtigen Dank Seiner Majestät des Königs hierdurch auszudrücken.

. . . . , am 2. Juli 1868.

Ministerium des Königlichen Hauses.

. . . . .

An
den Architekt und Ingenieur
Herrn Scharrath
Wohlgeboren
zu
Bielefeld.

Hochverehrter Herr Ingenieur
und Architekt!

Ew. Wohlgeboren sage ich meinen ganz ergebensten Dank für die gütigst zugesandten drei Exemplare Ihrer interessanten Schrift über Poren-Ventilation. Durch die Erfindung derselben ist der Gesundheitspflege (Hygiene) wie der Krankenpflege eine Unterstützung zugeführt worden, deren heilsame Wirkung unberechenbar ist. — Die Anerkennung dieser Wohlthat für die Menschheit wird eben so wenig als der Dank ausbleiben, der Ihnen für Ihre grossartige und Segen bringende Erfindung gebührt.

Von den beiden andern mir gefälligst zugestellten Exemplaren werde ich einen nützlichen Gebrauch machen.

Mit vorzüglichster Hochachtung verbleibe ich

Ew. Wohlgeboren

ganz ergebenster

Dr. Richter,
General- und Corpsarzt a. D.

Düsseldorf, den 30. September 1868.

Direction
des Albertvereins,
internationaler Frauen-Verein,
Königr. Sachsen.

Hochgeehrter Herr!

Mit wahrem Interesse habe ich Ihre geistreich durchgearbeitete Abhandlung gelesen und mich der neuen Ideen erfreut, die jedenfalls aller Orts Anklang finden müssen. Es war mir um so werthvoller, als wir selbst jetzt hier ein neues Garnison-Hospital bauen, bei dem ich als Commandant desselben sehr betheiligt bin und ausserdem der Albertverein, der unter der Leitung unserer Frau Kronprinzess steht, auch die Erwerbung eines Krankenhauses beabsichtigt. Ich habe deshalb auch Ihrer Königlichen Hoheit ein Exemplar Ihrer Abhandlung übergeben, da auch Höchstdieselbe vielen Antheil an den Verbesserungen nimmt, die so nothwendig und so viel zu dem Wohlergehen beitragen; weshalb auch Diejenigen, welche sie erdenken, zu den wahrhaften Wohlthätern der bürgerlichen Gesellschaft gerechnet werden müssen.

Herzlichen Dank, dass Sie mich durch diese Zusendung erfreut.

In vollkommenster Hochachtung

Ihr

ergebenster

Dr. Naundorf,
Major.

Dresden, den 4. Oktober 1868.

Der Oberpräsident
der Provinz
. . . . . .

. . . . . , den 5. November 1868.

Ew. Wohlgeboren erwiedere ich auf die gefällige Mittheilung vom 12. v. M. ergebenst, dass ich von dem Inhalte der mir mit derselben eingesandten Brochüre über Poren-Ventilation mit Interesse Kenntniss genommen habe und gern bereit bin, für die praktische Verbreitung der Erfindung mitzuwirken, sobald deren Ausführbarkeit und Zweckmässigkeit an Gebäuden bei denen sie angewendet worden, mir nachgewiesen sein wird.

. . . . . .

An
den Architekten und Ingenieur
Herrn Scharrath
Wohlgeboren
zu
Bielefeld.

Kaiserlich Königlich
Oesterreichische Gesandtschaft
am Königl. Preußischen Hofe.

Das K. K. Reichs-Kriegsministerium hat mit dem lebhaftesten Interesse von der Broschüre Kenntniss genommen, die unter dem Titel: „Gesunder Aufenthalt in geschlossenen Räumen durch Anwendung der Poren-Ventilation“ der Ingenieur und Architekt Scharrath aus Bielefeld ihm eingesandt hat.

Das Ministerium erkennt die grossen Vorzüge, die das neue, durch diese Broschüre angeregte System haben muss; es vermag sich aber aus dem Inhalte der Schrift kein genügendes Bild über Bau und Anordnungen der Räumlichkeiten nach diesem neuen Systeme zu machen. Um nicht zur Vornahme kostspieliger und vielleicht langwieriger Versuche genöthigt zu sein und nachdem Herr Scharrath die dankenswerthe Bereitwilligkeit aussprach, diese Erfindung im Interesse der Humanität und unter Verzichtleistung auf sein Erfindungsrecht der K. K. Regierung zu offeriren, so beehrt die K. K. Gesandtschaft sich denselben um Mittheilung solcher Details ganz ergebenst zu ersuchen, welche einem Fachmanne die Beurtheilung dieses Systems und seiner approximativen Kosten möglich machen würden.

Berlin, den 24. Januar 1869.

Der Kaiserlich Königliche Legations-Rath:
Frhr. v. Münch.

Von Ihrer unterm 9. v. M. dem Herzoglichen Staats-Ministerium hierselbst übersandten und von diesem uns überwiesenen Schrift über die Verhüttung des Ansetzens von Miasmen in Krankensälen durch Anwendung der Poren-Ventilation haben wir mit Interesse Kenntniss genommen, da die Idee, die Ventilation in den Krankensälen etc. durch Errichtung poröser Wände herzustellen, ebenso neu als genial ist und zu den wohlthätigsten Reformen im Bauwesen führen kann.

Indem wir Ihnen für die Uebersendung der gedachten Schrift danken, geben wir Ihnen anheim, ob Sie durch nähere Erläuterung der darin enthaltenen Andeutungen uns Gelegenheit zu eventueller Benutzung Ihrer Vorschläge geben wollen.

. . . . . , den 29. December 1868.

Herzogl. Regierung,
Abtheilung des Innern und der Polizei.
. . . . . .

An
den Architekten und Ingenieur
Herrn Scharrath
Wohlgeboren
in Bielefeld,
Westfalen.

Das k. k. Handels-Ministerium hat mit grossem Antheile Einsicht in die mit der Eingabe vom 6. Juli v. Js. übersendete Broschüre über Ferro-Ventilation genommen, und erkennt hiernach nicht die Möglichkeit, [illegible]

Der auf Seite 21 dieser Broschüre erwähnte Uebelstand, dass die Eisenbahn-Reisenden in den Waggons, insbesondere während der Vier- und Mehrstündigen, oftmals durch Rauch und Staub sehr belästigt werden, ist wirklich vorhanden, und wenn diesem Uebelstande durch die Ferro-Ventilation in einfacher und billiger Weise abgeholfen werden könnte, so würden die österreichischen Eisenbahn-Direktionen wohl geneigt sein, dieselben gegen eine mässige Entschädigung des Einführers zu adoptiren

Wien, am 28 März 1869.

Für den Minister

.....

An
Herrn W. Scharrath
Architekten und Ingenieur
zu
Bielefeld.

Literarische Anzeigen.

Der Verfasser dieser Broschüre, welcher seit zwanzig Jahren unter der Entwickelung der Industrie und des Handels das Glück hatte, mit einer grossen Zahl Bauten betraut zu werden, hat namentlich durch selbständige Entwürfe und Ausführungen von Kunstmühlen, mechanischen Webereien, Bleichereien, Wollspinnereien und Ziegeleien; Sägewerken, Flachsbereitungs- und Appretur-Anstalten; Lagerbier-Brauereien, Dampfbrennereien, Destillationen, Hefen-, Oel- und Tabaks-Fabriken; landwirthschaftl. Bauten und Maschinen, Wasser-, Thier- und Dampfkraft-Anlagen; Wohn- und Versammlungs-Gebäuden Gelegenheit gefunden eine grosse Zahl Neuheiten zu ersinnen und einzuführen, welche, nachdem sie sich bewährt, der technischen Literatur nicht länger fremd bleiben dürfen. Da ferner der Verfasser aus den vielen Concurrenz-Ausschreiben der neuesten Zeit ersehen, dass sich ein grosses Verlangen nach gesunden, bequemen und soliden öffentlichen Bauten geltend macht, hat derselbe ausführliche Entwürfe von Kirchen, Schulen, Heilanstalten, Theater-, Parlamentsgebäuden u. a. mit Einverleibung der Poren-Ventilation ausgearbeitet; so wie schliesslich in Folge der noch nicht aufhörenden Eisenbahn-Unglücke dahin gestrebt: auch dafür Verbesserungen zu ersinnen. In Anerkennung dieser langjährigen schwierigen Ar-

beiten ist der Verfasser mit der Wahl zum Mitarbeiter mehrerer technischen Journale und Sammelwerke beehrt worden, verfehlt desshalb bei dieser Veranlassung nicht, allen Interessenten fürs Reell-Neue auf die A. bereits versplittert erschienenen, B. noch unter der Presse, und C. in der Vorbereitung befindlichen Veröffentlichungen aufmerksam zu machen.

A. Bereits erschienen:

1. **Verbesserungen der Waschmaschinen** zur Gewinnung weisserer Wäsche mit Ersparung des Kochkessels. (Landwirthschaftliche Zeitung für Westfalen und Lippe.)
2. **Das Oeconomiegebäude** mit Steindecken, Ventilation, verbesserten Krippen, Fenstern und Dachconstructionen. Mit 3 Tafeln Zeichnungen. („Zeitschrift für Bauwesen".)
3. a) **Verbesserungen in der Mehlfabrication;** b) **Vereinfachung des unterläufigen Mahlgangs.** Mit 1 Tafel Zeichnung. (Zeitschrift „Mühle", Organ für Mühlen-Interessenten.)
4. **Die Mahl-, Stampf-, Oel- und Säge-Mühle,** theils durch eine Dampfmaschine mit horizontalem Schwungrad, theils durch ein oberschlägiges Wasserrad betrieben. Mit 5 Tafeln Zeichnungen. (Sammelmappe für Bauentwürfe, von Behse, G. C. Knapps Verlag in Halle.)
5. a) **Der Kraftsammler für Eisenbahnen** (beim Bergabfahren wird die Kraft für das Berganfahren gesammelt), b) **Erfahrungen bei Anwendung des Petroleums als Schmiermittel.** Notizen. (Deutsche Bauzeitung.)
6. **Vertilgung der Wasserpest.** Mittheilung mit Skizze auf der Versammlung deutscher Architekten und Ingenieure in Hamburg. (Ostseezeitung.)
7. **Verhütung des Lockerwerdens der Leerscheibenbüchse und Schonung der Wellen** bei Riemenbetrieb. Mit Skizze. (Der praktische Maschinen-Constructeur.)
8. **Fünfundzwanzigjährige Erfahrungen im Gebiete der Maschinenkunde, des Baugewerks, der Baukunst und der Bauspeculation.** (G. C. Knapps Verlag in Halle.)
9. **Gesunder Aufenthalt in geschlossenen Räumen.** Mit 2 Abbildungen. Als Manuscript gratis an Regierungen, Behörden, Universitäten, wissenschaftliche Academien und Vereine versandt.

B. Unter der Presse:

10. **Eine seit 8 Jahren bewährte Dampfbrennerei und Hefenfabrik,** nach den Constructionen des Verfassers, mit verbesserter Maischmaschine, Hefenpresse, Glasgährbottige etc. versehen. Mit 5 Tafeln Zeichnungen. (Verein der Hütte in Berlin.)

C. In Vorbereitung für die möglichst baldige Herausgabe begriffen:

11. **Die Lagerbierbrauerei** mit Etagenkeller, Eiskeller, neuen Maischmaschinen, Darröfen, Grünmalzelevatoren, Bierwinden, Kesselfeuerungen etc., nebst Bemerkung über nicht dem Verfall ausgesetzte Eiskeller für Oeconomien etc. Mit 10 Tafeln.
12. **Sägewerke mit Vollgatter und Kreissägen,** nach neuen, billigen und dauerhaften Constructionen. Mit 5 Tafeln Zeichnungen.
13. **Fahrkunst für Bergwerke,** beweisbar beste Lösung der von dem Vereine für die Beförderung des Gewerbfleisses in Preussen mit 1000 Thlr. und der goldenen Denkmünze

als Preis gestellten Aufgabe, nebst Einrichtung mechanischer Treppen für Hôtels, Heilanstalten, Glocken- und Uhr-Thürme, rücksichtlich eines Vortrages des Verfassers vor der Versammlung der Bergbeamten in Dortmund. Mit 5 Tafeln Zeichnungen.

14. **Der mechanische Getreidethurm.** Mit 3 Tafeln Zeichnungen. Enthält, auf Erfahrungen gestützt, folgende Vorzüge: Ersparung an Kosten für Terrain, Gebäude und Umschaufeln, so wie der Sack-Winde.

15. **Verbesserung der Dampfkessel.** Mit 10 Tafeln Zeichnungen. Die Entwürfe, auf die Erfahrungen von 50 durch den Verfasser ausgeführten Kessel-Anlagen gestützt, ergeben Ersparung an Herstellungs-Kosten und Brennmaterial; gewähren ferner grössere Sicherheit und Dauer.

16. **Die Dampfmaschine in ihrer verschiedenen Gestaltung zu dem Zwecke und der Localität.** Mit 10 Tafeln Zeichnungen. Nach eigenen Entwürfen und bewährten Ausführungen des Verfassers zusammengestellt.

17. **Die Verbesserungen in der Maschinenkunde,** als neu construirte und seit 10 Jahren bewährte, Zapfenlager, Wandlager, Hängelager, Bocklager, Mühlenbuchse, Halslager, Radverzahnungen, Gusseisenräder, Stopfbüchsen, Ventile etc. Mit 10 Tafeln Zeichnungen.

18. **Die Gesundheits- und Krankenpflege** auf Personen-, Auswanderer- und Kriegsschiffen, mit Rücksicht auf den von dem Verfasser in der Section für Marinetechnik bei Versammlung deutscher Architekten und Ingenieure in Hamburg gehaltenen und durch Skizzen erläuterten Vortrag. Mit 3 Tafeln Zeichnungen.

19. **Die Dach-Constructionen mit neuen sparsamen und soliden Verbesserungen,** in Rücksicht auf das Preisausschreiben des österreichischen Ingenieur- und Architekten-Vereins ausgearbeitet. Mit Zeichnungen im Text und auf besonderen Tafeln.

20. **Wichtige Verbesserungen im Eisenbahnwesen,** erfunden von dem Verfasser. Mit 10 Tafeln Zeichnungen. Die Vorzüge gegen die jetzt besten Constructionen sind folgende: grössere Sicherheit gegen Entgleisen, Ersparung pro Meile und pro Jahr durchschnittlich mindestens 2000 Thaler, Entbehrung theurer Schienenfabriken, Verhütung des Zusammenstossens der Personenzüge, Ersparung der Weichen und Zwischenstationen, bequemere Wartesäle bei zwei verschiedenen Bahnlinien, Verminderung des Rauches bei Locomotiven, Abhaltung des ungesunden Luftzuges und Staubes von den Eisenbahn-Coupés.

21. **Das Verhältniss des Kaufmannes zur Fabrikation.** Ein Vortrag, gehalten von dem Verfasser im kaufmännischen Verein zu Bielefeld.

22. **Die Reform des Unterrichts auf technischen Elementar- und Hochschulen.** Ein Vortrag.

23. **Der Bau gesunder, bequemer und solider Wohnungen nebst deren Möbelment.** Mit 10 Tafeln Zeichnungen. In Rücksicht auf einen im polytechnischen Verein zu Bielefeld gehaltenen Vortrag und dessen nach verbesserten Grundsätzen erbauten und möblirten Wohnhause des Verfassers ausgearbeitet.

24. **Das Verständniss der alten Baustile** bei ihrer Anwendung auf die Gegenwart, durch vergleichende Zeichnungen von sogenannten Autoritäten erläutert. Als Vortrag gehalten im wissenschaftlichen Vereine zu Bielefeld von dem Verfasser.

25. **Der Bau gesunder Gebäude**, als: Schul-, Gefängniss-, Casernen- und Stallbauten u. a. Mit 30 Tafeln Zeichnungen.

26. **Der Bau angenehmer und gesunder Hôtels, Gesellschafts-Gebäude und Theater**, nach den neuesten Bedürfnissen bearbeitet. Mit 12 Tafeln Zeichnungen.

27. **Der Bau eines deutschen Parlaments-Hauses** mit wesentlichen Vorzügen. Mit 5 Tafeln Zeichnungen.

28. **Der Bau der Heil-Anstalten, nach den Grundsätzen der Poren-Ventilation.** Mit 12 Tafeln Zeichnungen. Vorzüge den jetzigen besten Bauten gegenüber sind: Ersparung an Bau- und Curkosten, Verhütung der ansteckenden Miasmen, Erzielung schnellerer Heilung und Verminderung der Sterblichkeit.

29. **Der neue Berliner Dom.** Concurenz-Arbeit des Verfassers, mit Rücksicht auf einen Fortschritt im Kirchenbaustile, insbesondere Verbesserungen der Altaranlage, Kanzelstellung und Akustik, sowie des gesunden Aufenthaltes der Geistlichen und Kirchenbesucher. Mit 20 Tafeln Zeichnungen.

30. **Die Rechts-Zustände in der Technik**, nach eigenen fünfundzwanzigjährigen Erfahrungen bearbeitet und durch eine Anzahl Thatsachen aus der Praxis erläutert.

Inhalt:

a. Schutz der Bauherren gegen die Unreellität der Techniker und Baumaterialien-Fabrikanten.
b. Schutz der Techniker und Baumaterialien-Fabrikanten gegen etwaige betrügerische Absichten der Bauherren.
c. Schutz des Technikers gegen die Unreellität der Baumaterialien-Fabrikanten.
d. Die Honorirung für Ertheilung guten technischen Rathes.
e. Schutz gegen die Parteilichkeit der Preisrichter.
f. Schutz gegen ungerechtfertigte Anmaassungen der Referenten technischer Zeitschriften.
g. Schutz gegen ungehörige Vorkommnisse im technischen Examinationswesen.
h. Praktische Anleitung zur Erzielung der Erfindungspapatente auf reelle Erfindungen in Preussen und anderen Ländern.
i. Beleuchtung der jetzigen Rechtspraxis bei technischen Streitigkeiten in Deutschland.
k. Reform der Baupolizei.

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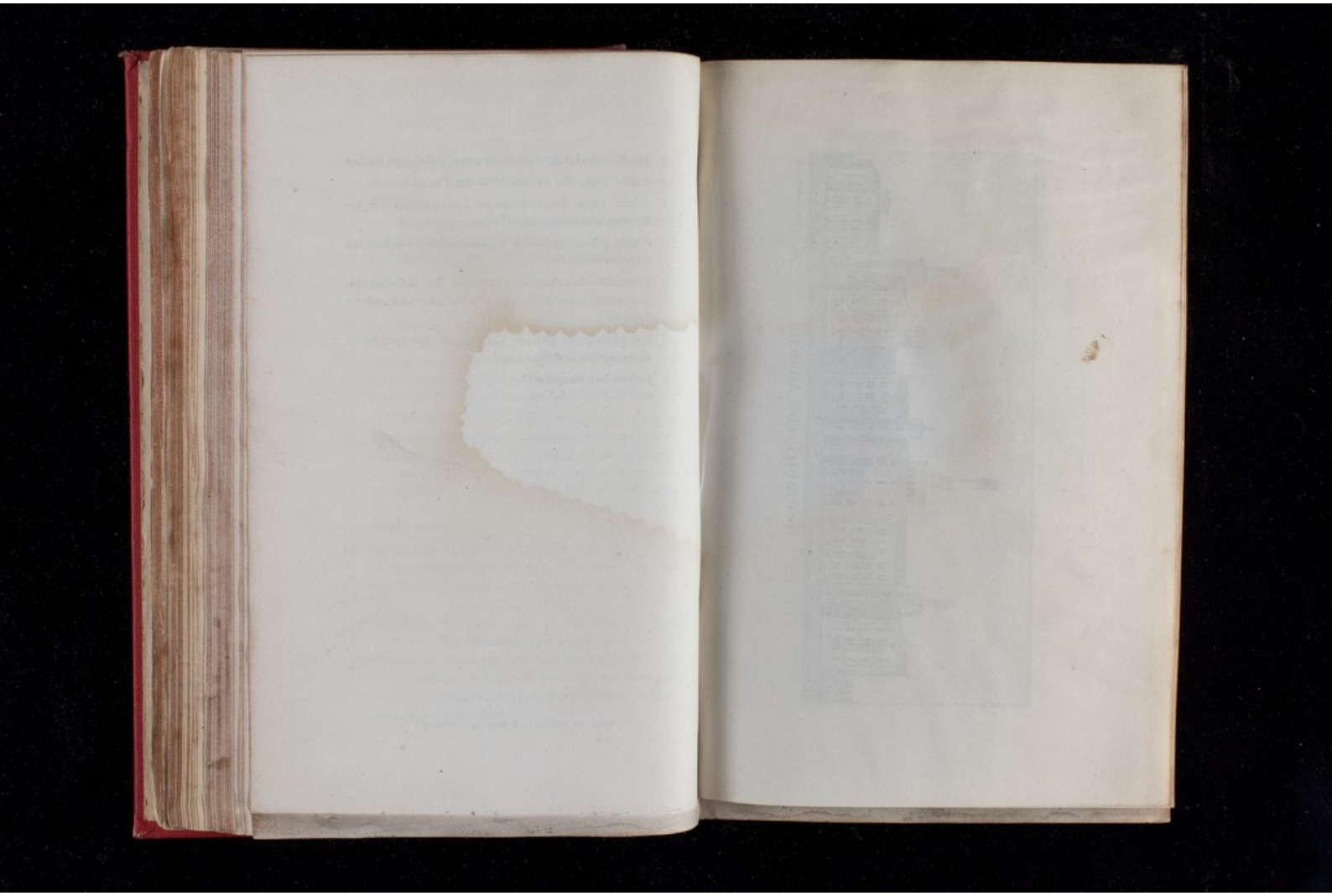
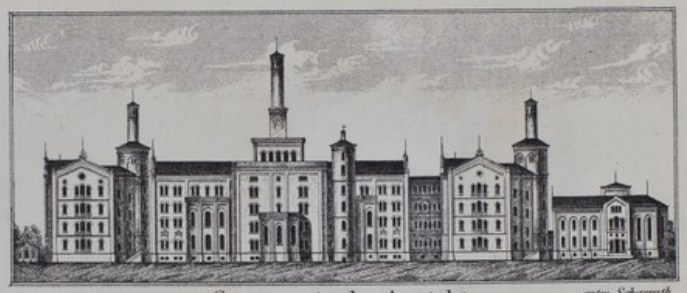
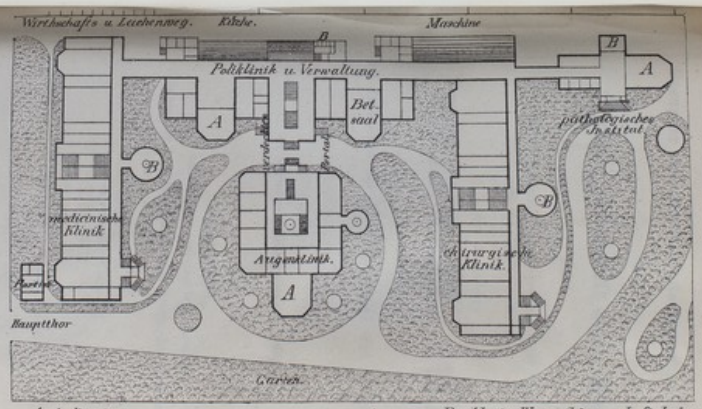




Geometrische Ansicht. entw. Scharrath.



A Auditorien. B Aborte, Wasserthürme u. Luftschächte.

Dispositionsplan
einer academischen Heilanstalt
erfunden von Scharrath.

Gesunder Aufenthalt in geschlossenen Räumen

oder

reine Lebensluft ohne Zug

und

Verhütung des Ansetzens der Miasmen in Krankensälen

durch Anwendung der

POREN-VENTILATION

mit einem Nachtrage

im Interesse der Verbesserungen der betreffenden Gebäude.

Zu weiteren Abhandlungen eingeleitet

durch

Scharrath,
Architect und Ingenieur in Bielefeld,
Inhaber der Erfindungspatente in Frankreich, England etc.

Als Manuscript gedruckt.

Druck von R. A. Schenk in Bielefeld.

Seitdem der grosse Werth der heilsamen Kraft der frischen Luft in geschlossenen Räumen allgemein zum Wohlbefinden der Menschheit anerkannt, haben sich die Bautechniker befleissigt, diesem früher zu wenig berücksichtigten Gegenstande ihre Erfindungskraft zu Theil werden zu lassen.

Wenn auch schon der Aufschwung der Industrie die Mittel zur Erzeugung künstlicher warmer Luft, oder auch künstlich gekühlter Luft, so wie zur beliebigen Bewegung derselben gegeben, blieb dennoch die Art und Weise der Wirkung der frischen Luft auf den Menschen die noch zu lösende Aufgabe. Betrachtet man also die verschiedenen Arten bisheriger Luftbewegungen, als durch Gitter, Windrädchen, Jalousien etc., ferner die eben so verschiedenen Puncte, sogar die entgegen gesetzten, so-

wohl der Einströmung als auch der Ausströmung; so muss sich Jedem die Ueberzeugung aufdrängen, dass noch ein eifriges Suchen nach dem richtigsten Prinzip der Luftwirkung stattfindet. Dass dieses Suchen hauptsächlich seinen Grund nur in der Verhütung der Zugluft bei Förderung grosser Luftmassen hat, ist bekannt, denn das Ideal der reinen Luft, wie es im Freien bei angenehmer Sommerluft verwirklicht vorhanden, bleibt bei den bisherigen Einrichtungen unerreicht. Nur diejenigen Menschen erhalten bisher in geschlossenen Räumen frische Luft, welche sich in einer solchen künstlich erzeugten Luftströmung befinden, während sie den ausserhalb einer solchen Luftströmung befindlichen Menschen leider fehlt.

Angesichts jener Uebelstände ergriff der Verfasser, welcher sich durch Ausarbeitung neuer Constructionen und Ausführung von vielen Bauten im Ingenieurwesen Erfahrungen gesammelt, die Ventilation für geschlossene Räume.

Zunächst stellte derselbe Vergleiche zwischen den Resultaten der Zelte, Krankenbaracken, Fachwerkhäuser und dergleichen zu den Steinbauten an, aus denen sich bekanntlich nach den neuesten Erfahrungen ergiebt: dass namentlich in den Zelten bei angemessener Sommerluft-Bewegung die Wundkranken bedeutend schneller, mindestens ein Viertel früher als in den jetzt üblichen Steinbauten genesen; weil in denselben meistens reine Luft und kein schädlicher Zug vorhanden ist. Da nun aber die natürliche Windbewegung häufig zu stark ist; mitunter aber,

wie besonders an heissen Sommertagen, dieselbe leider ganz aufhört, der Zustand auch in einem Zelte ein sehr unvollkommener wird. Die Sonnenstrahlen wirken dann zu intensiv auf das Dach des Zeltes und die schädlichen Dünste setzen sich leicht fest. Ausserdem haben aber Zelte durch die grössere Zahl, in welcher sie gewöhnlich zur Benutzung kommen, das Nachtheilige: dass die verbrauchte Luft von einem Zelte in das andere strömt, und dadurch schädliche Mischungen hervorgerufen werden.

Dass diese Krankenzelte nur für kurze Zeit im Jahre zu gebrauchen, ferner reparaturbedürftig und feuergefährlich, also auch sehr kostspielig sind, schliesslich wegen der Ausführung in nur einem Geschoss viel Raum verschwenden, bedarf keiner weiteren Auseinandersetzung.

Der Verfasser glaubte also den Ansprüchen der Mediciner auf's Einfachste zu genügen, wenn er den Steinbauten nur die Vorzüge eines Zeltes, aber nicht die Nachtheile einverleibte; also die Wände der Steinbauten, welche nicht den Witterungseinflüssen ausgesetzt sind, mit Poren versehen und durch dieselben die frische Luft, selbstredend im Winter erwärmte und im heissen Sommer gekühlte auf die Menschen wirken lassen würde. — Diese Poren sind es ja überhaupt, welche auch in sämmtlichen organischen Zusammensetzungen unentbehrlich sind, und vielleicht in unserer Bekleidung zur lebhaftesten Veranschaulichung gelangen. Das erheblich grosse Luftquantum, welches die Poren unseres Körpers consumiren, concentrirt auf einen

Punkt desselben, kann nur schädlich wirken, gesundend aber, wenn die Luft gleichmässig auf unsern Körper vertheilt wird.

In demselben Verhältniss wirkt z. B. das Gewebezelt oder die poröse Wand auf die Bekleidung. Wohl Jeder hat es erfahren, dass die einseitige Wirkung, selbst einer gelinden Luftzuströmung, die wir stets Zug nennen, im Zimmer oder Wagen fühlbarer und ungesunder ist, als stürmisches Wetter, wenn es von allen Seiten auf uns wirkt.

Eine Annäherung solcher Luftwirkung durch Poren haben wir ausser in den Zelten, in jedem dünnwandigen Gebäude, und ist der Aufenthalt, wenn nicht die Poren dieser Wände durch Tapeten verschlossen sind, unter allen Umständen viel gesunder, als in einem Gebäude mit dicken Aussenmauern. Selbstredend sind keine feuchten Wände vorausgesetzt; die Feuchtigkeit ist also stets auf's Sorgsamste zu verhüten.

Die bekannten Versuche vom Professor Pettenkofer haben überzeugend ergeben, wie bedeutend die Porosität selbst starker Wände in Bezug auf Luft-Durchdringlichkeit unter entsprechendem Luftdrucke ist.

Da nun aber die alten gesunden Fachwerkgebäude in Folge der hohen Holzpreise den Steinbauten Platz gemacht, und die mit trockenem Holze gefeuerten Camine und Oefen, welche zugleich Luftabzüge bildeten, der jetzt billigeren Kohlenfeuerung weichen mussten, ist die Lebensweise ja auch in dieser Beziehung eine andere und der Mensch

dadurch ebenfalls ein weichlicherer geworden. Tapeten, Doppelfenster, Teppiche verwöhnten uns immer mehr, und wir mussten mit Luftvorräthen rechnen. Also hohe grosse Zimmer konnten bisher dem Menschen nur Das periodisch verleihen, was er durch jene alten Fachwerk-Bauten permanent hatte. Es könnte demnach nur die Frage erwogen werden, ob fortwährend frische Luft oder nur periodisch frische Luft besser sei. Naturgemäss können nur Wenige der letzteren Eigenschaft den Vorzug geben; jedoch ehe alle Vorurtheile gegen die Porenventilation überwunden sind, lässt sich auch noch die Rechnung mit den bisher üblichen Luft-Vorräthen für gewöhnliche Wohnräume entschuldigen.

Wenn es nun aber auch zu den Unmöglichkeiten gehört, die früheren körperlichen Abhärtungen in geschlossenen Räumen einzuführen, liegt uns um so mehr die Pflicht ob: die betreffenden Räume so zu vervollkommenen, dass Körper und Geist nicht durch dieselben geschädigt werden.

Der Verfassar glaubte also zunächst bei Bauwerken, wo viele reine Luft ohne Zug erwünscht ist, sämmtliche Scheidewände, die bekanntlich nicht den Witterungseinflüssen ausgesetzt sind, zur prinzipiellen Durchführung der Poren-Ventilation benutzen zu dürfen und dadurch den Bewohnern fortwährend reine Luft, im Winter wärmende und im heissen Sommer kühlende zuzuführen.

Auf diese Weise würde es also möglich sein, jedem geschlossenen Raume eine Luft zu gewähren, die der freien

Luft an angenehmen Frühlingstagen in Betreff der Qualität möglichst nahe kommen dürfte.

Die am Eingange erwähnten Lufterwärmungs- und Abkühlungs-Methoden mit den zugehörigen Windgeschwindigkeits-Apparaten resp. Ventilatoren, gestatten diese Annehmlichkeiten in jedem beliebigen Grade.

Also Kerkerfieber, Hospitalbrand, Lazarethfieber, Schiffstyphus, ansteckende Augenentzündungen u. s. w. bleiben von jetzt ab, nachdem die Poren-Ventilation zur practischen Möglichkeit gelangt ist, nur noch als Folgen der Versäumnisse der letzteren zu betrachten.

Aber nicht nur alle aufgeführten gefährlichen Krankheiten, welche zum Teil eine Erbschaft von den betreffenden Räumen waren, werden durch die Poren-Ventilation verhütet, sondern es wird auch die Sterblichkeit wesentlich vermindert und jede Kur abgekürzt. Berechnet man z. B. blos den enormen Nutzen beim Militär, wo nur gesunde Leute ausgewählt werden, so ergeben sich demnach mindestens fünf Prozent für den Aufenthalt in den Krankenhäusern trotz der bisher an gewandten zugigen Ventilation, also für Europa allein mindestens fünfzig Tausend kranke Soldaten. Durch die Poren-Ventilation würde aber diese Zahl bei ein und denselben Verhältnissen wesentlich geringer, und der Gewinn für diesen Fall allein schon auf mindestens zehn Tausend gesunde Menschen zu berechnen sein.

Wenn man einen Kriegsfall, wo die Kasernen bekanntlich als Lazarethe zur Verwerthung kommen, auch unberücksicht lassen wollte, ist ausserdem die Zahl derjenigen Menschen, welche dem Mangel einer guten Ventilation im leiblich gesunden Zustande ausgesetzt sind, sehr gross. Namentlich gehören Gefangene, Soldaten in Kasernen und auf Schiffen, Irrenhauskranke, Waisenhauskinder, Schüler, Studenten, Bureauschreiber, Beamte, Gelehrte, Chemiker, Schriftsteller, Mitglieder grosser Versammlungen, und schliesslich die Besucher der Theater, die Reisenden auf Seeschiffen, sowie auf der Eisenbahn und Post u. a. zu diesen der gesunden Luft Beeinträchtigten.

Die Vorzüge der Anwendung der Poren-Ventilation würden nun in den verschiedenen Fällen hauptsächlich folgende sein:

a. betreffs der Miasmen.

Dieser böse Feind in den Heilanstalten lässt sich zwar durch Waschen der Wände u. dgl. vermindern, dennoch bilden die Risse in den Flächen zu geeignete Pflanzstätten, als dass sie vollständig vertilgt, oder besser ganz abgehalten werden könnten. Sobald aber die Wände derart porös sind, dass jede Pore zur Luftdurchführung verwerthet wird, also die Luftströmung die Miasmen von den Wänden abdrängt, ist ein Festsetzen derselben unnatür-

lich, abgesehen davon, als die gesammte Luft in einem solchen Krankensaale fortwährend so rein, dass ein Gedeihen der Miasmen kaum denkbar ist. Die Miasmen gedeihen bekanntlich nur unter bedingter Luftmischung und Temparatur; welche Bedingungen aber bei der Poren-Ventilation glücklicher Weise nicht vorhanden sind.

Diejenigen Wandflächen jedoch, welche keine Zuströmungsporen haben, als z. B. die Fensterwand und die Hauptthürwand, können den für Krankenzimmer gewählten Oelanstrich beibehalten.

Für die Abströmung der mit Miasmen gemischten Luft lassen sich zur Verhütung des etwaigen Ansetzens der ersteren die Poren entbehren und sind dafür messbare Oeffnungen zulässig, jedoch müssen dieselben auf der ganzen Deckenfläche zur Verhütung der ungleichmässigen Luftabströmung vertheilt sein. Je höher also die Decke, desto concentrirter dürfen auch die Luftabströmungen sein, indem es ja nicht darauf ankommt, welche Bewegung die Luft annimmt, nachdem sie die wohlthätige Wirkung auf den Menschen ausgeübt hat. Bei Schiffen z. B., wo sich die Decke unmittelbar über dem Kopfe befindet, müssen zur Verhütung des Zuges messbare Oeffnungen unterlassen, und Poren, wenigstens Fugen durchgeführt werden.

b. betreffs der Ansteckung.

Es ist schon bei Besprechung der Zelte hervorgehoben, dass die bisherige Ventilation für die Nachbarn leicht von

übelen Folgen begleitet sei, deshalb wird bei den Steinbauten mit Poren-Ventilation darauf Rücksicht genommen, dass keine verdorbene Luft durch die Fenster entweichen kann. Diese Poren-Ventilation ist bei ihrer Vertheilung auf die grossen Wandflächen nicht auf die Ergänzungs-Ventilation der Fenster und Thüren angewiesen, sondern alle verdorbene Luft wird, nachdem sie das Krankenzimmer verlassen, concentrirt; demnächst durch Verbrennen vernichtet und schliesslich so hoch durch einen Schornstein geführt, dass sie möglichst vertheilt und dadurch unschädlich für die Umgebung der Heilanstalt bleibt. Auf ähnliche Weise werden auch die ansteckenden Ausleerungen unschädlich gemacht. Letzterer Punkt gehört zwar nicht in das Bereich der Poren-Ventilation, kann aber bei der Abhandlung über Ansteckung nicht oft genug betont werden, weil zu einer vollständigen Verhütung der Ansteckungen die Vernichtung der Ausleerungen vor Allem nothwendig bleibt.

c. betreffs der reinen Luft in der Umgebung des Bauwerkes und schnelleren Heilung.

Durch die eben erklärte Eigenschaft eines Bauwerks ist es auch möglich: alle neue Luft für die einzelnen Kranken-Säle wesentlich reiner zu gewinnen, während es bisher nur bei stürmischem Wetter denkbar; bei einer ge-

ringern Windbewegung oder gar Windstille factisch unmöglich war.

Selbstredend rufen derartige Momente in den Heilanstalten leicht Rückfälle der Krankheiten hervor, welche aber bei der richtig durchgeführten Poren-Ventilation nur aus andern Ursachen möglich sind.

Durch die Zuführung der möglichst reinen Luft, welche gleichzeitig durch die Poren-Filtration vom Staube befreit wird, und ohne jeden schädlichen Zug ist, erhält die Heilkunde eine neue Basis, und ist dieselbe nicht genöthigt, wie der verstorbene Director der chirurgischen Klinik zu Heidelberg, Prof. Dr. Otto Weber treffend sagte: den Einfluss der schlechten Hospitalluft fortwährend bei der Behandlung abzuziehen. Ausserdem stellte derselbe den zweifellosen Grundsatz auf: „von der Reinheit der Luft hängt grösstentheils die Genesung der Kranken ab, und dieser Nutzen bestimmt zugleich die Dauer des Verlaufs der Krankheit und somit die ganze Oeconomie".

Diese letztern Worte sollten sich namentlich die Vorstände jener Gemeinde-Krankenhäuser zu Herzen nehmen, welche leider in folgender Weise calculiren: wir bekommen pro Tag für jeden Kranken nur so und so wenig, können desshalb keine Mittel aufwenden, die Luft zu verbessern.

In Consequenz des Strebens für Luftreinheit gehört noch, obgleich nicht wie schon bemerkt im unmittelbaren Zusammenhange zur Poren-Ventilation die Beseitigung

der Abortgruben. Wenn auch dieselben in der solidesten Weise erbaut, sie dennoch die Luft in der Umgebung der betreffenden Bauwerke verderben. Es ist allerdings für die Ausführenden nicht leicht, die unfehlbaren Mittel zur Beseitigung dieses in die Cultur tiefeinschneidenden Uebels zu treffen; doch das darf nicht hindern, einen solchen schreienden Uebelstand bestehen zu lassen, namentlich nicht dort, wo Tausende in einer Anstalt wohnen müssen, wie z. B. in grossen Militair-Casernen, Gefängnissen und dergl.

d. betreffs der Gefängnisse.

Dieselben haben in Bezug auf gesunden Aufenthalt bisher wohl das Meiste zu wünschen übrig gelassen, indem jede Oeffnung zur Luft-Ein- und Ausströmung leicht Veranlassung zu Fluchtversuchen geben konnte. Anders verhält es sich aber bei Anwendung der Poren-Ventilation, weil dieselbe, wie schon gesagt, keine Oeffnungen für die Ventilation bedingt. Und gerade Gefängnisse sind diejenigen Bauwerke, welche die Luft in jedem beliebigen Quantum auf billige Weise gestatten, indem die Gefangenen stets Zeit übrig haben, einen Flügelapparat zur Herbeiholung frischer und Fortschaffung verdorbener Luft zu bewegen. Die Gefangenen, und besonders diejenigen, welche einer Befreiung und demnächstigen Erfüllung ihrer Berufspflicht entgegensehen dürfen, werden gern die Zeit dazu von ihren Freistunden nehmen, um nur ihren Körper vor

dem nagenden Kerkergift zu retten. Also möge doch keine Verwaltung jetzt, wo diese neue Erfindung gemacht, noch länger die Gefangenen in dieser verrufenen Kerkerluft schmachten lassen, zumal das jetzt übliche Hülfsmittel, Erweiterungsbauten auszuführen, trotz der grösseren Kosten nicht zum Ziele führt. Man denke nur immer an einen Wagenraum, der trotz des kleinen Luftvorraths doch stets gesunder ist, als der zehnmal grössere Raum mit stagnirter Luft.

e. betreffs der Annehmlichkeiten auf den Sitzplätzen in den Kirchen, Sitzungssälen, Schlafsälen, Hörsälen, in den Betten der Krankensäle und Rücksicht auf Ableitung der Kohlensäure.

Die körperlichen Ausdünstungen sind für die Athemungs- und Geruchsorgane bekanntlich von erheblichem Nachtheil und grosser Unannehmlichkeit, welche Uebelstände in den oben genannten Räumen sich wesentlich steigern. Die Thätigkeit in der freien Natur lässt freilich jene Unannehmlichkeiten um so weniger empfinden, je leichter die Kleidung des Körpers ist. Durch Rohrstühle, Lattenbänke, Bettmatrazen ist allerdings auch in geschlossenen Räumen schon ein Anfang gemacht, diese Unannehmlichkeiten und Nachtheile zu vermindern; dennoch muss es erfreulich sein, dass sich dieselben, wenn auch nur für feste Bett- und Sitzplätze, auf's Aeusserste reduciren lassen. Denn gerade diejenigen Personen, welche an derartige Plätze

gefesselt sind, haben die Beseitigung jener Uebelstände am nöthigsten, und finden durch die Einführung der Poren-Ventilation endliche Erlösung, indem solche Dünste durch die Sitzplätze und Fussbodencanäle abgesaugt werden können. Auch die bekanntlich schwerere Kohlensäure nimmt gleichzeitig durch die mit der Poren-Ventilation verbundenen, im Fussboden liegenden Saugvorrichtungen ihren gesicherten Abzug und wird dadurch die schädliche Wirkung derselben, namentlich in den Schulen wesentlich vermindert.

f. betreffs der Theater.

Die ungleichen Ansprüche des Publikums in Bezug auf Temperatur sowie die verschiedene Beleuchtung und der ungleichmässige Besuch haben bisher eine allgemeine Ventilation unzureichend finden lassen. Der Verfasser hat desshalb auf Grund seiner Erfindung die Sitzplätze dahin verbessert, dass jeder Sitzplatz-Jnhaber, ohne die Danebensitzenden zu incommodiren, vermittelst eines bequemen Griffes sich beliebig kühlere oder wärmere Luft durch die Poren des Polsters zuführen kann. Welche heilsame Bedeutung diese Verbesserung namentlich für die häufig zahlreich besuchten Theater hat, ist kaum zu ermessen, namentlich, wenn man annimmt, dass jedes Wintertheater die Eigenschaften eins angenehmen Sommertheaters erhalten kann.

g. betreffs der Kirchenluft.

Dieselbe wirkt allerdings dort, wo man die Kirchen heizt, oder in den dünnwändigen Kirchen mit Holzdecken, wo schon eine unwillkürliche Poren-Ventilation vorhanden, nicht belästigend, dagegen aber ist solche Luft in gewölbten und mit dicken Mauern versehenen Kirchen sehr gefürchtet. Bekanntlich haben die Wandflächen grossen Antheil an diesem Uebelstand. Wenn man also die Innenflächen solcher dicken Mauern mit einer vollständigen Poren-Ventilation verbindet, würde, ohne der Festigkeit zu schaden, eine Luft zu ermöglichen sein, die mindestens eben so gut, wie sie in jedem andern gesunden Bauwerke zu treffen ist. Namentlich würden auch neue Kirchen, die in den ersten Jahren hindurch diese unangenehme Luft und ungesunde Feuchtigkeit im hohen Grade haben, sehr viel durch die Poren-Ventilation, welche sich, wie schon oben erwähnt selbstredend auch zum Heizen benutzen lässt, gewinnen.

h. betreffs der Sonnenseite.

Wie hoch dieselbe für Krankenzimmer geschätzt wird, bedarf keiner Betonung; diese Seite, welche von der Natur schon Dasjenige erhält, was der Mensch durch Kunst nicht zu ersetzen im Stande ist, kann für Heilzwecke nie Fläche genug erhalten. Doch unser Klima, sowie die oft bemessenen materiellen Mittel gebieten leider: mit der Sonnenseite Sparsamkeit zu üben; und kann es nur willkommen sein, einen, wenn auch kleinen Gewinn, durch die

n. betreffs der Akustik.

Nachdem diese Abhandlung schon gedruckt, machte der Verfasser bei Gelegenheit der Ausarbeitung eines Concurrenzprojects für den Berliner Dom die Entdeckung, dass die Poren-Ventilation auch von dem wohlthätigsten Einflusse für die Akustik sei. Es ist ja eine alte bekannte Erscheinung, dass das Hören von der Luftrichtung abhängig ist. In Räumen also, wo nur von einer Seite der Ton ausgeht, wie z. B. in Kirchen, Concertsälen, Theatern und dergl., kann man dadurch, dass man die neue Luft den Zuhörern entgegen strömen lässt, eine bisher unerreichte Akustik erzielen.

Zugleich wird diese Wohlthätigkeit der vertheilten Luftbewegung dahin erhöht, dass diejenigen Personen, für welche die neue Luft am wichtigsten in den genannten Räumen, als für Geistliche, Sänger, Schauspieler u. s. w., zuerst in den Vollgenuss derselben gelangen, selbstredend immer in der erwünschten Temperatur.

Bei Kirchen erwächst noch der günstige Umstand, dass der Hauptthurm meistens an dem Ende, welches der Kanzel und dem Altar gegenüberliegt, steht, sich also ersterer durch seine Höhe sehr gut zum Absaugen der verdorbenen Luft eignet.

Damit aber die Wand hinter jenen Personen nicht durch die Porosität an Resonanz verliert, wird die Ausströmung der Luft durch die unzähligen Fugen des Holzgetäfels hergestellt.

Unerwähnt darf bei dieser Gelegenheit nicht bleiben, dass man bei Neubauten von Kirchen die Gewölbe immer mehr verlassen möge, indem sie die Akustik am meisten schädigen. In alter Zeit, wo feuerfeste Dächer schwer ausführbar waren, gewährten allerdings die Gewölbe Schutz gegen einen Dachbrand u. dgl. Heute ist aber geboten: das Dach feuerfest zu construiren, die Deckenfläche aber mit festen Brettern zu bekleiden. Der Rückschritt zu den Gewölben bleibt selbst bei einem gothischen Gotteshause unverantwortlich. Die richtigste Gothik der Jetztzeit kann sich nur in Wahrheit, Solidität und Zweckmässigkeit gipfeln. Das bequeme Copiren der gothischen Gewölbe darf also für Kirchen nicht länger fortgesetzt werden, höchstens nur für Capellen, Sakristeien, Vorhallen und dergl.

Poren-Ventilation den bisherigen Anordnungen gegenüber zu erzielen. Es ist bekannt, dass man abgesehen von der Bequemlichkeit der Wärterzimmer zwischen je zwei Krankenzimmer; diese Lage mit desshalb vorzog, weil dadurch eine Isolation erzielt wurde, die eine reinere Luft enthielt, als sie in den Krankenzimmern vorhanden. Man rechnete demnach auf Infection der Wände mit reiner Luft, also auch schon auf die Poren der Mauern. Wenn also ferner bei der vervollkommeneten Poren-Ventilation, wie sie der Verfasser oben erklärt, die Scheidewände stets reine Luft für die Krankenzimmer durchlassen, werden die Wärterzimmer als Isolatoren überflüssig, und kann dieser, dafür bisher der kostbaren Sonnenseite entnommene Raum für den wichtigeren Zweck, also der eigentlichen Krankenzimmer, verbleiben, zumal bei einer anderen Anordnung die Wärterzimmer sich mit mehreren Verbesserungen ohne jeden Nachtheil verbinden lassen. Ausserdem wird auch die von mehreren erfahrenen Krankenhaus-Aerzten getadelte zu nahe Thür-Verbindung, welche in Folge des dazwischen liegenden Wärterzimmers üblich, beseitigt.

i. betreffs der Personen- und See-Schiffe.

Auf den See-Schiffen ist, soweit es den Deckaufenthalt betrifft, die reinste Luft auf der Welt zu finden. Ganz entgegengesetzt wirkt aber der innere Schiffsraum auf die Bewohner des Nachts; und namentlich bei stürmischer Zeit, wo alle Lucken ausser den Luftfängern

gedichtet werden müssen. Bekanntlich sind die Schiffsräume niedrig und ist auf einen Luftvorrath keine Rücksicht zulässig. Die bisher üblichen Luftfänger, sowie die durchlöcherten Röhren in den Hauptdecken des Schiffes bringen aber nur für Diejenigen reine Luft, welche sich in der Nähe jener Röhren befinden. Der Zustand ist also in solchen Fällen ungesund, bei Sturm aber, wobei die Räume überfüllt und gegen die Wasser-Einströmung gedichtet sind, besonders peinlich. Dieser Zustand ist durch die Poren-Ventilation zu mildern, indem die frische Luft, durch die Poren der gesammten Deckenflächen, also zunächst den Athmungsorganen zu- und durch die Seitenwandungen abgeführt wird. Sogar die Seekrankheit wird durch eine reichlichere Zuführung frischer Luft ohne Zug, weniger unangenehm auftreten.

Wie wohlthätig eine solche zugfreie Ventilation auch auf grossen Flusspersonenschiffen sein muss, kennt Jeder, der bei schlechtem Wetter sich längere Zeit in der Cajüte aufhalten musste. Von besonderer Bedeutung ist diese Ventilation für Auswandererschiffe, wo viele Menschen in den Zwischendecken auf einen sehr geringen Luftvorrath angewiesen sind. Selbstredend ist die auf Personen- und Kriegsschiffen vorhandene Dampfkraft im Stande, in bekannter Weise die neue Luft in den Raum zu drücken, und die verdorbene Luft auszusaugen.

Zügleich findet durch diese Poren-Ventilation eine bessere Conservirung des Holzwerkes statt.

k. betreffs der Personen in Eisenbahnwagen und Postwagen.

Der schreckliche Staub, den wahrscheinlich jeder Leser im heissen Sommer bei trockener Zeit empfunden, wird aber dadurch am peinlichsten, dass in solcher Zeit jeder Passagier nach frischer Luft lechzt. Die am Fenster Sitzenden erhalten zwar frische Luft durch die Fugen, wollen aber nicht des eintretenden Staubes und des zu grossen Luftzuges wegen die Fenster entsprechend öffnen, wodurch die in der Mitte sitzenden Passagiere allerdings weniger Staub ertragen brauchen, dafür aber den Mangel frischer Luft in der empfindlichsten und der Gesundheit schädlichen Weise erdulden müssen. Durch Staub leiden demnach Alle, ausserdem aber ein Theil an Zugluft und der andere besonders an Luftmangel. Auch hierbei ist der Eintritt frischer Luft ähnlich wie bei den Schiffen vermittelst der Poren-Decke zu ermöglichen, während die Abführung der schlechten Luft nach denselben Grundsätzen, jedoch unterhalb der Sitzplätze oder durch die Fugen der Fenster stattfinden kann, also der Staub abgedrängt wird. Als Erleichterung zur Ausführung dieser Verbesserung darf die Geschwindigkeit des Eisenbahnwagens betrachtet werden, indem dieselbe im Sommer zu dieser angenehmen Ventilation ohne Zugluft, verwerthet werden kann.

l. betreffs der Krankenhäuser-Verwaltung in Bezug auf Ventilation und Heizung.

Die meisten neuen Centralheizungen und Central-Ven-

tilationen erfordern durch ihre concentrirten Wirkungen eine bedeutende Aufmerksamkeit, damit keiner der Räume für sich im Laufe des Tages eine nachtheilige Differenz in Wärme und Luft erleide. Die Poren-Ventilation vermindert aber diese Differenzen, weil sie Wärme und Luft auf die gesammten Wandflächen vertheilt, also zugleich ein natürlicher Regulator ist, wie es unsere Sommerluft im Grossen.

In Bezug auf Temperaturregulation geben schon dicke Aussenwände ein sehr nahe liegendes Beispiel, indem durch dieselben trotz der äussern schnellen Temperatur-Schwankungen, im Innern eine nur langsame Nachwirkung fühlbar wird. Ueberhaupt beruht diese neue Verbesserung darauf: die Grundsätze der Natur-Einrichtungen möglichst nachzuahmen, denn nur dadurch gelangen wir zu dem Vollkommeneren.

m. betreffs der Anlagekosten und Reparaturen.

Nach Aufzählung aller dieser bisher durch die Poren-Ventilation gewonnenen Vortheile sollte man annehmen, dass dieselben mit grossen Anlagekosten und Reparaturen verknüpft sein müssten, indem man bisher bei Anwendung grosser Mittel in einer so wichtigen Sache, wesentlich geringere Resultate erzielt hat. Diese Annahme ist aber unbegründet, würde auch dort nicht zutreffen, wo man die Poren-Ventilation bei fertigen Bauten anwenden wollte, weil die Constructionen einfach sind.

Neuausführungen dagegen erfordern gar keine Mehr-

kosten. Selbstredend muss der Constructeur solcher Ausführungen das geeignete Material zu wählen suchen, welches allen Wänden, die nicht gegen das Wetter wasserdicht zu sein brauchen, eine Porösität mit Rücksicht auf die zugfreie kräftige Ventilation verleiht. Wollte man aber ein Gefängniss, eine Caserne, eine Irrenanstalt, ein Waisenhaus, oder ein Krankenhaus u. dgl., welche Bauten nicht des Lichtes halber hohe Räume bedürfen, ausführen, könnte sogar sehr viel durch Anwendung der Poren-Ventilation gespart werden. Es ist nämlich ein Luftvorrath, wonach unsere bisherigen Bauten berechnet waren, überflüssig, weil fortwährend neue Luft ein, und die schlechte aus strömt. Nach diesen Grundsätzen brauchten solche Gebäude nur eine zum Verkehr nothwendige Höhe.

Jedes eben genannte Gebäude wird durch die Poren-Ventilation bis fünfzig Prozent billiger, ohne noch die grossen Vortheile der bequemen Treppen, Aufsicht u. dgl. zu rechnen. Die Leistungsfähigkeit einer Heilanstalt berechnet sich unsern jetzigen, bisher bekannten besten Dispositionen gegenüber noch höher, wenn man die um ein Viertel frühere Genesung in Erwägung bringt.

Bei vorhandenen Räumen aber, namentlich wo schon die Zahl der Personen zum Cubikinhalt des Raumes ungesetzlich gross geworden, die Grundfläche jedoch noch reichlich geblieben ist, wird durch die Poren-Ventilation jenes Gesetz zur Null und eine noch grössere Benutzung solcher Räume möglich.

Schliesslich ist in Bezug auf die Heilungs-Resultate der bisher üblichen Krankenzimmer noch hervor zu heben, dass dieselben noch ungünstiger sein würden, wenn nicht Reservezimmer, welche periodisch ausgelüftet, zur Benutzung kommen würden. Aber gerade diese leerstehenden Reservezimmer vertheuern die Anlage, desshalb können nur diejenigen Anordnungen die vollkommendsten sein, die bei ein und denselben Geldmitteln die grössten Heilungs-Resultate erzielen lassen.

Die erste Ausführung des Erfinders liefert den Beweis gegen die bisher befolgte Rechnungsmethode. Es ist allerdings natürlich, dass dazu manche neue Studien, Erfahrungen und Geschicklichkeiten erforderlich werden. Doch dadurch darf sich die Jetztzeit, welcher alle Studien der Vorzeit durch Schrift und Zeichnungen vorliegen, nicht abhalten lassen, dieser alten Wissenschaft die Anwendung vollständig poröser Ventilationswände einzuverleiben. Diejenigen Bautechniker, welche sich bisher blos in dem Gebiete des Gebäudebaues bewegt haben, finden dadurch auch Gelegenheit, einigen Dank bei der Nachwelt zu erwerben.

Schlussbemerkung.

Nachdem durch die Spezialisirung der einzelnen Puncte die Tragweite der Poren-Ventilation kaum abzusehen, und durch Zeichnungen, Modelle, Versuche und wissentschaftliche Berechnungen die Untrüglichkeit derselben nachgewiesen werden kann, sind dennoch die Hindernisse nicht zu läugnen, welche sich der Finführung dieser Sache entgegenstellen. Obgleich diese Erfindung dem Ei des Columbus gleicht, indem Zelte schon seit Jahr Tausenden sich in Theorie und Praxis annähernd bewährt haben, wird es nicht an Feinden fehlen, die der Ausführung allerlei Bedenken entgegensetzen, und dadurch die noch mehr Befangenen in ihren Ansichten mitzureissen suchen.

Ja der Erfinder hat sogar bei den für jede Neuheit wichtigen Discussionen hochgestellte Baubeamte getroffen, welche zu behaupten suchten, wahrscheinlich weil Poren nicht mit einem Zollstock messbar, dieselben wären zu

klein für die Luftbewegung. Wollten sich doch solche Leute des alten Lehrsatzes aus der Schule erinnern: dass die Luft elastisch und unendlich theilbar, so könnten ihnen derartige Behauptungen zum Nachtheile ihrer Stellung nicht entschlüpfen.

Solche Leute gehören in das Bereich jener Finsterlinge, die vor Zeiten das Sonnensystem, die Buchdruckerkunst, die Dampfkraft u. s. w. befeindeten; sie werden vergehen, während der Segen dieser Neuheit, weil sie auf unumstössliche Naturgesetze beruht, fortleben wird.

Nachtrag

1. Schulräume.

1. Bei einem länglichen Zimmer müssen die Fenster stets an der Langseite angebracht werden, weil dann die Beleuchtung am sichersten ist.
2. Die Fenster dürfen nur an einer Seite des Zimmers vorhanden sein, damit das Licht nicht störend wird, und zugleich Zug entsteht.
3. Die Fenster müssen an der ganzen Längenseite nach, mit möglichst wenig Unterbrechung, ähnlich wie in einem Gewächshause angeordnet werden, damit das Licht an keinem Platze fehlt.
4. Alle Fenster müssen Doppelfenster sein, damit im Winter die Kälte und im Sommer die Wärme abgehalten wird und die Nahesitzenden keinen Zug zu ertragen haben.

5. Den Schülern muss das Licht auf die linke Hand fallen.
6. Vorzugsweise an der Seite, wo während des Unterrichts die Sonne belästigt, müssen statt der reparaturbehafteten Vorhänge Binnenläden aus eichenen Rahmen mit gefirnissten Leinen angebracht sein, welche bei Temperaturen, wo die Fenster geöffnet sein dürfen, zugleich den Zug und das störende Sehen nach Draussen verhindern.
7. Sämmtliche Fenster müssen Schiebefenster sein, damit die Oeffnung sowohl oben als auch unten geschaffen werden kann und die Binnenläden nicht incommodiren. Falls Gegengewichte angebracht werden, dürfen dieselben, der Reparaturen wegen, nicht versteckt liegen.
8. Der Lehrer muss dem Gesagten gemäss bei länglichem Zimmer an der schmalen Seite sitzen, damit er beim Ueberblicken nicht den Kopf drehen braucht und der Schall beim Vortrag sämmtliche Schüler trifft.
9. Die Erwärmung im Winter muss von der ganzen Längenwand kommen, am besten von der Fensterseite, damit die Kühlung durch die Fenster möglichst ausgeglichen wird.
10. Die neue Lebensluft muss gleichzeitig von der Fensterseite im Winter erwärmt in das Zimmer treten. Die üblichen Brustlambris aus schmalen Latten gebildet, eigenen sich vorzugsweise dazu, und können in der Zeit, wo es Draussen warm ist, mit der Aussenluft in Communication gebracht werden.

11. Die verdorbene, resp. verbrauchte Luft muss durch die Deckenschalungsspalten und demnächst vermittelst der Canäle, die zwischen je zwei Balken vorhanden sind, abziehen. Bei grossen Schulen durch den Ventilationsschornstein.
12. Die Kohlensäure muss in der ganzen Länge des Zimmers, der Lufteinströmung gegenüber durch einen Spalt in der Nähe des Fussbodens abziehen.
13. Wo einzelne Oefen angewandt werden, muss jeder Ofen seine Wärme hinter der Nr. 9 erwähnten Lambriwand ausstrahlen, wodurch die Wärme gleichmässig vertheilt wird.
14. Die inneren Treppen müssen, damit die Schüler nie hoch fallen können, vier Abtheilungen resp. drei Prodeste haben, gewundene Treppen und durchbrochene Geländer dürfen nicht erlaubt werden.
15. Die Fensterhöhe muss des Lichtes wegen mindestens $^2/_3$ der Zimmer-Tiefe von der Fensterwand abgerechnet, betragen.
16. Keine Bank darf mehr wie zwei Schüler fassen, wodurch der Lehrer zu jedem Schüler gelangen kann, die Schüler besser hinein und heraus können und dieselben zugleich gesunder sitzen. Frei-Gänge sind daher überflüssig und nur unmittelbar am Lehrerpult zweckmässig.
17. Der Corridor muss dort, wo keine Turnhalle an das Schulgebäude schliesst, als Spielplatz bei schlechtem Wetter ausreichen, desshalb möglichst gross sein.

18. Hohe Gebäude müssen in jeder Etage Abtritte und Urinirorte haben, damit sich einentheils die Kinder nicht zu sehr concentriren, hauptsächlich aber nicht veranlasst werden, der Unbequemlichkeit wegen ihre Bedürfnisse zu unterdrücken.
19. Die Uriniranstalt muss, damit die Reinlichkeit erhöht wird, für Stadt-Schulen aus gegossenem Glase bestehen.

2. Dampfmaschinen.

Zum Treiben der vielen Hülfsmaschinen, als Wasserpumpen, Ventilatoren, Waschmaschinen, Trockenmaschinen, Wäsche-Mangeln, Kartoffeln-Schälmaschinen, Winden, Paternostertreppen, Holzsägen und dergleichen, wie sie in jeder grossen Haushaltung und Anstalt fast unentbehrlich geworden, gehört eine Kraftmaschine. Die sehr bewährte Dampfmaschine, welche solche Hülfsmaschinen sparsamer betreibt, wurde bisher häufig der Kesselexplosionen wegen gefürchtet und desshalb auf jene Bequemlichkeiten verzichtet. Es muss desshalb an dieser Stelle hervorgehoben werden, dass ein richtig geformter Dampfkessel mit einem hohen Wasserstand oberhalb der Feuerzüge und richtigem Federsicherheitsventil noch nie explodirt und alle Furcht davor gleich der Gespensterfurcht aus Unwissenheit entspringt. Es werden in Folge dessen vielfach bei den betreffenden Anstalten die Kosten für eine solche der Gesundheit dienenden Maschine auf verwitternde Verzierungen verschwendet und die Kunst mehr geschändet als gefördert.

Schliesslich dient eine Dampfmaschine für eine Schule als vorzügliches Lehrmittel in einem wesentlichen der Naturwissenschaften.

3. Atmosphärische Kraftmaschine mit Gasbenutzung.

Wünscht der Interessent, trotz der eben behaupteten Sicherheit der Dampfmaschine eine einfachere und billige Kraftmaschine, so ist diejenige zu empfehlen, wo durch das Gas unterhalb eines Kolbens eine Luftleere geschaffen wird, demnächst die Atmosphäre den Kolben niederdrückt und auf diese Weise die Kraft erzeugt.

4. Paternoster-Treppen.

Das Steigen der Treppen in Krankenhäusern, Hôtels, Fabriken, Gefängnissen und dergleichen Bauten erschwert die Leistungen des Dienstpersonals ausserordentlich. Es sind deshalb verschiedene Mechanismen in Anwendung gekommen, diesen Uebelstand der hohen Treppen zu vermindern und haben besonders die Einrichtungen auf der Welt-Ausstellung 1867 Aufsehen erregt. Allgemein fand man aber in dem langen Warten, der grossen Raumeinnahme und den nicht unbedeutenden Kosten ein wesentliches Hinderniss in der Nachahmung derselben. Der Verfasser glaubt desshalb auf die Paternostertreppe, welche ununter-

brochen Personen auf und nieder befördert und dabei nur sechs Quadratfuss Flächenraum in Anspruch nimmt, aufmerksam machen zu müssen. Für Bergleute gewinnt dieses Paternosterprinzip allerdings die grösste Bedeutung.

5. Strahlenöfen.

Obgleich jedes Semester der physikalischen Vorträge seit 50 Jahren und länger wiederholten, dass die rauhen Oefen mehr Wärme ausstrahlen, als die geschliffenen, so führte doch erst eine englische Erfindung hauptsächlich auf der Weltausstellung eine Verkörperung jener Lehre vor die Augen, indem die betreffenden eisernen Oefen strahlenförmige Rippen am Umfange zeigten. Solche Oefen sind in ihrem Werthe von grossem Einflusse auf unser Heizverfahren, indem dieselben die alten verrufenen Luftheizungen auf einfache Weise zu Ehren bringen. Es ist hierbei keine durch Glühen verdorbene Luft, kein Reinigen der Röhren von Russ, sowie überhaupt eine undichte Rohrleitung zu fürchten; dieser Strahlenofen erwärmt die Luft in der mildesten Weise und führt dem Menschen zum Wohlbehagen die rein erwärmte Luft in reichlichem Masse zu. Der mitunter ausgesprochene Grundsatz, dass gewöhnliche Oefen mit Luftzuführung aus dem Zimmer für eine grössere Zahl Personen genügen, wird diesem bisher nicht übertroffenen Strahlenofen sicher keine Concurrenz bereiten.

6. Waschmaschinen.

Die Reinlichkeit und Gesundheit durch Wäsche ist so wichtig, dass die Waschmaschinen nie genug zur Empfehlung gelangen können und wird deshalb zur Erleichterung der Waschmaschinen-Arbeit hervorgehoben, dass das Waschen nur während des Kochens der Wäsche vorzunehmen ist, weil in jenem Stadium der Schmutz sich am leichtesten entfernen lässt.

Verzeichniss

derjenigen Sachkenner, welche, nachdem sie Kenntniss von den Entwürfen genommen, der Anwendung der Poren-Ventilation ihr Interesse zugesagt haben.

A. Speziell für Militair-Casernen und Lazarethe.

Leibarzt Sr. Majestät des Königs, Wirkl. Geh. Ober-Med.-Rath, Generalstabsarzt der Armee Herr Dr. Grimm in Berlin.

General und Director des Militair-Oeconomie-Departements Herr von Stosch in Berlin.

Geh. Ober-Medicinalrath Prof. Herr Dr. von Langenbeck in Berlin.

Generalarzt Herr Dr. von Stückradt in Berlin.

Königlicher Baurath Herr Hase in Hannover.

Kreisbaumeister Herr Heydrich in Berlin.

Generalarzt und Director des Friedrich-Wilhelms-Instituts Herr Dr. Löffler in Berlin.

B. Speziell für Eisenbahn-Personen-Wagen.

Geh. Oberbaurath im Ministerium Herr Koch in Berlin.

Eisenbahn-Betriebs-Director und Baurath Leopold in Cöln.

Eisenbahn-Betriebs-Director Herr Reder in Osnabrück.

Eisenbahn-Betriebs-Director Herr Baurath König in Berlin.

C. Speziell für Schulen, Universitäten und Krankenhäuser.

Geh. Minist.-Baurath Herr Flaminius in Berlin.

Königl. Bau-Inspector Herr Dickhoff in Bonn.

Geh. Med.-Rath und Director der geburtsh. Clinik Herr Dr. Veit in Bonn.

Geh. Sanitätsrath Herr Dr. Fischer in Cöln.

Prof. Director der chir. Clinik Herr Dr. O. Weber weil. Heidelberg.

Stadt-Baurath Herr Gerstenberg in Berlin.

Stadt-Baumeister Herr Schülke in Essen.

Professor, Director der Clinik Herr Dr. Surigar in Leyden.

Professor Dr. Herr van Gaudoever in Utrecht.

Universitätskrankenhausarzt Herr Dr. Imans in Utrecht.

Geheimer Regierungsrath, Verwaltungs-Director der Charite und der Thierarzneischule Herr Dr. Esse in Berlin.

Medicinalrath Herr Dr. Ruge in Berlin.

Professor und Hofbaurath Herr Strack in Berlin.

D. Speziell für Personen- und Kriegsschiffe.

General-Arzt der Marine und Dr. med. Herr Steinberg in Berlin.

Corvetten-Capitain und Chef des Stabes Herr Batsch in Berlin.

Corvetten-Capitain und Depot-Director Herr Olberg in Geestemünde.

Marine-Ingenieur Herr Brix in Geestemünde.

Director der Navigationsschule Herr Dr. Breusing in Bremen.

Baudirector Herr Schröder in Bremen.

Technischer Director des N.-D. Lloyd Herr Overbeck in Bremen.

Geheimer Admiralitätsrath Herr Jakobs in Berlin.

E. Im Allgemeinen.

Ingenieur und Professor der Künste und Gewerbe Herr Armengaud in Paris.

Ministerialreferent und Dr. med. Herr Kappeyne van de Copello in Haag.

Obermedicinalrath und Hospitalarzt Herr Dr. Brandes in Hannover.

Medicinalrath Herr Dr. Droop in Osnabrück.

Kreisphysikus Dr. med. Herr Suren in Soest.

Architect und Stadtverordneter Herr Dreyer in Osnabrück.

Ingenieur Newton in London.

Ingenieur Munn in New-York.

Waisenhausarzt Herr Dr. Schmid in Amsterdam.

Medicinalrath, Kreisphysikus Herr Dr. Caesel in Dortmund.

Kreisphysikus Herr Dr. Gerlach in Paderborn.

Dombaumeister Herr Güldenpfennig in Paderborn.

Director des anatomischen Instituts Herr Professor Dr. Virchow in Berlin.

Geheimer Obermedicinal-Rath Professor Dr. Frerichs in Berlin.

Geheimer Medicinalrath Professor Dr. Herr von Gräfe in Berlin.

Geheimer Obermedicinal-Rath Professor Dr. Houselle in Berlin.

Wie sehr das Interesse seit Absendung der ersten Abhandlungen zugenommen, lässt sich aus den nachstehenden Anerkennungsschreiben entnehmen.

Seine Königliche Hoheit der Kronprinz haben die von Ew. Wohlgeboren mit Ihrem Schreiben vom 22. d. M. eingereichte Schrift über Poren-Ventilation gern und mit grossem Interesse entgegen genommen und mich beauftragt, Ihnen für die Uebersendung derselben freundlichst zu danken.

Berlin, den 27. März 1868.

(gez.) **v. Normann.**
Königlicher Kammerherr und Major z. D.

An
den Architekt und Ingenieur
Herrn Scharrath
Wohlgeboren
zu
Bielefeld.

Berlin, den 22. März 1868.

Auf Euer Wohlgeboren sehr gefällige Zuschrift vom 15. d. Mts., mit welcher Sie mir Ihre Abhandlung über die Poren-Ventilation übersandt haben, erwidere ich Ihnen ergebenst, dass ich diese Schrift mit grossem Interesse gelesen habe und bitte Sie, falls es nicht mit Schwierigkeiten verbunden ist, mir die zu derselben gehörenden Pläne zur Ansicht zu schicken.

Generalarzt des Garde-Corps.

(gez.) Dr. **v. Lauer.**

An
den Architekt und Ingenieur
Herrn Scharrath
Wohlgeboren
zu
Bielefeld.

Seine Durchlaucht der Fürst haben die mit Ihrem Schreiben vom 14. d. M. übersandte Schrift über Poren-Ventilation gern entgegen genommen und mich beauftragt, Ihnen für Uebersendung dieser Schrift, welche eine Frage von so hoher Wichtigkeit behandelt, freundlichst zu danken.

Bückeburg, den 19. Juni 1868.

Praetorius,
Baurath.

An
den Architekt und Ingenieur
Herrn Scharrath
Wohlgeboren
Bielefeld.

Greifswald, 2. Mai 1868.

Ew. Wohlgeboren danke ich im Namen des Senats verbindlichst für die an denselben eingesandte Schrift über Poren-Ventilation. Dieselbe gewährt grosses Interesse. Zu besserer Einsicht wäre es jedoch sehr erwünscht, Kenntniss von den Plänen nehmen zu können, und ich stelle Ihnen anheim, ob Sie zu deren Uebersendung s. v. r. geneigt sind.

Der z. Rector der Königl. Universität.

Budge.

Herrn Scharrath
Architekt und Ingenieur
Wohlgeboren
in
Bielefeld.

Berlin, den 30. März 1868.

Ew. Wohlgeboren werden hierdurch ergebenst benachrichtigt, dass Ihre Eingabe vom 11. d. Mts. und die derselben beigefügte Druckschrift, von deren Inhalt hier mit Interesse Kenntniss genommen worden, mit Rücksicht auf die zur Verbesserung der Luft auf Schiffen darin enthaltenen Vorschläge dem Herrn Marine-Minister vorgelegt worden ist.

Das Bundeskanzler-Amt.

(gez.) **v. Delbrück.**

An
den Architekten und Ingenieur
Herrn Scharrath
Wohlgeboren
zu
B. K. A. 2261. **Bielefeld.**

Das Mir mit Ihrem Schreiben vom 26. vorigen Monats zugesandte Exemplar Ihrer Abhandlung über Poren-Ventilation habe Ich gern entgegengenommen, und sage Ich Ihnen für die Mittheilung Meinen aufrichtigen Dank. Ich habe die interessante und beachtliche Schrift an die medicinische Facultät zu Rostock abgehen lassen.

Schwerin, den 27. Juli 1868.

Friedrich Franz.

An
den Architekten
Scharrath.

SUGGESTIONS

FOR

THE SANITARY IMPROVEMENT

OF

LABOURERS' COTTAGES AND OF VILLAGES

BY

WILLIAM MENZIES

DEPUTY SURVEYOR OF WINDSOR FOREST AND PARKS

LONDON
LONGMANS, GREEN, AND CO.
1869

LONDON: PRINTED BY
SPOTTISWOODE AND CO., NEW-STREET SQUARE
AND PARLIAMENT STREET

THE SANITARY IMPROVEMENT
OF
LABOURERS' COTTAGES AND OF VILLAGES.

In the works which I published in 1865 and 1866, referred to below,* on the subject of the Drainage of Towns and Dwellings of the better class, I attempted to lay down the broad principle that, looking at the question in all its bearings, sanitary, engineering, and agricultural, the separation of the rainfall from the sewage was the only satisfactory solution of the difficulties under which the country was placed.

After much controversy, that principle has been officially sanctioned in the report, dated the 29th October 1868, by Lieutenant-Colonel Ewart,† of the Royal Engineers (appointed by the Home Secretary); and two of the leading towns in the Thames valley, viz. Eton and Windsor, have already signified their acquiescence in the

* *The Sanitary Management and Utilisation of Sewage in* 1865. *Additional Statements in support of his views on the Drainage Question. The Present State of the Drainage Question,* 1866. By William Menzies. (Longmans.)

† Second edition, Harrison & Sons, 59 Pall Mall.

soundness of the arguments given for following that course, and are now proceeding to prepare plans on that system.

This precedent will, it is hoped, to a great extent, settle the question.

I now venture to contribute to the kindred enquiry by laying before the public the result of my investigations into the best means of extending the benefits of health and comfort to those who are not congregated in towns, and I am induced to proceed a little further in the same direction by attempting to show the feasibility, as almost all agree in the desirability, of bringing in some law to regulate still further than has yet been done the Dwellings of the labouring classes in Cottages and Villages.

I am unwilling to join in much that has been written to show that the agricultural labourer has not the same position either in independence or comfort as he had, in some previous times, of this country's history. On the contrary, I believe they have been, as a body, gradually advancing from the earliest times. The amount of wages they receive, and a comparison of the prices at which articles of food and clothing could be purchased at different periods, do not afford so sure a test as is supplied by the average duration of life of the whole body of the people.

It would, I believe, be generally admitted that the life of all classes has constantly been lengthening, and this could only arise from the whole community possessing more comforts in the shape of house accommodation, better food, more skilful medical attendance, better provision in the shape of hospitals, unions, and asylums; all of which institutions are supported, some by voluntary contribution of the richer classes, and some by rates upon all descriptions of property. These institutions extend their benefits to all the lowest classes of society, and might safely, therefore, be reckoned as wages.

Special exceptions there may be and are to this statement of general improvement; such, for instance, as appears to be the case, referred to in the pages immediately following, giving an account of what has happened in those parts of England where the agricultural gang system has been developed to such an extent within the last fifty or sixty years; but I believe the general conclusion is correct. In former years there was no such enquiry into these matters as now exists; so that, when evils of the present day are strongly brought to light, it is too often at once assumed that in former times nothing so bad existed.

To extend provisions for health and decency still further, and to enlist, if possible, the active

co-operation of all classes in seeing that a healthy population is, in reality, the cheapest and the most beneficial for the country at large, is sufficient warrant, I hope, for my attempt to help on the work.

It is impossible that I could refer to the number of works I have consulted on this subject, or mention the names of so many able men who have been for years in the field. I have freely availed myself of their labours, and have incorporated their suggestions with the results of my own experience and observation.

I shall endeavour to make my remarks apply both to England and Scotland, but my attention has been more directed to Dwellings in the rural districts of the former.

It is quite evident to everyone that much of the unhealthiness and immorality, both in Cottages and Villages, arises from the bad condition of the dwelling-houses of the labouring classes, and as the effects of these evils fall upon the community generally, the legislature is entitled to deal with the matter.

On this part of the subject I may refer to the report lately made by the Commissioners appointed to enquire into the agricultural gang system in the eastern counties of England. I may make one quotation :—

'91. The public gang system does not appear to be 'anywhere in these eastern counties (where alone it is 'found) more than sixty years old ; in some localities it 'has not existed more than thirty years. It is the direct 'result, as has been described, of two causes: first, of 'the pulling down of cottages in what are termed close 'parishes, to avoid poor-rates, and thereby driving the 'agricultural population off the land into distant villages 'and towns ; secondly, of the formation, by the enclo- 'sure of wild land, or otherwise, of large farms, without 'providing an adequate number of cottages to contain 'the workpeople required to supply the demand of 'labour for the farm.

'92. It is not to be believed that any landowner who, 'either in the past or present generation, was led to 'adopt that policy, in regard to the distribution of 'agricultural labour, could have realised the amount 'of physical hardship, of unnecessary fatigue, imposed 'by it on old and young, on the strong and the weak, 'from day to day, and year to year, at all seasons, and 'in all weathers; still less could he have anticipated 'that the absence of a proper distribution of agricultural 'labour would have given rise to a system which has 'increased to so great a degree the temptations to, and 'opportunities for, moral evil to several successive gene- 'rations of the young of both sexes in the localities 'where it exists.

'93. The alterations in the law of rating effected 'by the Union Chargeability Act of 1865 (28 and 29 'Vict. c. 79) has happily put an end to the inducement 'which led in so many instances to the pulling down 'of cottages, and driving the rural population to a 'distance from the land which they cultivated. It may

'be expected that by degrees sufficient cottage accom-
'modation will now be provided on each farm.'

The good economical, social, and moral effects arising from the fulfilment of this duty are strongly pointed out by various persons of authority and experience in the course of the evidence.

Over the kingdom, generally, the demand for good houses for the upper classes every year is becoming greater, and the wages of mechanics increasing, so that builders will gradually become still more unwilling than they are at present to undertake the erection of cottages of the lowest class on speculation.

It is quite evident also to everyone that the effect of the Union Chargeability Act, passed for England in 1865, will be, in time, largely to increase the building and maintaining of cottages upon landed estates in the rural districts, so that the labourers necessary for these estates may be nearer their work than they have hitherto been. Speaking more particularly of agricultural labourers, it is a common calculation among themselves that every hour they can save in travelling to and from their work is worth 3*d.* to them, and directly or indirectly it is worth about as much to their masters.

Taking labourers in country districts from

fifteen to sixty-five years of age, two-thirds of the complaints from which they and their families suffer, are rheumatism, colds, fevers, or epidemics of that class; all of which diseases, more or less, either arise from or are influenced by the sanitary condition of their dwellings.

With respect to the number of dwellings in country districts, it would appear to be impossible to introduce a Bill compelling landowners to build so many cottages in proportion to their estate. Arable land is changed to pasture or to building ground, while clay land and light farming land require a different number of men and horses, so that, in fact, no rule could scarcely be fixed as to the number that would be required; but, subject to such special cases as I shall subsequently specify, I think the building of a sufficient number of cottages for their labourers may safely be left to the certain effect of landlords finding it their interest to do so, and they are becoming every day more convinced of this.

It is desirable, however, that information and different opinions should be collected on this head, so as to arrive at a safe conclusion.

Vast numbers of cottages, however, are built and kept up solely as an investment or on speculation; the owners having no other object

in view except to get as large a rent for as little outlay as possible.

The greatest offenders in this respect are small tradesmen, who invest their surplus money in such cottages, and compel the labourers to take all their supplies from themselves, and thus often inflict a double injury.

Residence in these cottages becomes then practically compulsory upon the labouring classes, as no others are available.

It would therefore appear to be the duty of the State to provide that such residence shall not, if possible, entail injury to the health of the people, or violate the common laws of decency, and thus lay the foundations of disease and immorality in the rising generation.

The principle adopted by the Government of this country for regulating emigration may, perhaps, be followed as a precedent.

Cottages and dwellings, as I have stated, are built to meet the general demand, and, in like manner, ships are fitted out on private speculation to carry emigrants from Britain to different parts of the world; but the legislature has carefully taken every precaution so that health and decency shall be maintained on the voyage.

Thus in a ship, where space is so immensely valuable, the legislature has provided that every

adult emigrant shall have on the upper deck, with all its facilities for ventilation by the sea breezes, a minimum of ninety cubic feet of space; on the lower deck, where ventilation is more difficult, a much larger area; there must be five feet superficial of deck for each passenger for exercise; the amount of space for ventilation to each cubic foot is determined; those of different sexes above twelve years of age must be separated; the number, sizes, and shapes of the berths made compulsory; sanitary arrangements made for each sex; the number of closets is specified, and, finally, the total number to be carried in any ship is fixed.

These laws have been passed for the safety and comfort of those who are probably leaving the country for ever, and in whose after-life those who remain might reasonably feel little interest. It surely cannot be thought unreasonable that the government of this country should make some similar stipulation for the protection and well-being of those who are its permanent and constantly increasing residents, and with whose fate the whole community is directly and indirectly involved.

In the merchant service, in like manner, the common sailor is secured by law his minimum sleeping space of either fifty-four or seventy-two

cubic feet according to circumstances, and it is encouraging to know that owners of ships, however valuable the space is, see that their interest lies so much in keeping the men in the highest state of health, and are anticipating a change of the law on the subject by voluntarily giving the men a larger area.

Under the Bakehouse Regulation Act (26 & 27 Vict.), the journeyman baker is secured against his master compelling him to sleep in a room that has not a proper amount of ventilation and communication with the external area.

In the Metropolis Local Management Act (18 & 19 Vict.) this principle of interference for the general good is carried much further by laying down most stringent stipulations as to the conditions under which inhabitants of London may live in buildings under the level of the pavement. The minimum height of the ceiling, the width of the surrounding area, the size of the windows, the fire-places, and many other details, are all specified.

Precedents are therefore not wanting on behalf of the interference by the government with the liberty of the subject, and the terms which the houseowner may make with his tenant.

Even the thief in his cell is secured by the law his six hundred cubic feet of space; has it

warmed for him in winter, and every medical comfort provided.

It is quite true that the principle of securing to the labourer a healthy dwelling is recognised by the existing laws, but for reasons afterwards mentioned these laws do not meet the necessities of the case.

Under the Local Government Act, 1858, local boards in England have power to make by-laws 'with respect to the closing of buildings or part of buildings unfit for human habitation, and the prohibition of their use for such habitation,' and under the Public Health Act, 1866, still more stringent power is given to them, and to 'nuisance authorities' for the country generally, thus including Scotland, to bring under control 'any house or part of a house' so over-crowded as to be 'dangerous or prejudicial to the health of the inmates.' The chief officer of the police within the district is usually the person charged to take the first steps in the matter, and bring any infringement of these Acts under the notice of the authorities.

The difficulty is the absence of any exact account of what constitutes an infringement of the Act. Police officers at present are little qualified to judge of the sufficiency of house accommodation.

If once, however, specific rules are laid down, the course becomes easier.

Anyone can measure, and everyone can judge of, the state of a house when he is told what to look for.

The general care of the health of a rural district is left by the vestry of each parish to an inspector of nuisances.

It would be difficult to conceive a more inefficient body of men. Sanitary science requires a vast amount of special study, and may well engage the most highly cultivated minds. The inspectors of nuisances, however, are almost always men of a low class in the community; have generally been unfortunate in business; are often ludicrously ignorant, and by appealing to the members of the vestry, on whom they are dependent, almost always outvote the higher and better informed class.

The last thing which they will think of doing is to take these precautionary measures which would prevent serious outbreaks of disease, and nothing ever rouses the vestry to action till some evil has broken out and cannot be stayed. No satisfactory system can be in operation until the whole community are better educated in these matters, and it is worthy of consideration whether the country should not be divided

into districts with an Inspector of a much higher class, and independent of all local influence, placed in charge of the health of that district, and also whether certain fixed conditions should not be specified beyond local question or objection.

I am desirous, therefore, of suggesting that legislation must proceed further than it does at present and be more precise and detailed. The country generally requires to be instructed in the knowledge of those conditions of dwellings which for the general welfare are essential to health, and to have specific rules laid down for their guidance so as to avoid dispute as to what is 'dangerous or prejudicial to the health of the inmates;' and, further, it is necessary to enlist the general support of the community in seeing these essentials carried out.

It may be added that a law against overcrowding cannot be thoroughly effective unless some provision is made enabling certain public bodies to provide dwellings for the poorer classes, as they cannot possibly build them for themselves; and I think everyone must see that private speculation never can meet the whole requirements of the labourers if stringent sanitary laws, which necessarily involve expense, are

to be enforced. On this point, however, I state my recommendations with the greatest diffidence, knowing how difficult the subject is, and what careful restrictions would have to be exercised if such a scheme were attempted.

The increase of wealth among the higher classes; the bringing of hitherto unoccupied lands into cultivation; the general progress of the whole community; and the effect of emigration show everyone that there is no superabundance of the strong labouring classes in the country; while it is desirable to economise their health and strength, and to attach them to the soil on which they live, as far as is practicable; a comfortable home being of the first importance. Private benevolence and exertion are quite unable to encounter the great difficulties of the question.

Neither clergyman nor physician can hope for much success for their labours in a dwelling where a family resides, and who, partly through long confirmed traditional habit, partly through ignorance, and, to some extent, under compulsion, violate all laws of sanitary science and decency; and such habitations unfortunately are very prevalent in the country.

To make a law regulating the building of future dwellings, without, at the same time,

attempting to remedy the evils of the present ones would be, probably, objectionable, as one of the first effects of such a bill for regulating new cottages would be to increase the value of the old ones, and the labouring classes might be driven even more than they are now to live in these objectionable dwellings.

I presume there would be no legal difficulty in devising the machinery by which cognisance should be taken of unhealthy dwellings.

If, when the notice to repair or reconstruct is served, the owner of the cottage prefers to pull it down, some arrangement, or some power, should be given to the officers of the union or parish either to build or provide by some means more wholesome lodgings for an equal number of those who have been ejected.

Further, I might suggest that an inspector appointed by some central authority, and quite independent of all local influences, should visit the different parishes or counties regularly to see, generally, that the officials on the spot do their duty.

As to the general state of cottages in England, Dr. Hunter's report to the Privy Council in 1864 may well be consulted, and will justify many of the remarks I have ventured to make.

There is no official report upon those in Scot-

land, that I am aware of, but the conditions are much the same, especially among the mining population.

It would prevent, as I have previously stated, a great amount of discussion and delay in all matters concerning the condition of cottages or dwellings for the labouring classes if certain principles could be defined and inserted in any bill that might be passed as being sanitarily essential.

I have attempted to define these from my own experience in this neighbourhood, and I think they will apply both to houses in the villages and cottages in England as well as Scotland. I have no doubt many others will be ready to give further information on the subject from their investigations in other parts of the kingdom. The object of this paper is to attempt to define the general principles on which such a bill might be framed. All these points marked as 'essential' would be added in a schedule at the end of such bill; and it is believed, with these specific data in his hand, any inspector would have no difficulty in acting.

Those recommended as 'desirable' might or might not be included in the bill, as was houghtt best afterwards.

Some special directions would be given for

temporary dwellings, put up for such purposes as during railway works, &c. Probably a stipulation that 'such houses, if occupied for more than six summer months,' must come under the general law, would be sufficient.

Situation.

The soil and subsoil should be dry, or made dry, as far as practicable. No site should be adopted, if possible, where permanent water underlies the surface at a less depth than three feet in winter. In support of these two recommendations, I may quote from the 10th Report of the Medical Department of the Privy Council (1868).

Speaking of the effect of damp soils in producing consumption, Dr. Simons says :—

> Distinction must, of course, here be drawn between populous and non-populous places. An undrained state of soil in any place where population is aggregated answers to the legal intention of the word 'nuisance;' and I apprehend that, even in the present state of the law, the local sewer authority is bound to provide that such a state shall not continue through want of proper constructions for the drainage. For agricultural lands, no doubt, the case is different. It may not be practicable to require that such lands, though damp enough to cause phthisis to the comparatively few and scattered persons who reside on

them, shall be artificially drained by their owners; and the interests of agriculture in this respect are not always identical with those of human salubrity.

But at least the law might unequivocally condemn, so far as detrimental to health, all damming of natural drainage. And for river conservancies it would be a function scarcely, if at all, less important than that of preventing the pollution of rivers, that they should also, so far as possible, prevent or remedy all such artificial and natural obstructions of water-flow as keep tracts of inhabited land sodden with stagnant wetness.

It is desirable that trees should not overhang the house, and essential for health that the house should not be smothered with trees, especially on the south and west sides. I attach much importance to this, and could give many reasons for doing so; the health of females and children always suffering from such overshadowing. The exact extent of this, however, is a matter of practical opinion. No site should be adopted where there is a wall more than five feet high in front of the house, if that wall is within a distance of twenty feet, and this clear distance in front might be modified according to the height of the houses and the population upon the area. After houses in such circumstances are occupied, some stipulations might be made that walls should not be built nearer to

them or higher than I have specified. The front of a house might be described to be 'that side where the window of the living room is situated.'

Foundations and Walls.

It is essential on all clay soils that there should be under the walls, and below the general surface of the original soil, concrete of a minimum depth of one foot and minimum width of two feet.

It is essential over all internal and external walls which communicate with the earth that there should be a damping course at least six inches above the level of the surrounding ground when finished.

This damping course to consist of slate, or tar and sand, or some impervious material.

It is essential that the outside walls, when of brick, be of a minimum thickness of nine inches; when of wood, that such wood should be built upon brick and concrete foundations, with damping course in the same manner as specified for brick walls, and that the structure of such buildings should be of quartering, four inches thick, covered outside with wood or tiles, and inside with wood, or lath and plaster, and air-tight, and when of stone, the walls

should be of a minimum thickness of one foot, with concrete and damping course as before specified.

It is desirable that the line of the floor be at least one foot above the surrounding ground.

When water stands permanently under the house as previously referred to, within a distance of three feet, it is desirable, if not essential, that the whole area of the house be covered with a layer of same impervious material to prevent the damp rising. On this part of the subject, I may remark that there are many excellent proposals at present being made for lowering, during winter, the level of the Thames above London, so as to give the inhabitants a drier subsoil on which to live; but unless there is some care taken, builders will take advantage of the improvement, and follow the water, so to speak, and erect new houses which will become as damp as the old ones.

Living Room.

The minimum size of any living room should be, where one or two bed-rooms are attached, 120 feet superficial, and where three bed-rooms are attached, 144 superficial feet, inside the walls,

and the minimum height of ceiling should be eight feet.

Where the floor is laid with stones or tiles, it is essential in all cases upon clay that there should be a layer of concrete not less than six inches thick under such stones or tiles.

It is desirable, however, that the floor should be of wood, upon joists with sleeper walls, and that there should be ventilating bricks in the side walls.

It is essential that there should be in the living room a fire-place fitted up with a grate and oven attached, of not less dimensions than two feet eight inches in width, and not less than fourteen inches in depth.

It is essential that the living room have a door of which the boards shall be of a minimum thickness of one inch and a half, and that the minimum width be two feet six inches, and height six feet.

It is desirable that there should be a porch to this living room, and that such porch should have a door.

It is essential that the living room be ceiled in.

It is essential that such living room have a window or windows of not less than twelve superficial feet.

It is essential that not less than one-third, and desirable that one-half, especially the upper half, of such window or windows should open. It is desirable that these windows should face east, south, or west. A due south aspect, as compared with one due north, will make two months' difference in firing in the year.

It is desirable that none of the doors of this living room should be in the chimney corners, that is to say, on the same line of wall as the chimney, but that they should be on the opposite or side walls. The reason for this recommendation is that, if the doors are at the side of the fire-place, it is impossible to sit at the fireside without being in a draught, or in everyone's way going out and coming in. Old and sick people especially have not a comfortable corner to sit in if the door is put near the fire-place. It is, I am aware, very desirable to retain the chimney in the centre of the house, but it will be found almost impossible to combine these two features economically in a single cottage, although easier in a block of two, and I should recommend the retaining of the chimney corner as being the more desirable alternative of the two, if the chimney has to be put on an outside wall.

Pantry.

It is essential that there should be a pantry in each house, not less in area than ten feet superficial, and having a minimum cubical area of forty feet, and that such pantry should have communication with the external air, with a window or opening facing north or east, and not less than two feet superficial. The size of pantry might be rather less for houses in villages.

It is desirable that such pantry be fitted up with two rows of shelving.

Scullery.

It is essential in every Dwelling that there should be a scullery not less than twenty superficial feet in area, and that this scullery be fitted up with a sink.

It is essential that this scullery be paved with stones or tiles. It is essential that the sink be connected with a drain not discharging into a privy, but taken to some safe distance from the house, and be properly trapped; and it is desirable, in addition to the trap, that the communication be broken outside the house. It would, however, be better if all such slops were saved in a pail, and distributed daily over the garden. The size of this scullery might also be a little less for houses in crowded villages.

It is essential that the cubical contents of the scullery should not be less than 140 feet.

It is essential that such scullery have a window not less than six superficial feet, and it is essential that one-half of it should open.

If there is a copper in the scullery, it is essential that there should be a ventilator from the ceiling into the open air, not less than one foot square, in addition to the window.

It is desirable that the scullery should have a door opening to the outside, *without* passing through the living room.

Staircase.

It is essential in all cottages of two stories that there should be a staircase, with a maximum rise of each step of nine inches, and a minimum breadth of step of nine inches. The same dimensions will apply to winders on the centre line of the stairs.

It is essential that the staircase should not be less in width than two feet six inches.

If the staircase is steeper than this, or narrower, it is dangerous for old people and children, and it is almost impossible to carry a sick person up or down. Where there is a staircase window, it is essential that it should be made to open, and be of a minimum size of four superficial feet. If

there is no staircase window, it is essential that there should be a ventilator not less than one foot square through the ceiling of the staircase into the space under the roof.

Fuel and Ashes.

It is essential in every cottage that an enclosed place be provided for fuel, of not less cubical contents than twelve feet.

It is desirable that each house have an enclosed place provided for ashes, of not less cubical contents than three feet, if inside the dwelling house, and, if outside, of not less than twelve cubical feet.

But such ash-pits must not be in the living rooms or bed-rooms.

Bed-rooms.

It is essential that any room to be occupied as a bed-room should have a wooden floor, and if upon the ground floor, upon sleeper walls.

It is essential that the superficial area should not be less than forty-eight feet, or contain less cubical contents than 336 feet.

It is essential that such bed-room have a window not less than six feet superficial, and that half of such window should open. Where such bed-room has not a fire-place, it is essential

that it should have an opening for ventilation, not less than one foot superficial, opening either into the ceiling or else into the staircase.

It is essential that all bed-rooms be ceiled in. Where there are one or two bed-rooms, it should be made essential that one have a fire-place; where there are three bed-rooms, that there should be fire-places in two of them.

It is desirable that the top of the window should be within one foot six inches of the highest point of the ceiling.

In Scotland it is very prevalent to have one or two, or sometimes more, folding beds in the living rooms. Where these are box beds, they are most objectionable on sanitary grounds, as they cannot be properly aired.

Where these beds are fitted into recesses in the walls, they are a little better, but they are not so good as open beds in rooms specially kept for that purpose. They are being gradually done away with, but it would be impossible to pass a law at present to render them illegal. More enquiry should be made on this point, and a stipulation might be inserted in the bill that where such use of a living room is sanctioned (although it would be better for the future if it should not be allowed at all) the cubic space provided should be the same as if a special bed-room was added.

All partitions between bed-rooms should extend from the floor to the ceiling, and be of permanent construction in framed wood, brick, or wood, lathed and plastered, and all bed-rooms should be fitted with doors.

The Water Supply.

It is essential that all cottages and dwellings have a wholesome water supply, if possible, within a maximum distance of a hundred yards.

A bucket and chain are probably the best means of raising this water, as they are least liable to get out of order, and are the most wholesome.

Where storage of water is relied upon for a supply, the minimum that should be provided for is five gallons per head per day for six weeks; and for this calculation, a house with one bed-room might be rated for two people; a house with two bed-rooms for four, and a house with three bed-rooms for six.

Where the rain-water is saved as the source of supply for domestic purposes, it is desirable that the house should not be overhung with trees, and that the tops of the chimneys should always be two feet higher than the ridge of the roof.

The Roof.

It is essential that the roof of whatever material be water-tight.

Spouting.

It is essential that every cottage be spouted, and that water so collected be carried away to a safe distance from the foundations of the house.

The Garden.

It is desirable, in all country districts, that each cottage should have a garden not exceeding thirty poles in extent. If it is larger than this, the labourer expends upon it his strength, which would be much better reserved for his more especial employment, and if he is a regular servant on fixed wages for a certain number of hours' work each day, the temptation is too great to take something off each end of the day for working in his garden, and so unpleasant feelings arise between him and his master.

The Privy.

It is essential that every house be provided with a water or earth closet or privy; such privy, when dry, not to be nearer a living room than five yards, and such privy or closet should be connected with an impervious system of drainage, or have an impervious iron pan or

cesspit; and it is most desirable, if not essential, in most cases that there should be no leakage into the subsoil.

The iron pan or cesspit should not contain more than four cubic feet, so as to prevent an unsafe accumulation.

If a water closet is attached to the house, it is essential that it should be on an outside wall.

Such privy or water-closet to have an external opening or window not less than one foot superficial to open, and such cesspit, when attached to a privy, to be covered from the weather.

It is most desirable that there should be no leakage from any privy or cesspit into the subsoil if there is any well used for domestic purposes within fifty yards of such privy, and it is an open question for consideration if the right of prescription should extend to such drainage into the subsoil, so as to prevent wells being opened at any future time.

For houses in growing villages, a general water or earth closet, with at least three separate compartments, with a door upon each, might be sanctioned for buildings calculated to hold twenty people; but it is very desirable for general cleanliness that each family have its own water or earth closet. In cases where sanction was given for closets for more than one

family, it should be made essential that one be provided for males and another for females.

The law as to drainage and privies should be made applicable to all houses, or else in country villages there would be a law for cottages and no law for the better class of houses alongside of them.

Much depends upon this law, for the following reasons :—

Villages of small houses, and, indeed, towns as well, spring up in the country districts very generally, and especially in England, where water can be found in the subsoil within twenty-five feet; that being the lift of an ordinary pump, or what can be reached by a well pole.

The soil and subsoil are therefore naturally porous, and the danger is increased by the water underneath being almost always 'travelling' water; that is, water passing from a higher level, however slowly, to some natural outlet. This has been thoroughly investigated and established by Pettin-Koffer, the German physiologist, in his researches on the causes of the cholera at Munich, in 1865. The wells thus draw from a large area, and if the cesspools or privies leak into the soil, as they almost always do, epidemics are thereby disseminated through the whole population, especially towards the

end of the summer and in dry seasons. I think it would be found, upon investigation, that epidemics of the class of fever and cholera spread in country villages in proportion to the number of the houses upon the ground, and the nearness to the surface of the water in the wells. It is also a subject for full investigation in enquiries into the health of certain districts to ascertain the direction in, and rate at, which this subsoil water is travelling, as I think it would be found that villages built across the line of direction are more healthy than those which are built on the same line as the water underneath is proceeding. In villages on the sea-coast, where the subsoil water is thus tainted, it will, I believe, appear upon enquiry that cholera and fever in all its forms spread with the greatest rapidity.

The generally received opinion among those who have investigated the subject is that organic matter must be taken up by the roots of living plants, and that it is not a safe practice to bury it in the earth with the idea that contact with the inert soil will render it innocuous. Hence the necessity of preventing, by every possible means, its passing down into the subsoil.

I do not, however, wish it to be understood

that I believe water and drainage alone are the communicating causes of epidemics; but I believe them to be very powerful agents in doing so.

These stipulations would almost lead to a compulsory bill for the drainage of towns and the utilisation of sewage by the whole country, which will probably come some day, although people are scarcely yet prepared for it. A general system of drainage becomes almost essential for sanitary reasons wherever there are some such number as 2,000 people living together upon such a space as would be equal to the area of one-half a square mile, or 320 acres.

Pig-stye.

It is desirable that no pig-stye should be permitted within twenty yards of the house, and prescription in like manner should not extend to them.

It is important, however, to consider that, if all these stipulations make the building of cottages, or similar dwellings, so expensive, or so irksome, that speculators will not build them, the labouring classes may not get houses at all.

In examining and certifying cottages already built, some discretionary power might be given

to the inspecting officer to interpret the law more liberally in such matters as are impossible to alter, without pulling the house down, such as the height of the ceiling in the living-room, and the steps up into the house; but this discretionary power should be carefully guarded. The former, for instance, provided that the old ceiling was not under *seven* feet high, might be sanctioned if the cubical contents of the room, whether 'living' or 'bed' room, were correspondingly increased, and the latter by stipulating that air bricks should be put under the floor; the floor, formed of wood, on sleeper walls, and the walls of the house itself lathed and plastered, and the earth removed from the outside of the walls, and kept off by brick or stonework.

As some of the basements of houses in villages are occupied, it would be necessary to make some special stipulations to provide for their not coming under the same law.

If the reasons I have given for passing these sanitary regulations are founded on correct principles, the general body of the inhabitants will benefit indirectly from the improved condition of the lower classes; they will have less rates to pay, and the two extremes of society will be brought more together. The object in view, it is submitted, should be to reach that

very lowest class who can do nothing for themselves, and who come upon the rates whenever the least misfortune overtakes them. A very large number of landlords have, for many years, been acting on the right principle of considering good cottages on their estates to be as necessary as farm buildings, and I do not think that I have stated anything as essential which they, as a body, have not been providing already; especially those who have been engaged upon it for some time, and have given their attention to the subject.

Perhaps, also, the Government might advance money on especially favourable terms to those who were inclined to undertake the building of cottages and dwellings which come up to the requirements of the description I have attempted to specify; or, still further, in cases where, upon full investigation by one of the inspectors, it was evident that, owing to the increase of population, the pulling down of houses, or some causes of this description, there were not sufficient houses for the labouring classes, the Home Office might grant powers under some very stringent conditions to the local authority to compulsorily purchase land in that parish or union; build a certain number of cottages, and

charge the union or parish with the full interest. This, however, is a question on which I feel scarcely entitled to give any opinion, as it is one of so much difficulty. Something of this principle has already been acknowledged in the Labourers' and Artisans' Act for towns, brought in by Mr. McCullagh Torrens, but how far that might be extended to country districts is a serious question.

It appears very doubtful if private enterprise or speculation can be relied upon to meet all cases, and there might be this final resort to the Government to provide for the wants of the poorest classes, but making the community of each district pay as far as possible for its own requirements.

The power spoken of here to be given is something of the same description as what already exists as to the authority of the Home Secretary over the drainage of towns. At present, if a town refuses to drain itself, he can send an inspector down, and on his receiving satisfactory evidence that such work is necessary, he can compel it to be done, and charge the inhabitants with the cost thereof.

The power is very seldom used, but the threat that it will be done is often the only effectual

argument that the better informed classes can bring to bear upon those who, generally from ignorance and indifference, oppose them in the vestry meetings.

As an illustration of the effect of the present system, and the probable working of the principles attempted to be laid down in this paper, for rural districts, let me quote the following from my own immediate neighbourhood. I think it advisable not to give the names.

The examination was made by me in December 1866.

There are at one place two double houses, built upon something less than one-fourth of an acre of land.

They are of one storey. There is only one privy and one well in the ditch immediately adjoining, for the whole families. All the houses are alike.

They are built partly of brick and partly of weather boarding, and covered partly with half-slating and partly with asphalted cloth.

There are only two rooms in each, without any other convenience whatever of pantry, cupboards, &c.: the living room, nine feet by ten feet; and the bed-room, about the same size, with a small window and no fire-place. The ceiling six feet six inches high.

The inhabitants told me that in wet weather the water streamed through the roof, and the smell of damp in the bed-rooms was very strong.

The inmates were as follows, on my visit:—

First Cottage.—W. P., a roadman, 10*s.* a week, 71 years of age, whom I found dying of disease of the lungs and diarrhœa. His wife lives in the same house.

Second Cottage.—J. W., a bricklayer's labourer; wife and four children, all sleeping in one room. One child died last week.

Third Cottage.—J. D., a heath getter. Wife and one child.

Fourth Cottage.—J. L., a bricklayer's labourer; wife and three children, all sleeping in one room. She informed me she had never been well since she lived in the house.

In all probability, the building of the whole of these, including the purchase of the land, did not cost above 50*l.* or 60*l.*

Each of the tenants paid 2*s.* 9*d.* a week, and did not complain of the rent if they only had better places to live in.

The total of this rent paid by them for these four houses is therefore 28*l.* 12*s.*

Supposing the law to which I have alluded was passed, these four cottages would, of course, at

once be condemned, and considering the rate of interest the tenants have already paid for them, the landlord, it would appear, would not have much claim for compensation.

Before, however, they could be ejected, the parish or union would have to provide houses for them, and would have to borrow the money.

Suppose that the Government advanced money for this purpose at five per cent. which would clear off principal and interest in a certain number of years.

The parish would be put to a still further expense of one per cent. for cost of management, and one per cent. for repairs.

This one per cent. would probably be sufficient until the Government debt was cleared off, when the houses themselves would become the property of the parish or union.

After that time more repairs would probably be necessary, but there would be more funds to meet them.

Seven per cent. therefore would be what the parish would require to raise.

Taking, therefore, the rent that these four cottages pay, namely, 28*l.* 12*s.*, the parish could afford to borrow 400*l.* to build houses for them.

To provide for these four families, there would be required two houses with one bed-room each,

and two houses with two bed-rooms each, and I think all of these might be built on the principles I have mentioned, and the land purchased, for about 400*l.*, or very little more.

When the Government loan was paid off, say, at the longest, in thirty years, the parish or union would sell the buildings, and thus put them into the general stock of houses in the country.

In order to prevent an undue accumulation of house property in the hands of local authorities, they should be compelled to sell these houses at the end of the term. They would thus have some funds either to begin the process again or recoup themselves for any outlay beyond the sum I have mentioned.

The case I have stated, no doubt, is exceptionally bad, but the general principle, I trust, is sound.

My experience would lead me to the conclusion that, taking all ages of married couples, blocks of houses in rural districts on the following arrangements would meet the general wants, that is—

One cottage with one bed-room Two with two bed-rooms . . . One with three bed-rooms . . .	In blocks of four.

With the greatest crowding, the number

of people which each could safely accommodate would be—

For the first, two adults, with two children under twelve years of age;

For the second, four adults, or two adults and four children under twelve years of age;

For the third, five or six adults, or two adults and six children under twelve years of age.

If anything much or, indeed, in any excess of that is allowed, the greater part of the good arising from the improved dwellings would be lost.

There would be great economy in building such houses as I have mentioned, as no high-skilled labour would be required to put them up, and especially if lithographed sets of plans and specifications were supplied by the Privy Council Department, and other facilities given to lighten the expense of the work.

If, for instance, as proposed in this paper, the minimum sizes of doors, joists, flooring boards, rafters, &c., were fixed by law, they could be made wholesale by machinery at central establishments, or in the native places where the timber is grown, far cheaper and better than they can be made in each parish or by each proprietor, and the necessary quantities sent to each place as required. These advantages might be extended

to all people building cottages of this description.

Anything approaching comfort or decency in dwellings of such a class as those I have described exist at present is impossible, and it is no wonder if labourers coming home from their work prefer the warmth and cheerfulness of the public-house.

As the law stands at present, it is the duty of no one specifically to interfere with these matters, and say where they are wrong, but however difficult and formidable a work it is, everyone who sees the effects is, I believe, convinced that some change for the better must be attempted.

Crime in every form would, I believe, decrease, and so would the poor-rates in the long run, whilst the lowest class would be raised from their present condition, and be saved much suffering and misery. Many special cases of hardship would apparently arise in carrying out this measure, but the general welfare of the country must take precedence of individual interests.

ADDENDUM.

Since the preceding paper was written, the first report has appeared from the Commissioners appointed to enquire into the Employment of Children, Young Persons, and Women in Agriculture.

On the subject of the condition of agricultural cottages and villages, the information is most full, and tends irresistibly in the direction in which I have endeavoured to point out. I will only quote a few of the most important of the statements and recommendations given.

The Commissioners themselves say :—

> Mr. Fraser's picture of the state of the agricultural cottages in the counties which he visited cannot fail to produce a deep impression. He says of it that 'It is a hideous picture,' and the picture is drawn from the life. 'It is,' he declares, 'impossible to exaggerate the ill effects of the present state of things, in every aspect, physical, social, economical, moral, intellectual.'
>
> At the same time, Mr. Fraser fully recognises the fact

that a great deal has been done of late years, especially by the largest landowners, to remedy the evil.

Unfortunately, the complete remedy does not rest with the wealthiest landowners. Many cottages belong to small proprietors, too indigent to have any money to spare for their improvement; some to absentee and embarassed landowners; some to mortgagees; a large proportion to speculative builders, particularly in the open parishes. 'It is estimated,' Mr. Fraser adds, 'that the proprietorship of less than half the cottages in Norfolk is in the owners of the soil.'

As the Artisans and Labourers' Dwellings Act has now become law, the time, happily, cannot be far distant when Parliament may be able to see its way to some measure, of a similar kind, applicable to agricultural districts; and also to some more effectual inspection for the prevention of overcrowding than the present one, depending, as it does, on the local authorities alone, which Mr. Fraser notices as quite ineffective.

The evidence obtained by the Assistant Commissioners is still more detailed as to the state of the cottages and villages, and in suggesting the propriety of a law for regulating those matters.

We find, for instance, among the evidence collected by the Rev. J. Fraser, the following statement by the Rev. W. Beckett, rector of Ingoldisthorpe, county of Norfolk.

Sanitary Arrangements.—As connected with the subject of the dwellings of the cottagers, I would mention the great neglect in country villages of sanitary measures and precautions. This, as giving rise to sickness, is, of course, a cause, also, of poverty. I think that a law is especially needed to provide against this evil, and to secure to the poor a supply of good water, and guard against the evils arising from bad drainage, open sewers, obnoxious cesspools, privies built against the very cottage walls, and dirty pig-styes, and heaps of rotting refuse, within a few yards of the doors and windows of the cottages. During the last twelve years there have been two visitations of sickness in this parish—diphtheria and typhus fever—and in both cases they originated in some of the causes I have mentioned, and ceased when those causes were removed. On both occasions my efforts to remove the nuisances which were poisoning the neighbourhood were not only not seconded by the resident gentlemen and the parish officers but were even opposed by the latter, and by the medical officer of the local board of health.

In the first case a month or six weeks elapsed before I could procure the removal of the nuisance, and several deaths occurred in consequence; in the second, in order to secure my object as quickly as possible, and so save life, I was obliged to threaten to apply to the board of health in London to send down a medical officer to enquire into the cause of the disease.

In the latter case, immediately on the removal of the nuisances I pointed out, the disease was stopped, and spread no farther.

Again, at a public meeting at Halstead, Essex, Mr. Fraser states—

A discussion took place with reference to the inspection of labourers' cottages, with a view to prevent overcrowding, the commission suggesting the appointment of an independent inspector for the district; and ultimately it was agreed — 'That some independent surveillance of cottages was absolutely required, to prevent overcrowding, &c.; and that an annual return should be made by the overseers of the cottages in their parishes, with the number of inmates, to a Government officer appointed for the purpose.'

Again, Mr. Borham, M.D., of Halstead, Essex, states :—

Considers that sanitary legislation, when left to be carried out by a local board, is certain to be so much affected by local influences, and personal interests, as really to evacuate all the purposes of the Act. Thinks that no beneficial results can be expected till independent inspection is introduced into the system.

Mr. Samuel Clark, sanitary inspector for Norwich, states :—

Before any considerable improvement can be expected in this respect, the inspection of the sanitary arrangements, &c. of the cottages in each union district must be entrusted to some officer (like the exciseman) independent of the local authorities, empowered and required to take legal proceedings in any case where the laws of health or decency are manifestly violated. The powers given by the present sanitary Acts, and the general force of public opinion, are far too weak to prevent, or even largely to mitigate, the evils that exist. The water supply (to take one instance) is frequently

very defective, and there are no provisions in the Act for enforcing its improvement.

The privy accommodation is also generally defective; and many cottages would have none were it not fixed up by the occupants. In fact, it is impossible to use too strong language in describing the condition of many of the cottages, considered as habitations of human beings, in a civilised country.

And Mr. Fraser then adds of himself :—

I could have multiplied these statements to any extent, but as the above opinions are given by gentlemen thoroughly competent, from their position and experience, to pronounce them, and embrace all the main medical and sanitary features of the question, as well as are, on the whole, remarkably harmonious, and entirely independent, I considered it unnecessary to add to their number.

The other Assistant Commissioners give much evidence to the same purport, and I may quote specially that of Earl Spencer, to show the feelings of some of the largest landowners.

He says :—

I think it desirable that cottages should be put under inspection, and that guardians should be able to indict the owners and occupiers of cottages which are overcrowded or unhealthy, and, if necessary, to do the repairs required for rendering such cottages wholesome and decent; the expenses so incurred should be charged to the owner, and, on failure by him to pay, I would give the guardians power of selling the cottages. They

should remunerate the union, in the first instance, for the outlay, and hand over the surplus, if any, to the former owner. Were such a principle adopted, machinery, no doubt, ought to be constructed, in the form of some appeal, to protect the landlord from arbitrary and vexatious use of the power thus given to boards of guardians. A clause in the Act of 1866 gives considerable powers for this object; but I believe its powers might be increased; and its enforcements and application should be compulsory.

I think it very desirable for the Government to give facility to proprietors who have no capital to raise money for the purpose of building cottages. I consider allotments of great importance, as tending to raise the independent character of labourers; they should be limited to a rood, or thereabouts, within easy reach of the village.

Occasionally, corn is necessary as a change of crop. On the whole, I am in favour of allowing these labourers to manage as they please, allotments becoming objectionable when so large as to detract from the labour which the employer has a right to expect, and not large enough to support independently the labourer.

Still stronger views are expressed by John Harvey, Esq., Chairman of Quarter Sessions, when speaking of the county of Bedford, in a letter addressed to Mr. Culley, Assistant Commissioner. He says :—

As to the question of cottage accommodation for the poor, it is one in which I feel so strongly that I am almost afraid of expressing my opinions. I am convinced that till the labourer has a decent habitation, you may try to teach him decency in other things in vain; it is the most frightful evil of the whole of the social condition of Great Britain.

There is not adequate accommodation for the labourer in any county, in any town, in any district, in England.

How can you expect girls to be uncontaminated who have to sleep in the same room with grown-up brothers, or, worse, with their father and mother? Can a man be expected to keep away from the beer-shop when his cottage is what it too often is? But the practical difficulty of providing a remedy is enormous. Cottages, unless at exorbitant rent, will not pay; and, till the Union Chargeability Act, 28 and 29 Vict. cap. 79, cottages were actually pulled down to save the rates.

I am very doubtful as to the working of that Act; and I think that every parish should be charged to the union rate, in proportion to the number of labourers it ought to employ, according to its acreage; i.e. where any parish did not contain sufficient cottages for the number of labourers sufficient for its acreage under cultivation, I would double all the union or common charges on that parish, until sufficient accommodation was provided.

Mr. Fraser adds of himself :—

The majority of the cottages that exist in rural parishes are deficient in almost every requisite that should constitute a home for a Christian family in a civilised community. They are deficient in bed-room accommodation, very few having three chambers, and, in some parishes, the larger proportion only one; they are deficient in drainage and sanitary arrangements; they are imperfectly supplied with water; such con-

veniences as they have are often so situated as to become nuisances; they are full enough of draughts to generate any amount of rheumatism, and in many instances are lamentably dilapidated and out of repair.

Such evidence and such conclusions will, I hope, amply justify the step I have taken in submitting my views with the hope of assisting in laying down the minimum of accommodation that will secure, so far as practicable, objects so important, especially as the details have not been specified in any part of the reports to which I have alluded.

LONDON: PRINTED BY
SPOTTISWOODE AND CO., NEW-STREET SQUARE
AND PARLIAMENT STREET

THE

A. B. C. SEWAGE PROCESS;

BEING A

REPORT OF THE EXPERIMENTS

HITHERTO MADE AT

LEICESTER, TOTTENHAM, AND LEAMINGTON,

ON THE

PURIFICATION AND UTILIZATION OF SEWAGE.

Second Edition.

PUBLISHED BY SPECIAL REQUEST.

LONDON:
ELLIOT STOCK, 62, PATERNOSTER ROW.

HAVING received many requests to publish an account of the Leicester experiments on the A. B. C. process, we have thought it best to issue this pamphlet, in which we have candidly given our opinions and experience on the subject, in order to furnish the public with the necessary information to enable them to form a judgment on the process.

W. C. SILLAR.
R. G. SILLAR.
G. W. WIGNER.

62, CORNHILL,
9th October, 1868.

THE

A. B. C. SEWAGE PROCESS.

THE great sanitary problems of the day are acknowledged to be, the purification of the water we drink, and the disposal of the sewage of our towns; and, when we consider that sewage is the principal source of the pollution of our rivers, we must admit that of these two problems the latter is of primary importance. Wherever men congregate, it becomes essential to devise some means of carrying away the excreta and refuse; and, all points considered, no method of doing this is so cheap, convenient, and expeditious as water carriage, or, as it is commonly called, town sewerage. Various suggestions have nevertheless been made to avoid this, but the great expense of working these schemes, and the nuisance created by them, have proved almost effectual obstacles to their general adoption. In viewing the question, we must bear in mind that nearly all our large towns are already sewered, and what we have to do is to treat the fluid discharged

by the sewers, and, to treat it in such a way as to prevent any of its deleterious ingredients from passing into the rivers, and, at the same time, to retain all that is valuable, for agricultural purposes, in such a form as shall be no bar to its practical application.

The large quantity of sewage (on the average nearly 30 gallons per head per day) and its consequent dilution have, hitherto, been a serious obstacle to its useful application; for we must bear in mind that no scheme can be considered successful, which does not utilize in some form or other the greater part of the valuable ingredients contained in it. These elements have been originally derived from the soil, and to the soil they must be returned, if we would avoid impoverishing and ruining it.

The plans hitherto attempted may be classed under three heads—Irrigation, Filtration, and Precipitation.

Irrigation has many advocates, and is in practice in several localities—Edinburgh and Croydon, for example—but its disadvantages are by no means inconsiderable, such as the application to a small area of what ought to be a benefit to a very large one, and the risk of propagating sickness or disease by the application to the surface of the soil of what should be buried beneath it, and, consequently, the presence of noxious exhalations from the irrigated land, and the tape-worms and other entozoa that adhere to the crops themselves.

It is a very significant fact that the chief advocates of irrigation have contented themselves with stating the *total* amount of solid impurity left in the effluent water, omitting to distinguish inorganic from organic matter, though the latter is the only injurious component present, the mineral matter being, as a rule, perfectly harmless.

Filtration—Of the systems dependent upon this alone, but few words are requisite. By this means the poisonous organic matter held in solution cannot be removed; the only substances arrested being those which would settle to the bottom if sufficient time were allowed. We are therefore forced to the conclusion that the only effective method is by precipitation, should an agent be found which would clarify the water sufficiently to allow its running into the rivers without unduly polluting them, and at the same time retain in their integrity the nitrogen and phosphates which, it is well known, constitute the principal fertilizing properties of sewage.

Precipitation—Various agents have been from time to time proposed for this purpose. The principal has been, Alum, long used by the Chinese, but patented by Pinel in this country in 1842, and since then in various forms by more than a dozen other inventors. In outward appearance the action of this substance is satisfactory, but when the supernatant water is submitted to analysis, it is found to contain all the soluble organic matters originally

present in the sewage. The only substances precipitated, as shown by Professor Way's analysis, being those which would have been separated by an efficient system of mechanical filtration; alum alone is, therefore, useless.

Next followed Wicksteed's Patents for Lime and Charcoal, and Higgs' for Lime alone. Both these processes were tried on a large scale—the former at Leicester, the latter at Tottenham. But the result in both cases was an unsatisfactory purification of the water, and the production of a large quantity of residuum which the farmers refused to use, because its principal ingredient was carbonate of lime, and it was almost wholly deficient in the nitrogen and phosphates in which the value of the manure really consists. After a trial of some years, the Leicester company handed their works over to the corporation, who continue to carry them on at a considerable annual expense. The Tottenham works also reverted to their Local Board of Health, and they still carry on a lime process, the results of which have been a Chancery suit and an injunction.

Perchloride of iron and Carbolic acid have also been proposed and tried for this purpose. The former removes the sulphuretted hydrogen, to which the smell of the sewage is mainly due, but leaves untouched all the dangerous organic impurities. The latter acts mainly as a cloak, by its own more powerful odour concealing that of the sewage.

These agents have also been tried in various combinations, but with little more success.

In this state the subject stood in May, 1868, when the extremity to which the Tottenham Board had been driven by the granting of the injunction led to an application to us, through Mr. Jones, of the Ratepayers' Association, for the results of some experiments which we were then carrying on on this subject. The full details of the process were at once laid before him, and the result was an arrangement for experiments on a somewhat large scale at Tottenham, which was the first public trial of the A. B. C. process.

The A. B. C. mixture (so called from the initials of the three principal ingredients—Animal-charcoal, Blood, and Clay) is a compound which, when dissolved in either sewage or water, and added to the sewage, produces an immediate precipitation of the greater part of the injurious matter in the form of large flakes, which rapidly fall to the bottom; the supernatant liquor being then allowed to flow into a tank, a small quantity of a solution of perchloride of iron is added to it, and this precipitates the sulphuretted hydrogen dissolved in the water, and removes the last traces of smell.

In addition to these four ingredients, it has been found desirable to add a proportion of alum, as, although the same degree of purity could be

obtained without its use, the process is very much accelerated by it, and this more than compensates for the addition of a small quantity of harmless mineral matter to the water. Nothing is used which can dissipate or discharge any of the ingredients which are of value; on the contrary, the larger part of the ammonia and all the phosphates are fixed in the residuum, together with about four-fifths of the organic impurities, the deposit, of course, being of great agricultural value, requiring only the addition of a small quantity of acid to render it fit for sale to the farmer.

The first experiment at Tottenham took place on the 19th May last, and was on about 5,000 gallons. The effluent water was sufficiently pure to justify further experiments, and accordingly on May 30th about 70,000 gallons were treated.

34,542 gallons of this were allowed to flow into a large tank, the A. B. C. compound running in at the same time from two small tubs. About 70 gallons of the solution were used. Another 35,000 were then treated in a small tank holding only 5,000 gallons, the object being to prove that the deposit from one lot of, say 5,000 gallons of sewage, possessed the power of precipitating the impurities from 5,000 gallons more; and that, with a very small addition of A. B. C.—not more than 10 per cent. of the quantity originally used—the same power was retained to the fifth time of using it; the purity of the effluent water was

nearly the same, and the manure increased in percentage of ammonia every time. This trial was extremely satisfactory, and proved that the preliminary experiments had been correct. In this experiment no attempt was made to separate the heavier deposit of silica from the lighter and more valuable particles of the manure. By a very simple mechanical arrangement made during subsequent experiments this was satisfactorily effected. The analyses of the sewage, effluent water and manure from these experiments are given in a separate table at the end.

These trials having been brought to the notice of Sir W. Denison, that gentleman called at 62, Cornhill, and there saw sewage, from the outfall at London Bridge, operated upon by A. B. C., in a manner so satisfactory, as to induce him to request us to undertake, for the satisfaction of the Royal Rivers Commission, a trial on a large scale for the purpose of demonstrating that it was as practicable as it appeared to be. In pursuance of this suggestion, and at the request of the Home Secretary, the Mayor of Leicester courteously placed the Abbey Meadow Sewage Works at our disposal, and as these works are in duplicate, so arranged it, that whilst the sewage in one set of tanks was being treated with the A. B. C. compound, the other set continued to work on the milk of lime process; by this means giving an opportunity of comparing the results of the two.

This trial, conducted, like the others, at our own expense, lasted from July 25th to August 1st, six days in all, during which period upwards of ten million gallons passed through each set. The trial was a most severe one, considering the absence of all experience in dealing with the refuse of a manufacturing town, containing not merely human excreta, but dyes, mordaunts, soap (in large quantities), and various other refuse matters, and the great rate at which (during the busy part of the day) it was necessary to purify this, a rate of not less than 2,500 gallons per minute through each set of tanks. Still our confidence in the *principles* of the process made us at once accept the responsibility of what the scientific journals properly called the application of a *breaking strain*. During the experiment the correctness of this phrase received remarkable confirmation. Mechanical difficulties, due to the fact that the pumps and tanks, although admirably suited for the lime process, were not so well calculated to work the A. B. C., continually arose. The temporary dam, erected between the two sets of tanks, was on more than one occasion breached by the wash of the sewage, and stoppages of several hours were necessary to repair these injuries. Besides this, great quantities of sewage, and (what was even more prejudicial) of sewage treated with lime were allowed to mix with the A. B. C. water, thereby liberating a very considerable portion of the organic matter and

ammonia which had been carried down, and conversely allowing a portion of the A. B. C. mixture to act on the lime-purified water, *from which it threw down a further precipitate*, thus rendering their water purer than usual.

It was singularly unfortunate that the most serious of these accidents happened on one of the days when the samples were being taken by the Royal Commission. The dam between the tanks being washed away, about 150,000 gallons of sewage were allowed to flow into the A. B. C. tank, utterly vitiating any results obtained on that day, since the A. B. C. effluent water was mixed with nearly its own volume of sewage.

As an illustration of the injurious effects produced by the accidents to the dam, an analysis marked with a star may be pointed out. This sample, which was taken *during the visit of the Royal Commission*, contained nearly as much sewage as purified water. It is not to be wondered at that it contains 18 grains per gallon of organic matter. To give analyses of more of such samples as this would be useless.

No river *could* object to receive water containing only ten grains per gallon of organic matter, and it will be noticed that several of the Leicester samples contained but a small fraction over seven grains.

The *Times* of the 4th of August contained a full report of the experiment, and of the difficulties

overcome, and the concluding paragraph of that report was as follows:—

> "The Leicester experiments are not yet completed, but we have said enough to show the importance of the pending inquiry, whether this new invention really is a marvellous boon to the world, or whether the whole is an illusion or a sham."

On this point the public can now decide.

In order to enable those interested in the subject to satisfy themselves upon this point, we have made analyses of the results of the trial, and, to facilitate comparison, arranged them in tabular form, where the figures may be compared. As an additional fact bearing upon the question, it may be interesting to know that a sample of a gallon of the effluent water still stands in our Cornhill office, perfectly clear and sweet, containing fish put in some weeks since.

In regard to the *mode* of working this process, we cannot do better than describe the arrangements made at Leicester.

The charcoal, blood, clay, and alum, with small quantities of gypsum, and one or two other ingredients, were allowed to soak in water for about one hour, in a tank holding some 800 gallons. At the end of that time they were allowed to flow into a circular well on the same level as the bottom of the sewer. An agitator, revolving in this well, kept the mixture in a state fit for use. Attached to each of the pumping engines, which

pumped about 200 gallons of sewage per stroke, was a small pump drawing from this well and throwing about 1½ gallons per stroke. These two pumps delivered their respective liquids into a culvert leading to the settling tanks, a perfect mixture being produced by a small agitator placed in this culvert. The sewage was about two hours in passing through the tanks, but in far less time than this all the suspended matter had fallen to the bottom and the water was clear. The precipitating tank was divided transversely into two parts, and at the division a small quantity of a very dilute solution of perchloride of iron was allowed to drip in; this precipitated the sulphuretted hydrogen, and entirely freed the water from smell. It then passed on through the other tank, and ran over a dam into the river Soar.

In order to use the mud over again, it was raised by elevators from the bottom of the tanks and allowed to flow into the mixing pit, thence to be again pumped into the tanks. Owing to the large size of the Leicester tanks and the comparatively short duration of the experiment, *a very small quantity only was thus used a second time;* it being obviously impossible to pump the mud out until the bottom of the tank was covered to some depth with it; consequently the Leicester manure is not so rich in nitrogenous compounds as it would have been even had the process been carried out in its integrity. The process is thus extremely

simple and applicable, requiring only very small alteration in the existing arrangements of most sewered towns.

In some respects the circumstances of Leicester are peculiar, the sewage has all to be pumped from a considerable depth below the surface. In the majority of instances this would be unnecessary, and the mechanical arrangements would be much simplified. It is only necessary to allow the compound to flow in at a regulated rate, and to cause an intimate admixture by an agitator.

Independently of the sanitary point of view, this question is of considerable importance in both a financial and agricultural sense—for whereas none of the other processes can be carried on without considerable pressure upon the ratepayers, the A. B. C. plan promises to be a source of revenue. Unlike the lime process, which, by dissipating the ammonia into the air, leaves a worthless deposit, the A. B. C. system retains the fertilizing properties of the sewage; and unlike irrigation, which involves the serious responsibility and expense of leasing large tracts of land, it promises considerable revenue with but little outlay of capital.

There is not one of the ingredients, excepting the perchloride of iron, that does not positively add to its agricultural value, and therefore the residuum possesses, as the analysis shows, a character closely resembling guano, and eminently adapted to farming purposes. The quantity of animal charcoal added is not sufficient to add materially to the amount of phosphates in the residuum, that being derived from the sewage itself. A considerable portion of that obtained from Leicester has been sold on the London Exchange at 70s. per ton—a price which seems fully justified by the fact of its containing 4½ per cent. of ammonia.

The actual result may be summed up as follows:—

1st.—The sewage contained 43.02 grains per imperial gallon of organic matter. Of this the A. B. C. process precipitated 33.33 grains, leaving only 9.69 grains in the water, and this from an average of fifty samples taken at intervals during the progress of the experiment.

2nd.—Hitherto the lime process has been acknowledged to be the best, and the Leicester mode of conducting it to be the best of its kind. The A. B. C. contrasts most favourably with this, inasmuch as, from samples taken at the same time from each, the water contained as follows:—

Water from the A. B. C. contained 9.69 grains per imp. gallon.
" " lime " 16.18 " " "

having precipitated from the sewage the following proportions:—

Organic matter precipitated by the A. B. C., 77.48 per cent.
" " " " lime 62.39 "

3rd.—Of the Nitrogen in the form of Ammonia in the sewage, nearly all is dissipated by the lime process, but by the A. B. C. about 80 per cent. was retained in the residuum.

4th.—Of the Phosphates in the sewage, the lime process threw down 82 per cent., in a form unavailable, owing to the presence of lime; but the A. B. C. threw down the whole, and in a form readily available.

5th.—During the act of precipitation by the A. B. C. process there was no objectionable odour, whilst that from the lime was "horribly offensive," owing, of course, to the ammonia and other gases being driven into the air by the lime.

6th.—The water from the A. B. C. is in no way detrimental to fish in the river. We have fish which have been for some weeks living in the purified sewage of Leicester.

7th.—By the A. B. C. process restitution can be made to the soil, by preparing in suitable form for putting *into* it (not *on* to it) what has been so freely given by it.

8th.—It solves the difficulty of which the Thames, at Barking, is an example. What is now an offence and an alarming deposit in the river, can be converted into a portable inoffensive material, of the value of which an estimate may be formed from the fact that in the Thames alone there is deposited London sewage which, according to the estimates of Professor Liebig and other eminent chemists,

has a money value of rather more than £4000 per day, or £1,500,000 per year. More than three-fourths of this manure would be utilized by the A. B. C. process, at an expense of not more than one-fourth of its actual money value.

Since the Leicester experiments were concluded, two small experiments have been made at Leamington. About 60,000 gallons were purified. The analyses of the sewage and effluent water are appended to this Report.

We are somewhat unwilling to introduce into this Report any valuation of the residuum made from the sewage; but we may mention the facts that two independent analyses give valuations of £3 17s. 3d., and that Dr. Frankland's estimate of a sample allowed to dry without the necessary addition of acid, whereby a large portion of the ammonia was lost, is (even then) £1 13s. 0¾d. per ton! These facts speak for themselves as to the profit to be derived from the process.

In an agricultural point of view, it is an acknowledged fact that, in order to retain the full fertilizing properties of the soil, it is requisite to restore to it all that is so freely given by it. Up to this time the soil has not had fair play, for we have been giving to the sea what we have been taking from the land, and trying, at great expense, to supply the deficiency by foreign importation. In *our* process we have aimed at restoring not merely the usual ingredients of sewage, but the blood, the most highly

organized compound known—in fact, the life itself. To use this for any purpose but manure is to deprive the soil of that which, more than anything else, will fertilize it.

Our object in investigating the matter has been to find the solution of this most important problem—to avert the slow but certain impoverishment of our English soil, and to endeavour to save the hundreds of lives now sacrificed to pestilence.

Our process is now before the public. *We* are fully satisfied with its results. If any other process does better, we heartily wish it success; but till we see some probability of this, we unhesitatingly say, that as the A. B. C. process will not only answer this purpose, but convert an annual outlay into a certain revenue, a great step has been taken in the right direction.

Since this Pamphlet was in the Printer's hands, the following letter has been received from Mr. Rochford, Florist, of Tottenham, to whom the first prize for Pines was awarded at the Autumn Show at the Crystal Palace:—

(Copy.)

Page Green, Tottenham,
Oct. 21, 1868.

Mr. Sillar.

Sir,—I have pleasure in stating that I have used the deposit obtained from the Tottenham Sewage Works by your patent process, mixed with the soil in which I potted a large number of pineapple plants, and I am much astonished and pleased with the result. There is a very *remarkable difference* between those and the other pine plants potted in soil mixed with crushed bones, and well-decomposed dung. The leaves are very broad, stiff, and intensely green, and altogether larger than the other plants *double the age*. I never before had pines look so well, and consider the sewage deposit you prepared, as of considerable value, and would feel pleased in showing these results to any gentleman wishing for an inspection.

I am, Sir, yours respectfully,
(Signed) M. Rochford.

I have given the following analyses in detail, for the information of those who may require it. The abstract on page 22 gives a summary of the total results.

The analyses of the samples contaminated with sewage have not, of course, been included: they do not afford any information as to *either* process. About thirty samples, *i.e.*, ten each, of sewage, lime, and A. B. C. have been omitted.

The solid matter has been dried in the usual way at 302 deg. Fahr. The organic matter is determined in the usual way by incineration. All the results are given in grains per Imperial gallon. Some uncertainty exists as to *a few* of the ammonia determinations, from the following cause. The A. B. C. compound gradually produces ammonia from the organic matter in the water; so that a determination made some ten days after the experiment showed more ammonia than was originally present in the sewage. Unless the determination is made within a few hours it is worthless. I consider this property of the A. B. C. most valuable, since it enables the plants on a river-bed to assimilate readily the small amount of injurious matter remaining in the

water. The samples, Nos. 23—30, show the gradual improvement after an admixture of sewage.

The analysis of the residuum is from a mixture of 12 small samples, taken from different parts of the bulk.

G. W. WIGNER.

Camberwell, 9th Oct., 1868.

AVERAGES OF ANALYSES.

TOTTENHAM EXPERIMENTS.

	Average sewage.	Avge. A.B.C. water from sewage.	Tottenham drinking water.
Total solid matter grs. per gallon	203·89	81·96	48·70
Organic matter	109·20	14·62	11·31
Ammonia	3·970	·584	·17
Phosphoric acid	7·23	—	—
Common salt	57·10	57·51	9·21
Silica, alumina, and various salts	30·36	9·82	28·18

Tottenham Sewage Residue or Manure.

Water	4·45
Organic matter	20·05
Phosphoric acid	5·33
Sulphate of lime	1·67
Silica, alumina, &c.	68·50
	100·00
Nitrogen Ammonia	2·37

LEICESTER EXPERIMENTS.

	Average of 42 samples of sewage.	Average of 52 samples lime purified.	Average of 52 samples A.B.C. purified.
Total solid matter	102·74	69·53	72·14
Organic matter	43·02	16·18	9·69
Mineral matter	59·72	53·35	62·45
Ammonia	4·81	3·08	1·76
Chloride of sodium	9·67	12·35	12·35
Nitrogen as nitrites	·16	·79	·09
Oxygen absorbed by organic matter from permanganate	3·754	2·148	·938

SUMMARY.—The lime process removed 62·39 per cent. of the organic matter, and left 37·61 in the water. The A. B. C. process removed 77·48 per cent. of the organic matter, and left 22·52 in the water. Therefore the average lime water contained 67 per cent. more organic matter than the A. B. C. water.

The best lime water contained 11·82 grs. organic; the worst, 28·42 grs. The best A. B. C. water contained 7·16 grs. organic; the worst, 13·31 grs.

Analysis of a Sample drawn from the River Soar, above the Sewer Outfall, Leicester, on August 1, 1868.

	Grs. per imp. gal.
Total solid matter	58·13
Organic matter	14·00
Mineral matter	44·13
Ammonia	9·86
Chloride of sodium	11·64
Nitrogen as nitrites	·624
Oxygen absorbed from permanganate	1·620

ANALYSES OF 42 SAMPLES OF LEICESTER SEWAGE.

Taken at intervals between the 27th July and 1st August, 1868.

Grains per imp. gallon.	No. 1	3	3	4	5	6	7	8	9	10
Total solid matter	82·40	100·06	107·64	110·15	106·50	100·61	104·37	107·91	97·21	100·88
Organic matter	35·40	39·20	40·31	49·39	48·00	40·10	47·60	42·80	46·61	40·37
Mineral matter	47·00	60·86	67·33	60·76	58·50	60·51	56·77	65·11	50·60	60·51
Ammonia	3·74	11·70	5·40	5·20	3·59	4·60	3·57	5·11	3·58	4·60
Chloride of sodium ..	9·05	9·06	9·27	9·70	9·70	9·75	9·68	9·60	9·63	9·75
Nitrogen as nitrites ..	·612	·240	·237	·190	·190	·191	·185	·187	·178	·191
Oxygen absorbed by organic matter from permanganate	4·900	3·900	3·897	4·261	4·116	3·300	4·100	3·900	4·082	3·300

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Grains per imp. gallon.	11	12	13	14	15	16	17	18	19	20
Total solid matter....	99·18	94·32	110·14	100·05	92·45	110·13	93·11	102.20	102·26	114·37
Organic matter	46·62	34·17	48·84	37·40	32·69	49·75	34·71	47·16	47·93	46·25
Mineral matter	52·56	60·15	61·30	62·65	59·76	60·38	58·40	55.04	54·33	68·12
Ammonia	3·68	4·60	3·71	11·51	16·61	3·87	2·19	3·29	3·29	3·47
Chloride of sodium ..	9·72	9·77	9·72	8·77	9·26	9·70	9·11	9·65	9·00	9·91
Nitrogen as nitrites ..	.181	·193	·194	·253	·245	·193	·116	·180	·118	·196
Oxygen absorbed by organic matter from permanganate	4·080	3·200	4·221	3·860	3·937	4·239	3·200	4·090	3·163	4·071

Analyses of Samples of Leicester Sewage—Continued.

Grains per imp. gal.	21	22	23	25	25	26	27	28	29	30	31
Total solid matter	97·21	100·86	100·91	107·16	104·21	100·67	99·27	94·26	94·33	98·21	122·01
Organic matter ..	46·61	40·29	36·21	41·68	40.19	40·62	46·92	44·11	44·11	41·28	46·90
Mineral matter ..	50·60	60·57	64·70	65·48	64·02	60·05	52·35	50·15	50·22	56·93	75·11
Ammonia.....	3·58	4·42	4·35	4·97	4·46	4·20	1·16	1.23	1·19	1·18	11·60
Chloride of sodium	9·63	9·84	9·62	9·63	9·66	9·57	9·00	9·17	9·11	9·09	9·07
Nitrogen as nitrites	·178	·191	·191	·194	·191	·187	·101	·111	·100	·116	·112
Oxygen absorbed by organic matter from permanganate	4·082	3·360	3·180	3·390	3·200	3·200	4·261	4·113	3·900	3·816	3·724

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Grains per imp. gal.	32	33	34	35	36	37	38	39	40	41	42
Total solid matter	116·36	115·29	101·47	100·34	97·23	109·11	92·16	100·83	107·92	100·90	118·62
Organic matter ..	39·71	36·67	33·63	36·69	38·17	38·51	39·70	49·16	61·13	49·12	60·11
Mineral matter ..	76·65	78·62	67·84	63·65	59·06	70·60	52·46	51·67	46·79	51·78	58·51
Ammonia.....	6·71	5·69	4·65	6·51	4·24	4·19	4·37	4·62	4·11	4·62	4·71
Chloride of sodium	11·69	12·37	12·82	11·91	9·31	9·29	9·46	9·39	9·18	9·39	8·16
Nitrogen as nitrites	·069	·081	·113	·072	·18	·01	·01	·00	·01	·17	·03
Oxygen absorbed by organic matter from permanganate	3·113	3·479	3·216	3·417	3·270	3·290	3·216	3·113	4·597	4·681	4·732

LEICESTER EXPERIMENTS.—ANALYSES OF LIME-PURIFIED SEWAGE.

Taken at intervals between 27th July and 1st August.

Grains per imperial gallon.	1	2	3	4	5	6	7	8	9
Total solid matter.....	59·36	60·11	60·84	61·30	61·11	61·02	68·07	69·84	73·78
Organic matter.....	13·79	13·87	13·61	13·57	13·51	14·11	16·19	15·37	17·85
Mineral matter.....	45·57	46·24	47·23	47·73	47·60	46·91	51·88	54·47	55·93
Ammonia	1·71	1·36	1·39	1·57	1·69	2·16	3·47	4·02	3·80
Chloride of sodium	12·00	12·20	12·20	12·60	11·76	11·90	11·80	12·00	12·96
Nitrogen as nitrites	1·19	1·62	1·37	1·43	1·61	1·16	1·97	2·11	1·11
Oxygen absorbed from Permanganate	1·860	1·867	1·864	1·858	1·830	1·921	1·980	2·070	2·116

Grains per imperial gallon.	10	11	12	13	14	15	16	17	18
Total solid matter.....	78·22	76·44	79·68	81·20	73·12	73·20	73·33	73·30	73·23
Organic matter.....	18·16	21·13	24·36	28·42	15·11	15·20	15·33	15·51	15·79
Mineral matter.....	60·06	55·31	55·32	52·78	58·01	58·00	58.00	57·79	57·44
Ammonia	2·11	2·55	5.61	6·14	3·37	2·16	1·22	1·24	1·29
Chloride of sodium	12·64	12·48	12·42	12·48	12·40	12·50	12·60	12·50	12·48
Nitrogen as nitrites	1·33	1·19	1·11	1·17	·07	·63	·09	·03	·06
Oxygen absorbed from Permanganate	2·134	2·169	3·426	3·972	2·013	2·056	2·071	2·111	2·161

Grains per imperial gallon.	19	20	21	22	23	24	25	26
Total solid matter.....	73·20	73·23	71·10	67·21	69·46	62·00	62·30	72.11
Organic matter.....	15·41	15·22	21·10	15·42	14·11	12·98	13·71	11·82
Mineral matter.....	57·79	58·01	50·00	51·79	55·35	49·02	48 59	60·29
Ammonia	1·32	1·18	6·46	6·27	5·19	5·02	4·37	2.47
Chloride of sodium	12·50	12·60	12·40	12·10	12·62	12·48	12·24	12·31
Nitrogen as nitrites	·04	·01	·02	·68	·09	·09	·42	·07
Oxygen absorbed from Permanganate	2·159	1·987	2·220	2·064	1·834	1·860	2·613	1.619

Each sample was a mixture of two samples taken at intervals of about one hour.

LEICESTER EXPERIMENTS.—ANALYSES OF 50 SAMPLES OF A. B. C. PURIFIED WATER.

Taken at intervals between 26th July and 1st August.

Grains per imperial gallon.	1	2	3	4	5	6	7	8
Total solid matter.....	71·24	72·19	72.44	72·15	73·10	74·50	74·13	74·90
Organic matter.....	13·31	13·11	12·44	12·89	12·86	10·09	9·13	7·47
Inorganic matter	57·93	59·08	60·00	59·26	60·24	64·41	65·00	67·43
Ammonia	1·42	2·87	2·57	2·18	1·35	1·32	1·50	1·60
Chloride of sodium	12·02	12·02	12·13	12·69	12·46	12·40	12·48	12·40
Nitrogen as nitrites	·057	·031	·016	·013	·013	·003	·007	·020
Oxygen absorbed from Permanganate	·852	·891	·874	·863	·852	·793	·639	·584

Grains per imperial gallon.	9	10	11	12	13	14	15	16
Total solid matter.....	73·70	72·61	67·10	68·61	70·14	71·44	72·36	73·12
Organic matter	7·26	7·23	9·14	9·13	7·26	10·62	10·99	9·24
Irorganic matter	66·44	65·38	57 96	59·48	62·88	60·82	61·37	63·88
Ammonia	1·56	1·37	2·50	2·84	2 87	2·91	2·17	1·13
Chloride of sodium	12·40	12·36	12·48	12·48	12·48	12·22	13·44	12·48
Nitrogen as nitrites	·091	·136	·011	·019	·027	·035	·047	·001
Oxygen absorbed from Permanganate	·523	·611	1·362	984	1·121	1·261	1·311	1·047

Analyses of 50 Samples of A. B. C. Purified Water—Continued.

Grains per imperial gallon.	17	18	19	20	21	22	23	24
Total solid matter.....	73·61	73.33	73·47	73·23	73·61	73·23	71·87	72·01
Organic matter	11·01	11·16	11·04	11·31	10·16	9·24	13·23	13·02
Inorganic matter	62·60	62·17	62·43	61·92	63·45	63·99	58·64	58·99
Ammonia	3·47	2·19	1·42	1·19	1·00	3·21	1·11	2·97
Chloride of sodium	12·50	12·60	12·44	12·32	12·61	12·40	12·10	11·98
Nitrogen as nitrites	·003	·071	·076	·012	·014	·019	·047	·019
Oxygen absorbed from Permanganate	1·211	1·216	1·211	1·234	1·065	1·021	·894	·891

Grains per imperial gallon.	25	26	27	28	29	30	31	32
Total solid matter.....	73·11	73·21	73·00	74·60	74·20	73·65	72·64	72·69
Organic matter	12·31	12·28	12·82	10·11	7·91	7·29	7·28	8·13
Inorganic matter	60·80	60·93	60·18	64·49	66·29	66·36	65·36	64·56
Ammonia	2·28	1·39	1·16	1·50	1·50	1·63	1·44	1.09
Chloride of sodium	12·20	12·49	12·37	12·45	12·40	12·42	12·36	12·10
Nitrogen as nitrites	·016	·012	·016	·006	·011	·070	·107	·08
Oxygen absorbed from Permanganate	·871	·858	·870	·647	·621	·519	·581	·712

Analyses of 50 Samples of A. B. C. Purified Water—Continued.

Grains per imperial gallon.	33	34	35	36	37	38	39	40	41
Total solid matter.....	73·61	74·87	72·00	72·80	72·61	73·47	71·39	72·00	71·13
Organic matter	9·07	11·31	7·62	7·17	7·19	7·43	7·61	7·42	7·87
Inorganic matter	64·54	63·56	64·38	65·63	65·42	66·04	63·78	64·58	63·26
Ammonia	·61	·34	·27	·82	·97	1·91	2·16	1·83	1·91
Chloride of sodium	12·10	12·30	12·20	12·16	12·30	12.30	12·30	12.32	12·30
Nitrogen as nitrites	·01	·01	·02	·11	·00	·01	·04	·07	·00
Oxygen absorbed from Permanganate	·714	·616	·621	·619	·634	·616	·725	·632	·630

Grains per imperial gallon.	42	43	44	45	46	47	48	49	50*
Total solid matter.....	71·11	70·00	70·44	66·19	68·72	64·13	65·21	68·32	83·60
Organic matter	8·11	9·06	9·14	7·16	7·34	7·22	7·25	7·97	18·01
Inorganic matter	63·00	60·94	61·30	59·03	61·38	56·91	57·96	60·35	65·59
Ammonia	2·27	1·98	·96	1·13	1·84	1·11	·96	·61	5·79
Chloride of sodium	12·30	12·26	12·24	12·26	12·33	12·30	12·24	12·24	12·16
Nitrogen as nitrites	·00	·00	·11	·16	·08	·07	·16	·11	1·87
Oxygen absorbed from Permanganate	·972	1·070	1·311	1·216	1·248	1·113	1·076	1·934	2·164

* This sample is contaminated with sewage.

Leamington Experiments.

Grains per imp. gall.	No. 1 Sewage.	No. 1 A.B.C.	No. 2 Sewage.	No. 2 A.B.C.
Total solid matter ..	264·6	74·8	95·0	91·02
Mineral matter	153·2	58·2	67·4	83·68
Organic matter	111·4	16·6	27.6	7·34
Nitrogen as nitrites..	7·61	·14	1·225	·075
Ammonia	5·44	1·7	6.20	1.13
Oxygen absorbed by organic matter	17·44	1·88	2·76	·968

Leamington Residuum.

Water	6·76
Organic matter	29·42
Alkaline Salts.....	13·71
Earthy salts, containing phosphoric acid=1·17	23·83
Silica	26·28
	100·00
Nitrogen = ammonia	3·79

Leicester Residuum, dried in bulk at Leicester.

Water	13·79
Organic matter	46·93
Alkaline salts	4·97
Earthy salts, containing phosphoric acid=1·31	12·88
Silica	21·43
	100·00
Nitrogen = ammonia	4·67

G. W. WIGNER.

Dr Parkes
With the Author's kind regards

THE SANITARY ASPECT OF THE SEWAGE QUESTION.

BY
JAMES ADAMS, M.D.

GLASGOW:
JAMES MACLEHOSE, 61 ST VINCENT STREET,
BOOKSELLER TO THE UNIVERSITY, AND TO THE FACULTY OF PHYSICIANS AND SURGEONS.
1868.

PREFACE.

My "Notes of an Argument in Reply" were prepared for a temporary use, and no consideration was further from my mind at the time than any thought of after-publication. They formed part of a discussion which commenced, and, in my opinion, should have terminated, within a medical circle. The discussion originated thus:—

A communication on "The Sanitary Aspect of the Sewage Question, with Remarks on the Scheme of Messrs Bateman & Bazalgette for the Purification of the River," was read before the Medico-Chirurgical Society of Glasgow (2d October, 1868) by Andrew Fergus, M.D. At this meeting an unusually large number of stranger visitors was present, many of whom were of the non-professional public. An abstract of the communication was furnished to the newspapers of the following day, and was therefore widely circulated. The arena was thus speedily changed, so as to include the general public. The communication itself contained much strong expression of opinion on disputed points, and the conclusions were in antagonism to my own conviction, and, as I think, to those of nearly all medical men who have been

accustomed to give consideration to questions of public health. They were, moreover, of a kind calculated to give rise to a mischievous panic, if not vigorously opposed and confuted. Therefore, at the next meeting of the Society (16th October, 1868) I read a counter argument.

Some misconception of the nature of my views appeared in the public prints, and I was alleged to have expressed opinions that I have repudiated. For these, and such other reasons as are stated in a letter to a newspaper, a reprint of which will be found at the end of the Appendix, I resolved to print my "Notes of an Argument in Reply," in their *ipsissima verba*, as delivered.

J. A.

Glasgow, 62 Cambridge Street,
Nov. 26, 1868.

THE SANITARY ASPECT
OF
THE SEWAGE QUESTION.

(Read before the Medico-Chirurgical Society of Glasgow, 16th October, 1868.)

The sanitary aspect of the Sewage question in its relation to Glasgow, and to the state of the river Clyde, is a subject upon which it is almost as difficult to speak as to remain silent. For while, on the one hand, we have admittedly the necessity of dealing with a nuisance existing at our doors of a character that revolts our senses, and discredits our position as members of a civilised community, we have, on the other hand, to make our choice of a remedy amid the distracting din of a multitude of conflicting counsellors.

It is a subject on which Dr Fergus has evidently bestowed much time and attention; and we have to thank him for bringing his views before us on a matter of vital importance in a manner so interesting, and accompanied with illustrations which convey so clearly their exact nature. He has thus made it easy for those who may comment on his argument to select the grounds on which they may agree or on which they differ.

He possesses the great advantage over many who may differ from him, that his mind is made up—he has no faint, cold-hearted doubtings—he is clear and decided—both the disease and what will mend it are patent to his sight, and he expresses his opinions with all the emphasis of earnest conviction.

In venturing, however, to dispute his conclusions, and to think that these are not fully warranted by such data as he has brought before us, I may premise that I also have given the subject serious consideration. On various occasions, extending back for many years, I have had opportunities of assisting in the labours, and of witnessing the results of the labours, of several investigators. I have had occasion to consider and to advise with parties who have engaged commercially in schemes of commerce that are closely bound up in the question; and I am at present, and for a considerable time past have been, associated with a colleague of high scientific eminence, in a special and very extended investigation of the effects of certain sewage matters on the pollution of rivers, during which investigation it has been necessary, among other tests, to conduct many hundreds of physiological experiments upon living animals. According to my light, I therefore feel entitled to speak with no uncertain voice.

I am sorry I have been unable to follow Dr Fergus to his conclusions. I think they are not only not warranted by his data, but that much of what he has advanced should have led him to results altogether opposite. To my apprehension, his whole argument resolves itself into a strenuous denunciation of the modern water-closet system. I hope that I state rightly his conclusions as being to the following effect:—

1*st*. That water-closets are opposed to Revelation.

2*nd*. That they are opposed to Nature, by causing an extravagant waste of matters necessary for agriculture—in short, a robbery of the soil.

3*rd*. That they are the *sole* cause of the polluted state of the river, by their conveying human excreta into the river through the medium of the sewers.

4*th*. That human excreta fills the sewers with noxious gases, which penetrate into our dwelling-houses despite the best contrived mechanical appliances in the form of traps.

5*th*. That even assuming that, by Messrs Bateman & Bazalgette's plan, the sewage of Glasgow could be fairly conveyed away—an assumption which is, however, opposed to his convictions, owing to various engineering defects which he holds to exist in their scheme—there would still, he says, be no improvement in the sanitary state of the city, owing to the noxious gases referred to as generated in the sewers.

6*th*, *and lastly*. That the use of dry privies, conjoined with one or other of the several methods for deodorizing human excreta, of which he has exhibited illustrations, would reinstate the river in a fair state of purity, and be preferable in every way to the water-closet system.

Allowing for its compression, I believe the foregoing to be a fair summary of Dr Fergus' opinion.

With regard to the argument founded upon alleged Revelation, I have simply to observe, that the children of Israel, camping in the desert, following for years a nomadic life, and unacquainted, or at least unprovided with sewers and a distributed water supply—very badly off, indeed, on some occasions for water—were rightly instructed by Moses to go outside the camp. This injunction was most suitable for the time and circumstances; but I know of no Revelation which should elevate this temporary regulation into a rule of faith, or a principle in sanitary science. Indeed, if Dr Fergus had not referred to the argument more than once, I would scarcely think that the name and authority of Moses had been imported into the question with a seriously intended application.

His next argument, that the human excreta of large towns is a material of great value to the agriculturist, is one of much importance, and, beyond cavil, merits the utmost attention of social economists. But the question which agitates Glasgow at the present moment—the question that Dr Fergus has asked us to specially consider—is, not the needs of the country farmer, but the sanitary necessities of the Glasgow citizen. We are not at present discussing the best means of conserving, as a source of revenue, the waste products of this large city, but how to deliver ourselves from their immediate hurtful influence on our comfort and on our health. That is the question, and that the recognised necessity. The commercial side of the problem is merely incidental, and, at a long distance, altogether secondary.

I willingly concede that the offensive state of the river is due in large part to the human excreta that is conveyed into it through the medium of the sewers.

And this brings us to the argument on which Dr Fergus devotes his chief force, viz., the production of noxious gases in the sewers.

I must go a little fully into this part of his argument, for, besides its intrinsic importance as regards the chemistry of the subject, Dr Fergus has very properly told us that, while we can take some tolerably fair precautions in the avoidance of unwholesome food and drink, we are almost helpless in dealing with the gaseous matters which may contaminate the air we breathe, and, in illustration, he has shown us how we may exhibit ourselves in an amusing state of apprehension, with fingers on nostrils, rushing past the vapours exhaling from a gulley hole, all the while unconscious that the same vapours, although not visible, are, or may be, leaking into our dwelling-houses through imperfect fittings connecting them with the sewers.

Dr Fergus has told us how these vapours—or, as he in preference calls them, gases—are produced. He has told us,

and with unexceptionable accuracy, that the human individual excretes from the bowels and kidneys a definite quantity of solid and fluid matters of a putrescible nature—that this matter is passed from the water-closets into the sewers, where it undergoes decomposition—that certain poisonous gases result—that these gases find their way, *to some extent*, through all obstacles in the shape of traps, and so contaminate the atmosphere of our dwelling-houses, and originate gastric fever.

Dr Fergus has endeavoured to advance the reception of his views by exhibiting a Table, showing, by chemical analysis, what he calls the "Products of Sewage Matter," which he, further on, as a convertible term, names "sewer gases," and he has striven to impress our minds with a conception of the appalling amount of the gases enumerated in his Table, by telling us that these gases escape, as was proved in the analysis referred to, at the rate of from 1 to 1½ cubic inches per hour from a single gallon of sewage. No limit is given as to the time the gases continue to be evolved.

Now, I have very often had occasion to observe that an undue weight is attached to the names of chemical compounds when used in connection with sanitary questions, and that they often produce the same stupifying terrorism that is caused by the use of the names of the awful "boggies" who, in nursery tales, are ready to lay hold of naughty, wakeful children who are troublesome, and should be off to bed.

Let me not for a moment be misunderstood. I am not about to contend that the emanations of decomposing matters are innocent; that is, are not injurious to health. I do most fully recognise the evils which, under certain circumstances, may arise from continued and prolonged exposure to them, even when diluted, and I am well acquainted with the recorded experience of their effects when concentrated. But it is of the highest importance that the extent of the evil should be defined, as far as that is possible, and that our imaginations should be

protected from the effects of misty, or erroneous, or exaggerated statements.

With the view, therefore, of disabusing your minds of the impression that may have been made regarding the dimensions of this monster of the sewers, I will again summon him before us, examine his exact form and size—his body and limbs—and will try if I cannot again drive him back, with teeth and claws extracted, to his lurking den, whence, we are told, he makes his raiding excursions upon our domestic hearths. Without metaphor, I believe I shall have little difficulty in satisfying you that Dr Fergus has fallen into several serious errors, and, *all unconsciously*, has exaggerated the *import* of the Table he has laid before us.

This Table is professedly taken from Dr Letheby, Medical Officer of Health for the City of London, and author of an admirable "Report on the Subject of Sewage," &c.; and we are informed by Dr Fergus that it exhibits, according to Dr Letheby, the composition of the gases produced in the sewers. Now, I no sooner looked at the Table, and heard the statement, than I saw that some great fallacy or error was underlying the whole. It was quite evident to me, that neither Dr Letheby, nor any one accustomed to prepare tables of chemical analysis, could have issued such a Table, because the summations of the per centages exceeded a *centum*, and because I knew well that, unless under some circumstances altogether exceptional, there never was evolved from sewage matter so large a per centage of sulphuretted hydrogen. I turned accordingly to Dr Letheby's Report, and found that this Table has no place there, and that it must have been made up by Dr Fergus himself—or by some one in whose capacity he has too implicitly trusted—from data which he has altogether misapprehended.

Here are the simple facts: Dr Letheby took a gallon of London sewage, selected, as he specially informs us, *from one of the worst districts of London*. It contained the enormous

amount of 278.5 grains of dissolved and suspended matter. This he subjected to a *laboratory experiment*, excluding it carefully from the air, and continuing the experiment for a period of *nine weeks!* In this experiment he thoroughly exhausted, by fermentative decomposition, the entire putrescible matters, and the results were, *in part*, what Dr Fergus has shown —viz., the *formation—not the escape ready formed*—but the formation of carburetted hydrogen, carbonic acid, and nitrogen, in the proportions given. But instead of from 2 to 3 per cent. of sulphuretted hydrogen, there was only an 80-000th part—of ammonia there was only as much as could be recognised—that is, a trace; and there is not a word of sulphide of ammonium, or of a putrid organic vapour in connection with this experiment.

Where, therefore, did Dr Fergus get all the sulphuretted hydrogen shown in the Table? Not from this experiment, nor from this gallon of sewage, but from *four additional experiments* made upon *other four gallons of sewage* taken from various localities. And these experiments, moreover, were *of a totally different* character. In these Dr Letheby allowed all the suspended matter in the sewage to subside, and then he took the clear liquid and *boiled it*, with the usual result of evolving *all the gases* which were in solution. These gases, of course, were in totally different proportion and quantity from those obtained in the first experiment, and the sulphuretted hydrogen was not in the proportion of from 2 to 3 per cent., as stated erroneously in Dr Fergus' Table, but in the proportion of barely 1 to 3 per cent. You will understand, therefore, that we shall be exposed to the influence of this quantity of sulphuretted hydrogen only *when we boil our sewage, not otherwise*. But Dr Fergus has discarded all the other gases obtained in these four experiments, in which the sewage was boiled, and, selecting the sulphuretted hydrogen alone, given it place in the Table that shows the result of the other experiment in which sewage was *fermented*. I need scarcely say to

my present hearers that that sulphuretted hydrogen has no more right to occupy the place given to it in the Table than if it had been purchased from a drug-shop and poured among the other gases.

We have still to account for the ammonia, the sulphide of ammonium, and the putrid organic vapour; and I find that their production was a result obtained from still another set of experiments made, not upon the sewage itself, but upon vapours contained in the atmosphere of different sewers. These vapours Dr Letheby *condensed, or concentrated into a liquid*, and the analysis of this *concentrated* liquid has been also added to the Table, as forming part of the 1½ cubic inches of gas that Dr Fergus tells us is evolved from a single gallon of ordinary sewage during a period not specified.

I hope I have made this matter sufficiently clear. Let it suffice that I tell you this Table laid before you by Dr Fergus is a mere jumble of pickings from three varied sets of investigations. In one set, Dr Letheby extracted certain of the *actual* matters contained and residing *in* the sewage; in another set, he *exhausted* the *potential* matters that could be *evolved out of* the sewage during its putrefaction, *when carried to the utmost extent;* and in the third, he *supplemented* results necessary to complete the inferences to which the others led. Let me put this in another form. In one set, he ascertained the gaseous products into which the sewage *could ultimately be resolved* under certain peculiar and *exceptional* conditions; and in another, he ascertained, by equally peculiar and *exceptional* means, the *actual matter* of which it was composed. Of course, I use the word "exceptional" with a restricted meaning that does not require explanation.

To return to the gases. What do you suppose was the quantity, after all, that was evolved from this gallon of very impure London sewage during the entire nine weeks under these *exceptional* conditions? Why, little more than one cubic foot of all the gases put together; and, instead of being

evolved at the rate of one and a-half cubic inches *per hour* for an indefinite period, they were evolved at the rate of 1·2, or barely one and a-*quarter* cubic inches per hour for *a limited period*. If the whole sewage of Glasgow was equally impure, and was subjected to the same exhaustive laboratory experiment—*i.e., fermented*—the total amount would not be more than 434 cubic feet per hour—a quantity that could be shut up in a box little exceeding seven and a-half feet cube. As for the sulphuretted hydrogen contained in the worst specimen examined, the extreme total quantity was three cubic inches. Further, the total quantity *of all the gases* extracted from any one of the four specimens of sewage that were *boiled* was only from 32 to 76 cubic inches—not a twentieth part of a cubic foot for the whole gases put together.

Enough of this unlucky Table of "sewer gases." I assume that I have satisfied you that any gases that may find a road, through imperfect fittings, from the sewers into your dwellings are not the gases that were *boiled* out of the sewage, or *manufactured* under a bell-receiver in a laboratory experiment. Let us, therefore, go directly to the atmosphere itself of the sewers, and let us look at the gases just as they are generated and just as they are found in the sewers, and from this examination draw our own conclusions.

It is well known that the atmosphere of the sewers is able to support vigorous animal life. Witness the myriads of rats that have their *habitat* in the sewers—the workmen who make their livelihood by constructing, repairing, and cleansing sewers—and the numerous individuals whose special industry it is to prowl through the sewers grubbing up and searching for lost articles and other matters of which they make a profitable disposal. A knowledge of such facts, and a little reflection, should therefore make us chary in believing all we are told of the hurtful character of the gases evolved in sewers. Indeed, it will seem strange, even to many here, to be informed that the atmosphere of the sewers differs very

little from the atmosphere in its normal condition as regards its elementary constituents. Referring again to Dr Letheby—and I might quote other authorities, but I know none better—I will place before you a table for which he is responsible, showing the composition of the atmosphere of the City of London sewers, and of atmospheric air in its normal state, assuming, of course, both to be in a dry condition—*i.e.*, free of watery vapour:—

	Atmosphere.	Sewer Atmosphere.
Nitrogen, ...	78·959 ...	79·962
Oxygen, ...	21·000 ...	19·506
Carbonic Acid, ...	0·041 ...	0·532
Carburetted Hydrogen, ...	None ...	Traces
Ammonia, ...	Traces ...	Rather abundant
Sulphuretted Hydrogen, ...	None ...	Traces rarely exceeding a 60,000th part.

Analyses, giving results which may be held identical, have been made of the atmosphere of the sewers of Paris by M. Claubry and others, and in our own country by Dr R. D. Thomson, Dr Angus Smith, &c., and they show that, as regards known chemical substances, such as the gases so often referred to, there is but little difference."

This, then, is the condition that obtains in the sewers of London and of Paris, where, in both places, there exist circumstances that favour, in a degree far beyond what can possibly affect Glasgow, the formation and the accumulation of vapours loading and contaminating the atmosphere with which the sewers are filled.

That the atmosphere of the Glasgow sewers is better than that of London or of Paris we are fairly entitled to assume, for numerous reasons. Thus, we know that air and water, in the degree that they come in contact with decaying matter, exert a great influence in modifying the putrefactive process. *The more air and the more water, the more potently the changes*

* See Appendix, Note 5.

are effected, and the less offensive are the products of decomposition. Now, the London sewage is diluted with water to the extent that there is furnished 30 gallons of sewage matter per head per day, while that of Glasgow amounts to 70 gallons per head per day—*a difference so enormous as to make any comparison altogether inapplicable*, and, consequently, to show the gross fallacy of drawing an inference from one state of things, and applying it to a condition where the circumstances are altogether different. And here I may inform you, in passing, that a gallon of average Glasgow sewage contains about 50 grs. per gallon of dissolved and suspended matters, and that it rarely exceeds 70 grs. per gallon.

"In seeking to know," says Letheby, "what part of the sewage it is which undergoes decomposition, I have ascertained that it is *not the liquid part* which continues to ferment, but the solid; and this keeps up the putrefactive action for months, evolving large quantities of ammonia, sulphuretted hydrogen, marsh gas, and carbonic acid. It is the sedimentary matter, therefore, which is the chief cause of the offensive effluvium." Again he says, "Wheresover the putrid refuse of a town mixes with a large volume of fresh water, there the process of oxidation is quickly carried out and the offensive matters *are rendered innocuous.* This is effected by the physical power which water possesses of transferring oxygen from the atmosphere to the putrid products; and this power is so great that it will even destroy the soluble organic constituents of ordinary sewage *without farther dilution with water.* I have ascertained, by repeated experiments, that when the clear liquid of common sewage is exposed to the air, it quickly absorbs oxygen and loses its offensive odour. It is the *insoluble organic matter which keeps up the putrefaction* and evolves the noxious gases. This happens because of its being beyond the reach of the salutary influence of atmospheric oxygen. In those sewers, therefore, where the supply of water is large, and the

current is rapid, there is little or no deposit of mud, and the atmosphere *is not particularly offensive.*"

Now, it is exactly this advantageous state of matters that ensures the atmosphere of the Glasgow sewers from becoming "particularly offensive." The city possesses great natural facilities for drainage, and it is certified by the very first engineering authorities, and admitted on all hands, that *the sewers* are *admirably constructed*, and *the runs short and rapid.* The *supply of water is very large*—in an exceptionable degree very large—and the solid matters of sewage have no chance whatever of lodging in the sewers for any considerable time—a few hours is the utmost. On this point I have made several special inquiries of Mr Bateman, and he informs me that "the rate of flow of the sewage within the sewers of Glasgow, and in the intercepting sewers which we have projected, will probably vary, according to quantity and declivity, from two-thirds or three-fourths of a mile to one-half or nearly two miles per hour; and in the syphon pipe across the valley to Pollokshields to two miles per hour and upwards. From thence to the sea I think the speed will vary from one to two miles per hour, according as the quantity of sewage varies in the day. The most distant sewage, therefore, that has to be conveyed *will not be more than seven or eight hours before it is quite out of the city*, nor more than twenty hours in being carried thence to the sea."

Under ordinary circumstances, the fermentative decomposition of solid sewage matter does not begin for three or four days; and as we have in the conditions of the Glasgow sewers powerful retarding influences, it follows that this decomposition is very trifling while the sewage is in the Glasgow sewers.

I shall have another occasion to refer shortly to the sewer gases; but meanwhile I think we may safely assume that any gases that are formed in our Glasgow sewers either remain there, or their escape must be trifling.

I pass now to the consideration of another aspect of the sewage question, to which I am necessarily led by Dr Fergus' argument, and to this I request your special attention. Throughout the whole course of his reasoning he has kept prominently in our view this statement—that a part of the deleterious gases, which he has satisfied himself are evolved from the sewers, make their escape and pass into the atmosphere, and are there unavoidably breathed by us. So far he is correct, and *the question between us is chiefly one of degree.* The danger he wishes us to guard against is a polluted atmosphere. But there is a view of the question that seems to have been entirely overlooked by him. He has restricted his vision exclusively to the gaseous exhalations from the human excreta of the *bowels* and *kidneys*, and has entirely overlooked *the other human excreta* that pollute the atmosphere we breathe.

I fear that he is fascinated by the gaseous *sprite* he has evoked from out the sewers.

> "His charmed eye o'er fifty fair ones roves;
> He *sees* them all, but *looks* at her he loves."

You must bear in mind that the argument *has been worked up by him mainly to a question of polluted*, or, as he phrases it, "contaminated" atmosphere. No question, in my estimation, is more important, for I have never lost the enthusiasm with which I witnessed and assisted in the observations that are recorded in the late Dr D. B. Reid's classical work on Ventilation. And I remember the confirmation my mind received many years back regarding one of these experiments, by the statement of one of our most respected and most eminent teachers of medicine—viz., that in his experience a medical man invariably loses his health when he begins to use a carriage—being destroyed by the contamination of his own breath. This is no small matter, positively or comparatively. Dr Fergus has told you that the annual excreta of the entire

population of Glasgow amounts to 400 millions of lbs. I tell you that it amounts to more than 1000 millions of lbs. I give the amount of millions of lbs. to follow suit, although I fear that the immense mass of figures may have the same bewildering effect as that of the gases of formidable nomenclature. Here is a table of the data, and although different estimates have been made, they all agree closely in the *relative proportions* of the constituents:—

HUMAN EXCRETA IN TWENTY-FOUR HOURS.

	Water.	Solids.		Total.
Bowels, ...	3¾ oz.	1¼ oz.	4½ oz.	5 oz.
Kidneys, ...	45¼ oz.	3¼ oz.		48½ oz.
Lungs, ...	20½ oz.	10¼ oz.	10½ oz.	30¾ oz.
Skin, ...	6¼ oz.	¼ oz.		6½ oz.
Total, ...	76 oz.	15 oz.		91 oz.

You do not require to be told that the matters excreted from the lungs and skin undergo precisely that form of decomposition—*i.e.*, *gaseous*—that Dr Fergus tells us is so dangerous in the case of the other excreta. Now, here is a monster contaminating the atmosphere more terrible still than that of the sewers. Let us try and estimate his vast dimensions. I fear we can form no conception whatever if we handle him so blown up with gas and water. We will, therefore, tap him, and let out the wind and drain away the water, and thus get at the solid substance.

I have made a calculation, from which I find that the total amount by highest estimate of dry solid matter excreted from the bowels and kidneys during an entire year by a population of 500,000 individuals amounts to about 12,500 tons. Of this a large portion is composed of mineral matter, which *does not enter into decomposition of a gaseous nature*, and therefore *does not pass into the atmosphere*. But the same population, during the same period, excretes from the lungs and

skin a quantity of solid matter considerably exceeding 50,000 tons, *all of* which matter is capable of, and *actually does assume, the gaseous form*—is evolved as noxious gases—and passes into and contaminates the atmosphere. Now, I beg of you to note that there is no essential difference, as I have already said, affecting the physiological action, or, for present circumstances, let us call it the sanitary action of the decomposition that takes place in the excreta of the bowels and kidneys, compared with that of the lungs and skin. In the popular and ill-informed mind a distinction may prevail, but none whatever in the educated. We have similar noxious gases, similar sulphuretted hydrogen, similar ammonia, and similar organic vapours. If the subject, therefore, is pursued in the course adopted by Dr Fergus, we must construct tables of "church gases" and "school gases," "barrack-room gases" and "ship cabin gases," and most assuredly "dwelling-house gases."

But I will not drag you over a lengthy reference to the various sides that belong to this many-sided question. If I did, I should have to speak of the excreta of cattle and of horses, which exceeds the amount of human excreta nearly tenfold; I should enlarge upon the facts that, in Glasgow, there is annually manufactured and consumed, so as to contaminate the atmosphere, upwards of 900 millions of cubic feet of carburetted hydrogen, or coal gas—a most noxious gas; that our steam-engines alone, irrespective of our domestic fires, consume upwards of 700,000 tons of coal, all resolved into noxious gases and vapours, each ton of coal representing about 10,000 cubic feet of noxious gases; that upwards of 300,000 oxen, cattle, sheep, and pigs, are slaughtered annually, skinned and disembowelled, contaminating the air with gaseous and animal exhalations, until their remains are finally disposed of; that 13,000 human beings die annually in Glasgow under circumstances of disease which, during their fatal illness, lend additional virulence to the deleterious emanations which

proceed from them during life, and continue to exhale until they are consigned to the grave; and I should not omit to estimate at full value the volatile matters that are the products of the filth of kitchens and washing-houses, stables and cow-houses—of the various liquid and gaseous impurities of trades and manufactures—or of the decay of animal and vegetable food and garbage in markets and storehouses. Dr Fergus tells us that it is the human excreta of the water-closet alone which pollutes the sewers. I wish he could show us in what essential respects all the other matters that do, and necessarily must, enter the sewers differ from human excreta, considered as sewage. Has he really reflected on the nature of these matters, or calculated their amount, when he hazards so bold an assertion? I have ascertained, by careful calculation, that the quantity of solid matter contained in the annual sewage of Glasgow, excluding rain-falls and storms, is about 41,000 tons; while the entire solid matters that have their proper destination in the water-closets are, as I have already shown you, little more than *one-fourth* of that quantity; and yet we are told that water-closets are the *sole* cause of the pollution of the river! I commend all this to your serious consideration.

But, it may be asked, does Dr Adams mean to tell us that the emanations of decaying organic matter are not hurtful?—that the exhalations from sewers are not a source of danger to be guarded against?—that, if the communications between our dwellings and the receptacles into which filth is cast out from our abodes are defective, neglected, or worn out, we are still to remain passive, satisfied, and free from apprehension? I do not mean to tell you so; but I say that the offence and the danger in dealing with this question consist in ignoring the painful experience of the past—in disregarding the utterances of the many eminent sanitary authorities who have conjointly, in special Parliamentary commissions, and separately, by individual warnings, taught us that few sights are so

demoralising and so degrading as the common privies of our lanes and courts and sub-tenements of large towns, and few social institutions that are so likely to lead to a systematic disregard of all the precautions for the preservation of public and of private health; and who assure us that nothing improves the habits so much—nothing civilises a population so much—nothing serves so much to uphold the barriers of at least conventional propriety, that place the sexes in a position of mutual and of self-respect, as improvements in the mode of removing the excreta of the population.

I believe that in the modern water-closet we have an improved social institution based on the truest and best established principles of hygiene, and I am well satisfied that, in comparison, all other systems for removing human excrement from the large towns fall short of these principles.

It is in those places where the modern water-closet system does not exist that we are to look for the presence of those noxious gases of which we have heard so much. It is in those localities that have no sewers that we find disease most active. "It seems really to be the fact," says Dr Aitken, "that the cholera poison (and probably also typhoid fever poison and dysentery), if it can at all be multiplied within the body, almost certainly has its great centres *elsewhere*—namely, in those avoidable foci of corruption where excrement accumulates and decays."

And it is to these "accumulations of excrement" that Dr Fergus invites us to return, although he gilds the pill with deodorants and various little mechanical contrivances, together with hopeful allusions to the manufacture of profitable merchandise. To estimate aright the value of such palliatives, let us glance at the state of things in those places where privies are an institution, and, *par excellence*, let us take Paris, where, like all other institutions, they are under surveillance. There the condition of the privies is regulated by the best provisions that have been approved by councils of health, composed

of the most eminent scientific men, all distinguished by special fitness for the work. Now, I appeal to any one who has been on the Continent, and visited any of these places, to recall his sensations, if possible, and contrast them with those he experiences in a Glasgow water-closet. All kinds of separators for dividing the liquid and solid excrement, and so retarding the fermentative action that is so rapidly engendered in the compost—all kinds of deodorants are and have been in practice, and what is the result?(!) I recollect the first visit to the Continent made by a medical friend in my company—a gentleman connected by early habits with agriculture, and then as strong in his opposition to water-closets as my friend Dr Fergus. In our hotel, one of the very best in Paris, he was so disgusted with the sight of the ramming brush and other little arrangements provided to enable each visitor to be his own sanitary commissioner, that he walked out of the hotel, and, under my guidance, entered a tip-top "*Cabinet d'aisance sans odeur*," situated in the most fashionable boulevard. On rejoining me he did not speak, but walked on, making short convulsive expirations to clear his lungs, while with handkerchief round his fingers he gouged his nostrils. On asking him how he was satisfied, he burst out with an expletive regarding the "stink," which he qualified by a succession of such adjectives as a discreet printer would indicate by ominous dashes, and which had better be imagined than described. He was thoroughly convinced that these things at least were not better managed in France.

If we turn to the countries of the Chinese and Japanese, we find that Dr Fergus' problem has been solved and his counsel the rule of conduct; for there every house diligently treasures up its own putridity and incorporates its own stink. So impressed there is even the humblest domestic circle with the value of Dr Fergus' golden maxim of "the excreta to the soil," that the idlest members are stationed in the highways and by-ways with receptacles

entreating the charitable contributions of benevolent travellers to the family store. But the experience of ages has not led these ingenious people to the discovery of any scheme applicable to the life of European large cities. On this point Professor Blyth, of Cork, the translator of Liebig's latest work, "The Natural Laws of Husbandry"—himself an intelligent advocate for the conservation of human excreta for agricultural purposes—observes, "Chinese rural life, as it is described by travellers, as well as the report of the Japanese system of husbandry given by Dr Maron, would scarcely lead us to wish for the improvement of agriculture upon the plan of these Orientals! The requirements of modern civilisation would not permit the purchase of manuring matter, however valuable, at the cost of all domestic comfort. The sewers must, we fear, still receive what would be offensive to our English senses."

But Dr Fergus hopes, through deodorants and other means, to disguise the filthy matters, and thus to prevent the other senses besides that of smell from being offended. I need scarcely tell you that the chemical appliances that have been recommended for deodorising, disinfecting, and utilising the matters of sewage and of cesspools of large towns are very numerous; and I will not dwell upon the causes that render them *all failures in practice*, so costly and difficult are they in application, and so disappointing in results.* Chemistry has

* All agents hitherto recommended for the deodorisation of sewage, &c., act in one of two modes—they either *check decay* or *destroy offensive properties*. "This they do," says Dr Letheby, "either by fixing the effluvium and forming compounds which are inert, or by breaking up the putrid molecule, and changing its nature, or by expediting the process of decay, and hurrying it on to the last stage of oxidation." The first class are anti-septics or anti-putrescents; the second are deodorisers and disinfectants. The effects of either, as shown in a laboratory experiment, or exhibited in a little bottle at a Society meeting, are frequently very striking. There are, however, many objections to their use. This increases the quantity of solid matter that must be ultimately removed—that cannot be tempered so as to act equally for a given time; another requires costly arrangements for its application, and so on. If used in dwellings, there must, in every case, be provided *stores of the material*, some of which are very bulky; and there must be *some kind of reservoir or*

been unable to solve the problem, although enthusiastic projectors of new and infallible schemes have been furnished with every facility, however costly, and although all desirable time has been freely granted. And engineering science has at length conclusively pronounced that in no way can the filth of large towns be conveyed away with so little trouble or nuisance, or so cheaply, as by water.

Even if deodorisation was successful in practice, and the cost brought within possible bounds—if every house was furnished with its store of deodorants, and every individual was duly instructed, and faithfully performed all the necessary "cabinet" operations, we should still, in a sanitary point of view, be little the gainers; for, with the exception of prepared earth, or, still better, prepared charcoal, deodorants only fix the offensive gases of known composition, removing the offensive smell, but leaving the organic vapours untouched; and it is in these alone, so far as we know, that the property of generating disease exists.* What these organic vapours are has not hitherto been resolved by chemistry, nor has the microscope been more successful. Many of you must be

"*filthy facility*" in which the *conserve* is *retained* until the time when these matters—stored by hand labour or costly mechanical appliances and frequent operations—shall be ultimately removed from the dwelling. Even if practicable in their action, the bare cost, with one exception, of the raw material makes all idea of their use on a large scale quite utopian. I have made, from data furnished by Professor Thos. Anderson, Dr Letheby, and Dr Angus Smith, a rough calculation of the annual cost of such a quantity of six of the best deodorisers as would remove the odour *more or less completely* of the sewage of Glasgow. Here is the result:—Carbolic acid, £2600; quicklime, £30,000; chloride of lime, £47,000; peat charcoal, £192,000; Condy's liquid (*permanganate of potash*), £628,000; Burnett's liquid (*chloride of zinc*), £1,000,000. And this is altogether irrespective of the cost of necessary arrangements for effective application and working expenses.

Of these agents, the best equally for sanitary and for agricultural purposes, and for easy and inexpensive application, viz., carbolic acid, is also the cheapest. It is, however, fortunate for Glasgow that the excellent construction of its sewers, and the abundance of its water supply, render it unnecessary to give serious consideration to any of these appliances.

* See Appendix, Note 5.

acquainted with investigations made by R. D. Thomson, Rainey, and Hassall on the constitution of offensive atmospheres, as elicited under the microscope. I have myself bestowed much labour on this part of the question, but I have learned nothing truly reliable, and I know that nothing truly reliable has been established. Whether, therefore, we speak of a putrid molecule, or of a fermenting atom, we can only refer to a recognised effect. The miasms of pestilential countries—the wards of hospitals—the crowded lairs of the wretchedly poor, have all defied investigation into the secret of their morbific virulence. But two important facts have been ascertained, viz., that, whether in causing sudden death by poisoning, or in generating disease, there do exist atmospheres capable of such, and yet utterly devoid of odour; while many of the most revolting and stinking atmospheres have been proved to be practically harmless. "It is evident," says an able writer on this subject, "that we have still much to learn before we shall fully appreciate the laws of hygiene, and be able to dispel the ignorance which can tolerate so false a faith as that there is no danger from putridity and filth when they are no longer offensive to the sense of smell."

For examples of the deadly effects of mephitic organic vapours, I must ask you to consult French literature, which abounds in references to such instances as being of ordinary occurrence among the workmen employed in clearing out the *fosses d'aisance*, and what may be termed the dry sewers of Paris. In this country they are so rare, that over a period of 60 years there have been but five such accidents in the sewers of London—sewers that exceed 1500 miles in length, while those of Paris are little above 50 miles.*

* In Paris the sewers are for the most part mere drains, communicating with the large sewers which have been constructed to a limited extent in special districts of the city. Essentially, however, the system in Paris is that of the cesspool, or *fosses d'aisance*, fixed or movable, according to the exigencies of the locality. The drains and sewers are chiefly used to carry away the liquid overflow of these cesspools, which are of great size, in many instances 40 feet square and 12 or 16 feet in depth. Those

I will not at this time discuss the defects, whatever those may be, of Messrs Bateman & Bazalgette's plan for the purification of the river, nor the advantages that other schemes are said to possess. I content myself with affirming that the principle on which this scheme is based accords with the best teachings of sanitary science. I have already drawn largely on your time, and I sincerely wish I could have better occupied it. As it is, I feel that I have very inadequately expressed the fulness of my sentiments on this important subject. I regret that I have felt constrained to differ so widely and so totally from my friend Dr Fergus; but I have endeavoured to lay fairly before you some of the reasons which make me decline to follow him as a safe guide. The hearty energy with which he has expressed his conscientious convictions has my unfeigned respect, although tinctured somewhat with a feeling that reminds me of an elderly village matron who, once upon a time, headed a deputation of her strong-minded sisters, when waiting upon a certain reforming sanitary major, whose threatened improvements they looked forward to with much apprehension:—"Na, na, major," she said, "ye may tak' our lives, but ye'll no tak' our middens!"

of the Central Markets (three in number)—where there is "une affluence des visiteurs"—have a conjoint capacity of about 10,000 cubic feet; and those of the Grand Hotel de Louvre (fifteen in number) have a capacity of about 6000 cubic feet. These cesspools are cleared out at stated intervals, varying from several days to several months, and it is in these "filthy facilities" that so many fatal accidents occur. They are constructed under the superintendence of the public authorities, and although professedly water-tight, it is yet well known that this is a fallacy. The gases which are formed blow through the joints; or, under extra pressure, pass through an escape pipe. The liquids, which filter away in spite of precautions, soak into the soil, which thus becomes "excrement sodden." Hence pollution of the wells which furnish drinking water, and hence the diarrhœa that so commonly affects water-drinkers within a few days after a first visit to Paris; and hence, in all probability, the peculiar virulence of cholera when it becomes epidemic in that city.

APPENDIX.

Since reading my communication to the Medico-Chirurgical Society, certain denials, allegations, and misrepresentation of statements have been made, all tending, so far as I am concerned, to obscure the points at issue in the discussion of the sanitary aspect of the sewage question. Some of these are of sufficient importance to merit consideration, and I have dealt with them in the following order:—

I.—The denial of an argument based upon Revelation.
II.—The assertion that I consider the emanations of decomposing animal excreta "harmless"—that is, incapable of injuring health.
III.—The history of a table of chemical analysis, entitled "Products of Sewage Matter."
IV.—The assertion of Dr Fergus, that, in discussing the sanitary aspect of the sewage question—this being the question which interests the general public—he has "followed the leading of the highest sanitary authorities."
V.—Miscellaneous annotations.

I.—The Denial of an Argument based upon Revelation.

Before discussing Dr Fergus' arguments, I endeavoured, in a succinct form, to reproduce them to my hearers; and that I faithfully did so I infer from the fact that my summary was tacitly acquiesced in on the part of Dr Fergus, with one exception, which he made as follows:—In replying, he said (I quote from the Society's reporter), "that, with regard to the argument which he had been alleged to have drawn from Revelation, he begged to state that he had never used the term 'Revelation' at all, but had appealed to the command of Moses, the lawgiver of the Egyptians. Far too much, he thought, had been made of this appeal."

Now, I have it recorded in my notes that Dr Fergus, on two several occasions, advanced the argument referred to, and appealed very emphatically to "Moses" and to "Revelation." I also find that the abstract of his paper, for the accuracy of which the Mail, Herald, and Morning Journal, of October 3d, are responsible, has the following passage:—"*He* (Dr F.) *expressed the opinion that water-closets were contrary*

to Nature and Revelation." It therefore appears that the reporters of the Mail, Herald, and Morning Journal concur with me in asserting that we have it from Dr Fergus' own lips, or (as I wish to speak only for myself) from his own pen, that he did use the words and express the opinion referred to.

However easy on this point, I feel it hard to be told that I made *too much* of the appeal, when I really intended and thought I had made *very little* of it. Indeed, I made as little as courtesy would admit; for I would no more have thought of taking up the time of an intelligent audience in attempting to prove that "Moses" and "Revelation" were not opposed to water-closets, than I would in showing that Moses was *not* the lawgiver of the *Egyptians*, but, on the contrary, that his legislative functions were restricted to the *Jews*. Considering that it was twice used, I thought it only courteous to notice the argument. Dr Fergus seemed to mean to say something on the subject of revelation in its relation to water-closets, and I thought he had said what he meant.

II.—The Assertion that I consider the Emanations of Decomposing Animal Excreta "Harmless"—that is, Incapable of Injuring Health.

I have studiously kept in view the fact that I do not contend that gaseous and vaporous emanations from sewage matter are "perfectly innocuous," "utterly harmless," although the holding of such opinions has, despite my frequent protests, been persistently attributed to me. I have, however, shown that, under ordinary circumstances, they are nowhere present in the relative proportions—quantity and quality—that Dr Fergus has alleged; and that whatever may be their development in London sewers, there is unequivocal evidence to prove that they cannot be produced to the same extent in Glasgow sewers. And it is only because I am so well satisfied that in the modern well-appointed water-closet, with effectively washed and flushed sewers, we are fully protected from even an exceptional hurtful influence that I have undertaken to show that, in the circumstances, present and prospective, of Glasgow, there is nothing whatever to be apprehended from the continuance and the extension of the institution.

That this is the purport of what I said, and what I meant, will not be doubted by any one who reads my argument. Thus it will be noticed that, almost on entering upon the question, I made an emphatic protest against any possible misunderstanding of my sentiments on this point—(see page 6)—and several times afterwards, while striving to prevent the spread of fanciful and exaggerated notions, I showed that I was fully alive to the real danger of such influences. (See pp. 15, 16, 18, &c.) I am therefore somewhat puzzled to account for the persistency with which my protests and clear expressions of opinion have been ignored by Dr Fergus. It may partly be owing to the want of the perceptive power that failed to recognise, even when pointed out, an error in a simple sum of arithmetic—the inability to perceive that 102 is more than 100—that 100 is necessarily the true, or required summation, and that any part of 102 is not a per centage; or it may arise from a

habit of either surrendering or not exercising his own independent judgment when following the leading of high sanitary authority, or it may be the faithless memory which so early denied Moses and Revelation. Whatever the cause may be, the fact indicates a peculiarity of mind.

Those who have honoured me with their attention, have no doubt observed, that while I have carefully recorded my belief that emanations from decomposing human excreta can, and do, under certain circumstances, prove hurtful—not only to the extent of generating disease, but even of causing immediate death—I at the same time have not entered upon any consideration of the *nature* of the injurious influences, their *mode of action, or the special diseases* they are capable of causing. On these points I hold matured opinions; but I do not feel that there is any pressure upon me to bring them forward in the present discussion. The question between Dr Fergus and myself is *chiefly one of degree.* I maintain that where there are well-appointed water-closets, soundly constructed sewers, and abundant water supply, the injurious influences referred to cannot exist *to the extent of causing injury to health*, and can only exist in a *minimum degree.* If I am right in this position, it is manifestly altogether unnecessary to follow Dr Fergus into a consideration of the *nature* and *effects* of a cause, when the *cause* itself is *altogether wanting.*

Dr Fergus is either not aware, or he withholds his knowledge, that the products from animal excreta vary according to the conditions to which it is exposed; and, while restricting his search for deodorants and other disguising chemical agencies, he overlooks altogether the admirable virtues of cold water. I cannot, indeed, refrain from expressing my surprise that he, of all men, should not have sympathised with my efforts to show how efficiently the "water cure" acts in the way of removing and destroying filth; and I can almost fancy the genius of Hydropathy hovering over our field of contest, and murmuring in his ear, in reproachful gurgle, "*Et tu Brute!*"

If I am right in my estimate of the virtues of an abundant supply of water as a sanitary agent in the removal and inoffensive decomposition of filth, and if I am right in the statement that the sewers of Glasgow are efficiently constructed, then the only sanitary difficulty remaining is one of petty mechanical detail as to the proper mode of connecting water-closets with the sewers. Any respectable tradesman will tell Dr Fergus that this difficulty has long since been overcome; and if he doubts the tradesman's statement, I must then appeal to the docility with which he "follows the leading of high sanitary authority," and refer him to Dr Parkes' work, where he will find references to arrangements that render the reflux of the dreaded sewer gases "almost impossible."

I have now to notice a statement adopted by Dr Fergus, and declared by him to be "completely established," viz., "That the logical deduction from Dr Adams' argument as to the innocuous nature of the exhalations from our sewers (Glasgow) is, that those from our river are even more harmless."

Keeping in recollection what has been said regarding our sewers at pages 10, 11, 12, &c., where it is evident that a Glasgow sewer is regarded as a smooth lined tube traversed by an ample stream of water, carrying in a few hours away from the city

all sewage matter as fast as it is formed; and, keeping in view what has not been described, but what is notoriously true, that our river is an enormous cesspool that receives the sewage in a condition several stages advanced towards that state when it begins to evolve "sewer gases," and that the inequalities of the sides and depths of this cesspool are loaded with a slimy and sludgy fermenting mass that is only removable in bulk by the never-ceasing operation of dredging, then it is, I think, difficult to imagine sewage matter in circumstances more widely different than when passing through the Glasgow sewers, and afterwards lodging in the river Clyde.

By "a logical deduction," I understand "the inferring of any assertion *from assertions already admitted*;" and, in logic, it is laid down that "when an assertion is proved by the help of others, *there are always at least two assertions necessary* to make the proof or justify the inference." We are all aware of the schoolboy's tricky logic by which he proved that "a horse chestnut is a chestnut horse;" and where truth itself is not the object aimed at, we know how logic can be abused by

> "Making plain things in debate
> Appear confused and intricate."

With these considerations premised, all that has been asserted regarding our sewers and regarding our river is now on record, and I am quite content to leave my readers to draw their own logical deduction.

Leaving this matter of logic to adjust itself, I take the opportunity of stating, shortly, the view in which the present state of our river may be regarded. My only previous reference to the river is made at the opening of my argument, and there I speak of it as a nuisance with which there was an admitted necessity to deal, because it revolted our senses and discredited our civilisation. Efforts, however, are being made to throw back the continued ventilation of the question, and to delay the consideration of proposals for the immediate purification of the river, because an assurance has been given from a good authority that the state of the river has no appreciable effect on the death-rate of the city.

This statement has been eagerly caught up by a community that is fearfully anticipating increased taxation, and it is being echoed wherever interest, ignorance, or indifference can become ruling motives.

In the statement *per se* I quite concur, and I believe it would be extremely difficult, if at all possible, to show conclusively, or in the form of a numerical statement, that fatal illnesses are caused by the exhalations from the river. The expression of the fact is quite fair when used to illustrate the effects that free exposure to the action of air and of a large volume of water has in modifying the injurious influences that otherwise can arise from decaying sewage matter; and I do not understand that the statement was emitted with any other intended application.

This, however, is only one view of the fact; and I think it has been misconceived and put to an unfair use by many who would shrink from an extension of the inference to cases where their own immediate comforts and interests were concerned.

A thing may be a shame and yet not a sin; and one may not be able to prove that the state of the river has an appreciable influence upon the death-rate of the city, and yet be well satisfied that common law, common sense, instinct, and conventional decency are all conjoined in declaring that it is a nuisance, and that it should not be permitted to continue.

The avenue to a gentleman's domain does not lead through his stables, his cow-house, and his ash-pit; and we do not admit our guests by the back court or through our kitchen. The trader who is compelled to make his access to our markets along a highway filled with the flooded filth of our city does not carry away with him impressions that we would willingly have recorded in our history or disseminated among our contemporaries.

We have practically recognised the sanitary advantages of providing public parks, and other open spaces, to be freely used by the masses of our town population, and we know that by so doing we secure for them some of the beneficial influences that in the country nearly double the value of human life. Our parks and open spaces have been well termed the "lungs" of large cities; and, in like metaphor, our rivers may be called the arteries and veins.

Wherever a large stream of water traverses the centre of a town, it carries with it a current of the foul air immediately overhanging, and there follows upon this advancing current a steady rush of pure air which "flushes" the atmosphere of the city. Lateral currents of air converge upon the stream, and the atmosphere within a large area is thus diffused and prevented from stagnating. These movements of the atmosphere are caused by the change in temperature imparted by the water. The water itself, if pure, contributes, partly mechanically, partly chemically, a purifying influence, by absorbing and carrying away with it atmospheric impurities. A river thus becomes a great sanitary agent within a town.

If, however, the water of the stream is impure, it not only fails to remove the impurities of the air, but it contributes much to the contaminations with which the atmosphere is already loaded.

Therefore, in the degree to which a town river is pure or impure, the town itself is benefited or injured, and in a negative manner the death-rate of that town may be affected, although not appreciably.

Then our river is a public highway, and if it traverses a pure atmosphere, how great are the pleasures, and how great are the health-giving influences it can bestow upon the convalescent and the occasionally infirm! Every medical man, who has practised for any length of time in our city, knows the anxiety with which a working-man, stricken with illness, awaits the permission of the doctor to try a day "down the water." The invalid cannot afford, nor safely endure nor enjoy a railway journey, nor be benefited by it. A private or specially-hired conveyance for a day's "outing" is equally beyond his means. He can, however, afford and endure and enjoy "a trip on the river," and would be benefited by it, because the cost is trifling, the mode of transit easy and agreeable, and the senses—in the absence of an impure atmosphere—are stimulated and gratified by the pleasing panorama that

the beautiful scenery of our river unfolds. If his own previous experience, or the doctor's warning, prevents him making trial of the aid that such a sanitary agent as the river in a pure state would prove, or if the impure state of the river counteracts the agency that might so largely contribute to cheer his drooping spirits and restore his health and wasted strength, then, in a negative manner, the death-rate of the city may be affected, although not appreciably.

I am very sensible that, when first emitted, there could be nothing further from the mind of its author than any idea that the expression referred to would be used with the object of retarding the purification of the river; and yet it has been so used, and that very effectively, and it has given rise to much misconception. Thus one gentleman of position, in following up what he supposed to be a legitimate illustration, has publicly declared that he had learned that the ferrymen on the river enjoyed good health. The same fact has been ascertained regarding skinners and glue makers, and other tradesmen who pursue their calling in a polluted atmosphere; and in this communication I have directed special attention to individuals who labour in the atmosphere of sewers. In our own profession we know well what the atmosphere of a dissecting room is, and we know of many other disagreeables that, in the course of our avocations, we must endure because we cannot cure. Would, however, a denizen of our West End Park, who saw a portion of it converted into an enormous dung depot, and its walks traversed with dung carts, be silenced or satisfied, or tolerate the nuisance, because the men who emptied the carts, and laboured among the dung heaps, enjoyed good health, and he was assured that the death-rate of the city was not appreciably affected?

III.—The History of a Table of Chemical Analysis, Entitled "Products of Sewage Matter."

To prevent misconception, or any after "muddling up" of the several points that ought to be kept entirely distinct in connection with the history of a Table of Chemical Analysis, I deem it necessary to give the history in separate sections, viz., (*a*) The Table itself; (*b*) The charges I have preferred against it, and the proofs I have brought forward to establish my charges; (*c*) The use made of the Table by Dr Fergus; (*d*) Circumstances which *followed* the use of the Table, and which *followed* my commentaries upon it.

(*a*) *The Table itself.*

The Table referred to was a large placard, hung up so as to be properly exhibited, and was as follows:—

Products of Sewage Matter.—(Letheby.)

Light carburetted hydrogen, ...	73 per cent.
Carbonic acid, ...	16 "
Nitrogen, ...	10 "
Sulphuretted hydrogen (variable), ...	2 to 3 "
Ammonia, and sulphide of ammonium, ...	—
A putrid organic vapour, ...	—

Of course, it could not fail to be understood that these per centages related to the gaseous products only, evolved *in some way or other* from sewage matter. The Table itself gives no details as to any process to which the sewage was subjected.

The essential part of the statements of Dr Fergus, the accuracy of which were questioned by me, is as follows:—"Human excreta *are continually decomposing in the sewers* and giving off gases, some of which, being volatile, the air passes up into our houses, poisoning the air we breathe. . . . . We are *breathing continually*; and fancy having the air we breathe contaminated with sewer gases! These are sulphuretted hydrogen, sulphide of ammonium, carbonic acid, and, occasionally, phosphoretted hydrogen and free ammonia, which render sewer gas alkaline, and a putrid organic vapour, which is also ammoniacal. Dr Letheby tells us that ordinary London sewage gives out 1 to 1½ cubic inches of gas per gallon per hour, *the composition of which is stated* in the table."

(*b*) *The charges I have preferred against the Table, and the proofs I have brought forward to establish my charges.*

Among other objections to this Table, I urged (1) that it was inaccurate as a Table, *apart from all authorship*; and (2) that *it did not truly represent the results of Dr Letheby's experimental investigations*, for which it was professedly brought forward.

I refer to p. 9 *et seq.* for the details of the manner in which I proved that my objections were valid; and considering the time, place, and circumstances, it is difficult to conceive how more could have been done to show that the data offered by the Table *could not by any possibility* be correct, but were necessarily erroneous, delusive, and unsubstantial. I am well informed that, unless in the case of Dr Fergus himself, who would admit no error, there was no doubt left in the minds of my hearers.

But Dr Fergus not only refused to admit that there was error, but he has since stated in the public prints that my "own assertion" was the "only proof" I brought before the Society, and that he still waits, and requests others to wait, for actual proof.

Under these circumstances, it was only left for me to apply directly to Dr Letheby himself, and I am happy to have the opportunity of submitting to my readers a complete and decisive corroboration of all that I have advanced regarding the Table.

In my main argument I have given at length my interpretation of the Table; and the reader is requested to keep my comments in view while he reads Dr Letheby's explanation of his own views and investigations. I forwarded to him a copy of the Table, and asked if he accepted it as one issued by himself, and if it truly represented or gave an intelligible or correct exposition of his investigations. He very kindly and promptly favoured me with the following reply, which, besides its conclusive flat upon the point at issue, furnishes additional matter of extreme interest and high value in relation to other points:—

"*Nov.* 5, 1868.

"DEAR SIR,—There is a mistake in the figures, which you say were given in the Table of "*Products of Sewage Matter*," and chiefly in the proportion of sulphuretted hydrogen in the gaseous products; for the largest amount of this gas in the naturally evolved gases is but 0.2 per cent. of the entire gas.

"My Table (No. X.) shows three sets of facts:—

"1st. The quantity of gas evolved from sewers during the entire time of decomposition (air being excluded), and the composition of the gas; and, for obvious reasons, a very bad sewage, containing as much as 128·8 grains of organic matter [and 149·7 grs. of mineral matter.—J. A.] per gallon was used. This sewage (with atmospheric air excluded) went on decomposing and evolving gas for nine weeks, and the average amount of gas evolved per hour for the whole time was 1·2 cubic inches per gallon of sewage. This gas had an average composition by volume of

Marsh gas, ...	73·833
Carbonic acid, ...	15·899
Nitrogen, ...	10·187
Sulphuretted hydrogen, ...	0·081
	100·000

"2nd. The quantity of gas dissolved in sewage, when in a state of active fermentation, and the composition of the gas. Here, for the sake of comparison, I examined *very bad* sewage (averaging 101.8 grains of *organic* matter per gallon), and *ordinary* sewage (averaging 27 grains of organic matter per gallon). These contained and evolved the following proportions of gas when boiled for some time:—

Bad sewage, ...	76·5 cubic inches per gal.	
Ordinary do., ...	33·1	" "

And the composition of the gas was

	Bad Sewage.	Ord. Sewage.
Marsh gas, ...	20·352	13·352
Carbonic acid, ...	72·245	35·962
Nitrogen, ...	4·320	49·725
Sulphuretted hydrogen, ...	3·083	0·961
	100·000	100·000

"3rd. The quantity of gas contained in diluted sewage, as the marginal water of the Thames at Blackfriars and London Bridge at high and low tide.

"This evolved an average amount of 10·3 cubic inches of gas per gallon when it was boiled for some time, and the gas consisted of

Marsh gas, ...	trace.
Carbonic acid, ...	59·613
Nitrogen, ...	40·387
Sulphuretted hydrogen, ...	traces.
	100·000

"It may be said, therefore, that the gases evolved from ordinary sewage, *in the presence of atmospheric air, are chiefly carbonic acid and nitrogen*, with but mere traces of sulphuretted hydrogen.

"I find, however, from an extensive series of experiments, made in 1866, with carbolic acid *in the sewers of the city*, that the gases evolved from the sewage were chiefly marsh gas, thus:—

Marsh gas, ...	88·45
Carbonic acid, ...	5·48
Nitrogen, ...	6·07
Sulphuretted hydrogen, ...	none.

"My attention was directed to this in consequence of the frequent firing of the sewer gases by the candles of the sewer men, and I had the gas collected from the sewage in the sewers. The carbolic acid had evidently checked oxidation and promoted the marsh gas decomposition.—Truly yours,

(Signed) "H. LETHEBY."

I suppose there will now be no difficulty in admitting that my reference to Dr Letheby's official Report, and my interpretation of his investigations as contained in my main argument, proved then and there that the data exhibited by Dr F. was "erroneous, delusive, and unsubstantial," and that my "own assertion" was not "the only proof" brought before the Society.

(*c*) *The use made of the Table by Dr Fergus.*

Dr Fergus used the Table entitled "Products of Sewage Matter," together with the words I have appended to it, as a definite and authoritative statement of the *Quantity, Quality*, and relative *Proportions* of the noxious gases that are given off in *all sewers*, by *ordinary sewage*, *under the ordinary circumstances* in which sewage is found in sewers.

Beyond this his argument consisted mainly of narratives of special cases of diseases, which he stated were illustrations of the hurtful effects of the gases referred to, and of assertions that no contrivances could exclude those gases from a dwelling that is provided with a water-closet.

He thus made the Table the *premise* or *major proposition* of his argument.

I, however, challenged the soundness of his *premise*, and showed that sewage, *under ordinary circumstances*, never furnished the noxious emanations referred to, either in the quantity, quality, or relative proportions stated by Dr Fergus; and I maintained that Dr Fergus, by the use of this Table, and by the manner in which he made it bear upon and illustrate his arguments, conveyed, or attempted to convey, an exaggerated notion of the evils which can arise from sewage *as it is found in Glasgow sewers*.

He has done this by citing the products resulting from sewage subjected to *laboratory* experiments, whereby there is obtained the greatest quantity of noxious

gases that sewage can possibly furnish under any circumstances, but which is never furnished by sewage under ordinary circumstances, as it is found in sewers, and from sewage that was *exceptionally impure*, and which therefore furnished an exceptionally large quantity of noxious products, after being placed in exceptional conditions.

Owing to the same error of using the results of laboratory experiments, he has conveyed an exaggerated notion of the *quality* of the gases that are produced by sewage under ordinary circumstances. Thus, the most deadly of these products is sulphuretted hydrogen, and it is stated to be present in a proportion of from 2 to 3 per cent., whereas it is never evolved, under ordinary circumstances, in a proportion exceeding 0·2, or about the fifteenth part of the amount stated by Dr Fergus.

In like manner, a totally unreliable notion is conveyed of the *relative proportions* in which the several gaseous products are evolved from sewage placed in ordinary conditions.

A friend of acute, critical mind, whose opinion I obtained on this point, says that Dr Fergus "is open to the charge of having failed to explain *the true bearing* of the per centages in the Table *upon the question at issue—e.g.*, a tumbler of Harrowgate water would probably yield, by boiling, a much larger per centage of sulphuretted hydrogen than the most highly charged sewer water in London; yet Dr Fergus would not argue that the *spontaneous* exhalations of Harrowgate water could, under any circumstances, become so dangerous as the composition of the gases of its ebullition would suggest." To this extent the gentleman thinks Dr Fergus is fairly open to criticism, and he suggests that Dr Fergus ought "to remove carefully from his paper all inaccurately worded statistics and all expressions which might tend to suggest an erroneous application of the per centage of gases extracted from sewer water."

The points to which my criticisms were directed are here brought clearly forth, viz., his "having failed to explain the true bearing" of the Table, and "the use of *inaccurately worded statistics* and *expressions which might tend to suggest an erroneous application.*"

Dr Fergus could not, however, explain, for the simple reason that he did not himself understand them. He had, as I have previously stated, altogether misapprehended the data he was using.

(*d*) *Circumstances which* followed *the use of the Table, and* followed *my commentaries upon the Table.*

Dr Fergus, when replying to my argument, introduced, for the first time, the name of Dr Parkes, from whose work on Hygiene, and not from Dr Letheby's writings, he stated that the Table was taken *verbatim*.

I thereupon exonerated Dr Fergus from the errors in the compilation of the Table, but kept in view that this did not in any degree alter the fact that the errors still existed.

Shortly afterwards, Dr Fergus published a letter, in which this kindly intended

acknowledgment, confirmed by private letter, was travestied, and I was placed in the position of having withdrawn from my ground." (See Letter in last Note of Appendix.)

I had not previously concerned myself in following up the reference to Dr Parkes, as the mere authorship of the erroneous Table had no influence either upon Dr Fergus' argument or mine. Still I suspected that, as neither Dr Letheby nor myself had been fairly represented, there might be a similar failure in connection with Dr Parkes. I accordingly turned to Dr Parkes' work on "Practical Hygiene," and found my suspicions verified.

I may here observe that Dr Parkes' work is the only one in which I have found, in a condensed form, so well digested a mass of valuable matter—almost invariably accurate and reliable. All parts of this work are so kept *en rapport*, by references and correlative facts, that any professional man resorting to it, and applying a moderate share of attention to the subject on which he wishes information, can scarcely imbibe an erroneous view, although, in some matter of detail, he might stumble upon an error.

In Dr Parkes' work there is a chapter headed "Products of Sewage Matter," embracing several sets of facts, all evidently requiring to be examined under the guidance of the principle on which the book itself is constructed. This chapter contains the Table, *but with no title*, and in reference to it Dr Parkes says, "Ordinary London sewage disengages from 1 to 1½ cubic inches of gas per hour per gallon (Letheby), consisting of"— (Here follows the Table.) No explanation is given of the *manner* in which the gas is *disengaged*. The chapter then refers very shortly to "the liquid which collects on the walls of *sewers*," to "the organic vapours," to what "is found in sewer water," to "the air in sewers," and to "the asphyxiating gases" of sewers.

From this chapter Dr Fergus has extracted the Table, which is evidently intended to represent one set of facts, and has given to it the title which rightly designates the entire chapter. How far he is justified in so doing it does not, in the present discussion, concern me to inquire; but some light might be thrown on such an inquiry by a reference to the immediately preceding chapter of Dr Parkes' work, headed "Products of Combustion." In this chapter there is shown the very noxious "products" which "pass into the atmosphere at large" from *coal*, such as carbonic acid, sulphide of ammonium, sulphide of carbon, sulphuric acid, &c. There is also shown the "products" of *wood*, such as carbonic acids, and oxides, &c.—that is, when the wood is "decomposing" by exposure to heat and atmospheric air, for, *if decomposed* by heat, with air excluded, we would, no doubt, be told that pyroligneous acid and tar would be the products given off. Then we are told of the "product" *coal gas*, to which I request Dr Fergus' attention, because it is really of very deleterious composition, and consists in large proportion of light carburetted hydrogen, carbonic acid, sulphuretted hydrogen, and sulphide of ammonium—very similar, indeed, in many respects to the composition in Dr Fergus' Table of the "Products of Sewage Matter." Dr Parkes' work treats of other "products" all passing into

the atmosphere, and "contaminating the air" which "we are continually breathing." The student is, however, reminded, at the beginning of the section, which embraces "products" of combustion and of sewage matter, that to compensate for these contaminations "a wonderful series of processes goes on in the atmosphere as on the earth, which keeps the air in a state of purity." In a pithy and admirably clear summary, the learner is reminded that "gases diffuse" and "become so diluted as to be innocuous," and that "diffusion, dilution by winds, oxidation, and the fall of rain, are the great purifiers," and that by these "counterbalancing agencies it is wonderful how the immense impurity which daily passes into the air is soon removed, except when the perverse ingenuity of man opposes some obstacle, or makes too great a demand even upon the purifying power of nature."

After a careful examination of all that relates to the "Products of Sewage Matter," *and to the separate section on sewerage* in Dr Parkes' work, I found that the soundest and most judicious *conclusions* were carefully inculcated. I therefore wrote to Dr Parkes directing his attention to the chapter, or section, headed Products of Sewage, and I now append his reply, premising, that whatever ambiguity may exist in the *popular* treatise referred to, there is none whatever in Dr Letheby's *official* Report, or in his letter at page 34 :—

8th November, 1868.

"My dear Sir,—I conceive the *section* at page 79 of my Manual of Hygiene, headed 'Products of Sewage Matter,' is quite correct. There are two points noted —1*st*, The nature of the substances disengaged from decomposing sewage; and 2*dly*, The composition of the air in the sewers into which these products are disengaged.

"I gave a Table, taken chiefly from Letheby's own account in the *Encyclopædia Britannica* (article Sanitary Science) of his experiments. The only addition I made to this Table was an item of sulphuretted hydrogen, which was quite necessary to prevent subsequent statements from being inconsistent.

"Then the second point—*the composition of the air in sewers*—is given in the last two paragraphs of the section.

"*Now*, here I thought, and do still think, that a Table of the average composition of sewer air is of little use; still more useless is a Table of the composition of a well-ventilated sewer. What is wanted is to know the limits of impurity. You will see, therefore, I stated the case in this way: I gave the lowest amount of oxygen recorded in sewer air, and said the amount might vary from this to the normal amount. I then gave the extremes of sulphuretted hydrogen and of carbonic acid, &c., which might occur; and of course it is implied that the amount of these substances might be from the stated extreme quantity to *almost complete absence* in the air of perfectly ventilated sewers.

"I still think this plan of statement safer, as indicating the *possible impurities* and consequent danger.

"Believe me, very sincerely, yours,

(Signed) "E. A. PARKES."

Before leaving this "unlucky Table of sewer gases," I may state that under ordinary circumstances I would not have thought it necessary to have criticised it so closely as I did at the Society meeting; but, *ex pede Herculem*. That Table was but a small matter considered *per se*. When, however, a professional man comes forward, stating that his object is to change the habits of a people—when he denounces an institution, the sanitary advantages of which we have been taught to believe in as accepted facts—when he urges us at enormous cost to alter the constructive economy of our dwellings—and when he states that in all this he feels the responsibility of dealing with what he considers to be "the most important sanitary question of the day"—then it is surely right that, if he can base nothing on original research, he should at least exercise the most critical vigilance when he employs the researches, or makes any use whatever of the statements of others. The data, or alleged facts, given in that Table was not matter of *mere testimony, which could be verified in no way except by appeal to Dr Parkes' credibility or well known accuracy*, but matter of experiment and of fact, which, in the circumstances Dr Fergus had no right to assume as accurate *without some measure of personal verification*, since he made the data in that Table the main basis of his argument. In such a case he was more responsible for the data than Dr Parkes himself, who, in a large work, might unwittingly allow an inaccuracy of the kind described in the Table to escape him, but who would instantly have detected the errors if he had designed, like Dr Fergus, to make the data there given the foundation of a special argument and the main point of proof. The Table is made use of by Dr Parkes in no such special way, but it was so made use of by Dr Fergus, to reach conclusions which are wholly at variance with the views given in Dr Parkes' work —a fact which makes the act of so using the Table all the more reprehensible.

If I had been commenting on that Table as I find it placed in Dr Parkes' work, I would have pointed out the discrepancy in the summation, the difference in the per centage of sulphuretted hydrogen from that given by Dr Letheby, and the absence of explanation as to the manner in which the gases were disengaged from the sewage; and these I would have said were points to be amended in future editions. In the case before us, however, the Table was made to form the fabric and colouring of the flag that was being flaunted in the eyes of the public to goad it into panic, and hence the necessity of acting energetically, and, in reference to it, of dropping the honied mouthings of debate that might have been appropriate in discussing the merits of an embrocation, or the composition of a poultice.

IV.—The Assertion of Dr Fergus, that, in Discussing the Sanitary Aspect of the Sewage Question—this being the Question which interests the General Public—he has "followed the Leading of the Highest Sanitary Authorities."

The battle that Dr Fergus has attempted to revive was decided many years ago, and the details are familiar to all who have lived in the atmosphere of medical

circles. Previous to 1840, there prevailed the system of cess-pools, pots, or reservoirs, outside each house or group of houses, and the sewers merely received the partial escape or overflow of liquid impurity, while the liquid which did not overflow soaked away into the sub-soil. Closely following the labours of Parliamentary Commissions into the state of the Public Health, the use of water-closets became more general, confined at first to the houses of the wealthy, but gradually and steadily becoming common among other classes as their sanitary advantages and the evils of the old system became better known. Their extended use met at first with much opposition, owing to ignorance of facts and the existence of interested motives; to the dislike, for instance, which owners of house property had to any interference with the existing arrangements of that property as to changes that involved expense; to the dislike of the inhabitants of towns to a new imposition of rates; and to many other causes which are known to retard the progress of improvements of which the utility and desirableness are otherwise not called in question. Ultimately, however, the issue of the struggle may be said to be gazetted in the following words taken from the preliminary Report of a Parliamentary Commission on the Sewage of Towns, 1858:—

"It is undoubtedly in a growing acquaintance with the laws of health, which we have derived, during the present century, from the devoted labours of eminent men, *principally of the medical profession*, that we must seek for the origin of those extensive changes which have brought us to the present condition with regard to town sewage.

"These labours have led to certain practical conclusions, which we may sum up very shortly in the shape of two or three axioms:—That the offensive effluvia given off by animal and vegetable substances in a state of decay are highly prejudicial to health and productive of diseases of the worst forms; that decaying human excrements, solid and liquid, are among the most injurious of such substances; that the retention in cesspools of such decaying matter beneath and around the dwellings of crowded populations is a serious nuisance, and that for the rapid and regular removal of such substances immediately after their formation, and before they can become a source of offence and disease, the only practicable means is an abundant employment of water—that is to say, the adoption of some form of water-closet."

Serious evils were, however, soon observed to follow upon the extended use of water-closets. Hitherto, the sewers had been employed exclusively for carrying away the surface waters of the towns. When, however, the practice was introduced of flushing house drains into the sewers, then the night soil began to find its way into the rivers. The rivers were becoming fouled to an extent that interfered with the convenience and comfort of the people and endangered public health. The sewers being of limited capacity, and not originally constructed for the offices they were now being made to serve, proved inadequate. Moreover, the flow of water in the sewers was scanty and irregular—they got choked up—noxious exhalations

accumulated and regurgitated into the house drains—the drains were unprovided with other traps than mere gratings, for there had been no previous necessity for other contrivances. Hence arose many instances of discomfort and injury to health. At the same time, it became more and more widely known that the same facts which established the sanitary advantages of water-closets showed that, wherever water supplies for drinking purposes were obtained from wells, there was frequent danger of infected matters being conveyed into the wells from the drainage of cesspools, dung-heaps, and dry privies, &c. Medical men now began to send forth warning cries, each as his peculiar opportunities inclined him to take up special interests. Some eminent men, as Dr Acland, urged the attention of the Legislature to the necessity of guarding rivers, the basins of rivers, and entire watersheds from pollution. Other earnest investigators, as Drs Snow and Murchison, drew the attention of their medical brethren to the injurious influence upon health of imperfect drainage and sewage, and of insufficient or of imperfect water supply. Through such exertions, and by the agency of such labourers, medical men of mature years, and more lately medical students, the local authorities of towns, and the better educated of the general public, are gradually becoming enlightened on the subject of sewage; and from time to time, as the movement in favour of sanitary progress reaches a locality, there generally commences an agitation such as now exists in Glasgow. This agitation invariably assumes the same form, viz., an endeavour, on the part of the community, to conform to the requirements of advancing civilisation by the improvement of social habits, but always, if possible, with the proviso of some immediate or ultimate assurance against increase of local tax burdens.

Hence the origin of special Parliamentary Commissions, and of experiments on a large scale for the deodorisation and utilisation of sewage matter, the result of which has ripened to a degree that the question is regarded as solved by all earnest inquirers. That question, viz., the disposal of town sewage, it is not my present intention or object to discuss. I have neither time nor inclination for the task; and I merely allude to it *en passant*, feeling perfectly assured that the same spirit and intelligence that secured for the city of Glasgow a pure water supply that is pre-eminent among cities, that secured it against as stubborn a battle of predictions that experience has falsified, and of interests that are now thoroughly reconciled, and in the results fully compensated, will likewise secure the efficient disposal of the sewage to a locality where it can be dealt with safely as regards the public health, and with economic advantages as regards the public purse.

In the reports of Parliamentary Commissions, in special reports to the Board of Health, and to the Privy Council, and in separate writings of many distinguished medical men, there is contained a great mass of evidence, showing, both in an isolated and in a collective form, the facts which illustrate the conclusions to which I have adverted in the preceding short and rapid sketch.

Familiar as these writings are to the majority of well-informed medical men—as familiar as "the Shorter Catechism with proofs" is to intending church probationers—the present discussion has afforded a convincing and surprising illustration that they

may be misunderstood. I can only account for this occurrence by supposing a pre-occupied state of mind. Don Quixote, when he went forth on his mission of reforming abuses, attacked decent going windmills as destroying giants, and invested his frowsy Dulcinea with all the attributes that chivalric courtesy can assign. And, in like manner, Dr Fergus, in his onslaught upon the water-closets, is evidently stimulated by a passion for an "idol of the mind"—than which there is no greater obstacle to the entrance of true light. The mind so pre-occupied affords a marked illustration of two very different conditions of sense—the difference that exists between *seeing* and *perceiving*. Thus an individual fails to perceive the spectacles on his nose, and another in a search for a familiar face may retire from a crowd and retain no lasting impression of the thousands of indifferent and unregarded faces that met his vision.

Indeed it is a most significant fact, but one that is to me not at all surprising, that, although brought under the notice of the Medico-Chirurgical Society *at three consecutive meetings*, there was not one medical man who had a word to say in support of Dr Fergus' peculiar views. There was, by the way, an exception, for one gentleman contributed a support that consisted mainly in the reading of an early opinion (since recanted) from an old report of Dr Anderson and Mr Bateman, and which opinion was adverse to the water-closet system. This exceptional support may therefore be recorded at its full value. Another significant fact may also be recorded. When Dr Fergus first read his communication, with its voluminous "extracts from high sanitary authorities," he was heard respectfully and with interest, although it was plainly seen to what use he intended to put them; and at the second meeting he was heard with patience, in the expectation that something better than "extracts" would be forthcoming. But when at the third meeting there was nothing adduced but "additional extracts," it was not surprising that he obtained a reluctant hearing from a wearied auditory, or that he was so entreated to "make it short." If he had not been, to use the words of his own appeal, "almost a stranger in the Society," he would have known that, while he was reading "another" and "another extract," with all the zeal of an enthusiast inculcating truths to a knowledge of which he was himself newly awakened, he was only "cramming the ears" of his hearers "against the stomachs of their sense," and that to them the *recherché* of details was only inflicting the repetition of a well conned lesson. He would have known that he was addressing men to whom fever and its exciting causes was no new subject—men who had associated with cotemporaries whose names are classic in medical literature, and who had many times, within the Society walls, heard these cotemporaries expound all that science and experience records on the subject of fever as a question of public health.

The manner in which these "extracts" were made to do service was, however, a novelty to the medical mind, and at first came with all the exciting feelings of a surprise. But it was a mere startle, and no hearer was moved from the path in which his experience and convictions had previously inclined him to travel.

Every medical man who heard these "extracts," recognised immediately that they were the old familiar warnings against drinking "sewage dissolved in water"—against "living on excrement-sodden earth"—against permitting "filthy facilities to exist for the fouling of earth, and air, and water"—against disposing of sewage "in such a way" that sewer gases "confined in the pipes," and "having no other exit," are forced into our houses—against permitting the existence of "cesspools" where, "during times of drought," foul gases may be engendered, but from the effects of which gases we may be delivered promptly and easily, as in the latest "extract" published by Dr Fergus, where "the fever subsided as soon as openings were made into the sewers from certain houses where it had before maintained itself for months."

Something of that blindness which is caused by excess of light must exist in the case of an individual who can study the writings of the highest sanitary authorities and fail to perceive the clear expression of the opinions to which they give utterance in reference to the sewage question. Even a casual perusal, conjoined with a habit of "skipping," will scarce save the reader from falling plump upon some of the numerous passages by means of which these authorities iterate their opinions. The sensational "extracts" quoted by Dr Fergus are merely the illustrations they advance to show the soundness of their views, and the necessity that exists for adopting their conclusions. The authorities are numerous, and if the space I have assigned myself should limit my comments to those who have been selected and brought forward by Dr Fergus himself, I shall nevertheless be well content. They are among the very first, and no better names can well be adduced than those of Mr Simon, and Drs Murchison, Parkes, and Acland.

How shall we know the views of these gentlemen? Not by the extracts to which I have so often referred, for these, as I have stated, are applied to uses which their authors never intended. But no possible mistake can arise if their opinions are quoted in their own words, and this I shall now do.

Commencing with Mr Simon, medical officer to the Privy Council, author of reports to the Board of Health, &c., and oftentimes a member sitting on Parliamentary Commissions specially appointed to make inquiry on questions affecting the public health, his opinions have been frequently expressed, and probably nowhere better than in the quotation from a Parliamentary report, at page 40, to which his name will be found appended.* That is one expression of his opinion. Here is another, where, in the course of animadverting upon a faulty district, he says—"The solid fecal matter of the inhabitants is still retained amidst their dwellings, *instead of being discharged into their sewers*. The mass of the people are denied the *comfort and advantage of water-closets*, and, *in spite of all medical evidence* of the perniciousness of the cesspool and middenstead system, it seems probable these will be maintained in this district longer than in any other; for even in these towns in which a complete system of sewers has been laid down, the noxious middenstead, pent up in confined yards and courts, remains as a rule. If one of the two evils were unavoid-

* Parliamentary Report on Best Mode of Distributing Sewage of Towns. August, 1861.

able, it would be better that the rivers should be polluted than that the atmosphere in which we live should be subject to constant deterioration."

The next authority, Dr Murchison, is nowhere explicit on the subject of water-closets—that is, he has not, so far as I am aware, been called upon, like Mr Simon or Dr Parkes, specially to treat the question; and he can only, therefore, be held responsible for such inferences as can be derived from his very important observations on the spontaneous generation of typhoid, or, as it is frequently called, gastric fever. He has endeavoured to explain how *pythogenic*, another name for enteric or gastric fever, is endemic, or circumscribed in many localities, and the evidence he adduces (p. 438 *et seq.* of his book on fevers) to show that it can arise from the emanations of decomposing fæcal matter is very striking. He tells us of many instances of illness arising from the clearing out of *a choked up drain*; from living in a room over *a stable and cesspool* which had become *choked* up, and from which issued smells so offensive that the horses had sometimes to be removed; from the open course of a stream that had been conveying sewage, but which stream had *dried up* during extremely hot weather; from a *stagnant pool* which was *the receptacle of dead animals and of all the sewage of the district*; from the main sewers being all *closed up* and *obstructed with accumulated filth* proceeding from the privies and farm yard; from *a foul and neglected sewer* in which fæcal matter had been *accumulating for years without any exit*; from exposure to the fetid emanations liberated during *the opening and emptying of cesspools*, the cleansing of *old drains* and open ditches, and to the foul gases which were found in the houses *when any obstruction took place* in the narrow drain pipes; from *an accumulation of upwards of ten feet of soil that had been going on for years*, &c., &c. He says that "in most of the instances where enteric fever had been traced to *bad drainage*, the noxious gases have escaped into the interior of the houses. Hence, a privy outside a house is much less dangerous than *a badly appointed water-closet* within." He "readily admits that we cannot succeed in tracing every case of enteric fever to organic impurities;" but during the last four years he "has met with few examples of enteric fever, which, on investigation, he could not trace to *defective drainage*."

Among those labourers, therefore, who have done good service in showing the evils which arise from permitting filthy facilities to exist for polluting earth, and air, and water, Dr Murchison deserves honourable mention.

I shall now adduce Dr Parkes, of whom Dr Fergus says—"Every medical man knows the high standing of Dr Parkes, and that in the English language we have no better authority on hygiene than his work." I gladly seize the opportunity of showing that there are some points on which Dr Fergus and myself are agreed, by subscribing cordially to the foregoing statement, and I will only add that Dr Parkes' opinions have the force of *injunctions*, owing to the official and authoritative position he holds in relation of the Army Medical Department. His views are, therefore, given under the weight of responsibility.

Under that chapter of his work in which Dr Parkes treats of sewage, he says:—"The question of the proper mode of disposal of sewage has been somewhat perplexed by not keeping apart two separate considerations. *The object of the physician is to remove as rapidly as possible all excreta from dwellings*, so that the air shall not be made impure. The agriculturist wishes to obtain from the sewage its fertilising powers. It is not easy to satisfy both parties; but it will probably be conceded that *safety is the first thing to be sought*, and that profit must come afterwards.

"There are only two modes of removing sewage from dwellings. It must be washed away by water, or it must be carried or carted away to such a distance as to be innocuous, or partly washed away and partly carried by hand. It must not be about houses, or be buried in pits, which is only one degree better—if, indeed, it is better.

"If the supply of water be sufficient, and if sewers are efficient, *this is by far the readiest and most inexpensive* way of disposing of the excretions. The sewage matter *is at once diluted with water, and washed away* to a distance. On the other hand, *if sewers are badly made*, and *if the amount of water be insufficient*, they are worse than useless, as they have the appearance of efficiency without the reality."

Dr Parkes then refers to the matters that require attention "in order that sewers may be efficient," such as construction, water supply, ventilation, not opening into basement of houses, as no *traps* will prevent the gases from rising into the warmer atmosphere of a dwelling-house, &c. Regarding water supply, he says:—"It has already been stated in the chapter on Water that, to keep sewage clear, the amount of water, in addition to rainfall, must be 25 gallons per head daily."

He proceeds to say that: "*In case there is any suspicion of diseases connected with sewage*, the examination should be conducted in the order of the previous paragraphs, viz., the kind of sewage; their fall; the velocity of the current in them, and the amount of their discharge, actual (if it can be ascertained) and calculated; their condition as to construction; ending and trapping; ventilation and amount of water. The facts just given will serve as a guide to show if *any defect exists* in any of these points."

Regarding the *form* of water-closets, he thinks "little need be said. A simple syphon, with a good flow of water (10 gallons), *is as good as anything*, and it is easily cleaned if it gets out of order. Mr Jennings has patented a syphon with a plug, *which would seem to render reflux of gas almost impossible*."

Under the heading of "General Conclusions," he says:—"Bearing in mind that the problem with which we deal is *the immediate and complete removal of excreta from our dwellings*, the following conclusions seem justified:—If our opinion is asked regarding *the best method* to be adopted in a temperate climate, *we should advise removal by water*, provided there is water enough, good fall, and proper means of disposal of the sewage, and, of course, available materials for properly constructing the sewers. All these points should be carefully considered. It must be understood, however, that this plan renders the sewage *comparatively* valueless.

"If the plan by water *cannot* be adopted, one of the dry methods must be used, and of these the mixing with dried earth is the cheapest, and probably the best. *This requires, however, much greater labour and superintendence*; but if the soil is saleable, it may repay this. Even if not saleable, it may be considered to fairly repay

its cost, in the case of barracks, if it is applied to soldiers' gardens. In many stations, *where water is scarce*, this plan must be adopted. Only *until there is greater evidence* about the complete deodorisation *and innocuousness* of the mixed soil and earth, when retained in houses (especially in the tropics), *it should be desirable to have the earth-closets always external to the houses*, and, *if possible, the soil should be removed daily.*"

The value of the foregoing expression of Dr Parkes' carefully matured conclusions will justify the length of my quotations, and they are, I think, as explicit as language can make them.

The next of the sanitary authorities, whose leading Dr Fergus says he is following, is Dr Acland, Regius Professor of Medicine at Oxford. This gentleman has given a great deal of attention to the subject of the pollution of streams, and his inquiries have been pursued in a systematic and extensive manner. I was greatly puzzled on what grounds he had been cited and his name used to give support to Dr Fergus' conclusions, because it was evident to me that, in his published writings, he had proved the possession of an extensive practical knowledge of questions affecting the public health. The same evidence assured me that his opinions, if anywhere expressed, would be given in carefully accurate language, and would almost certainly be derived from personal investigation. He had, I knew, stated emphatically his views regarding the allowing of animal excreta to remain "within the precincts of the house," and had said that the evils of such "could not be exaggerated;" in fact, he thought "they could not be expressed sufficiently strong." He had also said—and I mention this *en passant*, because the fact is connected with his special line of investigation—"As to the general fact that the neighbourhood of polluted streams is a cause of death, I have not the slightest doubt." With regard, however, to his views on land carriage of sewage, and the comparative merits of water-closets and earth-closets, I could find no special expression. I therefore addressed to him some explicit inquiries, to which he most kindly and promptly furnished the following reply:—

"*November* 12, 1868.

"My dear Sir,—No one has any ground for claiming me as an advocate for cesspools, earth-closets, or any substitute whatsoever for entire removal of sewage by water from large towns.

"I have never written or spoken a word in public or private in a contrary sense.

"I have, on various occasions, public and private, calmly discussed the several methods, and I have insisted mainly on one principle, viz., that every great town has to be considered *in its own circumstances* by a skilled and honest engineer.

"I feel this so strongly, that I have always refused to say how, *in the abstract*, a town should be sewered.

"One place has good water supply, and sufficient fall, and land below the town fit for receiving sewage by gravitation for irrigation purposes. There the problem is so simple as to have only one complication—the disposal of surface rain-water.

"Another town is quite flat, has bad water supply, and no fall near, and has the houses wide apart, and is poor. There I can quite imagine that a regulated system of closets or tanks may be successful for health and economical. But this is a rare case, and wholly inapplicable to large towns.

"To them I believe there is no sound method yet known, but taking the sewage by water to the land.

"The earth-closet system will answer, in a restricted sense, where nothing else is attainable. So also may the Chinese tanks. But I entertain no doubt that they may be considered as secondary and imperfect contrivances, applicable only where sewers *cannot*, for some special reason (generally monetary), be constructed.

"I shall be very glad that you should make any use of this letter that you think fit.

"I am, ever yours truly,

(Signed) "H. ACLAND."

Dr Acland's opinion is a fair summary of my own, and I have frequently had occasion to put it in practice, by advising, orally, or by letter and drawings, &c., the fitting up of earth-closets in garden outhouses, detached dwellings, and small country places where good sewerage did not exist.

On the whole, it may be said that the opinions expressed by Drs Parkes and Acland are the best exposition that can be given of the relative merits of the Water-closet, and of the only other appliance which, in the most distant degree, approaches it in efficiency, viz., the Earth-closet.

In the particular case before us—that of Glasgow—I feel warranted in saying that not one of the gentlemen who have been referred to by Dr Fergus, nor any other gentleman who may be named, and who holds at the present moment a position as a sanitary authority, will be found to give his support to such a wild project as that of suppressing the water-closet system in Glasgow.

It is therefore abundantly evident, that if the citizens of Glasgow "follow the leading of the highest sanitary authorities," they must continue and *extend* the use of water-closets, and connect them with the sewers. But how shall they dispose of the sewage? Not into the river. That proposal I will not debate, so certain am I that, although the formal decision may be delayed, it is virtually a settled question. I will only interrogate another sanitary authority—one of the greatest names in modern medical science, whether considered as an original investigator, a practical physician, or a sanitary apostle—Dr W. B. Richardson, who, among other positions favourable for the acquisition of *special* knowledge, was for some time editor of the *Journal of Public Health*. In a lecture* delivered before "the Congress on the *Sewage Question*," at Leamington, October 25, 1866, he says, "I have only one other subject to treat of. Perhaps you will consider it the most telling. It is the question—What is the best way to apply sewage to avoid the propagation of these poisons? [viz., typhoid or gastric fever, cholera, &c.] Putting aside economy, I think there can be no doubt that *that town would be most happy in regard to its health*,

* On the Poisons of the Spreading Diseases. London: Churchill. 1867.

that should have *a proper water supply, derived from one source*, and *a drainage well flushed*, but not over large, and *a conduit to take away, as it is produced*, every particle of sewage into the sea. I am not speaking of the economy question at all. I am speaking of the HEALTH QUESTION. *The town thus placed*, would, I say, be A MODEL TOWN."

V.—MISCELLANEOUS ANNOTATIONS.

(*a*) *Erroneous Notions regarding the Production and the Accumulation of Sulphuretted Hydrogen.* (Page 10.)

Sulphuretted hydrogen is the most deadly of the gases that result from the putrefactive decomposition of animal matters. Thenard and Dupuytren found that 1 part in 800 of atmospheric air killed small birds in a few seconds. Chaussier found 1 part in 250 was fatal to a horse. More recently, Dr Barker has shown that 1 part in 2100 was almost invariably fatal to birds—1 part in 1800 was certainly fatal; 1 part in 200 killed dogs very speedily, and 1 part in 500 as certainly but more slowly. Dr Letheby finds 1 part in 500 soon fatal to rabbits. Orfila, and other observers, have recorded the fact that this gas also kills by its action through the skin, and that rabbits, ducks, &c., have died within a few minutes after having their bodies (the head excepted) immersed in a vessel of sulphuretted hydrogen. When introduced directly into the blood, the effects are still more powerful; and Weber has lately shown that two drops of a saturated solution of the gas in water injected into the crural vein killed a rabbit instantly, three drops killed a small cat in six hours, and a large cat died after the injection of four drops. The thoroughly reliable character of these facts has been corroborated by many competent observers.

It is, however, well known that, though poisonous as a gas when introduced directly into the lungs or blood, it is one of those gases which is perfectly harmless when taken, dissolved in water, into the stomach—*e.g.*, in Harrowgate or Moffat water, or carbonic acid in Seltzer water.

The deadly potency of sulphuretted hydrogen makes it a matter of much importance that the closest heed should be given to the statements which may be, and frequently are made, regarding the alleged presence of sulphuretted hydrogen in any situation where it can possibly be supposed to affect the health of individuals. I have known several instances of assertions regarding this gas causing exaggerated and mischievous inferences in connection with questions affecting the public health. In one case, the Dumbarton churchyard inquiry, a professional witness stated that "sulphuretted hydrogen was the most noxious gas *which escapes from graves*." And he believed, and stated his belief, that he had demonstrated the evolution of the gas from the surface of the soil of the churchyard. To combat this evidence, Professors Anderson and Penny, and myself, made careful experiments on the surface of the soil—on the fresh soil of newly-opened graves, and on the air of coffins freshly opened, and the results, as regarded the evolution of this gas, were entirely negative. In another instance, that of the old Hamilton churchyard, Professor Penny

and myself had (by permission) numerous graves and coffins opened, and being provided with suitable appliances, we made experiments on the instant, and afterwards in the laboratory conducted careful observations on the soil immediately adjacent to the coffins, and on matters contained in the coffins, with entirely negative results as to the presence of sulphuretted hydrogen. In these instances, the animal matters had been in a state of decay for periods varying from three weeks to several years. While giving evidence at Dumbarton, much surprise and some incredulity were manifested, especially when it was stated that Dr Waller Lewis had, in 1849, inspected from fifty to sixty vaults and catacombs in London, and examined the exteriors of 22,000 and the interiors of 100 coffins, the interments having varied from weeks to centuries, and yet he was unable to discover a trace of sulphuretted hydrogen, except in one instance, and it was so faint that he had some doubt whether it came from the dead bodies. I have frequently applied tests to the atmosphere of dissecting-rooms, and invariably with like negative results. On several occasions I have found it necessary to correct the popular notions which exist on this subject, particularly in connection with "nuisance" cases.

The mistaken view and the false inferences arise from a want of sufficient consideration of two points—1*st*, The *quantity* of this gas that can be formed from decomposing animal matters; 2*nd*, The quantity that is *capable of collecting*, or that is ever *found accumulated* in any situation *where atmospheric air has access*, or where there is running water. It seems not to be sufficiently well known, that *sulphur is an elementary substance*, of which only a very *limited quantity* exists in the human body, or in its excreta. If, therefore, all the sulphur in the human body, or in its excreta, could enter into combination with hydrogen, and form sulphuretted hydrogen, it would still be a small and a definite quantity. Much of it, however, combines with oxygen, and it has various other combinations not disengaged as a gas, many of which are quite harmless in relation to health. Nevertheless, the gas is formed, and in considerable quantity, during the ordinary putrefactive decomposition of animal matters; but it does not *accumulate* wherever it has access to the three great sanitary agencies of earth, air, and water. Earth absorbs and decomposes it; running water dissolves and carries it away; and in air it is *diffused* with such wonderful rapidity that a cubic inch of the gas liberated in an apartment forty feet square can be detected almost instantly on the moment of liberation. It ranks as one of the most diffusible of the gases. It is very little heavier than common air. Owing, therefore, to its light specific gravity, and to its extraordinary power of diffusion, it cannot accumulate to any great extent in situations where atmospheric air has moderately free access.

It can, however, be extricated suddenly in large quantities, as in the opening or cleaning out of the *fosses d'aisance*, where, along with other gases, chiefly carbonic acid—the latter a heavy gas, not readily diffusible, and easily accumulating—it is occasionally disengaged with such rapidity that the miserable workmen employed in the disgusting labour are stricken down by these gases as if by prussic acid, and die asphyxiated. This form of accident is called *plomb*, and the precautions required

against its occurrence are, in Paris, under police surveillance, and are numerous and stringent.

Unless, therefore, under exceptional circumstances, sulphuretted hydrogen does not accumulate in a poisonous degree in situations where atmospheric air has moderate access. Owing, however, to the observations of Parent-Duchatelet, a contrary impression prevails, and there is found in many of our best text-books statements (chiefly based on his authority) to the effect that the air in sewers can contain, and usually does contain, 2 to 3 per cent. *or more* of sulphuretted hydrogen. In 1823, G. de Claubry analysed air from a sewer, and he gives a per centage of 2·99—say 3 per cent. of sulphuretted hydrogen. This seems to have been his first analysis, and in this same year he made another, which gave a result of 0·90, or 9-10ths of a per centage. All his other analyses were made six years later—that is, in 1829, during which year he made 19 analyses of the air in different sewers. In one case he found sulphuretted hydrogen in the proportion of 1·25 per cent.; in two instances he found 1 per cent.; and in the 17 remaining cases the amount did not reach 1 per cent., but varied from complete absence of the gas to 0·95 per cent. If, therefore, this exceptional analysis of 3 per cent. is excluded, and if an average is made of the remaining 20 analyses, I find the amount to be 0.81, a result which corresponds exactly with that obtained by Dr Letheby when he subjected sewage to conditions which favoured the greatest possible evolvement of the gas (see p. 34). In the presence of atmospheric air, as Dr Letheby's experiments show (see page 35), sewage evolves *mere traces* of sulphuretted hydrogen. Regarding G. de Claubry's, or, as more frequently quoted, Parent-Duchatelet's experiments, Dr Christison remarks that "they are scarcely so precise as those of his predecessors;" while Dr Letheby inclines to think that the means which were at the disposal of De Claubry and Duchatelet "were not sufficient to determine the actual proportion of the mephitic gas."

There is, however, another explanation to give of this remarkable per centage of sulphuretted hydrogen, which, as erroneously stated by many British authors, is usually found in the atmosphere of sewers; and it illustrates the facility with which false inferences may be perpetuated in our manuals or text-books by the frequent practice of one author copying the statements of his predecessor, instead of resorting to the original source of information.

Parent-Duchatelet was the secretary or reporter of a scientific commission specially appointed to devise measures for the "cure" of a gigantic *cloaca*, called the Amelot sewer, which had become choked up—had inundated the neighbourhood—and, in the fruitless attempts to clear it out, had caused the loss of several lives. Duchatelet, having observed that the workmen sustained no injury under ordinary circumstances, even when "altogether immersed" in the atmosphere of the sewers, suspected that when serious accidents did occur, they must have their origin in some *sudden development* of the gases caused by *stirring* up the decomposing masses. He was then only entering upon the investigation, and he resolved to test this point by *a special experiment*. He accordingly selected *the very worst part* of the sewer, where the accumulation was greatest, and ventured on a ladder into the pit (20 feet deep),

and remained two or three minutes, suffering only a difficulty in his breathing. He then withdrew, and made his arrangements for collecting samples of the gases "without risk." He had a special apparatus, which was suspended by a cord and lowered into the pit. Then, "instead of contenting himself with collecting the gases at the surface, in the manner that was followed in the case of the other analyses, he *stirred up* and *agitated strongly* the matters with the leg of a very long ladder, and it was *only when the disengagement of the gases had reached the greatest degree of intensity* that he filled the flasks, by the aid of the special apparatus, which held the flasks as close as possible to the surface of the matters from which the gases were disengaged."

The air in the flasks was then analysed by his colleague, De Claubry, who conducted the chemical part of the investigation, and it was found to consist of—oxygen, 13·79; nitrogen, 81·21; carbonic acid, 2·01; sulphuretted hydrogen, 2·99.

The report proceeds—"Such a difference merits the most serious attention, and *shows the cause* of the accidents which our workmen sustained. . . . . The oxygen was diminished in a *frightful proportion*—our other analyses showed at most one per cent. of sulphuretted hydrogen—here we found three per cent., *an enormous proportion*, . . . little more than what is necessary to destroy in an instant not only the strongest man, but even the strongest horse."

In the course of the official report various references are made to this exceptional experiment, and to the fact that there was "no ventilation" in the sewer, &c.; and finally, to prevent any erroneous inferences, the analysis is placed separately from the others, and a farther analysis is given of the air in the same sewer at other times, and which is as follows:—Oxygen, 78·07; nitrogen, 18·01; carbonic acid, 2·03; sulphuretted hydrogen, 0·09.

The *result* of this special experiment, surrounded by so many exceptional qualifications, has, however, been handed down by one writer to another, not only without a hint that it was obtained by exceptional means, but with a bare simplicity of statement that it is the *common* or *usual* state of things *in sewers!*

The fact that rats and mice were found thriving in the sewers to which Duchatelet refers, and in which, he says, workmen were able to labour—while, as we know, the same animals, and men, exposed elsewhere to the effects of the gas in question, in proportions very much less than three per cent., are speedily killed—has led some close observers to question the accuracy of the analysis itself. The mischief, however, has arisen entirely from erroneous statements of the nature of the experiment, just as there was an erroneous representation of Dr Letheby's experiments (page 19), and from these early errors, or misrepresentations, a shoal of authors have scattered broadcast the germs of dangerous practical conclusions.

The knowledge I have long had of the facts referred to—regarding the actual properties of the gas, and of the mistaken notions that prevail regarding the amount that is usually furnished from decomposition of animal matters, or that accumulates in atmospheres—caused me to suspect the accuracy of Dr Fergus' Table; and apprehension of the mischievous inferences to which the exaggerated statement

might give rise was the motive that induced me then, and induces me now, to direct special attention to the quantity of this gas that exists in sewers of the worst kind. In Glasgow sewers (see p. 14 *et seq.*) there can only exist "mere traces."

Dr Parkes says, and I concur in his common-sense view, "What is wanted is *to know the limits of impurity*." This I have endeavoured conclusively to show.

(*b*) *It is in those Localities that have no Sewers that we find Disease most active.*
(Page 21.)

Water, which has served all the uses of a household, becomes filthy from the rinsings of animal and vegetable food, the washing of articles of clothing, necessary personal ablutions, &c. Where there are no sewers, the liquid impurities of the household are cast out from the dwelling. The paved ground and open drains are, in consequence, rarely dry, but, on the contrary, are generally wet and soaked, and in puddles from the "slops." The invariable companion of this "gutter drainage" is the abominable "*midden-stead*," and into it the ashes, night soil, and all other solid refuse, both animal and vegetable, from the adjoining houses, is collected, and there it accumulates and decays. The ground underlying and adjoining the midden-stead is "excrement sodden," and its pernicious qualities are carried *downwards* with every rainfall percolating the earth in the direction of a "well," or, it may be, leaking into a service pipe carrying water supply. The noxious exhalations that are carried *upwards* by evaporation from these excrementitious matters contaminate the atmosphere, and the neighbouring inhabitants live in a really malarious climate. There exists, with such a state of things, many concomitants that lie in the way of domestic and personal cleanliness, and produce habits of carelessness which rapidly lower both the moral and physical conditions of a population.

I have long been satisfied of these truths, and at one period they were so forced upon my observation, that I had it in view to prepare a comprehensive treatise on the *morbility*—that is, the diseases which prevail among the poor.

From 1843 till 1849 inclusive, I acted as parochial surgeon, and had charge, at first, of a suburban, and afterwards of a central city district. The latter, although half a mile in length by a quarter in breadth, furnished fully nine-tenths of all the diseases of an endemic and epidemic character from an area of 280 yards in length by 120 in breadth. I have thus described this "disease preserve," with which I had long a daily and hourly familiarity.* "The locality consists chiefly of five or six narrow streets, and about a dozen of the dirty 'closes' or 'wynds' for which Glasgow has acquired a discreditable notoriety. *There are very few sewers, or gratings which conduct to sewers*, and the greatest *amount of drainage consequently takes place on the surface*. The receptacles for filth consist of large open dung-steads, with an open window, through which the refuse is cast, and in these places of deposit *the filth accumulates, till it is in such quantity as to necessitate the removal of a portion from want of space for further deposit*. The cases are exceptional in which regular

* "Observations on the Epidemic Cholera of 1848-9," by James Adams, M.D. Edinr. 1849.

arrangements are made for this purpose, and in all they are miserably inefficient. Thus, in three of the worst closes of the district, I occasionally observe a frail old pauper paddling about the principal dung-stead with a broom or shovel, and the entire sanitary operations of these localities are due to his solitary exertions, in return for which he receives the shelter rent free, of a wretched cellar in the neighbourhood.

"The supply of water is very scanty—a single pipe or fountain is made to suffice for one or more of these closes, and the trouble of going such a distance, as is required, in order to procure a supply, seems to be sufficient excuse for the people to restrict the use of this essential element to the narrowest limit compatible with necessity."

In this field of study, the more I saw of the diseases prevailing among the poor, the more strongly I was satisfied that good sewage and an abundant water supply were necessaries for healthy existence, and in connection with these sanitary requisites it became specially impressed upon me that the proportion of the diseases that in great measure are preventible—viz., epidemic, endemic, and contagious—as well as the mortality arising therefrom, was much greater among the poor than among the general population. I set myself to elucidate these and several other points in which I felt interested. I applied to the proper authorities, and obtained possession of a very large number of the old "registers," or "case-books," of the district surgeons, and, with the assistance of a hired clerk, I laboured constantly for fully six months in extracting and tabulating all the data these registers could furnish. I thus noted and arranged in various forms the details of upwards of 150,000 cases of disease, and in so doing, the localities of disease, the streets, closes, or tenements which gave the largest returns became necessarily very familiar, and from time to time I made special inquiries regarding some case or group of cases more than usually interesting. At length I came to the belief that a map showing the *unsewered spots* of the city would faithfully represent at the same time the localities of fever and of other forms of disease often endemic. Accordingly, I got a quantity of skeleton maps lithographed, and aided by some friendly coadjutors, I laid down the lines of many gutter-drained districts. This was a serious labour, for there was little reliable information at that time. The municipality had just been extended, and our excellent master of works, Mr Carrick, although very willing to aid me, was now in office, and only beginning that course of reconstruction and extension of the Glasgow sewers for which he has received so much deserved commendation in every quarter where the value of such labour is appreciated. It was, therefore, under the influence of this teaching that I formed my opinions regarding the effects of sewerage on a town population.

This is not the place to go into details, but I may refer to two sets of the kind of facts which serve to show something of the over-proportion of preventible diseases which affect the poor.

Of 103,136 cases of disease of all kinds occurring among the poor during the years 1838 to 1848 inclusive, epidemic, endemic, and contagious furnished 56,049 cases, and of these 51,068 consisted of fevers and bowel complaints. I can give no similar

information regarding the morbility of the better class of the population, but many facts show that there cannot be so large a relative proportion of the epidemic, endemic, and contagious diseases.

I have calculated from several sources the subjoined Table. It shows the per centages which deaths caused by epidemic, endemic, and contagious diseases bear to the total number of deaths resulting from all causes:—

			Deaths from all Causes.	Deaths per cent. in Epidemic, Endemic, and Contagious Diseases.
Selected lives,	Scott. Amic. Ass. Soc.,		695	18·7
English rural districts,	Registrar-General,	...	29,693	20·3
„ towns,	Do.,	...	47,953	26·6
Glasgow, general population,	Dr Alex. Watt,	...	35,000	44·8
„ poor,	Dr J. Adams,	...	4,987	48·0

An observing mind will at once infer, from the results so broadly displayed in the above data, that the morbility and the mortality affecting different classes of the population are materially affected by different circumstances. Of course the same conclusion has been often reached by independent observers. I have, to the best of my ability, searched into the details of the data, and my conviction, founded on independent inquiry, is that in the poorest localities of a town there exists, with a view to *the general good*, a necessity for everything that can come under the name of cleanliness. The ignorance, faulty habits, and daily occupations of the poor are only too apt to render them insensible to the physical advantages of the golden maxim, that cleanliness is next to godliness. Unless there is good water supply for necessary use, and an easy and inoffensive mode of disposing of the water after use, there cannot be cleanliness. It would be irrelevant to discuss the immediate causes of fever or diarrhœa, or the various diseases that advancing medical science is inclining to term *preventible*. It is sufficient to affirm that a gutter-drained district—a district that has no sewers carrying off, by the cleanly agency of water-carriage, the solid excrementitious matter of the population is a district of malaria—that the health of its indwellers becomes deteriorated—the vigour of their bodily constitution becomes lowered, and a condition of the general health is produced that disposes the organism to receive the impressions of certain *very common, very deadly*, and *very spreading* diseases.

The hardships which the poorer class—living under a municipal rule that tolerates the midden-stead and cesspool—have to bear are unquestionably very grievous. At this moment I call to mind many instances of the aged and infirm decent poor, who for years could rarely descend from the upper flats of the tenements where they had their abode, and who had very scanty aid from relatives and neighbours in maintaining in some degree a cleanly house and a pure atmosphere; and I review the terrible disadvantages under which many wives of operatives, mothers of growing families, maintain a struggle to preserve some measure of decency in their household arrangements. In times of sickness, in inclement weather, &c., how hard

is their lot, and how great are the obstacles they encounter in the preservation of conventional morality and habits of common decency.

I am quite unable to see why water-closets should be considered unsuitable in any well-sewered district, with abundant water supply. They may get out of order, like other arrangements, and they require supervision, just as the common latrines. There are various modes in which they may be modified to suit special localities. In any form, and in any locality, they can be made a nuisance. I am informed at the present moment of a discreditable state of things existing in costly premises within a few yards of the New Club, and I know that like exceptional instances may be found anywhere. The poor who live amid these unfavourable conditions have, however, very little ability to alter their external relations. It is, therefore, obviously the duty of those having better knowledge and unblunted instincts to exert themselves for the removal of the obstacles which lie in the way of the maintenance of the personal and domestic cleanliness of those who are ignorant and lack the power. In so doing, they will be acting in accordance with the Christian precept, "Love your neighbour," and they may rest assured that they are thereby best securing their own personal advantage. There is in a civilised community no real division of interests. We are all liable to suffer from each other's maladies, and have, therefore, a direct interest in each other's wellbeing. The physical ailments that are the lot of the ignorant and unprovided poor filter through a thousand unperceived channels from the abode of Lazarus to the mansion of Dives.

There has not been at any time in Glasgow a want of public spirit in meeting the burdens of sanitary improvements, but until a comparatively recent date that spirit was only awakened to action under the stimulus of public alarm. With other medical men, I have, on several occasions, shown that these measures were erroneous in principle, and that "so long as the practice and hygienic measures of our public men" are not guided by intelligent counsel, "so long will their personal energies and their influence be withheld from devising and carrying into effect other remedies which are better calculated to *prevent disease*, or at least to overcome those causes which are known to foster its growth, and aid very greatly its extension." I have said, "I place no value whatever on those superficial measures adopted during the temporary excitement which occurs during times of epidemic sickness. No medical man of experience in the condition and diseases of the poor, whose opinion I have obtained, considers that the bustling proceedings I allude to, in the way of lime-washing, fumigating, burning of old clothes and straw-beds, &c., effect any real benefit in preventing or breaking the force of the epidemic. . . . These measures may have the effect of allaying the apprehensions of that timid portion of the public who have least cause of fear, by giving colour to the usual newspaper announcements that the 'authorities' are fully alive to the emergency, and are adopting all necessary precautions,'" &c. When, however, the alarm has passed away, I have shown the generating influences that are permitted to remain, such as "the dark, damp, filthy, and noisome labyrinths of narrow wynds and deep

courts," "without sewerage or water supply" requisites, "the want of which in large towns is incompatible with healthy existence."*

This was the state of things at the period to which I am referring, but I am happy in having the opportunity of stating—from personal verification of the fact—that much of what I have described as existing in the district of which I had experience (and the same description applies to many others) has passed away. In a steadily progressive manner, changes are being effected in the poorer districts of the city, the necessity for which was long recognised, and called for by numerous eminent medical men of Glasgow, who have given heed to its actual condition, and to its shortcomings in relation to sanitary requirements.

In any measure designed for public improvement, it is not at all times easy to ascribe the true credit of the initiative; but it is the fact that, during the *regime* of our last Chief Magistrate, an officer of health, Professor Gairdner, was appointed, and, under his guidance, the changes referred to are taking place. The public prints have recorded the name of Provost Blackie, and that of Councillor Ure, among those of our leading municipal authorities who have steadily, and in an appreciative spirit, supported the measures devised by that public officer; but it is only those who can contrast by personal experience the state of things that formerly existed with our present stages of progress who can understand how much the thanks of the citizens are due to these men.

(c) *Noxious Gases and Organic Poisons.*

The general public are often perplexed and led into serious error in consequence of not recognising the great distinction that exists between the effects produced by *gases of known composition* and by the *organic* poisons.

Among other modes of production, some of these *gases* are the results of the decomposition of sewage matter, viz., carburetted hydrogen, carbonic acid, sulphuretted hydrogen, &c. Exposure to the concentrated action of these gases will kill by poisoning speedily, or within a few hours, or after a lapse of days, just as certainly as prussic acid, or laudanum, or arsenic will kill by poisoning. If the gas does not immediately *poison*, or if it has not been imbibed in a fatal dose, the individual begins to recover as soon as he is removed from continued exposure; and whatever may be his symptoms or his sufferings, these cannot be *communicated* to another person.

The mode of action of the organic poisons—about fifteen in number—is altogether different. Small-pox, typhus fever, and glanders furnish good examples. The individual who suffers from their effects exhibits a series of symptoms following a regular course, subject to modification according to the severity of the dose, state of bodily habit, &c. These symptoms constitute *disease*, which, in the case of most of the organic poisons, and probably of all, is *communicable* from the person affected to another in health.

* Results of the Treatment of Fever in Glasgow Hospitals and Out-door Practice Contrasted. James Adams, M.D., Edinburgh. 1859.

The essential distinction, therefore, is, that in the one case—that of the gases—the symptoms diminish gradually, and pass away when the individual is removed from the gas; while in the other—that of the organic poison—the symptoms go on developing from the time the poisonous dose is received. The symptoms produced by the gas can never be communicated from one to another individual. The symptoms produced by the organic poisons can be, and frequently are, communicated to other individuals.

The best knowledge we possess of the nature of these organic poisons has resulted from the experimental investigations of Dr W. B. Richardson. As regards their special properties, they are all separable, and Dr Richardson has separated some of them—*e.g.*, hospital fever. In the course of some diseases, as small-pox, they are separated by nature in an almost pure state. Dr Richardson says—"We can take certain of these organic poisons *from the body*, reduce them to an extract, and from that extract produce a purer substance containing the true poisonous matter. This may be then communicated to another animal, and will give to the body of that animal the same poisonous property as was possessed by the poisonous substance first introduced. Again, the poison can be passed on and made to affect another animal, and so through a series of subjects. . . . . I may state that *all the organic poisons are perfectly inodorous*, have no smell whatever, and that *no communicable disease ever depends upon the gases of decomposition*, viz.—carbonic acid, sulphuretted hydrogen, ammonia, phosphuretted hydrogen, or carburetted hydrogen."

Regarding the properties of gases or polluted atmospheres, I might refer to many observers, but probably to none who have given the subject more careful consideration, based upon original research, than the late Dr R. D. Thomson. In his "Report on the Examination of Certain Atmospheres," furnished to the Board of Health in 1855, he says:—"There are no facts with which we are acquainted having any tendency to indicate that the respiration of vapours is capable of producing a disease characterised by a regular type, or that gases act physiologically otherwise than as diluents of oxygen, or, as simple poisons. Neither is the evolution of gases alone from organic matter calculated to induce such diseases of endemic nature as are recognised by a regular sequence of symptoms. . . . . The products of putrefaction of an elastic gaseous nature are not the chemical substances most to be dreaded in the production of disease. . . . . It is the fresh, undecomposed matter which is alone capable of propagating the noxious influences in the instances to which allusion has been made; and any agent which interferes with the integrity of the morbific molecule destroys its capability of inducing a regular disease. . . . . The practical bearing of this conclusion is, that we are not to expect any information respecting the morbid condition of the air from experiments on a small scale upon the chemical constitution of the normal gases in any given atmosphere, or even on the minute traces of abnormal gases, which may be detected by the most delicate appliances of science."

To destroy the poisons, either organic or gaseous, the best antidote will be found in the great natural sanitary agencies of air and water. Referring to organic

poisons, Dr Richardson has found that "as we progress in diluting them with water *they entirely lose their active power*." The effects of free exposure to air in modifying and destroying the noxious action of gases disengaged in respiration, combustion, and chemical manufacturing operations are so familiar as to require no illustration, but I am tempted to give one because of its direct bearing on the present discussion. I quote from Dr Richardson:—"The influence of the poisonous gases to which I have referred does not differ very widely from the influence of chloroform, or of any volatile bodies which produce sleep. Dr Barker of Bedford most conclusively shows that the mere noxious exhalations from sewers produced only temporary effects. Dr Barker carried out a series of experiments which we may call crucial. He made a chamber to hold live animals of large size. This chamber was ventilated from a sewer, and week after week animals were made to breathe the sewer air. These animals all showed peculiar symptoms—something like the symptoms which we see in the close cottages of the poor during the winter time, when there is great overcrowding and a great accumulation of bad air. They sometimes showed symptoms of vomiting; they had heat of skin, quick pulse, and loss of appetite; but this was invariably the fact—that within an hour after their removal from the chamber they began to recover. The symptoms were from the distinct effect of the air from the sewer, and had nothing to do with the organic poisons which produce specific disease."

From what has been adduced to show wherein the real danger lies, the general reader will concede that I was justified (p. 9.) in stating that undue weight is often attached to the names of chemical compounds when used in connection with sanitary questions; and he will understand how very small may be the result, even when attained, of the fussy, costly, and practically inoperative appliances that are eagerly vaunted for removing the *smell* from sewage matter; and he will better appreciate the danger of permitting "filthy facilities" for such matters, even when *deodorised*, remaining within or about the precincts of our dwellings.

(d) *The Mechanical Detail as to the proper mode of connecting Water-closets with the Sewers.* (See pages 7, 29, and 45.)

Although thoroughly aware of the fact, that there is no difficulty in having proper arrangements which will prevent the reflux of unpleasant emanations from drains and sewers into the interior of our dwellings, I have deemed it advisable to have the statement from a thoroughly competent authority, and therefore subjoin a letter from Mr Robertson, C.E.:—

123 St Vincent Street,
Glasgow, 30*th November*, 1868.

My Dear Dr.—In reply to your inquiries made a few days ago, as to the ventilation of the drains and soil-pipes in houses, I have to state that the lead soil-pipe, into which jaw-boxes and water-closets in the several flats of a tenement discharge, is a vertical continuation of the fire-clay pipe-drain from the street sewer to the house, and it terminates with an open end above the ceiling of the upper flat, or in the open air. Between the street sewer and the house the pipe-drain is trapped, to prevent vermin and gases passing into the house from the sewer; and the several branches from the jaw-boxes, water-closets, or bath-rooms, are also trapped, so that none of the gases or vapour, even in the soil-pipe, *can escape* into the house.

These are the arrangements made in all *properly drained houses*; but I have no doubt you will find many *exceptions* to it in Glasgow and elsewhere.

Yours truly,
WILLIAM ROBERTSON.

Dr J. Adams, 62 Cambridge Street, Glasgow.

(e) *To the Editor of the North British Daily Mail.*

Sir,—A letter from Dr Fergus in this day's *Mail* on the "Sewage Question" contains the following passage:—"'J. A.' says that the second essayist showed that the data on which the essayist (Dr Fergus) based so much of his conclusions were 'erroneous, delusive, and unsubstantial.' Now, the fact is, I quoted Dr Letheby from Dr Parkes' work on 'Practical Hygiene,' and at the close of the meeting Dr Adams shifted the responsibility from my shoulders to his (Dr Parkes'), Dr A.'s own assertion being the only proof brought before the Society that Dr Parkes was in error."

There is here a mixing up of varied occurrences, and a challenge for proof that can only be put right by a publication *in extenso* of what I actually did say on this subject. Pending this publication, which will be as speedy as circumstances can allow, I request you will do me the favour to give place to the following statements, the object of which is to keep clearly before the minds of those who take an interest in this controversy the issue that has actually been raised:—

On the 2nd of October, Dr Fergus read a communication to the Medico-Chirurgical Society, and exhibited a Table containing certain data, or alleged facts, on which he mainly based his conclusions, regarding the relative composition, quantity, and quality of gases generated in sewers. He attached the name of Dr Letheby to this Table, and stated that he was its author. No remarks were made at this meeting, the discussion being simply adjourned. At the following meeting I opposed his argument, and, *inter alia*, stated that the Table bore on its face such palpable error that I was certain it could never have been issued by Dr Letheby, whom I knew to be accurate and reliable; that, accordingly, on turning to Dr Letheby's works, I had ascertained that this Table had no place there, and that it must therefore have been made up by Dr Fergus himself, or by some one whom he had too implicitly trusted, from data which he had altogether misapprehended. Those statements I then and there satisfactorily proved. This I think, and this I affirm.

At the close of the debate, and when winding up the discussion in his reply, Dr Fergus explained that he had not named Dr Letheby as the author of the Table on the authority of Dr Letheby's own writings, but had copied at second-hand from

a work by Dr Parkes. I thereupon, animated with a kindly feeling, willingly conceded that the statement, now for the first time made, showed that the Table had not been made up by Dr Fergus himself, but, as I had previously suggested as an alternative possibility, by another person whom he had too implicitly trusted. The illegitimate use made of this concession constrains me now to point out the exact extent to which the responsibility has been shifted by me from Dr Fergus' shoulders. The builder who is charged with having erected an edifice upon basement-timbers that are thoroughly hollow and rotten may have his explanation willingly admitted when he states that he himself did not grow the wood nor dress it into shape. But this does not shift from his shoulders the responsibility of having selected and used the material. By this illustration I mean to declare that my admission of the correctness of the alternative I had with confidence predicted—viz., either a blundering compilation by Dr Fergus himself, or by some one he had implicitly trusted—does not, in the very smallest degree, relieve Dr Fergus from my criticisms on his argument, which, being mainly based on the data or alleged facts professedly furnished by the Table referred to, necessarily partakes of the error, and vitiates all the conclusions derived from it.

But Dr Fergus still, to my amazement, maintains that there are no errors, and that my own assertion is the only proof I have given of these errors. There is, therefore, now a necessity for the publication of my proof *in extenso*, and this I now promise.

It will show to the most limited capacity, as I hope, that Dr Fergus could not possibly have given a more unfortunate illustration for himself than when he says that my position reminds him of a party "who, being told that facts were against him, got out of his difficulty by exclaiming, 'So much the worse for the facts.'" He who makes use of data (*i.e.*, alleged facts), unless he puts forward the caveat that he takes them upon trust, makes himself responsible for their accuracy, the more especially if he comes to conclusions which only the accuracy of his assumed data can warrant. If the alleged facts are against him, and yet are no facts at all, then so much the worse for the facts, or rather for the man who constructs his whole theory upon them.

I am, &c.,

JAMES ADAMS, M.D.

62 Cambridge Street, *Nov.* 2, 1867.

GLASGOW:
PRINTED AT THE CITY STEAM PRINTING WORKS, ANN STREET.

SANITARY SIFTINGS,

OR RESULTS OF

SEWAGE SYSTEMS

COMPARED.

BY A NAVAL OFFICER.

LONDON:
E. & F. N. SPON, 48, CHARING CROSS.
1868.

Price Sixpence.

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SANITARY SIFTINGS.

Mens sana in Corpore sano is an ancient adage expressing the connection that had been observed to subsist between a healthy body and a sound mind; and *ceteris paribus*, the greatest results from mind and morals, and such measure of pleasurable feelings, as consists in a good physical condition, can only obtain when the body is performing all its functions well, and without being subject to any injurious or depressing influences.

As the preservation of health and prolongation of life is a primary condition of well-being, so effective measures to secure these must be a primary obligation upon the Ruler of a State.

That which seems to exercise the most extended influence on the health and longevity of any community is the quality of the air breathed, and that of the water drank, and these, again, seem to be most extensively affected by the manner in which sewage matter is disposed of.

The numbers of a community may be limited by two causes:—

1st.—Bad sanitary arrangements.

2nd.—By the insufficiency of food to support an increase.

The effects of these causes will increase in a greater degree with every increase of the population, making it more imperative to adopt correct sanitary measures as the population increases, or is large within a limited area.

It has been objected that the sewage question has been often too exclusively viewed from a sanitary point; yet the greater or less production of food, arising from the more or less judicious disposal of the products of the food consumed, resolves itself into a sanitary question. Any one acquainted with the condition of the poor knows that

life and health suffers in their case more from a deficiency of food than directly from disease.

Even when there is a large quantity of food, there is often a deficiency in some of the ingredients necessary for health and longevity.

This will take place, even before the land has become barren, which it will do when the ingredients taken out of the soil are not returned, which never is wholly the case when the sewage matter is washed into the sea, or is unduly wasted before it reaches the land to be fertilized.

Moreover, a larger than proper quantity of such food must be consumed to obtain a sufficiency of some one necessary ingredient, which throws an undue and injurious labour on the human system. The correlation of laws is so intimate that any violation of one entails difficulties from another. The order of Providence is a circle of nutrition from earth to plant—from plant to animal and man—back from animal and man to earth—nothing wasted, all precious—an order of perfection. It is hardly necessary to offer elaborate proofs of the injurious consequences to life that arise from allowing sewage matter to ferment and give off its noxious gases, polluting air and water; this is admitted in the expensive schemes that have been undertaken to mitigate or prevent the evil by getting rid of sewage matter. It being held that any sacrifice of wealth must be made to retain health.

Suffice it to say that Endemics and Epidemics of various kinds are generated, and various dangerous diseases propagated and perpetuated by the escape of these gases into the air, and when this matter is allowed to run off into the streams the water is poisoned, the fish destroyed, the water rendered unfit for use, and even when employed to cleanse the body some of the poison is imbibed by the skin.

It is clear then that the great desiderata must be to

prevent the diffusion of the mephitic gases which are so injurious to health, or better still to prevent their formation.

Though not easily perceived it is no less the fact that the atmosphere is greatly deteriorated by the emission of gases from the open privies throughout the country from the stables, piggeries, slaughter houses, knacker's yards and farm steadings, and there can be no reasonable doubt but that the passage of such gases into the air should be prevented, no less for economic than for sanitary reasons, and especially should this be attended to during the prevalence of diseases; as no doubt the wholesale deaths amongst men, fowls, pigs and cattle are to be traced to carelessness arising from disbelief of the danger from sewage emanations. To prevent disease or limit it, dried earth should be extensively used in stables, piggeries, and cow sheds. Accepting it as proved that the gases emanating from sewage are injurious to life, and that it is a double blunder, inasmuch as in addition their formation deprives the land of a large and active portion of the fertilizing property that ought to be restored to it, we may profitably consider the various schemes that have been devised for dealing with sewage matter.

1. *Filtration through artificial beds*—to extract the valuable ingredients for agricultural purposes. On this head it has been well said in the "Builder" that—

"There is hardly a single district of any importance under the jurisdiction of the General Board of Health which has not at some time or other been more or less engaged in attempts to bring this theory into practice."

"*Amid all these efforts, no satisfactory case can be pointed out in* which valuable results have been obtained from the adoption of artificial filter-beds; and it is now generally acknowledged that organic matter held in solution cannot be extracted by filtration. What is extracted is simply

the solid matter suspended, that which is in chemical combination being practically untouched."

"Sand, gravel, lime, charcoal, animal and vegetable, alum, shale, magnesium, and an indefinite number of purifiers, have each had their turn; have undergone every variety of combination and permutation; and have invariably met with the same fate."

"It is but recently that at Aldershot, the eminent civil engineers who carried out the drainage of the permanent camps, erected near their outfall costly and elaborate beds of prepared lime, &c., through which it was proposed to filter the sewage on its way to the Blackwater. These works may now be seen (1867), a square, solid fabric of masonry, with all the signs of recent erection, silent, and utterly abandoned. It was found, as might have been expected, that the fluid, although by no means freed from its offensive sewage matter, became so charged with lime during its passage through the beds, that in a very short time all the fish for miles down the river were killed, and an injunction from the Court of Chancery was obtained, commanding the Government to stop the works."

"At the oft-quoted Croydon, amongst the many schemes forced upon the Local Board by the proprietors of the river Wandle, filtration in every form was tried,* with such results as are recorded in the extensive works which are now rapidly falling into ruin near the site of the present irrigation tanks at the outfall."

"At Wakefield, the adoption of Mr. Spencer's magnetic carbide filter for the water supply does not appear to have been devoid of success, as there is undoubtedly a material improvement in the water obtained from the river Calder after filtration; yet in the gross and polluted state of that river the removal of an immense amount of organic and inorganic matter in suspension, does not by any means

* Amongst other processes tried, were, — filtration through charcoal; Higg's patent lime process; treatment with carbolic acid and per-chloride of iron. Mr. Latham, Leamington Congress Papers, p. 139.

destroy the dangerous condition of the liquid. Even yet, the filtered water placed in a newly-washed decanter throws down a precipitate which presently turns putrid, indicating the noxious presence of nitrogenous matter or ammonia."*

"At Rugby, Mr. G. H. Walker, the lessee of the Rugby sewage, says that the filter-bed did more harm than good, inasmuch as it was always full of putrefying matter, and the sewage flowing through it passed into the river in a fouler state than before."†

"Coventry, Leamington, Leeds, Leicester, Nottingham, Carlisle, Tottenham, Bury St. Edmund's, and other towns have witnessed the failure of artificial filtration to meet its required purpose. Concerning artificial fitration, the following clause is extracted from the report of the Committee on Metropolis Sewage, 1864:—'No efficient artificial method has been discovered to purify, for drinking and culinary purposes, water which has once been infected by town sewage. By no known mechanical means can such water be more than partially cleansed; it is always liable to putrefy again. Processes of filtration and deodorisation cannot, therefore, be relied upon to do more than mitigate the evil. Water which appears perfectly

* Third Report of Rivers Commission, Aire and Calder, 478 and 2,201. The Calder at Wakefield is in a state of extreme pollution, draining in its course thither an area containing 460,000 inhabitants, the whole of whose sewage passes into the river, which, moreover, is polluted in every imaginable form by the refuse of no less than 1,200 manufactories of various kinds. To this pollution, Wakefield, a manufacturing town of 20,000 inhabitants, adds the contents of its own sewers, and the discharge from its own manufactures; and having done so, draws from the stream three-fourths of its own supply (vol. i. p. 46).

In an analysis of the water of the Calder, 1864, Mr. Fowler, surgeon, found five varieties of animalculæ, decaying muscular fibre, constituents of fæces, several varieties of vegetable life, and other noxious matters. This water was at that time drunk by the people of Wakefield, without filtration (vol. ii. p. 18.)

† Rep. Met. Sewage, 1864: 3728-29.

pure to the eye, is sufficient, under certain conditions, to breed serious epidemics in the population which drinks it." "Soils, however, and the roots of growing plants, have a great and rapid power of abstracting impurities from sewage-water,, and rendering it again innocuous and free from contamination."*

2. *Deodorisation and Precipitation of the Organic and Inorganic Matter.*—As the alchemist of olden time passed his life in the vain pursuit of the philosopher's stone or the elixir vitæ, so in the present age the resources of chemistry have been wasted in the endeavour to extract wealth by precipitation into a portable and concentrated manure, of the valuable parts of sewage."

"The history of the Patent Solid Sewage Manure Company's works, at Leicester, with such names as those of Robert Stephenson and Professors Aikin and Taylor as the chief proprietors, and that of Wicksteed as projector and engineer, forcibly illustrates the errors into which a too keen enthusiasm may lead men of acknowledged reputation. The capital is reported to have been £40,000, and seventeen steam engines were required for pumping the sewage. Two reservoirs, 200 ft. by 44ft., were constructed, and over these were erected ware-houses, engine-houses, &c. Very hopeful reports were issued by Mr. Wicksteed, and the attention of very high dignitaries was directed to the enterprise, which after an enormous expenditure, collapsed into utter ruin as a commercial speculation, and now is ranked as one of the most signal failures on record."

"At Tottenham, the process of deodorisation and precipitation was tried with the same want of success, the works being now abandoned. The like result has occurred at Bury St. Edmund's, Croydon, Leamington, Coventry, and many other places.

* Rep. Met. Sewage, 1864, p. vi.

"In Paris, some years ago, gigantic reservoirs were excavated at Montfauçon, into which all the filth of that city was conveyed in covered carts, for the purpose of being converted by the action of sun and wind into a solid and useful manure or *poudrette*. The stench from these pools was intolerable, and bred putrid fever in the hospital in their neighboorhood. The nuisance at Montfauçon, however, did not arise from what is now understood as sewage, *i.e.*, the *contents of our* sewers in their dilated condition, *but from the night-soil, consisting chiefly of urine and excrementitious matter.*"

Thus, the water system that is in use in London, Croydon, and other places, only partially relieves the evil; while these varied schemes and signal failures had for their primary object the utilization of the fertilizing matters in solution, it was hoped that they would also subserve the ends of health—with what little success we may gather, from the fact, that in no case has there been any attempt to prevent the generation of the dangerous gases. We now consider (1) other plans proposed for mitigating the evils arising from the escape of gases into the air and waters.

2. For *preventing* their escape into either air or waters; and

3. For preventing their formation.

There are two systems which propose the removal of sewage by water carriage, differing professedly in an economic point of view, but both defective in this, that they propose only to mitigate the evil.

Thus in the water system that is in use in London, Croydon, and other places, whatever the relief afforded may be, a very serious and growing evil remains in the fact that it is indispensable, as stated by Mr. Bazalgette, that "all sewers should have free ventilation into the open air, or the gases generated in them will escape through the untrapped house drains into

the houses, where they become dangerous and offensive." Moreover, without such ventilation it would not be possible for men to enter the sewers to cleanse and repair them.

All propositions to destroy the gases by fire have failed, and a complete system of ventilation by furnaces and chimneys in London would cost nearly half a million of money, and upwards of £200,000 a year, exclusive of labour with other expenses to keep them up; while the result would be most probably an utter failure. The only other substitute proposed was that of flushing the sewers with 42 million gallons of water additional. But as the existing waterworks could supply only 5 millions additional that scheme is impracticable. Were it otherwise, water would not be a remedy, for the more water the more smell, as it supplies the hydrogen for forming the deadly sulphuretted hydrogen of sewage.

The London Medical Times, March 23, 1861, says, "Now the first advice we give is, not to take any house close to the line of a large sewer, unless the number of favourable circumstances are such as completely to outbalance this disadvantage, and disadvantage we hold it to be, because we believe as an important fact that *more deaths and illness occur along the line of the great sewers than elsewhere.*"

Then as to the portion which is removed, as in the case of Croydon, there is a serious evil; though a further attempt to mitigate the danger is undertaken by separating the solid matter. This, however, is done in open tanks which emit, especially in warm weather, an overpowering effluvium; while the liquid which is passed along channels to irrigate fields near Croydon and at Norwood, gives off noxious gases, especially so from the channels through which it is conveyed to them. After it has irrigated the fields, it is said indeed to be clear and inodorous, but it is still far from being innoxious, inasmuch as it destroys the

fish. And Professor Voelcker, according to the Economist, Feb. 1867, "has repeatedly analysed the clarified water of sewage after it has undergone the purifying influence of irrigation, and in the majority of instances has found such water, though clear and free from smell, almost as unfit for drinking, cooking, and washing purposes as it was in its filthy condition."

This must be so; for though earth possesses the power of deodorising and of absorbing all the ingredients necessary for plant life, it can absorb only a limited quantity and kind, suitable for the plants that may be grown on it, and the earth must be brought into contact with the sewage to effect this, and this is done only to that limited and insufficient extent upon land covered with grasses, while the quantity generally put on land irrigated is so great, that a large portion passes off, still saturated, to poison the streams and springs near. The farm at Croydon comprises 312 acres, the crop raised on which brings annually £1800, but the value of the sewage passed over it is £17,500, therefore seven-eighths is wasted, and the air and water poisoned in that degree.

The Registrar General has shewn that 78 per cent. of the deaths has been due to the use of impure water—rendered impure from the presence of sewage matter. It has also been shewn, that since the introduction of water-closets, owing to the lowering effect of the poisons emanating directly and indirectly from them, the type of disease has been altered and become more dangerous. Dr. Richardson has told us that water is the active agent in rendering these poisons active. As stated in the *Lancet*, 100 cases of fever at Tottenham were distinctly traced to the water from the sewage works that irrigated the fields in the neighbourhood. Dr. Macadam says, "the irrigated meadow is not so healthy as ordinary pasture land."

Irrigation, as employed in Italy, has been alluded to with favour; but Dr. Antonio Capelli, in answer as to

how the irrigation acts on the health, says—"First, in producing every kind of ague; secondly, in producing other forms of disease, such as neuralgia, rheumatism, chest inflammation; thirdly, in sometimes producing pernicious remittent fever, which often kills in a few days."

Dr. Capelli "regards the cesspool as a safer receptacle for sewage matter than the open ground," doubtless as confining the evil.

We may further quote a remark of Mr. Thorwirth of Berlin, who is an advocate of irrigation, in proof that the smell is not a sufficient test; he recommends that the "lands to be irrigated should be a mile or so away from any human habitation." "Not by any means, he adds, on account of any unpleasant smell arising from them, *but only because they are not healthy.*" "Organic poisons are perfectly inodorous, having no smell whatever."

Irrigation could not be carried out in many places from the fact of their lying so low as respects the adjacent land, or from the extensive inequalities of the land, or from the great expense attending the obtaining a sufficient supply of water, without expensive water works, pumping-engines, straining tanks, &c.

Secondly, it could not be carried out during frosty weather, which uniformly damages the pipes of water-closets even-in this climate, while in North America we know they are an intolerable nuisance, and injurious to health, owing to the disorder frost throws them into.

There is another system of removing sewage by water which has yet greater defects than those mentioned, though the sewage is in a more valuable condition, because less diluted with water. Yet because the gases are in a more concentrated, and therefore more dangerous form, so those which are allowed to escape into the streets or escape by the lifting up of the plugs of the water-closets, are more injurious to health. While stoppages from the limited quantity and power of water are more frequent, and so

also are the openings for repair and all their consequent expenses more large and numerous.

In both systems the cisterns are in connexion with the water-closets, and hence there is a frequent rise of the foul gases into the former, by which the drinking water is poisoned, and to which may be traced many of the illnesses and deaths that occur.

The separation of the soap and cabbage water, &c. entailed on the latter system, requires a separate system of drains and a double provision for purifying the water at the outfall, or else the streams and wells will also be poisoned.

Nor does the evil of these two systems end here. Though it may be said that the sense of smell is a sufficient test of the purity either of air or water, it is in truth not so, for chemical analysis has detected poisons when the senses had failed.

Besides, the microscopic fungi and infusoria developed during the fermentation of fœcal matter, floating in the air, and taken into the circulation by the lungs, there will be similar pernicious germs received into the lungs and body of animals from the grasses that have been covered with sewage matter—propagating lung disease in them and in man also, from the meat and from vegetables that have been also covered with similar matter, generating yellow fever, cholera, and in some cases every kind of marsh miasma.

In the Menzies system, it is supposed that by having the pipes only of sufficient size to carry the sewage matter, gases will have no room to form, or will be forced downwards. Unfortunately for him, facts are otherwise. For the pipes often choke at Aldershot, where this system is in operation, and the matter bubbles up, entailing *an expense* of several hundred pounds annually to open and repair the damage; in effecting which it is impossible to avoid danger from letting loose some of the gas. This plan is difficult of adjustment, when the amount of sewage is great and necessarily variable in quantity.

Dr. Hawkesley justly observes, "*but the great fault of the irrigation system is, that it leaves unredressed the crying evils of polluted air and water. The drains and sewers remain exactly where they were, an enormous laboratory of pestiferous gas and the deadly adulterators of our water. Under this system, the double and treble mortality must go on—the degeneration of the human constitution—the spoiled homes of our labouring classes.*"

To any one, having even a limited acquaintance with the sad condition of the habitations of the poor of London, this is no over-drawn picture. To such it is clear that a scourge is not far distant, that will drive the authorities into making radical changes.

Thus a few hours revealed the following with respect to a very small district near the centre of London.

"6 houses, 18 occupants, only two water-closets, no water, very offensive.

8 houses, 20 occupants to each, 8 water-closets, no water, very offensive.

14 houses, 14 occupants to each, 14 water-closets, but no water.

4 cottages and one large house, about 12 occupants to each. They have two water-closets, one of which is without water, is *very offensive*, and *adjoining this closet is a well, into which much sewage matter drains, and yet it is from this is drawn the water for these houses.*

4 houses with about 12 occupants in each, each house has a water-closet in back basement, but not *one of these is supplied with water.*

8 houses with about 16 occupants to each, each house has a water-closet, some have water, some are without, the tenants complain of bad smells.

22 houses with about 26 occupants to each, and each house has a water-closet, some of these are without water."

These may be accepted as not bad samples of the poor districts of London. Therefore there are many thousand open privies, which practically these are, without water,

emitting from their thousands of mouths the fetid gases of the sewers, into the midst of the dense masses of the poor, producing disease and death. No wonder that they should escape into the well lighted gin-palaces. Then if these outlets of gas should be stopped, it will become so dense, that it will push up through the water-trapped drains; or when the plugs of the water-closets are raised, into the Palaces of Belgravia. "These gases are met with, filling the carriages passing by, lying in wait to receive us in offices, parlours, private boudoirs; being stored up in every burrow of the earth, in every hollow of the walls and ceilings, ready to issue forth at any moment, to make us sicken and shudder, if not worse."

On this subject Dr. Hawkesley justly observes, "To condemn the helpless poor to breathe sewer air and to drink sewer water, with its degrading and disastrous influence upon their minds and bodies, is a state of things intolerable to minds of common humanity, when once seen and recognised."

He adds, "Before we can Christianize or even enfranchise them, deadened and degraded by incorporated filth, we must *humanize* them; make them physically clean as far as in us lies, by seeing that their surroundings are not those of an *atmosphere* dealing to them, instead of life-giving energy, a loathsome deadly influence; and of a water that should purify and invigorate, imparting instead a loathsome impurity and rottenness; and of difficulties in dwelling accommodation, whereby, instead of the elevating influence of a comfortable home, compatible with the requirements of health, they are driven to take the only shelter they can get, amid darkness, damp, filth, impure air; conditions that must infallibly banish all hope and enterprise, deaden the sensibility and degrade the human being, comparatively to the level of the reptile."

The same authority truly adds, "In the 'Irrigation System,' to almost as great an extent as before, the progressive loss of our lands' fertility goes on, except in

so far as that may be staved off by a very costly (*amounting to thirty million pounds sterling annually*), and may be precarious supply from abroad, of the very elements we cast away with so much pains and at such a price."

Of the immense sewerage systems of Rome, Baron Liebig says, "*that in the course of centuries it engulphed the prosperity of the Roman peasant, and afterwards drained the wealth of Sicily, Sardinia, and the fertile lands on the coast of Africa.*"

There is a third system, that of Capt. Liernurs, which has some decided advantages over either of these already mentioned in a sanitary, if not also in an economic point of view; as it proposes not to allow the gases to escape to poison the air. Provision is also made that the wells and streams shall be guarded against pollution or injury, but here again the sewage matter is allowed to ferment, and the gases being in a highly concentrated form, as it is impossible to trap the closets perfectly, they being the same as in the other systems mentioned, there will be an escape of gas, which will be more dangerous from the concentration. In this system, equally with the former, the water-closets and drains being in connexion with the cisterns, the water will be unavoidably poisoned, unless by the employment of separate systems and a separate set of pipes.

Then again it is truly admitted that there is an almost free escape of the gases during the operation of decanting.

The moral effect of the open privies, common to both these systems is very bad. Being placed for safety sake at a distance from the houses. The inhabitants are obliged to visit them, in view of their neighbours. By this the moral sense and delicacy is blunted, instead of being protected with jealous care.

There is a *Fourth system* which seems to answer all the conditions, that of using *Earth*, for this prevents fermentation. The evacuation is immediately covered. It is deodorized by chemical action. It is at once thus

deprived of offensiveness and is also rendered innoxious, and so may be transported from place to place without danger. There is not any emission of gases, and the rivers and wells are preserved pure.

It has been alleged in proof, that sewage matter is practically valueless, that when offered for sale at Aldershot, no one would take it without a payment of £500 a year.

The reason is obvious, and far other than that stated. It was because of the disgust and danger of removing a fermenting mass of poison—a condition which by the use of earth is prevented.

A few quotations may be given to shew the extreme value of this system to Hospitals, in preventing the extension of disease by at once covering the evacuations. Without the use of earth there must always be great danger in carrying the evacuations of patients, through the wards or to the closets, or indeed from patients using the closets after such had been thrown down them.

Professor Petterhofer says:—

"Both yellow fever and cholera germs, whether of the vegetable or animal fungus or infusoria, abound in the evacuations of the stomach and bowels of patients. A single drop contains millions of those poisonous atoms which are taken up into the air.

"Cholera is neither altogether a contagion nor certainly a miasma, but a most dangerous bastard, combining all the virulence of both.

"The origin of cholera lies in a specific germ, contained in the excrements of cholera-stricken persons, or of otherwise healthy people coming from an infected locality.

"Cholera is propagated, not only by the atmosphere when charged with fœcal gas, but also by wells, when contaminated by excremental percolation.

"Petterhofer, Bubb, and Ranke have succeeded in proving the connexion between the appearance of cholera

and the miasma produced by an accumulation of putrid organic matter.

"There can, therefore, not be the slightest doubt but that cesspools receiving the fœcal matters of populous cities, *and allowing them to pass* into a state of fermentation, if they do not actually originate, they at least propagate epidemic diseases, above all cholera and typhus."

It is proposed, in this system, that the soap and house-water shall be carried off in ordinary rain drains to be applied to subsoil irrigation, thus avoiding all the evils of pollution, both of air and of water. And, in addition to the completeness of the arrangements for sanitary purposes, all injury to the moral sense is entirely avoided. For the closet may be in the house, or close to it, for the sewage matter is changed into a form free from danger and easily dealt with in all its stages.

The question then arises, Why is not this latter plan generally adopted? Is there any economic difficulty arising out of it? or is there some supposed or real engineering difficulty? or is it simply a conservative feeling as to old plans? We believe the latter only. Architectural difficulty there is none; as has been shewn by actual practice.

Thus Lord Leigh stated:—* "I have thought a great deal on the subject of these earth-closets, and we have adopted the plan with a reformatory school in this neighbourhood, of which I am chairman, and used it with great success."

J. James, Esq., said:—*"The villages of the country, when situate near the mansion of the great proprietor, generally present a most picturesque appearance of neatness and comfort; but you cannot help noticing the small building, dotted here and there, through the gardens.

* Leamington Congress.

They are the plague spots of the village; few in comparison with the cottages, for the proprietor is unwilling to multiply such centres of disease. They stand in situations of indecent publicity, at a distance from the tenements, for both cottagers and proprietors avoid encountering their foul exhalations oftener than necessity obliges. But nobody had had the faintest idea of the manner by which these hotbeds of fever could be turned into pleasant places and sources of profit to those who had hitherto experienced nothing but annoyance from them."

"The system employed at Halton is this:—We use Mr. Moule's closets, and employ a self-acting apparatus, so that the moment the person rises from the seat, a pound and a half of earth is thrown in. The closets we have established serve 800 people, and we expect to be able to do all this with the services of a man and a boy. The round will be about eight miles altogether." "The same force employed in a town would probably satisfy the requirements of double such a population."

Again. "The earth method" "has this great advantage over the sewage system—that, although the liquid must be discharged at all times and seasons when the tanks are full, the earth may have its fertilizing property increased to almost any extent, and may be stored dry in sacks, and transported to any part of the country as necessity arises."

The idea of economic or of engineering difficulties may now be considered.

We have already remarked on the ineffectiveness of the water system of carriage, and on some of the evils which arise from its employment, also somewhat of its great cost; Yet this of which we have spoken only is a part of that cost, for besides the cost of the drains in the vicinity of the houses, there is the cost of the very long drains necessary to carry the sewage away from the habitations. And it is requisite

they be built of first-class masonry, since the emanations from the sewage would destroy inferior masonry, and allow the gases to escape. Cost of the system of drains for London is not perhaps over-estimated at thirty millions. To this is to be added the cost of keeping up the works, &c., and keeping going the system, together with the consequent injury to the country by throwing away the valuable matter that should be returned to the land if it be desired that it should continue fertile, and feed the population. There is perhaps a still greater disadvantage arising from the very large consumption of water, which by reducing its quantity or by enhancing its value, places a sufficient quantity for cleanliness and health out of the reach of the poorer inhabitants of many neighbourhoods.

In some places, especially in tropical climates, it is impossible to obtain sufficient water for the water carriage systems.

In Capt. Liernur's Pneumatic system, if the drains are not so large or so extended, nor the consumption and expense of water so great, yet there is a large outlay required for an expensive description of air-tight cesspools (if such can be made and kept so) and for the expense of engines, pumps, air-tight barrels, patent ploughs and other plant, for preventing the escape of gases, and which will be more expensive, and less effective, if the sewage matter is not used, as Captain Liernur proposes, by a fallow system of culture, the feasibility of which seems very problematical. Whereas for the Earth system there is not any plant required beyond the inexpensive drying closet and the commode seats, common to all systems, with these advantages in the Earth system that the machinery is less complicated, and therefore less liable to get out of order, and there are no expensive pipes or cisterns liable to damage in frost.

It is objected that the requisite amount of earth for the effective employment of the earth system is so great as to

render its application in large places impossible.* But for this idea there is no foundation in fact. The idea arises from estimating the quantity necessary for a whole year, whereas the earth might be changed and returned in less than three months. So that less than a fourth of the quantity generally estimated by opponents of the system would suffice.

There is an impression also that the increased traffic of carts which it would entail, would block the streets. This is a complete fallacy.

It is estimated that 7000 cart-loads would be required weekly for 3,000,000 people; but if so, these would be distributed over the enormous area of London and its suburbs, say 120 square miles. Take Westminster, with its 60,000 inhabitants. For these, at the above rate, only 133 carts each day would be required, and these would be distributed over the area of the parish. How far these would glut the streets, may be gathered from the fact, that from 2000 to 5000 vehicles visit each of the nine large Railway stations each day; and yet there is no perceptible block, though 240,000 vehicles in the week are concentrated on very small areas.

It is also objected that proper care would not be taken by the poor,† nor would they pay for the change of earth, but this would be undertaken gladly by a company, or by the parish authorities, and the manure would well repay them, and doubly so the latter, as it would give work to a class of the poor the parish have now to support in idleness, while the process would secure that supervision which is now so fatally neglected.

The over-estimate of the quantity, and of the difficulty of obtaining sufficient earth, vanishes before a moment's thought. For the larger the place the greater is the

* Contractors have offered to supply the quantity that might be requisite for any part of London.

† Nothing could well be worse than the state of things illustrated. Page 14.

area on which it stands. The market gardens therefore of each would almost supply earth enough if kept rotating.

In a no less degree is the manure undervalued, as no chemical analysis, as has been stated by the best authorities, can give any idea but one wholly inadequate.

It is also stated "as a final, and perhaps a fatal, objection to the introduction of this system in towns of great magnitude, that it no more affects the evils of river pollution and ill-ventilated sewers than anything most foreign to the matter. The refuse of water-closets forms but a minor portion of what we term sewage: the household refuse, the scourings of market-places, stables, slaughter-houses, knackers' yards, the refuse matter of tanneries, hospitals, and innumerable sources of pollution still remain to be dealt with. The same main sewers and house drains are required, of the same depth and of the same sectional area; the same need of sewer ventilation exists, and the same fouling of streams goes on,—in short, the whole question which it has been alleged this matter has entirely solved, still remains in all its original force."

This is a fallacy contradicted by the facts as given by the objector, who says, "water-closets were still in futurity; manufactures by steam power had but arisen from their infancy, and what was sent through the miserably incomplete systems of drainage then extant, was in fact little else than the household drainage, and a portion of the rain-fall. So slight an admixture of sewage in the huge volumes of our rivers, was therefore comparatively harmless; and up to a very recent period their waters, with a few exceptions, such as the clothing districts of the West Riding of Yorkshire, were *clear and pure, abounding in fish.*"

Now this last is the condition to which the adoption of the earth system would restore things—indeed rather

better, for *all* the rainfall would be drained into the sewers.

As I have stated, stables, slaughter houses and knacker's yards, should be treated with earth, the latter as well as tanneries should be forbidden, except in the suburbs, and the owners would find their profit in being near the soil, and near a market for their manure.

In fact, horses, and especially milch cows, should stand on earth, to be changed day by day, instead of on stones or boards, both for health and economy; for though the health of cows may appear not to be injured by the air they breathe, yet is their milk injured.

The use of earth as a disinfectant has been enjoined from the earliest days, and the practice has been in some degree observed, both in India and China, possibly because of the greater necessity for attending to sanitary arrangements in hot countries and thickly inhabited districts.

It is not easy to exaggerate the value of earth for such a purpose in hot climates where water is scarce, and fermentation sets in, and generates disease so rapidly and so virulently.

The system could be applied with great advantage in steam boats and yachts, ashes being used instead of earth.

The use of earth was under certain conditions commanded in the Scriptures, Deut. xxiii. 12, 14., and in the Shasters of the Hindoos, but it was left for Mr. Moule to discover why such commands were given. Not knowing its value led to the desuetude—and there can be no reasonable doubt but that its proper and extended use would put an end for the most part to those terrible scourges of the human race, cholera, yellow fever, craw craw and small pox, with other less destructive diseases.

Little is required to establish its efficacy, feasibility, and cheapness. I mention cheapness in order to shew

that no sacrifice is required to obtain the most complete sanitary system.

A distinguished medical officer, Dr. Mouat, has borne ample testimony to the Government of India as to its very great value.

The reports of the Commission of Enquiry in India, showing amongst other things a great decrease of mortality in jails and hospitals in that country are most positive as to its efficacy: so much so that the Government and Secretary of State for India have, in token of their sense of the benefits conferred upon the inhabitants of India by the system, awarded the Rev. Henry Moule £500.

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THE REALITIES OF

MEDICAL ATTENDANCE ON THE SICK CHILDREN OF THE POOR IN LARGE TOWNS.

BY

T. P. HESLOP, M.D.,

Physician to the Queen's and Children's Hospitals, Birmingham.

Medical Attendance of Sick Children in poor of large towns

. . . . . penitusque cæsa contrusa jacebant
Impertate et morbo dedita morti.

LUCRETIUS, "*De rerum natura*," liber vi.

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This Paper was written in order to be read in the Public Medicine Section of the British Medical Association, at the Annual Meeting holden at Leeds in July, 1869. *The pressure of communications in that Section prevented the carrying out of this intention, but, at the request of Dr. Farr, the President, the main facts and inferences arrived at were made the subject of a short verbal statement. It is now published in a separate form, in the belief that the materials collected, being at once new and of serious import, are worth the consideration of the Medical Profession and of the Government. It is proper to add that the Paper has become somewhat expanded beyond its original limits.*

August 20, 1869.

THE REALITIES OF MEDICAL ATTENDANCE

ON THE

SICK CHILDREN OF THE POOR IN LARGE TOWNS.

THERE is a grave misconception, both among the members of the medical profession and among the public, as regards the amount and quality of the medical attendance actually obtained by the sick children of the poor in these countries. This is the only explanation of the comparative indifference, not to say hostility, with which the establishment of Children's Hospitals has been viewed by some members of the most humane of the professions, and by the people of Great Britain in general, who, however regardless of the claims of education, cannot be truly said to be deliberately heedless of the cry of physical suffering.

It is hardly necessary to tell such an audience as this that the mortality of young children is very great, but I will in a few words indicate how this matter now stands. In one of the Reports of the Registrar-General it is stated that "of the deaths in England in 1859, no less than 184,264—two in every five of the deaths of the year—were of children under five years of age; and above half of these—105,629—had scarcely seen the light, and never saw one return of their birthday." It appears from Dr. Farr's English Life-table* that of every 1,000 children born in England, 737 survive to attain their fifth year of age; the annual mortality

* See *British Medical Journal*, March 21, 1868.

in the interval averaging 67 per 1,000 of the mean numbers living. The mortality in the first year after birth is at the rate of 165; in the second, 65.6; in the third, 36.1; in the fourth, 24.3 per 1,000, living at those ages. A more minute subdivision of infantile existence shows that the mortality in the first month of life is at the annual rate of 571 per 1,000, in the second month 218, and so on. The deaths in thirty large town-districts in the ten years 1851-60, of children under five years of age, were 338,990. If the mortality in these towns had been no higher than in the healthy districts of England, the deaths would only have amounted to 135,470; consequently, there was an excess of 203,520 deaths justly ascribable to preventable causes. The most recent returns show that the proportion of deaths under five years of age in England is 41 per cent. of the total; but in London it is 43 per cent., and even higher than that in some of the northern counties. In some of the metropolitan districts more than 50 per cent. of the deaths in 1865 were of children under five years of age.

In his supplement to the twenty-fifth annual Report of the Registrar-General, Dr. Farr gives the proportion of deaths to the *population* at different ages in every registration district, from which it appears that the average annual rate of mortality per 1,000 in the ten years 1851-60, of children under five years of age, amounted to 66.9 in Islington, and arrived at 101.5 in East London; 102.5 in Whitechapel; 108.5 in St. Giles'. The two highest rates of death are for Manchester, 117.3; and Liverpool, 132.0.

Further evidence is adduced in the admirable paper read in this Section at Oxford last year, by Dr. Morgan. He quotes the Sanitary Reports on the State of Salford, for seven consecutive years, extending from 1860 to 1866, with the view of shewing that some districts are far more trying to early life than others. Here 49.9 per cent. of the deaths

registered occurred among children under five years of age. The deaths at this age, in Salford proper, being four times as numerous as in the adjoining district of Broughton. Now Mr. Sargent* tells us that in the adjoining Borough of Manchester, which we may take as presenting the same population-characteristics as Salford, there were in 1861, out of every 1000 persons living of both sexes, 134 of both sexes under five years of age. While, therefore, the population under this age was only 13.4 per cent. of the whole number living, the deaths under this age were half of the whole number of deaths at all ages. If a similar inquiry were extended to the worst districts of other towns, excluding the upper classes, I believe that at least as bad results as these would be arrived at.

But appalling as the rate of mortality among children is known to be, the rate of sickness in proportion to that of the whole population must be far greater. The experience of every medical man may be appealed to in confirmation of this fact. If we take certain acute diseases, as Diarrhœa, Diphtheria, Scarlatina, Hooping Cough, Bronchitis, Catarrh, &c., the predominance of them among children, as compared with adults, is so great that they may be fairly called disorders special to childhood. In London, in 1865, there were 3,611 deaths at all ages from Diarrhœa: of these, 2,519 were among children, but this is very imperfect evidence of the comparative *sickness* from this cause, at different ages. If we had the means of knowing the real prevalence of Diarrhœa among the children of the poor, I have no doubt that it would be found to be many times more common among them than among adults of the same class.†

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* Town Life among the Poorest, p. 16.

* On the Vital Statistics of Birmingham and seven other large towns-1865.

† See Appendix, No. 2.

The question now arises, how far is this great amount of infantile disease provided for in our towns? The first point to settle, is the extent of relief afforded by ordinary Medical Institutions. When the Birmingham Children's Hospital was set on foot in the year 1861, I instituted an inquiry into this point. The Lying-in Hospital and Dispensary for Women and Children did not admit children as in-patients, and the whole number of children at and under seven years of age treated during the first three months of that year, amounted only to 15. At the General Dispensary there were 4,456 patients, either treated at their own homes or at the Institution, in the year 1860. The number of children under seven years of age amounted to 269, or about $\frac{1}{16}$, though the mortality of male children under five years of age was more than 50 per cent. of the whole mortality of that sex in the town. There are two General Hospitals in the town. The list of in-patients at the Queen's Hospital shows, during the first three months of 1861, 12 children under seven years of age out of 286 patients, or $\frac{1}{24}$. Of the out-patients: 208, out of 1,288, were under seven years of age; 143 of these were surgical cases, with which we are not now concerned.

In the same period there were admitted as in-patients into the General Hospital, 40 children at and under seven years of age, out of a total number of 499 patients. Out of 4,159 out-patients, there were 541 children at and under seven years of age. The proportion of surgical cases among these was, I believe, even greater than at the sister institution, but the ratio is little more than one eighth of the total number. These figures, drawn from Birmingham, accurately represent the degree of attention paid to infantile maladies at our General Charities. Proof of this may be adduced from the last Report of the Infirmary of the town in which we are now assembled. In the year 1868, there

were 1,673 in-patients admitted: of these, 207, or less than one-eighth were children under twelve years of age. What was the proportion of medical cases? 21 only, or ten per cent., represent the care bestowed by the General Infirmary of this great town, and by this illustrious Medical School on the ailments of childhood. Even this gives an inadequate picture of the matter. Of these 21 children labouring under disorders of other than surgical nature, five only were under six years of age, in spite of what we know from authentic sources of the mortality up to this period of life in large manufacturing towns in the north.

The Metropolis supplies equally startling evidence of the utter abandonment of all effort to cope with infantile disease in quarters where it might have been least expected.

In the admirable statistical record of St. Bartholomew's Hospital for 1868, I find that among 2,351 medical in-patients admitted during the year 1868, there were only 60 below five years of age, and only 88 between five and ten years of age. At this great hospital, the seat of one of the most distinguished schools in Great Britain, there were only 148 children, labouring under medical disorders, admitted into the wards throughout a whole year. There was not one case of diphtheria; three only of enteric fever; nine of scarlatina; ten of croup, up to the age of ten. When it is considered that there are 250 medical beds in this wealthy and free general hospital—that there are no restrictions either in reference to disease or to the necessity of obtaining a privileged note of admission—and, moreover, that this institution is situated in the midst of a dense and poor population, these facts must be allowed to offer ample proof either that our General Hospitals do not profess to respond to the necessities of infantile sickness, or that there is an invincible repugnance, even among the poorest, to avail themselves of the benefits proffered.

These figures suffice to demonstrate that the diseases of children among the poorer classes are but partially attended to at our great charities, or rather are all but wholly neglected. This fact is particularly manifested by the small number of children admitted into the wards of the General Hospitals, for, as no home visiting is carried on in these great charities, those children who are too ill to be conveyed to the Hospitals must seek relief elsewhere. There are, unfortunately, methods of obtaining relief only too familiar to mothers in great towns. The children are treated, at a small cost in money, mainly by druggists and unlicensed practitioners, until the case assumes a dangerous aspect, and then, perhaps in the last hour of the little patient, the mother hurries to the nearest surgeon for the purpose of securing a legal certificate of the death, when that shall occur. Even this precaution is not always taken, and the child dies, as it has lived, outside the pale of medical science. Out of 252 deaths recorded by Mr. Leigh, one of the Manchester Registrars, 49 were uncertificated; 41, out of these uncertificated cases, were children. In referring to the thousands of children who helplessly perish in this country from bad treatment under this system, who ought to have "grown up men and women, bulwarks of the state," the same gentleman makes the following apposite remarks:—"How far the evil might be mitigated by medical men themselves, by an extension of eleemosynary aid, it is difficult to say, *for the poor cannot pay medical fees;* in many cases they will not pauperize themselves by applying to the Parish Surgeon, and the profession already contributes more to the relief of the poor than any other body in society."

In order to remedy this state of things, so far as concerned Birmingham, the Children's Hospital was opened nearly eight years ago. Its operations had commenced but a few months when it occurred to me to inquire from the

mothers what they had previously done in order to obtain medical relief for their children.* Although many statements had been issued in the Reports of the Registrar-General, and in other quarters, regarding the sources of medical relief among the children of the poorer classes, no exact numerical view of the matter had been published. The results conveyed the clearest evidence of the necessity for Children's Hospitals in large towns, and demonstrated the truth of the oft-repeated assertion, that the sick children of the poor are either completely uncared for or attended by persons having no right, derived either from law or from knowledge, to undertake such a charge. Out of 215 cases brought in succession to the Hospital on particular mornings, 76, or more than one-third, had been treated exclusively by unqualified persons, and nearly half had been submitted to no treatment whatever; 21 had obtained relief from public institutions, combined with other sources; 15 only had been previously under the exclusive care of qualified medical men. These figures afford positive evidence of the large sphere of usefulness open to Children's Hospitals, and show the fallacy of the allegation that the sick children of the poor are already generally attended by legally qualified medical men. The table, however, gives but an imperfect measure of the real state of things. Those who are brought having had no previous treatment have often been ill for weeks or months, and those who may have once consulted a medical man had long abandoned the attendance upon him from their inability to pay the expense.

Subsequent experience has only confirmed the facts then arrived at. On the 25th of May last I commenced an investigation with the same object in view, and completed it at

* Second Report of the Birmingham Free Hospital for Sick Children, 1862, page 26. A slight error crept into these figures, owing to one medical man, practising after the manner of a druggist, having been erroneously classed as a druggist.

the end of six weeks. Every mother who brought a child to the Hospital during that period, on my days of admission, was asked a series of questions involving the following points —previous application to a Druggist, a Surgeon, or a public institution, and length of illness. As the inquiry proceeded, many additional questions of a subsidiary nature were asked, as I desired to obtain a complete picture of the realities of infantile medical attendance among the poorest. Then they were asked what they had given for the medicine—what was the medicine administered—why they went to a Druggist—why they did not apply to a Surgeon—and, when they had applied to one, why they had desisted from proceeding on with him until the child was well. In many cases also the nature of the disease under which the child was labouring on admission was notified, in order to yield an idea of the severity of the case.

In this way 383 cases were made the objects of investigation, and are separately given in the Table appended to this paper. Of these 383 cases, 341 had not previously been taken to a Medical Man; 154, or two-fifths of the whole, had applied to a Druggist alone; 33 to a Surgeon alone, or one-twelfth of the whole; 187, or about half of the whole number, had previously been altogether without even the rudest aid; 163 had employed either a Druggist alone, or (in 9 cases) a Surgeon conjointly with him; 1 only had been to a Birmingham General Hospital before applying, and 1 to a London Hospital two years previously.

I will assume that the members of a Medical Association are fully agreed that human lives, at all ages, are worthy of being saved; and that children, though unable to earn their bread, or to push on the world's progress, are not entirely indifferent objects, to be cast aside and allowed to rot among the débris of alleys and cellars.* I shall also

* See Appendix, No. 3.

take the liberty to believe that Medical men sincerely hold the opinion that it is useful for the ignorant mothers of the poorer classes to be taught what is good for their offspring, as regards food, medicine, cleanliness, and so forth—that medical aid is often of the highest advantage to suffering children. More than all, that the rude interference of a Drug-seller may be highly perilous, and cannot possibly be of benefit. What, then, do my colleagues think of these figures? What are likely to be the sentiments of the eminent State Official who represents in this Section the Government department for the Registration of Deaths, on being told that out of 383 sick children, many of whom had been ill for months, 187 had been without the aid of medical science, and 154 had only come in contact with that science as it is represented by a trader in drugs,—or in an exactly similar sense in which we may say that a man has come in contact with legal science who has applied to an engrosser of deeds, or to the stationer who has supplied the parchment?

These totals give, however, but a meagre view of the reality. Let us examine some of the cases individually. I will take the first 28 cases of my Table. Of these, 20 had been neither to a Druggist, nor to a Surgeon, nor to a Public Institution. They had been ill for periods varying from one day to two-and-a-half years. Eight had been ill for seven days and upwards before application. One of these had been fourteen days ill with Fever, another for four months with Hydrocephalus; one for seven days with Hooping Cough; one, who had been ill for eight days, was affected with double Pneumonia. The mother's account of the case was as follows:—"Her husband was very ill; Parish Doctor attending him now. Declared that the reason she did not go to the Parish Doctor was that she had no opinion of them—'they are so neglectful'—and do no good. Would not have had him if she could

have got a Dispensary Note." Of those ill under seven days, one had been ill for four days with severe Diarrhœa and Convulsions; another for six days with modified Small Pox; another for three days with Diarrhœa.

Seven of the first twenty-eight cases had sought aid from a Druggist. Of these, one had been ill for seven days, and teething powders, in other words, calomel powders had been administered, costing at the rate of 6d. per box: one had been ill eight days, three powders, costing 2d. had been given: another labouring under very severe Bronchitis for three days, had had three teething powders for 2d: another had Bronchitis after Measles for eleven days: and three had had Scarlet Fever for four days, two fever powders, costing 1½d., having been given: "mother did not take the child to the Druggist, because she had not the money."

Of one child, who had been ill for six weeks, the mother gave the following account—"Went to the Druggist before going to the Surgeon. Bought two notes, costing 3s.6d. each, lasting three weeks. Child no better; found it too expensive to go on with." One only of these 28 cases had been to a surgeon alone. It had been ill for ten days, and not being relieved was brought to the Hospital.

Other parts of the Tables give exact data of a similar kind to those now presented. A few further examples I must attempt to give in the time allotted to this paper. The 264th case had been ill for fourteen days with Bronchitis and Diarrhœa, had had powders and medicine from a Druggist; could not afford to pay a Doctor. The 265th was a heart-rending case: the child was labouring under wasting and inflammation of the eye; had been under the Parish Doctor for five months; child no better. Mother could not afford to pay a private Surgeon; had had five children ill; came nearly eight miles to the Hospital. The 267th case, three weeks ill, had been taken to a Doctor because the

medicine from the Druggist did no good. Doctor's medicine was 1s. "Mother could not afford to take her again, as husband only got 10s. 6d. last week." The 268th case, ill nearly three weeks, had also been to a Druggist. It was very ill with Scarlatinal Dropsy. Three at once ill with Scarlet Fever. Mother could not afford to pay a Doctor. Child taken into the Hospital wards. The 274th case had been taken to a druggist because a M.D. and Fellow (by examination) of the College of Surgeons had given an unfavourable opinion of the case. The 284th case was illegitimate. The mother, a stitcher, could not afford to pay the Doctor any longer; child had been nine weeks under his care. The 286th case had been for two months under two Parish Surgeons; no relief, so was brought to the Hospital. The 288th, ill two weeks, was a bad case of St. Vitus' Dance. "No medicine or advice until brought to the Hospital." The 249th and 250th cases were suffering from the Itch. Another in the house had it. They had been ill for two years. A Druggist had been applied to; "could not afford to pay a doctor." The 233rd case had been ill for three months; had been under a surgeon, a 3s. 6d. note having been obtained; mother could not pay longer.

I maintain this to be a faithful picture of the kind and amount of medical aid obtained by the sick children of the poor in our large towns, for there is no reason for presuming that Birmingham differs from other cities in this respect. The inference is forced upon us that these children are neglected, and that this neglect needs to be obviated by better arrangements than those now existing.

It may be said that the Poor-Law Medical Officers are the proper persons to deal with the children of the destitute. Granted, if these officers were so circumstanced as to command the confidence of their patients. This is not the right time or place to indicate the organic changes needed in this

department of medical labour. I will content myself with declaring that I know the disastrous effects of our Poor-Law system, both in principle and in detailed administration, upon the officers engaged in working it. I shall not speak hardly of my brethren engaged in this work. Tempted as they are, I know not why I should presume to think I should be different from them were I placed in their position. But this I know full well that these gentlemen in our large towns do not possess the confidence of the sick poor—that mothers prefer the druggist, with his pennyworth of deadly syrup or of calomel powder, to the so-called care of the bankrupt Parish Surgeon, or his utterly unqualified assistant.

Let it be observed, too, that the Birmingham Children's Hospital only professes to deal with actual paupers when the children are suffering from other than ordinary maladies, or such as have been unrelieved by previous treatment.* There is a class, partly poor, partly criminal, hovering between uncertain employment, the workhouse, and the gaol, who are not destitute in the Poor-law sense of the word—not even poor enough to claim a note for *medical* relief from the relieving officers. These people inhabit the worst quarters of our great commercial towns, and form a body apart from the mass of intelligent and skilled artisans. The difference, indeed, between these last and the wretched denizens of cellars and lodging-houses is far greater than that which exists between the artisan and the lower middle classes. Intemperance and crime, ignorance and brutality, make this class poor when in full employment. In bad times of trade they are constantly on the verge of starvation, and become the natural pabulum of pestilence. Their children, the offspring of vice and misery, are condemned to disorder from the hour of their birth.

* See Appendix, No. 4.

But it may be said that were these children placed in Provident Dispensaries by their parents, they would be enabled to have good medical assistance when wanted, and that it is injurious to the interests of the poor that they should get medical advice or anything else without paying for it. Granted again. But supposing the parents are improvident, are the children to be unheeded? Are the children to be sacrificed because the mother is vicious or the father drunken? I verily believe that some of my brethren are unconscious of the error in their logic and of the lapse in their humanity, when they talk in this strain, unless they deliberately desire to carry out actively and in its entirety the primeval curse, that "the sins of the father should be visited on his children even unto the third and the fourth generation."

Yet again it may be objected that the children of poor persons, just above the status of paupers, should be under the care of private surgeons; that attendance upon them is needful to enable these to gain a subsistence by their profession. Quite true, if such persons could pay and would pay for medical advice for their sick children. But these tables show conclusively that even the smallest remuneration, far below the point of any tariff hitherto considered professional, is more than these poor persons are willing or able to pay. I take it to be as sure as anything in our social life that the sick children of the very poor do in fact scarcely come within the range even of the humblest practitioners of the healing art.

What, then, is the refuge of these unhappy people? They resort to the Druggist—to the tradesman who gets his livelihood by the sale of drugs. All he knows of disease is, that drugs are good for it, whatever may be its guise. Some of my hearers, who know how much more moderate are our views than those formerly current with regard to

the efficacy of drugs in many acute diseases, will think the intervention of the Druggist peculiarly unfortunate. We fail to recognise in him, even dimly, the features of a High Priest of Nature—of a Physician armed with all the knowledge attainable of the Science of Life. What is left undone among children must be serious enough, but how infinitely small this evil appears to us when compared with the positive injury inflicted by an ignorant and self-seeking pretender to medical skill!

Evidence exists that in this point at least, modern civilization is behind ancient ideas. To Horace, 2000 years ago, it seemed a thing too absurd to suppose, that the Herbalist should give drugs to the sick—or that other than Physicians should administer remedies. He could find no fitting analogue to such rash folly but in the attempt of a man ignorant of navigation to work a ship.

> Navim agere ignarus navis timet; abrotonum ægro
> Non audet, nisi qui didicit, dare; quod medicorum est
> Promittunt medici; tractant fabrilia fabri.*

I must not now dwell at length on the remedies for these evils. The most important is undoubtedly the general diffusion of Children's Hospitals and Dispensaries on a much larger scale than now prevails in these Islands. They should be partly voluntary; partly supported by rates.† They should be in close relation with a reformed Poor Law system on the one hand, and with thoroughly organized Societies of Beneficence on the other. These Hospitals should be the centres of Sanitary Associations and of Nursing Sisterhoods. The formation of Provident Dispensaries for Children should also be encouraged, both by the Medical Profession and the general public—and a sincere endeavour

* Epistolarum, liber 2., 1.

† I am glad to note that the Corporation of London sees its duty so clearly that it has just voted £150 towards the grounds of the East London Hospital for Children.

should be made to limit their work to proper objects. The most urgently needed amendment, however, is the reorganization from the bottom of the Poor Law Medical Service.

The British Government and the Guardians of the Poor have hitherto thought it becoming to offer to the medical profession the attendance upon the poor on such terms, both pecuniary and administrative, that it will be one of the wonders of the next generation that any member of a liberal calling could have condescended to degrade both himself and his profession by accepting them. In small towns and villages, where competition is small, and the medical men, as a class, are far superior, both in education and character, to the average in large towns—the natural results of a vicious system are greatly modified. The personal qualities of the public medical officers, their humane sentiments of regard for the poor, perhaps well known to them throughout their lives, disguise in country districts these natural results as they are to be observed in large communities. What, then, are these results in our great centres of population?

A Board of Guardians, consisting in the main of small shopkeepers, tavern-landlords, and the noisiest of the Town Councillors, are elected by the Burgesses to take charge of the interests of the poor—to perform, under Act of Parliament or a Local Act, the sublime office of ministering to the necessities of the destitute. Sometimes poverty engenders sickness; sometimes sickness engenders poverty. In either case, the aid of the medical profession must be invoked and, forthwith, a certain number of doctors are duly advertised for. The advertisement sets forth the stipend, or what in Poor-Law language is called the stipend, to be paid to these gentlemen. The amount, as compared with the work done, is such as a junior clerk in an attorney's office would consider an insult. It is much less than an ordinarily skilled artisan

would accept from his master. It is a lump sum; it has no relation with the work done, unlike the remuneration of other branches of the profession. In order to insure that the poor should have all needful drugs and appliances, this stipend includes the cost of these. In order to give the requisite independence to the Doctor, should he desire to censure the neglect of officials, or to order expensive nourishment for his patients, his appointment is sometimes an annual appointment. In order to elevate the personal dignity of the applicant, he is counselled to furnish his testimonials by a certain day, and to make an appearance before the electing body. In order that every precaution should be taken to preserve the reputation of the candidate, he is formally prohibited from canvassing, with the distinct understanding that if he refrain from it his success is impossible. This is the advertisement; but there are other conditions implied therein, which the Guardians with rare moderation do not expressly lay down. The foolish prejudices connected with "the enthusiasm of humanity," and the notions which sprang up nearly nineteen centuries ago in the remote East, forbid an open allusion to these conditions. It is often desirable to economise the truth. Why should not the truth be as much admitted to cheese-paring as the rates of the tax-payer? These unexpressed conditions are not, of course, important; but speaking historically I ought not to omit them. They are, that the Doctor should be poor—if a bankrupt, so much the better;—that he should be young, half-educated and inexperienced, without too many private patients; or, on the other hand, that he should be old, without being less ignorant, to whom the world has cruelly denied its confidence in other walks of practice. A large and growing family forms a sensible addition to his claims. If he has already lost his fair name, either in a professional or private capacity, the Guardians, with an honourable

regard for the interests committed to them, give him an opportunity of retrieving himself in the high latitudes of public office. Socially he must not be too far removed from the region where slang and gin-and-water reign supreme—for the Doctor must not be above or different from the Guardian who elects and pays him, not to speak of clerks and relieving officers.* But the most weighty of all the unspoken requirements remains behind. I find it hard to define—though it is fundamental, nay, a terrible reality. Perhaps from the Guardian's point of view it is easiest comprehended by saying that the Poor-law Surgeon must be a man "without any nonsense." Wine and meat cost money—this comes from the pockets of the tax-payer. The Surgeon who orders too freely such articles injures this last estimable person, and becomes thereby an undesirable officer. It is all a matter of sentiment after all. No doubt some poor people want nourishment rather than physic; but why did they become poor? Why should the honest burgesses be burdened with payments of this sort because the Surgeon is weak, and unable to comprehend the difference between a respectable rate-payer and a poor wretch who thinks he needs that his body should be sustained?

I summarize these requirements in this formula—any Surgeon in a large city is good enough for the service of the parish, if only he is bad enough.

I cannot persuade myself to delineate the natural results of these advertisements, with such conditions expressed and

* I have often thought that when a poor Player, the sport of fortune, comes under the manipulation of the worthy, ironically termed in Parliamentary phrase the "*Relieving* Officer," he must describe him in some such words as Antipholus, of Ephesus, described Pinch in *The Comedy of Errors*.

> They brought one Pinch, a hungry lean-faced villain,
> A mere anatomy, a mountebank,
> A thread-bare juggler . . . . . .
> A needy, hollow-eyed, sharp-looking wretch,
> A living dead man! this pernicious slave.—ACT V., SCENE I

implied. I willingly draw a veil over the character of the men who respond to them. Still more willingly do I desist from entering on a picture of the depth of humiliation and ignorance—of recklessness and hardness of heart, finally, step by step, reached by those cursed with success in their efforts to obtain a Poor Law medical appointment in a large English town. Alas! the Surgeon who enters those gates must leave all hope behind. If by its fruits we know the tree, we have an easy method of knowing the Poor Law system, which is a disgrace to the Government, a perpetual source of dishonour to the Profession of Medicine, and the cause of cruel injury to the poor, who at once despise and reject its aid, excepting in their direst necessity.*

* See Appendix No. 5.

APPENDIX No. 1.

TABLE SHOWING THE KIND AND AMOUNT OF MEDICAL ATTENDANCE OBTAINED BY THE SICK CHILDREN OF THE POOR.

No.	Previous application to Druggist.	No medical aid before application.	Consulted a Surgeon.	How long ill.	Remarks.
1	—	—	—	6 days	
2	—	—	—	14 days	
3	1	—	—	7 days	Had teething powders, 6d. per box: gave one a week.
4	—	—	1	10 days	Not relieved.
5	1	—	—	8 days	Had two powders: three for 2d. was the price.
6	—	—	—	8 days	Case of double inflammation of lungs. Husband very ill: Parish Doctor attending him now. Mother delares that the reason why she did not go to the Parish Doctor was that she had no opinion of them,—"they are so neglectful"—and do no good. Would not have had him if she could have got a Dispensary Note.
7	—	—	—	4 days	Severe diarrhœa. Convulsions.
8	—	—	—	3 days	
9	1	—	—	3 days	Very severe bronchitis. Teething powders, three for 2d.
10	—	—	—	6 days	Modified small-pox.
11	1	—	—	11 days	Bronchitis after measles.
12	1	—	—	6 days	Bronchitis: two fever powders for 1½d.
13	1	—	1	6 weeks	Went to the Druggist before going to the Surgeon. Bought two Notes at 3s. 6d. each, lasting three weeks. Child no better: found it too expensive to go on with.
14	—	—	—	2 days	
15	—	—	—	6 days	
16	—	—	—	2½ years	
17	1	—	—	3 days	Mixture for cough, 1d.
18	—	—	—	1 day	
19	—	—	—	7 days	Hooping cough.
20	1	—	—	4 days	Scarlet fever. Two fever powders 1½d. Did not take the child to the Druggist, because had not the money.

* I beg to record here my obligations to Mr. Hogg, the active House Surgeon of the Hospital, for aid in preparing this Table.

No.	Previous application to Druggist.	No medical aid before application.	Consulted a Surgeon.	How long ill.	Remarks.
21	—	—	—	3 days	Diarrhœa.
22	—	—	—	2 days	
23	—	—	—	1 day	
24	—	—	—	14 days	Fever.
25	—	—	—	4 months	Hydrocephalus.
26	—	—	—	2 weeks	
27	—	—	—	2 weeks	
28	—	—	—	4 days	
29	1	—	—	5 days	Severe diarrhœa. Medicine did no good.
30	—	—	—	1 week	Hooping cough.
31	—	—	—	2 weeks	Bronchitis.
32	—	—	1	8 years	Eczema.
33	1	—	—	6 weeks	2d.
34	1	—	—	2 weeks	Four powders, 1d. each.
35	1	—	—	3 weeks	Syrup, 1d.
36	—	—	—	6 weeks	
37	1	—	—	2 days	
38	—	—	—	2 months	
39	—	—	—	5 weeks	Diarrhœa.
40	—	—	—	2 days	
41	—	—	—	2 days	
43	—	—	—	3 days	
44	—	—	—	1 week	
45	1	—	—	9 days	Urticaria. Milk and sulphur, 1d.
46	1	—	—	1 month	
47	—	—	—	2 days	
48	—	—	—	1 week	Severe diarrhœa.
49	—	—	—	1 week	Went to Surgeon 3 weeks ago for hooping cough; did not pay. Has pleurisy now, for which no advice had been had.
50	—	—	—	7 weeks	
51	1	—	—	2 weeks	Two powders for 1½d.
52	—	—	—	2 weeks	
53	—	—	—	1 week	Measles.
54	—	—	—	2 weeks	
55	1	—	—	2 weeks	Two powders, 1½d.
56	—	—	1	1 month	Bronchitis, Urticaria. Went to Surgeon twice; 6d. charged each time; no relief. Could not pay more.
57	1	—	—	2 weeks	Powder, 1d.
58	—	—	—	2 days	
59	—	—	—	4 days	
60	1	—	—	1 month	Powder, 1d.

No.	Previous application to Druggist.	No medical aid before application.	Consulted a Surgeon.	How long ill.	Remarks.
61	—	—	—	6 days	Bronchitis.
62	—	—	—	2 days	
63	—	—	—	5 days	
64	—	—	—	2 days	
65	—	—	—	8 days	
66	—	—	—	2 weeks	
67	1	—	1	1 month	Had a Note costing 3s. 6d. from the Surgeon, lasting 10 days. Could not afford to have him again. Convulsions.
68	—	—	—	2 months	
69	—	—	—	1 week	Diarrhœa.
70	1	—	—	3 days	Diarrhœa.
71	1	—	—	14 days	
72	1	—	—	7 days	Scarlet fever. The Druggist's widow saw the child and made up the medicine. 4d. charged.
73	—	—	—	1 day	
74	1	—	—	12 months	
75	—	—	—	3 days	
76	—	—	—	1 week	
77	—	—	1	2 weeks	Obtained a 3s.6d. Note; no relief.
78	—	—	—	6 days	Had castor oil from a woman who sells medicine for children.
79	—	—	—	1 week	
80	—	—	—	1 month	
81	1	—	—	8 days	Two fever powders, 1½d.
82	—	—	—	2 weeks	
83	—	—	—	1 week	
84	—	—	—	1 week	Gave the child some herb-tea, for which she paid a Herbalist ½d.
85	1	—	—	3 weeks	Cough mixture, 5d.; Fever powders, 3 for 2d.
86	1	—	—	2 weeks	Cough mixture, 3d.
87	—	—	—	9 days	
88	—	—	—	9 days	
89	—	—	—	1 week	
90	1	—	—	2 weeks	Syrup, 3d.
91	—	—	—	4 days	
92	—	—	—	2 months	
93	—	—	1	1 week	Bottle of medicine, 4d.; no relief.
94	—	—	—	1 month	
95	—	—	—	2 days	
96	1	—	—	3 weeks	Powder 1d.
97	1	—	—	5 weeks	A powder occasionally.

No.	Previous application to Druggist.	No medical aid before application.	Consulted a Surgeon.	How long ill.	Remarks.
98	1	—	—	3 days	Two fever powders.
100	—	—	1	2 years	
101	1	—	—	1 week	
102	—	—	—	2 weeks	
103	1	—	—	3 weeks	
104	1	—	—	14 days	2d. for each bottle of syrups.
105	1	—	—	3 days	2d. worth of "stuff;" all the mother could afford.
106	—	—	—	1 month	
107	1	—	—	3 days	Went to two Druggists; 2d. worth of syrups from one—1d. from the other; also grey powders.
108	—	—	—	4 days	
109	1	—	—	3 weeks	3d. for syrups; no relief.
110	—	—	—	3 days	
111	—	—	—	7 days	
112	1	—	—	6 days	Powder 1d.
113	—	—	—	5 days	
114	1	—	—	2 weeks	1d. for syrup; no relief.
115	1	—	—	1 week	1d. powder.
116	1	—	—	1 week	1d. powder.
117	—	—	—	14 days	
118	1	—	—	3 days	1d. powder.
119	—	—	—	14 days	
120	—	—	—	2 days	
121	—	—	—	6 days	
122	—	—	—	5 days	
123	1	—	—	3 weeks	Five ill at once with scarlet fever. No Doctor at all. Powders obtained from Druggist. Two brought to the Hospital with dropsy.
124	1	—	—	3 weeks	
125	—	—	—	2 months	
126	1	—	—	3 weeks	
127	—	—	—	2 days	
128	—	—	1	3 weeks	Surgeon for three weeks; no better, so brought the child to the Hospital.
129	—	—	1	2 weeks	
130	—	—	—	1 year	
131	—	—	—	3 days	
132	—	—	1	4 weeks	Took it to the Doctor twice; did not go again because she could not afford it. 1s. charged each time.
133	—	—	—	5 days	

No.	Previous application to Druggist.	No medical aid before application.	Consulted a Surgeon.	How long ill.	Remarks.
134	1	—	—	2 weeks	Mixture and powder, 6d.
135	1	—	—	1 week	Two powders, 2d.
136	1	—	—	3 days	Powder, 1d.
137	—	—	1	4 days	
138	—	—	—	2 weeks	Diarrhœa.
139	—	—	—	2 days	
140	1	—	—	1 month	Eczema. Ointment, 1d.
141	1	—	—	2 weeks	Eczema. Ditto.
142	1	—	—	2 weeks	Mixture, 3d.
143	1	—	—	2 days	Powder, 1d.
144	1	—	—	4 days	Severe diarrhœa. 2 powders, 1d.
145	—	—	—	6 days	
146	—	—	—	3 days	
147	—	—	—	3 days	
148	1	—	—	2 weeks	
149	—	—	1	2 weeks	
150	1	—	—	3 days	
151	—	—	—	2 weeks	
152	Tailor	—	1	1 month	Patent drops from Tailor; found Surgeon too expensive.
153	—	—	—	3 days	
154	1	—	—	3 days	
155	1	—	—	4 days	
156	—	—	—	9 days	
157	1	—	—	6 days	
158	—	—	—	18 days	
159	—	—	—	21 days	
160	—	—	—	3 weeks	
161	1	—	—	4 weeks	
162	1	—	—	5 days	
163	—	—	—	1 month	
164	—	—	—	4 days	
165	1	—	—	1 week	
166	1	—	—	10 days	
167	—	—	1	6 weeks	
168	—	—	—	3 weeks	
169	1	—	—	9 days	
170	1	—	—	1 month	
171	—	—	—	12 days	
172	—	—	—	Several months.	
173	1	—	—	14 days	
174	—	—	—	3 months	
175	1	—	—	5 days	
176	—	—	—	3 days	

No.	Previous application to Druggist.	No medical aid before application.	Consulted a Surgeon.	How long ill.	Remarks.
177	1	—	—	14 days	
178	1	—	—	7 days	
179	—	—	—	3 days	
180	1	—	—	1 week	
181	1	—	—	3 months	
182	1	—	—	1 month	
183	—	—	—	2 weeks	
184	—	—	—	2 days	
185	—	—	—	3 weeks	
186	—	—	1	7 weeks	
187	—	—	—	2 weeks	
188	1	—	—	3 weeks	
189	1	—	—	14 days	
190	—	—	—	2 days	
191	—	—	—	1 week	
192	—	—	1	1 month	3s. 6d. Note for 14 days, but not much relieved; thought she should like to try the Children's Hospital.
193	1	—	—	14 days	
194	—	—	—	2 days	
195	—	—	—	7 days	
196	—	—	—	14 days	
197	1	—	—	9 days	
198	—	—	—	1 day	
199	1	—	1	2 months	Went to the Druggist first, then to the Surgeon for 14 days; could not go on because of his high charges, and child no better.
200	—	—	—	2 weeks	
201	—	—	—	3 days	
202	1	—	—	2 days	Fever powder, 1d.
203	1	—	—	2 weeks	Two fever powders, 1d. each.
204	—	—	1	1 week	Had taken the child to General Hospital; not having ticket, refused farther attendance.
205	—	—	—	2 weeks	
206	1	—	—	3 weeks	
207	—	—	—	1 week	
208	—	—	—	2 months	
209	1	—	—	3 weeks	
210	—	—	—	4 days	
211	1	—	—	5 months	
212	1	—	—	14 days	Druggist gave a prescription for syrups. Woman made it up herself.
213	1	—	—	14 days	

No.	Previous application to Druggist.	No medical aid before application.	Consulted a Surgeon.	How long ill.	Remarks.
214	—	—	—	4 days	
215	1	—	—	2 days	
216	—	—	—	3 years	
217	—	—	1	6 weeks	Too expensive; child did not get better.
218	1	—	—	1 week	Went to the Druggist nearly every day; sometimes charged 5d., sometimes 1d.
219	1	—	—	2 weeks	
220	—	—	—	2 weeks	
221	1	—	—	1 week	
224	—	—	1	6 months	
225	1	—	—	3 weeks	Had one prescription made up.
226	—	—	1	3 months	Been under two Surgeons: came here because child did not get better, and mother could not pay longer.
227	1	—	—	2 months	
228	1	—	—	2 months	
229	—	—	—	2 years	Only been to this Hospital.
230	1	—	—	4 days	
231	—	—	—	1 week	
232	—	—	—	3 weeks	
233	—	—	1	3 months	3s. 6d. note; could not pay longer.
234	1	—	—	7 days	
235	1	—	—	7 days	
236	—	—	—	10 months	Been to this Hospital.
237	—	—	—	1 week	
238	—	—	—	2 weeks	
239	—	—	—	2 days	
240	—	—	1	4 months	Came here because could not afford to pay Doctor longer.
241	1	—	—	From birth	Wasting. Teething powders.
242	—	—	Parish Surgeon	3 weeks	Ordered to go to Parish Surgeon again, as the child wants nourishment and oil only.
243	1	—	—	2 months	Druggist is a Herb Doctor.
244	1	—	1	6 months	Went to the Surgeon first, and afterwards had medicine from the Druggist.
245	—	—	—	9 days	
246	—	—	—	4 days	Acute bronchitis. Extremely ill.
247	—	—	—	3 days	Measles.
248	—	—	—	4 days	Diarrhœa.
249	1	—	—	2 years	The itch; another in the house has it. Could not afford to pay a doctor.

No.	Previous application to Druggist.	No medical aid before application.	Consulted a Surgeon.	How long ill.	Remarks.
250	1	—	—	2 years	
251	1	—	—	From birth	New disorder lately, and applied for remedies to Druggist.
252	—	—	—	6 days	
253	—	—	—	4 days	
254	—	—	—	4 days	
255	1	—	—	6 days	Acute catarrh.
256	1	—	1	14 days	Surgeon charged 6d. for advice and bottle of physic. As the child was no better, brought it here.
257	1	—	—	4 days	
258	—	—	—	3 days	
259	—	—	—	7 days	
260	1	—	—	3 months	
261	—	—	—	4 days	
262	—	—	—	6 days	
263	—	—	—	4 days	Was a patient here lately, but could not afford to take him to a doctor, as husband is very short of work.
264	1	—	—	14 days	Powders and medicine; could not afford a doctor. Bronchitis, Diarrhœa.
265	—	—	Parish Doctor.	5 months	Wasting. Inflammation of the Eye. Has had the Parish Doctor for five months; child no better. Could not afford to pay a private surgeon. Has had five ill. Came nearly eight miles to the Hospital.
266	—	—	—	3 weeks	Bronchitis.
267	1	—	1	3 weeks	Took her to a doctor, as the medicine from the druggist did no good. Doctor's medicine was 1s.; could not afford to take her again, as husband only got 10s.6d. last week
268	1	—	—	Nearly three weeks	Very ill with scarlatinal dropsy. Three at once ill with scarlet fever. Could not afford to pay a doctor. Child taken into the Hospital.
269	1	—	—	1 week	
270	1	—	—	6 days	
271	1	—	—	14 days	
272	1	—	—	2 days	
273	—	—	—	14 days	
274	1	—	—	2 months	Took her to a druggist because a M.D. and Fellow (by examination) of the College of Surgeons, gave an unfavourable opinion of the case.

No.	Previous application to Druggist.	No medical aid before application.	Consulted a Surgeon.	How long ill.	Remarks.
275	—	—	1	6 months	For the first five months had medicine in London from a doctor; nothing for the last month since living in Birmingham.
276	1	—	—	8 days	Diarrhœa; getting worse.
277	—	—	—	4 days	Inflammation of mouth.
278	1	—	—	3 days	
279	—	—	—	1 month	
280	—	—	—	3 weeks	
281	—	—	—	3 days	
282	—	—	—	2 days	
283	1	—	—	1 week	Mixture 2d.
284	—	—	1	9 weeks	Illegitimate. Mother, a stitcher, could not afford to pay the doctor longer; nine weeks under his care.
285	—	—	—	14 days	
286	—	—	Parish Surgeons.	6 months	Under two Parish Surgeons for two months—no relief, so brought to the Hospital.
287	1	—	—	1 week	
288	—	—	—	2 weeks	Bad case of St. Vitus' Dance. No medicine or advice until brought to the Hospital.
289	1	—	—	1 week	2d. for syrups.
290	—	—	—	5 days	
291	1	—	—	3 days	Severe case of scarlatina; no empty beds; six children.
292	1	—	—	6 days	1d.
293	1	—	—	14 weeks	
294	1	—	—	6 months	Often had a 3d. bottle from Druggist.
295	—	—	—	6 days	
296	1	—	—	2 weeks	Bad case of stomatitis. Two powders, 1d. each; honey and borax; no improvement.
297	1	—	—	4 days	
298	1	—	—	1 month	
299	—	—	—	14 days	Diarrhœa.
300	1	—	—	3 weeks	
301	—	—	—	3 weeks	
302	1	—	—	7 days	Scarlet fever. Went to a Druggist, who recommended that the child should be taken to a Surgeon. Was then taken to an unqualified practitioner.
303	—	—	—	3 days	
304	1	—	—	3 weeks	

No.	Previous application to Druggist.	No medical aid before application.	Consulted a Surgeon.	How long ill.	Remarks.
305	—	—	—	3 days	
306	1	—	—	14 days	
307	—	—	—	From birth	Wasting.
308	—	—	—	18 days	Epilepsy. Had a Surgeon 18 months ago for fits.
309	1	—	—	3 days	Diarrhœa.
310	1	—	—	14 days	
311	1	—	—	14 days	
312	1	—	—	6 days	
313	1	—	—	4 days	
314	—	—	Parish Surgeon.	12 days	Bronchitis after measles. Had him to the Parish Doctor first; brought him here because had had relief for him on a previous occasion.
315	—	—	—	6 days	
316	—	—	—	14 days	Laryngitis. Rheumatism.
317	1	—	—	7 days	
318	—	—	1	1 month	Child very ill with inflammation of lungs and hooping cough. Had a Surgeon for a week at the beginning of the illness. Did not send for him again because could not afford to pay him; two other children ill at same time with hooping cough.
319	—	—	—	3 days	
320	1	—	—	9 days	
321	—	—	1	11 weeks	Six powders, 6d. Surgeon practises like a druggist.
322	1	—	—	7 days	Syrup, 3d.
323	—	—	—	3 months	
324	—	—	—	2 days	
325	—	—	—	2 months	
326	—	—	—	1 week	
327	—	—	—	3 days	
328	1	—	—	3 weeks	Bottle of mixture, 1s.
329	—	—	—	2 weeks	
330	1	—	—	1 week	Syrup 1d.
331	—	—	—	1 month	Itch.
332	—	—	—	1 month	Itch.
333	1	—	—	4 days	
334	1	—	—	1 week	Syrups 3d.
335	1	—	—	1 month	Syrups 1d.
336	1	—	—	4 days	Powder 1d.
337	—	—	—	5 days	
338	—	—	—	4 days	
339	1	—	—	2 weeks	Syrups 2d.

No.	Previous application to Druggist.	No medical aid before application.	Consulted a Surgeon.	How long ill.	Remarks.
340	—	—	—	2 weeks	
341	1	—	—	3 weeks	Powders, two for 1½d.
342	1	—	—	2 weeks	Two powders, 2d.
343	—	—	1	6 weeks	
344	1	—	—	1 week	Two powders, 2d. each.
345	1	—	—	5 days	
346	—	—	—	7 years	
347	—	—	—	3 weeks	St. Vitus' Dance.
348	—	—	—	4 days	Convulsions.
349	—	—	Many Surgeons.	Almost from birth.	Fits; loss of power of limbs; nothing has done him good.
350	1	—	—	6 days	
351	—	—	—	14 days	
352	—	—	—	10 days	Diarrhœa.
353	—	—	—	7 days	
354	—	—	—	3 weeks	
355	—	—	—	5 days	
356	—	—	1	5 days	3d. for three powders. Surgeon keeps a druggist's shop like an ordinary druggist.
357	—	—	Parish Surgeon.	14 days	Acute pleurisy; made an in-patient.
358	1	—	—	some weeks.	9d. for bottle from druggist, who also gave advice. Child brought to the Hospital before.
359	—	—	—	2 years	Took her at first to St. Thomas's Hospital, London; not since anywhere.
360	—	—	—	12 months	
361	1	—	—	14 days	Hooping cough.
362	—	—	—	8 days	
363	—	—	—	From birth.	Child moribund; brought here five weeks ago. Cannot afford to pay a doctor, and was afraid to delay while getting a Note for the Parish doctor some distance off.
364	1	—	1	4 weeks	Was three weeks under a doctor with a 3s. 6d. Note; could not afford to pay for child any more, so brought the child, as it was no better, to the Hospital.
365	1	—	—	1 month	Hooping cough, syrups for 1d.
366	—	—	—	6 weeks	Bronchitis.
367	—	—	—	14 days	Bronchitis.
368	1	—	—	10 days	Measles; very ill. Took her to a druggist two days ago, who advised her to take it to a doctor.

No.	Previous application to Druggist.	No medical aid before application.	Consulted a Surgeon.	How long ill.	Remarks.
369	—	—	—	3 days	
370	—	—	—	12 days	
371	1	—	1	14 days	Bronchitis, hæmoptysis. Took her to a surgeon, and afterwards obtained powders from druggist.
372	1	—	—	from birth	Two or three powders a week for six months from druggist.
373	1	—	—	4 days	Diarrhœa. Two powders, no relief.
374	1	—	—	2 months	Diarrhœa. For 14 days under care of an unqualified practitioner. No improvement.
375	1	—	—	1 month	
376	—	—	—	3 months	
377	1	—	—	2 weeks	Powder, 1d.
378	1	—	—	6 weeks	Bronchitis six weeks ago. Pneumonia of whole of left lung; came on during the last four days. Medicine, 6d.; four powders, 1d. each. Went to Druggist four times; was to have gone again to-day, but could not afford to pay more.
379	1	—	—	1 week	Syrup, 3½d.
380	—	—	—	3 months	
381	—	—	—	1 week	Diarrhœa.
382	—	—	—	4 days	
383	1	—	—	3 weeks	Powders.
384	—	—	—	1 week	
385	1	—	—	5 days	Powder and Mixture, 3d.
386	—	—	—	2 weeks	
387	—	—	—	2 weeks	

4 Numbers accidentally omitted.

383 Total.

GENERAL SUMMARY.

Total number	383
Had applied to Druggist alone	154
Ditto to Surgeon alone (including one to a Hospital)	33
Ditto to Druggist and Surgeon	9
	196
Number of those who had been without any medical aid	187
Total	383
Number of those who had not had the attendance of a Medical Man	341

187, or about half, had been without any medical aid whatever.

154, or two-fifths of the whole, had only applied to a Druggist.

163 had employed a Druggist alone, or (in 9 cases) both Surgeon and Druggist.

33, or one-twelfth only, had been under the exclusive care of a qualified practitioner.

1 had been to a General Hospital previously.

1 had been taken to a London Hospital about two years before.

APPENDIX No. 2.

We can form an approximate estimate of the amount of diarrhœa-sickness in Birmingham from the weekly table of new cases of disease furnished to the newspapers by the active Borough Analyst, Dr. Hill. The tables are based on returns furnished by the General Hospital, the Queen's Hospital, the General Dispensary, the Children's Hospital, the Workhouse, and the Out-door Pauper Department; in other words, by all the general medical charities of the town and by the parochial service. In the week ending the 31st of July, 1869, there were 259 cases of diarrhœa. The distribution of these cases is very interesting, and demonstrates the truth of the general statements in the paper. 69 occurred at the General Hospital; none at the Dispensary; 37 at the Queen's; 110 at the Children's Hospital; 2 at the Workhouse; and 41 in the Out-Patient Pauper Department. In the following week there were 281 cases of diarrhœa and dysentry. 33 of these occurred at the General Hospital; none at the Dispensary; 40 at the Queen's; 160 at the Children's Hospital; 1 at the Workhouse; and 47 in the Out-door Pauper Department. Nearly two-thirds, then, of the whole number were brought to the Children's Hospital, and when it is considered that the other numbers include a large proportion of children, we can thus form a notion of the prevalence of diarrhœa sickness in early life in a large town. The whole number of new cases amounted to 1,362. Of these 376 were accidents, leaving 986 cases of disease. There were 281 cases of diarrhœa and dysentry, or about 28 per cent. of all the cases of disease.

Another noteworthy circumstance is the small number of cases attended by the parish surgeons—47 in all the five districts. There can be no doubt as to the class of persons among whom diarrhœa is most prevalent; and when we read of 40 cases at a General Hospital, 160 cases at a Children's Hospital, and 47 in all the poor districts of the town distributed among five parish surgeons, we are forced to conclude that the destitute do not obtain aid from the quarter which is believed to afford it.

I would also draw the attention of those interested in questions of hospital administration to the fact that at a period when

more than a quarter of the sickness of the town proceeded from diarrhœa and dysentry, no case of these disorders was admitted at the Dispensary! This last is a strictly privileged institution, and is, therefore, not disturbed by epidemic influences. The Directors of the Children's Hospital seem to think that a charity should endeavour to respond to the wants of the community, be they great or small. Hence, at this last institution there were only 40 cases of diarrhœa and dysentry in the week ending the 5th of June, against 160 in that ending on the 7th of August. In neither of these weeks were any cases reported from the Dispensary.

The summer-rate of mortality is remarkably affected in some towns by diarrhœa, and nowhere more than in Birmingham. The annual rate of mortality was 25 per 1,000 in the week ending August 14th. This was greatly above the rate prevailing for many months previously. In the week ending the 24th of July it had descended even to 14 per 1,000. This marked increase is mainly caused by diarrhœa, though, as is so well known, cholera proper has never been epidemic in Birmingham. It may be useful to note here that the annual death rate per 1,000 from diarrhœa in the first of these weeks amounted to 2 in Bristol, 4 in Hull, 5 in Bradford, 6 in London and Newcastle-upon-Tyne, 7 in Leeds, 8 in Birmingham and Sheffield, 9 in Liverpool, 10 in Manchester, and 12 in the Borough of Salford. The annual increase in the mortality of Birmingham from the prevalence of diarrhœa during the summer quarter deserves the careful consideration of the Town Council. I entertain no doubt that more energetic measures of sanitation, under the guidance of a scientific observer, would be productive of important results and place the midland metropolis in a still more favourable position than it at present holds. Unhappily the town motto "Forward," is made to apply chiefly to politics, and does not sufficiently guide its public men in other spheres of labour. When a Birmingham magistrate is told that the town might be made more healthy, he displays the same tone of mind as if a tolerably respectable man charged with ill-doing were to defend himself by saying that he was more virtuous than the inmates of the Borough Gaol.

APPENDIX No. 3.

The tone of some remarks in a paper by Mr. Bridges, published in the August number of the *Fortnightly Review*, leaves on my mind the impression that the writer is not very strongly convinced of the propriety of saving the lives of the children of the poor, in the present stage of sanitary legislation. He tells us, page 152, that "in Liverpool one out of every four children that are born dies before it is a year old. In the cotton towns it is one out of every five; in England at large it is one out of every six; in the south-west counties, one out of every seven; in Sedburgh, Farnborough, and other healthy districts, it is one out of every ten. But a thought will at once occur to many of those who listen to me—a thought which most of them will shrink from expressing, but which I for one think it best to face boldly. Is it not best, some will ask, that these children should die? Given the circumstances of their parentage and birth; given the atmosphere, moral and physical, which surrounds their childhood, is it well that unhealthy lives should be saved to propagate a yet unhealthier offspring?" After allusions to the habits of classic nations, the author further asks—"Is not the tremendous mortality of infants in overcrowded towns Nature's process for ridding us of the sickly lives, and sparing those only that are strong?" Mr. Bridges speaks of the "natural process" interfering with the maturity of many animal ova, and of the ancient nations and tribes of the present day "who do not hesitate to assist that natural course by deliberate infanticide. How stands it then with nations whose religious faith, whose trained instincts of benevolence lead them to the opposite course of revering and preserving the sickliest and weakliest human life? Was not Plato right in his antipathy to physicians? Do we run no danger, in our excessive medical and sanitary care of unhealthy lives, of deteriorating the offspring, of sacrificing the future to the present." . . . "I believe the course of action to which the avoidance of this danger points us to be very clear, and definite also. The lesson is this: there are two roads to follow, one lies straight before you, the other straight behind. Stagnation is the *one fatal course*. Your sanitary legislation must go far in advance of its present standard, *or else it had better cease altogether*. . . . . to Nature's savage,

cruel methods, of course we cannot recur. The moral tradition of our race forbids it. We cannot, even if we would, eradicate the instincts of pity, the passion of benevolence. We cannot go back; therefore, if we would avoid death, we must go forward," p. 153. I do not intend to enlist popular prejudices against this sincere writer, but must express my dissent from the declaration that "stagnation is the one fatal course;" or that sanitary legislation had better cease than stop where it is—a more fatal course than stagnation is going back, and passing over in neglect the preventable deaths of even the weakest children. If sanitary legislation is not equal to the wants of the people, let us improve it, instead of abolishing it altogether. I find my answer to the questions propounded by the author in these considerations. Human lives are not quite so unimportant as the ova of fish. The naturalist's view of the affair is weighty; but natural history has not much to do with the human soul. Its aspirations and sorrows, its capabilities of the heroic, its "looking before and after," its inextinguishable and inarticulate longing after the unknown, do not easily submit themselves to definition and classification. But, moreover, there is the obligation on us to remember what we owe to our neighbour; and that, under all conceivable circumstances, we are bound to perform the duty which lies nearest to us. The full appreciation of this last solves many difficulties. In the present case it teaches us to save the lives of the children of the poor by all the means in our power. The next step in sanitary progress will the more surely and rapidly come, when this first duty shall have been seriously performed.

APPENDIX No. 4.

REGULATIONS FOR THE ADMISSION OF PATIENTS AT THE BIRMINGHAM FREE HOSPITAL FOR CHILDREN.

1. That the Secretary shall give out the notes daily, between the hours of nine and ten in the morning.

2. That in the absence of the Secretary the House Surgeon shall perform this duty.

3. That previous to giving a note, the Secretary shall institute a series of inquiries as to the pecuniary means of the parents or friends of the child, to embrace the following points:—

(*a*) The total earnings in family.

(*b*) The number of family.

(*c*) The nature, so far as he can learn, and the duration of the illness.

(*d*) The reception or non-reception of parochial relief at the time of application.

(*e*) The number of children for whom relief is desired.

4. That in the event of the earnings of the family amounting to 25*s.* per week (the number of children not being more than three), the Secretary shall refuse a ticket, supposing the case to be one of ordinary illness of recent origin.

5. That he shall refuse a ticket to the parents of the child, the united earnings of whose family amount to 30*s.* per week, the children being more than three, supposing the case is one of ordinary illness of recent origin.

6. That he shall refuse a ticket to more than two of one family at the same time, unless the cases are of great urgency, or of a contagious nature.

7. That he shall not refuse relief to children of persons in receipt of parochial pay, unless the cases should be those of ordinary illness of recent origin.

8. That in the event of parents bringing a child for relief, suffering from a disease of unusual severity or of a protracted duration, or labouring under a condition requiring for its cure a delicate surgical operation, a note shall be given to such parents, even if their weekly earnings should amount to a sum above the maximum mentioned in regulations No. 4 and No. 5. In such cases the above facts to be endorsed upon the back of the notes, for the further consideration of the Physician or Surgeon under whose care the cases shall come.

9. In the event of a case having been under the care of a qualified medical attendant, and of that attendant furnishing a certificate of fitness, a note to be given without further inquiry. The Medical Committee reserve to themselves the right already accorded to them by the laws and by the express resolution of the Managing Committee of admitting without delay, either as out-patients or as in-patients, children labouring under disorders of great urgency, as croup, hæmorrhage, scarlatina, or malignant sloughing, &c., &c. They propose, however, that in the event of the parents of such children being in no proper sense of the word "necessitous," that the administration should be entitled to charge them such a sum per diem as will just cover the expenses of the class of patients to which they belong. In the event of a refusal to comply with this regulation the Medical Officers propose to exercise their power to dismiss the patients.

APPENDIX No. 5.

An amusing illustration of the chaos reigning in the Poor Law service has lately been offered to the Birmingham public. I make no comments on the following letter, which I extract from the columns of the *Birmingham Daily Post* for August 14th. That such a letter should have been necessary—that it should have been written from a Central to a Local Board—and that this last should be still flourishing in spite thereof, constitute satisfactory evidences of the stage of advancement arrived at in Poor Law administration.

THE BIRMINGHAM GUARDIANS AND THE POOR LAW BOARD.

EXTENSION OF THE WORKHOUSE.

In the report of the Guardians' meeting, on Wednesday, we mentioned that the Poor Law Board had refused their sanction to the proposed extension of the Workhouse by the erection of wards for epileptic patients, and had advised the erection of schools for girls and infants, in order to separate the children entirely from the pauper inmates. The question is of so much importance that we think it desirable to publish the full text of the communication from the Poor Law Board. It is as follows—

"Poor Law Board, Whitehall, S.W.,
"July 20, 1869.

"Sir,—I am directed by the Poor Law Board to acknowledge the receipt of your letter of the 8th instant, in which you inform them that the Committee of Guardians of the parish of Birmingham to whom the duty was referred of consulting with their medical officer as to his opinion when any of the wards occupied by epileptic bedridden cases and infants were overcrowded, and, if so, in what manner the additional accommodation required for them could be most readily and satisfactorily obtained, has recommended the erection of a building capable of accommodating 200 epileptic patients.

"The Guardians further inform the Board that direction was given for advertisement for plans, that plans have accordingly been received from five separate architects, and that one of these plans has been selected and approved by the Guardians, at an estimated cost of £4,850.

"The Board feel it their duty, in the first instance, to comment on the very unusual course taken by the Guardians, in employing architects and obtaining plans without consultation with, or authority from, the Board; and in incurring expense, and involving themselves in engagements, not only prior to any understanding having been arrived at with the Board, but with a full knowledge, on the part of the Guardians, derived from previous

correspondence, that the particular plan which the Guardians have thought proper to sanction—viz., for the erection of a building for the accommodation of 200 epileptic patients—is one to which this Board entertain and have already expressed their objection.

"In a letter, dated October 13th, 1868, the Board declined to consent to the proposal of the Guardians to build additional wards for the reception of harmless imbecile patients who were at that time in the Borough Asylum, and in a subsequent letter, dated December 1st, 1868, in reply to a letter of the Guardians, in which they propose to build for the accommodation of 125 male epileptic patients, the Board observing upon the similarity and connection of the two proposals repeated their objections, and urged that, if additional accommodation was required for any of the adult classes in the Workhouse, the completion of the schools for girls as well as boys, would, in the opinion of the Board, be the most economical mode of providing it.

"The Board must, therefore, express their regret, not only that the Guardians persist in recurring to a proposal which has been thus emphatically condemned, but that they have proceeded upon the assumption that the Board would now assent to that from which they have already dissented.

"The Board must repeat their opinion that the accommodation which is needed for adults must be sought for not in the direction suggested by the Guardians, but rather by erecting a school for girls and infants, and thus obtaining in a larger measure that relief which will, to a certain extent, be experienced when the school now in course of erection for boys shall have been completed.

"The Board are of opinion that the number of inmates now aggregated together in the Workhouse under a single management is already sufficiently large; and that if there is any one class which it is inexpedient to collect together in large numbers, it is that particular class of epileptic patients which the Guardians seek to accommodate.

"It is very doubtful whether the proposed arrangement would tend to the diminution of the cost, while it is certain that it would directly aggravate the existing difficulties of management.

"I am, Sir, your obedient Servant,
"H. FLEMING, Secretary.

"W. Thompson, Esq., Clerk to the Guardians
of the Parish of Birmingham."

I cannot speak of the next illustration of the Poor Law system, extracted from the *Daily News*, August 18th, 1869, as amusing. I read it with mingled grief and anger, and ask with impatience, how long is this to endure? We have now to deal with the Metropolis itself, and with doings not far removed from the direct observation of the Poor Law Board.

TREATMENT OF THE ST. PANCRAS POOR.

Yesterday Dr. Hardwicke, deputy coroner, held an inquest at the College Arms, in Crowndale Road, Camden Town, on the body of James Crew, aged fifty-nine, a coachman, who died in the infirmary of the St. Pancras Workhouse.

The history of the case, as gathered from the evidence, is as follows:—Deceased some time ago attempted to commit suicide, and after having been taken to the House of Detention, was removed first to the insane wards of the Workhouse, and then to Colney Hatch Asylum. He was discharged from Colney Hatch as cured towards the end of last year, and then received 5s. a week and three loaves a week from St. Pancras as out-door relief. The guardians a short time ago discontinued this relief, and said the man, his wife, and three children must go into the house if they required more relief. The wife objected to break up her home, as she received 10s. a week for taking care of a gentleman's house, with which she was enabled to pay 4s. 6d. a week and support her three children. The husband, however, went into the house. The discharge committee suggested to him (as admitted by the relieving officer) that what little goods his wife had must be sold to pay part of his maintenance, and that the whole family must go into the house. The wife of deceased objected to give up her lodging and sell her goods, as she said the gentleman whose house she was tending might return at a moment's notice, and then she would have nowhere to go to. She objected to go into the workhouse, and alleges that she told the relieving officer she would support her husband out of the house if the guardians would only allow her 1s. or 1s. 6d. per week. This the relieving officer did not remember, but he stated that he advised the discharge committee to continue the out-door relief as a better course than pauperising the whole family. The committee did not agree with this, but insisted that the house must be broken up and the goods sold. Before any action however was taken the man died.

The widow said the threat of the committee to sell them up preyed upon deceased's mind, and when she visited him in the workhouse he said he should get on very well "only for that horrid committee." He several times said he dreaded going before those men again. She believed his death was accelerated by anxiety, the result of the way the committee treated him.

The medical evidence showed that death was caused by apoplexy last Saturday morning.

Mr. Watson, one of the "minority" in the Board of Guardians, said if the alleged threat had been held out it was a most unusual and inhuman one.

A juror said there was great blame to the guardians for acting as they had done.

Dr. Hardwicke said it was the fault of the Poor Law system, which did not profess to endeavour to prevent pauperism.

Mr. Watson said in spite of the Poor Law they often gave out-door relief sooner than break up the homes of the poor. (Remarks of approval from the jury.)

The Foreman of the Jury (Mr. Ward) said it was a wretched policy to try and make this poor woman give up a situation of 10s. a week, break up her little home, sell what few goods she had, and go into the workhouse with her children because her husband was too ill to work for his own living.

A juror said that if that was the policy of their new guardians it was a disgrace to them.

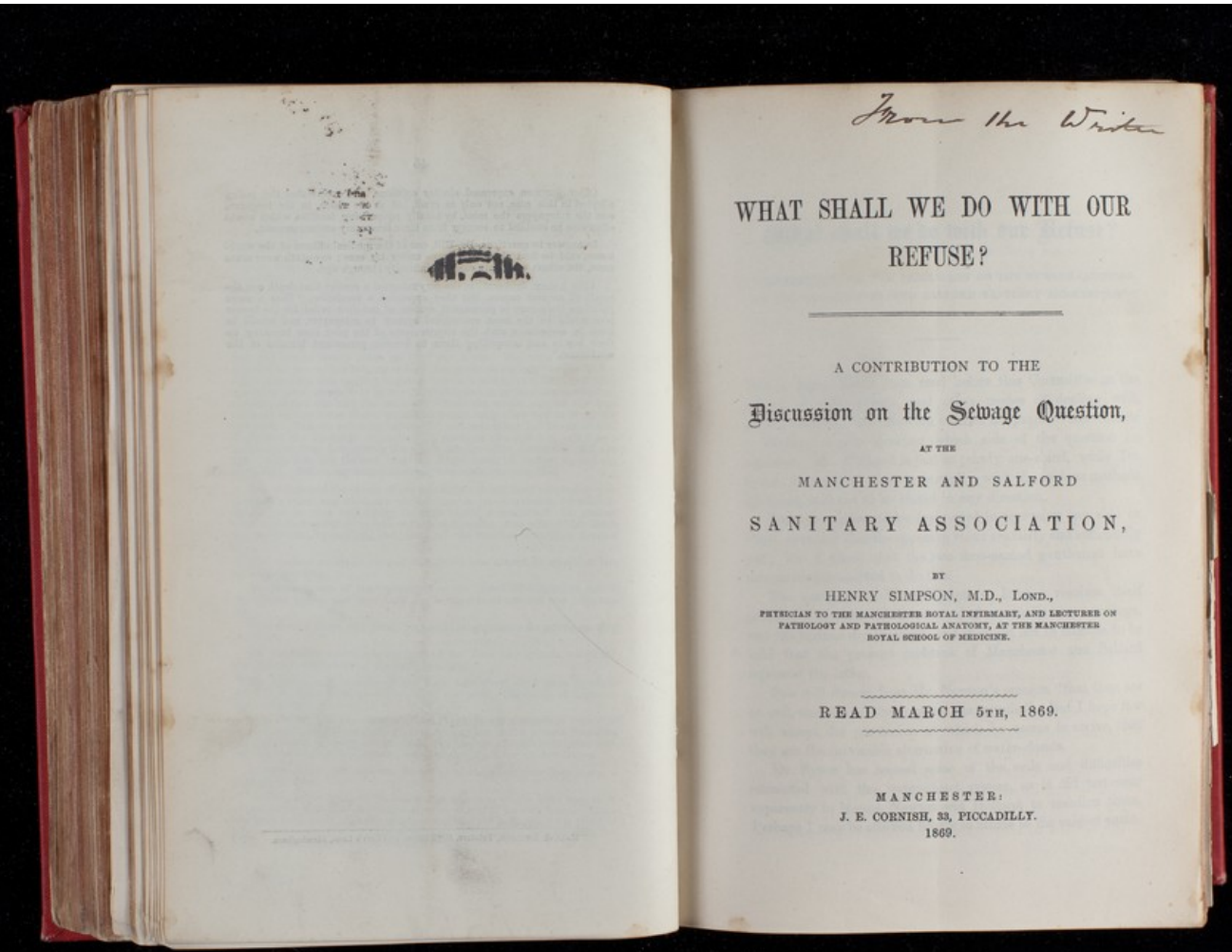
Another juror expressed his belief that the man would have been alive at that moment if the guardians had relieved him at his own home. There was very little doubt that the apoplexy was brought on through his dread of having his home broken up, and his wife and children brought into the house. (Hear, hear from the rest of the jury.)

Other jurymen expressed similar opinions, and repudiated the policy adopted in this case, not only as cruel, but as one which, in the long-run, cost the ratepayers the most, by totally pauperising families which would otherwise be enabled to recover from their temporary embarrassment.

In answer to questions, Dr. Hill, one of the medical officers of the workhouse, said he had about 600 cases under his care; one-sixth were acute cases, the others were only cases of infirmity through age.

After a short deliberation, the jury returned a verdict that death was the result of natural causes, but they appended a resolution, "That a more judicious temporary or permanent system of out-door relief for the honest poor would be the most economical system to ratepayers, and would be more in accordance with the requirements of the poor than breaking up their homes and compelling them to become permanent inmates of the workhouse."

HALL & ENGLISH, Printers, High Street, and Carr's Lane, Birmingham.



From the Writer

WHAT SHALL WE DO WITH OUR REFUSE?

A CONTRIBUTION TO THE

Discussion on the Sewage Question,

AT THE

MANCHESTER AND SALFORD

SANITARY ASSOCIATION,

BY

HENRY SIMPSON, M.D., Lond.,

PHYSICIAN TO THE MANCHESTER ROYAL INFIRMARY, AND LECTURER ON PATHOLOGY AND PATHOLOGICAL ANATOMY, AT THE MANCHESTER ROYAL SCHOOL OF MEDICINE.

READ MARCH 5TH, 1869.

MANCHESTER:
J. E. CORNISH, 33, PICCADILLY.
1869.

Take a town of any size you please. The system involves a complex arrangement of drains, commencing at the closets themselves, and terminating usually at the bank or bed of a river, or somewhere about low water mark on the shore of the sea, or of a tidal estuary,—and to terminate in time future—in enormous tanks, almost lakes, of diluted excrement. The small drains from the houses have theoretically a fall to the street-drains, and these again to the larger ones to which they converge, and so on till they reach the place of exit, which is the lowest point. Provided that the engineering skill, practical and scientific, brought to bear on their construction has been perfect, so that this gradual and continuous fall has been maintained,—provided that the walls of the drains and the joints are everywhere, as they should be, impervious to air and moisture, you have an admirable arrangement for carrying away soft and soluble matters,—assuming that sufficient water is used to sweep them along. These drains commence in the houses,—form an almost endless ramification under our towns; our houses, our streets, and our public buildings, are undermined by the tributaries of our "sewer rivers." But, perfect as this arrangement of tubes may be for the conveyance downwards of liquid and suspended solids, just as perfectly is it adapted for the ascent of the noxious gases rising from the decomposing mixture slowly flowing along them. These gases, unable to pass downwards, take advantage of every chink or cranny, of every imperfect trap, of every street grid, to escape into the air, and at every raising of the water-closet handle, our dwelling-houses are invaded by sewer air.

So then, granting that a system of drains may almost approach theoretical perfection, you only deal with the liquid and solid, and leave the noxious gases—subtle promoters of disease—struggling for and gaining access to your houses.

But we have heard from those whose authority is unquestionable—just what we expected to hear—that in Manchester the drainage is not perfect; that drains have sometimes a fall, sometimes none, (at least in the right direction,) but go up hill instead, and, in short, that the irregularities in their level convert them, in many places, into enormous underground cesspools, from which tons of matter, chiefly decomposing human ordure, have to be removed. Then, too, by practical experience we know that they are not air and water-tight, that joints will give, and that rat-holes form an important means of sewer ventilation, too often unfortunately into dwelling-houses.

Dr. Hawkesley says that "about fifty-six years ago, a clever and eminent man invented water-closets, by which he hoped to wash away, and consign to oblivion, the material he was only anxious to put out of sight." But we *cannot* consign matter to oblivion, and it was never intended that we should do. A constant cycle of change is going on, or ought to be, by which matter taken from the soil and the air is formed into the tissues of the plant; afterwards into those of the animal; and, when its purpose in the animal organism is served, it is thrown back again to its original inorganic condition, ready once more to pass through the same series of changes. In the early days of water-closets, these familiar facts were unknown or ignored, and the land was believed to be inexhaustible. It seems as if, even now, there were scarcely a belief in the importance of obeying what is so clearly nature's method. We are engaged in a constant effort to remove from our midst—and to destroy if we can—matter that is of the utmost value as manure, and at the same time are importing manure at great cost to take the place of that we wilfully throw away. In Dr. Hawkesley's pamphlet you will find calculations showing the enormous amount, and the great money value, of what we now waste, but with which I will not weary you. But he instances

China, with its dense population, where "the soil has for upwards of three thousand years *never decreased in fertility:*" where they have no meadow culture or fodder-plants, or farm-yard manure, and yet "their fields yield a crop twice a year and never lie fallow." But "they return to the soil the elements taken from it." He quotes also from a report to the Minister of Agriculture at Berlin, by Dr. H. Maron, a statement to the same effect respecting Japan. That it is better cultivated than England,—has a greater population than Great Britain and Ireland,—and maintains them without any supply of food from other parts. "The only manure producer is man." Now, although we do not wish to follow them in all their arrangements, there is no reason why we should not get a hint or two from China and Japan. Much more might be said respecting the waste which the present water-closet system entails; a waste by no means compensated for by any system of irrigation of sewage yet adopted.

For the advocates of irrigation of sewage must admit that, by the time the land receives it, the greatest part of its value has been dissipated. The mixture of excrementitious matter with water already charged with decomposing matter, and its exposure to the action of the sewer air, leads of course to its speedy decomposition and the evolution of various gases to be inhaled at every visit to the water-closet. If these gases could be fixed, and the material, still containing them, be applied to the land, it would be a sanitary advantage and a national gain. Irrigation deals with the sewage when many of its most important constituents are lost, and when it is but the shadow of its former self.

After writing this sentence, an article in *The Times*, copied into the *Manchester Examiner* of the 25th inst., came under my notice, describing the successful results of irrigation with the sewage from the camp at Aldershott, where fifty acres of flinty

ferruginous sand were fit for sowing with Italian rye-grass at the end of a year, after the daily application of 170,000 gallons of sewage. But it is said that "one of Mr. Blackburn's great secrets is to get the liquid manure on to the land as soon as possible. Sewage very rapidly decomposes when exposed to the air, and with its decomposition and evaporation of its gases half its fertilizing elements are lost. A decomposed liquid manure he considers as almost injurious to the land."

This bears out my statement. The farm at Aldershott, distant only two miles from the camp, is of course much more favourably situated than the neighbourhood of Manchester, or indeed most large towns, for the reception of sewage, and there are but few lands so "dry and thirsty" as this is described as being.

Granting therefore, most willingly, that the application of liquid sewage to the land is much better than poisoning our rivers with it, or pouring it into the sea, I maintain that it is disposing of it in a wasteful and costly manner, inapplicable to the country at large.

But the water-carriage method not only entails the poisoning of the air in our houses as well as in our streets, but for a long time to come the poisoning and pollution of our streams and rivers. If *ever* they will be kept free from sewage admixture remains to be seen.

The advocates of the water-closet system are all willing to allow the reality of the mischief caused by the percolation of sewage into wells and water-courses from badly constructed cesspools, but they are unwilling to grant the force of the well-known examples of the outbreaks of cholera, as for instance that in Golden Square, that at Theydon Bois, near Epping, and others that could be cited, that have arisen in connection with water-closet drains. They must, however, acknowledge that the water-carriage system offers the greatest possible facilities

for the distribution of specific poisons discharged from the alimentary canal, and for the pollution of drinking-water—owing to the imperfections *always* actually present, even if not necessarily so, in an extensive system of sewers.

I have said nothing as yet of any other modes of dealing with excrementitious matters.

Most of us will admit that the present system of uncovered middens, so graphically described by Mr. Newton, is an evil and a disgrace, the effects of which can scarcely be exaggerated; and that the proposed plans of the Manchester and Salford corporations, although they have some good points, will provide an imperfect remedy. I may safely leave them, however, in the hands of Dr. Syson. But I demur to Mr. Newton's statement that "by the water-closet system the evil is removed from the midst of dwellings, and conveyed miles away before decomposition sets in." According to evidence brought before us at this committee, in the correctness of which, if I mistake not, Mr. Newton agreed, this is impossible in Manchester from the faulty construction of the drains.* And I demur, also, to the inference which I think may be drawn from his paper,—that the only alternative is the Manchester and Salford plan of storing up putrid soil in the ashpits.

Although at the Congress held at Leamington in 1866, to discuss the question of the sewage of towns, the advocates of the water method had a numerical triumph, I think they sustained an argumentative defeat; and that, to say the least, a case was made out for the dry method, which gave it a claim for a fair trial.

No adverse opinions can ever lessen the force of ascertained

* Bearing on this point I may mention a remark made to me the other day by Dr. Syson, "that he had never heard any of the advocates for water closets account for the fact that no paper is ever seen after the closet handle is once raised. In the course of a few yards does this paper get reduced to pulp and dissolved?"

facts, and evidence was then given, which no one could contradict, as to the success of the dry method at Halton, and at Lancaster, in the gaol and other places, where it has been tried by Mr. Garnett. This was in 1866. If it had been a failure it would have been given up; but yesterday morning I received a note from Mr. Langshaw, a well-known surgeon of Lancaster, referring to the gaol, in which he says that "it answers admirably. A little dried earth is always put into the commode, immediately after it is used, and the pan is emptied as soon as it is full enough. All disagreeable smell is done away with, and the manure which results is, I am told, *very rich,—a small quantity going a great way!* The plan is also carried out in our Royal Grammar School and at Ripley's Hospital, and I have been told that it is perfectly satisfactory in both establishments."

In the *Lancet* for February 20th there is an account of the success of the dry-earth closets at Broadmoor, in the State Criminal Asylum, where they have been in use for many months. They were used experimentally at first,—and for what reason? I will quote the answer. "As originally constructed, water-closets were everywhere provided throughout the wards, attendants' houses, &c.; but it appears that the constant tendency of the water-closets to get out of order, coupled perhaps with the prevalence during 1866 and 1867 of continued fever, of a mild type, yet showing marked tenacity of hold on the establishment, led to the experimental adoption last year of the earth closet, the result of that experiment being so satisfactory as to determine the government upon substituting the dry earth for the water-closet system altogether." There are now sixty-six in use, and "the further conversions are to be made when the necessary money shall be available."

I will not go into the details given, further than to say that there was "the strongest testimony from those most interested in the matter that the dry-earth system, in its sanitary aspects,

is, so far as Broadmoor is concerned, unassailable. The best proof, indeed, of this is that water-closets are being gradually abolished, and all their expensive paraphernalia of pipes, cisterns, cocks, &c., fixed at so great a first cost, and maintained at a considerable yearly outlay, are being removed."

More evidence of a similar character might be brought forward, and a paper which has been kindly sent to me from Lancaster, by Mr. Garnett, of Quernmore Park, gives a list of places where this method is in successful operation, from which it appears that it is gradually gaining ground. In this paper some plain directions are given as to the construction of common privies on the dry system.

But you will remember that this is not the storing up of *putrid soil* in the ashpits. This epithet, so familiar apparently to the water-closet school, I suppose from the continued contemplation of the result of their own ingenious apparatus, is not correctly applied to the product of the dry system when properly carried out. One distinctive character of this scheme is, that by it you avoid putrescence, and you preserve the excreta in a state the most valuable for manure, and the least offensive to the senses. It is no longer a question as to whether dry earth will accomplish this. This point has been proved and is acknowledged by the advocates of the water-carriage system. But as there are still some who may wish that this statement should be supported by authority, I will quote the words of Dr. Angus Smith, as given in his work on Disinfectants, just published:—"One may very correctly look on the soil as the greatest agent for purifying and disinfecting." But he says there is a limit to its powers, and that it "will not compare with metals or tar acids, if we look at bulk." He quotes Mr. Moule, and then says—"No one can doubt the disinfecting power of the soil, and certainly Mr. Moule has found a mode of applying it in very many cases." But, as all who know him

will anticipate, Dr. Smith sees both sides of a question, and cannot be held as a partisan by one or the other. You see, however, the power of the soil as a deodorizer is granted. He gives full credit to the "beauty" of the water-closet, but says, "its mechanism must be very excellent, and with the best a little chemical assistance from disinfectants is often needful to ensure comfort at home and avoid loss of property abroad." He says, however, a little further—"We live over a mass of putrescent matter in sewers; the water increases its activity.... The liquid matter, when neither removed rapidly nor disinfected, is our old enemy the cesspool, with a territory extending miles long instead of feet only, as in old times. The midden is better than the bad sewer. We find it not easy to obtain the theoretically good sewer of the Board of Health, which allows of no accumulation;" and further he says, "I believe we shall never see the extinction of either middens or water-closets."

I must apologize for making so many quotations, but you will, I am sure, willingly allow that one from Dr. Angus Smith is always worthy of careful attention.

I had now intended to give the view of Professor Rolleston, of Oxford, who is adverse to the use of the earth-closets. He was kind enough to promise me the proof of a paper to appear in to-morrow's *Lancet*, but unfortunately I have not yet received it; I may, however, say that he believes that the earth-closet "will fail as regards the spread of infection," as he "is more than equally certain that it will in other particulars." As the reasons for this belief cannot as yet be given, I abstain from more than mentioning Professor Rolleston's opinion until his paper is published.*

We may now, I think, consider the point of practicability as it regards the dry method. Dr. Syson dismisses Moule's earth-

* See Appendix.

closet in a somewhat summary manner. First, he says, it is not dry, as he has heard of unpleasant splashing. This, I think, is a mistake. In an institution I am acquainted with where a few are in use for the infirm and feeble, and found to be a great comfort, the "persons" he names have rather complained of the dryness causing the ascent of dust than of the opposite fault. But this is a trifling matter easily dealt with. Next, the quotation from Krepp, advertising Lienur's system, is of course intended "to make the boldest pause." When you speak of *millions* you are dealing with numbers of which we can form no estimate whatever, of which we have no definite idea, and in order to grasp their full meaning they must be subdivided into more manageable quantities. When you classify and systematize, and work out into a proper organization, these monstrous numbers lose their terror-exciting and bewildering vastness. Dr. Hawksley calculates that 3,000,000 inhabitants will occupy 500,000 houses, and divides these into 500 sections of 1,000 houses each. Each section he divides into ten sub-sections, each requiring a man and a boy with a waggon and pair of horses. A town of 100,000 inhabitants, according to this calculation, will occupy 16,666 houses and a fraction; but say 17,000 houses; *i.e.*, 17 sections—each divided again into 10 sub-sections—so that you would require 170 waggons,—no great number after all. If we take the population of Manchester and Salford as 500,000 it would give 83,330 houses in round numbers, but say 85,000 houses. This would be broken up into 85 districts requiring 850 waggons, &c., and if these were distributed over the vast area occupied by these towns I venture to say that the streets would not be blocked up, nor the traffic interrupted, more especially as this work would be over by nine in the morning.

But in this rough calculation I have proceeded on the supposition that the earth would have to be brought into the town,

as well as carried out. We are, however, not confined to the use of earth. In both the Manchester and Salford privies, ashes, in the former case sifted, are intended to be used; and they are also to be used in Mr. Morrell's closet. Now, if sifted ashes will serve the purpose of a disinfectant and deodorizer, a great part of the bugbear in the shape of the carriage into and out of a town of mountains of earth, that the opponents of the dry method make much of, will vanish. But will they do this? It is acknowledged that earth if used in sufficient quantity will do so. I will give one experiment made by the late Dr. Herbert Barker of Bedford—a man too early lost to his profession and his country—which is recorded in the Hastings Prize Essay for 1865. He went through a most extensive and laborious series of experiments, or rather through several series, and tested various substances as to their action on sewer gases, putrefying liquids and solids, &c. The one I quote consisted in burying completely 2 lbs. weight of intestines of the ox in 2 lbs. of wood and coal ashes, on the 15th of May. "On the 17th no change; 19th, fresh and sweet; 21st, very slightly offensive; 23rd, slightly offensive; 27th, yields no odour externally, but very slight odour internally; 29th, slightly offensive internally and somewhat softened; 31st, rather offensive; June 2nd, offensive—thrown away."

The same substance, treated with the same quantity of earth and placed in the same conditions became putrid much sooner.*

* Dr. Barker's experiments with 2 lbs. weight of intestines from an ox, completely buried in 2 lbs. weight of charcoal and earth, commencing May 15th, are as follows:—

Ex. 27.—Fresh-burned vegetable charcoal. May 17th, no change; 19th, a putrid odour emitted through the charcoal as well as from the substance; 21st, offensive; 23rd, slightly offensive, interior of good colour; 25th, rather offensive, but of fresh colour; 27th, yields a strong odour internally, but is of good colour; 25th and 31st, offensive, but still has fresh colour; June 2nd, very offensive and entirely decomposed—thrown away.

Ex. 28.—Earth-mould. May 17th, no change; 19th, putrid odour emitted through the mould; 21st, offensive; 23rd, very offensive, and contains maggots 25th, extremely offensive and full of maggots; 27th, entirely decomposed—thrown away.

He says that "wood-ashes possess a very decided deodorizing property; being in fact little inferior to carbolic acid." In his summary he says:—"For the deodorization of vegetable matter or offal that cannot be immediately disposed of, the zinc [meaning a salt of zinc] and sawdust mixture would answer perfectly. In its absence, or in the absence of carbolic acid... wood-ashes afford by far the best substitute. Wood-ashes act far better than pure charcoal, and after them, coal-ashes well pounded, stand next in efficiency."

Ashes we have in abundance, and have to pay for their removal. Separate them from the cinders, which should be burned, though they are now too often wasted, in spite of Professor Jevons telling us we shall soon be short of coal; then apply them either alone or mixed with earth to the excreta, and you will render them a valuable commodity, instead of useless refuse.

And in this way the difficulty of the dry-method becomes immensely lessened.

Of the various plans that we have had before us that of Mr. Morrell approaches the requirements of the case more nearly than any other. If it could be simplified in some points, as the action of the cinder-sifter, it would no doubt be improved, particularly for very low-class property. For middle-class houses and those occupied by the better-paid artizans I should be quite willing to abide by Mr. Morrell's judgment as to its keeping in order, even though Dr. Syson says it will not work. Mr. Morrell, as an engineer who knows the strength of materials and the strain they are equal to, will be allowed by Dr. Syson, I am sure, to be a competent judge of a question of this kind; and as an attempt to render the dry method available as a substitute for water-closets in our houses his scheme, I think, promises more of success than anything of the kind I have yet seen, especially if a little disinfecting powder is used with the dry-ash.

But we are told that dry methods will not work, that in the low parts of the town the people are so incorrigibly bad—so dirty—that no dry method will answer. That they steal the wood-work of the privies for fire-wood, that they are idle, so filthy and altogether so much below the brutes, that they cannot be expected to serve as anything but as instruments of destruction for any apparatus that can be devised. Now I beg to doubt a good deal of this, more especially when it is to apply with so much more force to the dry method than to any other. I believe that a little patience and some judgment, will in a short time do much to alter the habits of the people; and I do not suppose that this marvellously vicious and untamed class constitutes a large proportion of the population, nor do I see why it should be taken as the standard. But this unfortunate "residuum," occupying the cellar-dwellings, the back-to-back-houses, the undrained and filthy courts the disgrace of our authorities, where the people breathe the Manchester air (perhaps I ought not to call it the corporation compound of smoke and fœtor), instead of the air of heaven, would, if placed in somewhat more favourable circumstances, be gradually brought to appreciate the simpler decencies of civilized life. With our abundant supply of water we have none too much distributed in the "low parts" of the town. The *difficulties* of cleanliness and decency for these poor people must not be lost sight of. Baths and wash-houses for the poor should be more abundant and easy of access, and there should be a constant supply of water. The patient and persevering kindliness of the well-to-do and comfortable, should, as it could, wear away the crust of suspicion and shame with which the poor too often surround themselves, and which causes them to see enemies, till they prove to be friends, in all who are higher in the social scale than themselves.

With the use of the dry method the water supply to the

low parts of the town might be much more abundant than at present; and the cleanliness which is next to godliness—and without which the latter must rarely exist—would be more possible than at present.

We must not look at this question of middens as the only blot in our social condition, or the only cause for the high death rate for which we are too well known. It is difficult to separate the causes of the latter one from the other, and to assign to each its proper value; but we know that they go hand in hand, that food and drink, occupation and habits, the condition of the dwelling-house, and many other things, all combine to produce the result. The diminution of the infant mortality during the cotton famine, when the mothers could stay at home and nurse their children, illustrates this,* and points out one way in which our wealthy manufacturers could do much to increase the happiness of the mothers in their employ, as well as to lessen the number of those cut off before their time.

I hope it will not be thought that because I have said what I think as to the various methods of the disposal of sewage, I am insensible to the good points of the water-carriage system, and blind to the difficulties of the dry method. My object is to aid, in however small a degree, in inducing our authorities to give the latter a trial, and, when this is done, that it shall be tried thoroughly in all its completeness, so that it shall fail or succeed on its merits. If it succeed it will be an invaluable boon; and if it fail, which I do not expect, we can only hope to attain the minimum of the inconvenience, the danger and the loss incident to the water-closet system, by gradually approaching that perfection in construction from which we are now so far distant.

* My friend, Dr. Noble, took exception to the above statement, considering that the diminution of infant mortality was due to the mild winters during the cotton famine. But we know that the want of their natural food, and improper feeding, in lieu of it, is a cause of much of the loss of infant life, and I allow the passage to stand unaltered.

Appendix.

In the paper referred to, which appeared in the *Lancet*, of March 6th, Professor Rolleston draws attention to Von Pettenkofer's opinion which is adverse to "disinfection with earth and peat." Indeed he "fears the greatest danger from it, especially as regards cholera," from impregnation of the soil with excreta. Now without entering on the arguments for or against Von Pettenkofer's theory, we may be quite assured that the soil in the immediate vicinity of the earth-closets runs no more risk of impregnation than where water-closets are used, provided that we have, as we have a right to expect, the earth-closets and their appurtenances properly constructed. Of course some impregnation of the soil of the open country is a necessary condition of successful agriculture.

Professor Rolleston very properly applies this reasoning to "the localisation and diffusion of typhoid fever," and expresses the opinion that "of the two recognised foci for infection—the bespattered privy and the contaminated well,—the former may be the one which is more commonly at work." He then says, "for though it is said that the larger proportion of women—and children—sufferers points to the water, of which they are said to drink more, being the cause at work, the facts are, not that the women and children drink more water in tea, &c., than the men, but that they get less beer; whilst many of the men in our semi-savage villages never use a privy at all, or at least not habitually. This last is the true differentiating condition." Now I apprehend that it makes all the difference in the world as to whether the water is boiled or unboiled. If the men only drink water in tea, after boiling, they are much less likely to be attacked by typhoid fever than the women and children, who at their mid-day meal, or at other times, drink it fresh from the well; and in this way the beer may be a negative protection, by preventing the men from drinking unboiled water.

safely, and without reproducing "the horrid Manchester middens;" for the composition of these middens is generally very complex.

The fourth objection to earth-closets is the double journey into and out of town which the earth would have to make. This seems at first sight a great difficulty, but I believe that it would become much less of one if the scheme were thoroughly systematized. Such a scheme for any large town could not be perfected all at once; time and thought would be required, but this cannot be considered as remarkable in a new and extensive undertaking. This difficulty Professor Rolleston thinks may tempt us to advocate the employment of ashes (which are better than earth), and he fears the supply would be insufficient. If this should prove to be so in the cottages of the poor, why not utilize the vast quantities produced at the various works in most large towns? If this source were made use of I do *not* think with Professor Rolleston that "quantitative considerations" would prove the stumbling-block he anticipates. Contrary to his opinion, moreover, there is good evidence of the success of the dry method at Lancaster and other places, where it is tried on a considerable scale. And we must remember that it is only quite recently that any attempts have been made in this direction with scientific method; while the water-carriage system has long been and still is a favourite subject of engineering skill, and the construction of a *cloaca maxima* which shall rob the soil of its due, throw away the agricultural wealth of a country, and cost magnificent sums of money, is still an object of engineering ambition.

EXPERIMENTS

ON THE

REMOVAL OF ORGANIC AND INORGANIC SUBSTANCES IN WATER.

BY

EDWARD BYRNE, M. Inst. C.E.

WITH AN ABSTRACT OF THE DISCUSSION UPON THE PAPER.

EDITED BY

JAMES FORREST, Assoc. Inst. C.E.,
SECRETARY.

By permission of the Council.
Excerpt Minutes of Proceedings of The Institution of Civil Engineers.
Vols. xxvi. and xxvii. Sessions 1866-7 and 1867-8.

LONDON: PRINTED BY WILLIAM CLOWES AND SONS,
STAMFORD STREET AND CHARING CROSS.
1868.

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THE INSTITUTION OF CIVIL ENGINEERS.

May 21, 1867.

JOHN FOWLER, President,
in the Chair.

No. 1,183.—"Experiments on the Removal of Organic and Inorganic Substances in Water."[1] By EDWARD BYRNE, M. Inst. C.E.

As an abundant supply of pure water is now universally acknowledged to be most essential for the preservation of health, it is a subject which naturally attracts increased attention. Whilst new sources of supply for the metropolis are still under discussion, and extensive works are being carried out to provide the inhabitants of Dublin, and elsewhere, with good water in abundance, the results of some experiments, on the removal of the organic and inorganic substances in water, recently made by the Author in the laboratory of the Dublin Government School of Science, may not be without interest to the Members of the Institution.

Although these experimental results can only be considered as a slight contribution to a great subject, still, they will not perhaps be deemed without value; for as they were not undertaken to support any theory, and as, in a search after truth, the utmost care and attention were observed to obtain correct results, they will, it is believed, be found perfectly reliable.

Many are the substances spoken of as having a purifying effect on water; but, of all these, charcoal (especially animal charcoal) has been considered the most efficacious.

In works which treat on spring and river waters the assertion is constantly made, that both vegetable and animal charcoal remove the organic and inorganic substances met with in waters. For instance, in Dr. Parkes' Hygiene, page 38, it is stated that, "one

[1] The discussion upon this Paper and its supplement extended over portions of three evenings, but an abstract of the whole is given consecutively.

part of animal charcoal purified 136 times its weight of any impure water; and 1 part of vegetable charcoal 116 times (Gaultier de Claubry). But if the water be moderately good, 1 part of charcoal will purify 600 times its own weight of water; or 1 lb. will purify 600 lbs. or 60 gallons." However, no experiments are given to enable one to judge to what extent these statements are true. And it is evident, that charcoal cannot purify the same quantity of different samples of water, which vary from each other in the amount they contain of organic and inorganic substances.

The fact is well known, that charcoal removes some classes of organic substances from their solutions, but there are others which it does not remove. For instance, it removes the colouring matter in raw sugar, but not the sugar itself. It removes, from their solutions, a variety of inorganic substances, such as lime, potash, oxide of lead, ammonia, and other bases. It also removes various salts. Graham states that it even separates iodine from iodide of potassium. And Stenhouse has shown that its action on putrescible substances consists in the rapid process of oxidation of these bodies, depending upon the power which the charcoal possesses of condensing oxygen. The question therefore arises,—Is the organic matter, which occurs in water, removed by charcoal, and if so, is it removed unchanged, or is it oxidized like putrescible bodies? Moreover, is either the organic or inorganic matter, after being once removed from the water by charcoal, given up again on the further percolation of water through its pores? These questions seemed important to answer; but first it appeared necessary to ascertain if possible, whether water, uncontaminated by either decomposing animal or sewage matter, but containing dissolved vegetable matter, would contain any nitrogenous bodies, for this important question has been very obscurely dealt with, in treatises on water, except in Dr. Parkes' Hygiene, page 12, where it is stated: "it seems probable that a nitrogenous vegetable matter is not uncommon in waters."

In order to ascertain whether vegetable nitrogenous, as well as vegetable non-nitrogenous matter, is dissolved by waters, a quantity of bog water was procured on which to experiment. This water, which was of a yellowish-brown colour, was taken from a bog hole on the Wicklow side of the County Dublin mountains, between Killakee and Loughbray, in an unfrequented locality, and under circumstances that precluded the possibility of its containing any animal or sewage matter.

EXAMINATION OF THE BOG WATER.

According to Dr. Clark's method, its hardness was found to be 1·20 degree, that of distilled water amounting to about ½ a degree.

The ascertained amount of non-volatile organic and inorganic matter in a gallon, was as follows:—

Organic matter	. .	3·02 grains
Inorganic matter	. .	1·26 „
Total solid matter	. .	4·28 „

It was found, by the aid of a standard solution of permanganate of potash, that the organic matter, amounting to 3·02 grains, required 0·8831 grain of oxygen to oxidize it; the water, upon oxidation, becoming perfectly colourless.

This bog water contained a trace of ammonia; but neither nitrates nor nitrites.

In order to decide whether any nitrogenous matter was present or not in the water, five gallons of it were evaporated to dryness; and the nitrogen, in the solid matters obtained from that quantity, was determined by a modification of Will and Varrentrapp's method. As much as 0·84 grain of nitrogen, that is (dividing by 5) 0·17 grain in a gallon was yielded; proving that in bog water, at least, vegetable nitrogenous matter is present.

Whether on the oxidation of the non-nitrogenous organic substances in the bog water by exposure to the air, the nitrogenous matter remains unoxidized and in solution, or whether it undergoes, like the non-nitrogenous matter, oxidation, the Author is not prepared to state; but he found that nitric acid was formed, when the organic matter was oxidized by permanganate of potash.

That it is possible for nitrogenous organic matter of vegetable origin to exist in water in an innocuous state, may be fairly concluded from the fact, that much soluble nitrogenous matter is found in beer, especially in porter; for, according to the analyses made by Jackson and Wonfor, there is, in a gallon of Guinness's Dublin porter, nitrogen corresponding to 552 grains of albumen.[1]

From the foregoing experiments on bog water, it is manifest that vegetable nitrogenous organic matter can be present in waters; and as this, under the same conditions, will no doubt be decomposed, like animal nitrogenous matter, into ammonia and nitric acid, the conclusions come to by Dr. Frankland, with regard to the London waters,[2] that after deducting the nitrogen corresponding to the nitrates and nitrites of the rain water, any remaining nitrogen must be due to the infiltration of sewage matter, can scarcely apply in all cases.

As putrefactive nitrogenous matter is the most hurtful of all the substances that can be present in water, it must be regretted that,

[1] See "Journal of the Royal Dublin Society," vol. iii., Nos. 20 and 21, p. 169.
[2] See "Chemical News" of 5th April, 1867, pages 170 and 171.

so defective are the methods for estimating organic matter in water by chemical means, no distinction can be made between the nitrogenous organic matter which exists in a putrefactive, and that which exists in a non-putrefactive state.

Examination of the Removing Power of Animal and Vegetable Charcoal.

The water selected for this purpose was pumped up from a garden well at the back of one of the principal streets in Dublin. It was of an agreeable taste; and, in appearance, clear and sparkling.

Four sets of experiments were made with this water.

1st. On animal charcoal.
2nd. On wood charcoal.
3rd. On peat charcoal.
4th. On animal charcoal.

The water in the last case was treated with permanganate of potash, slightly in excess, previous to its passage through the charcoal.

For convenience, the water used in these experiments was conveyed from the well to the laboratory at three different periods; one sample being used for the 1st set of experiments; another sample, for the 2nd and 3rd sets; and a third sample, for the 4th set of experiments. In each case the degrees of hardness were ascertained, as well as the amount of organic and inorganic matter in a gallon; but it was not considered necessary (the total quantities varying so little) to make a complete analysis of more than the 1st sample. This was found to contain no ammoniacal salts, but a very perceptible trace of nitrates.

The following is the amount in grains, of the fixed constituents contained in a gallon:—

Fixed organic constituents, and nitrates .	10·80
Fixed inorganic constituents	88·30
Total solid matter[1]	99·10

The hardness of the water before boiling.	50·50 degrees
The hardness of the water after boiling .	33·00 „
The degrees of hardness lost by boiling .	17·50 „

The amount of oxygen required to oxidize the organic matter contained in a gallon, and which was determined by a standard solution of permanganate of potash, was 0·0116 grain.

The following is the composition of the fixed inorganic constituents in grains:—

Carbonate of lime. . . .	15·144
Sulphate of lime	39·037
Carbonate of iron . . .	trace
Carbonate of magnesia . .	3·260
Chloride of magnesium . .	10·391
Silica	0·740
Alkaline chlorides . . .	19·460

The total amount of solid matter has been already given as 99·10 grains in a gallon; whereas, according to Table 1, the total quantity is 98·832. This trifling difference of 0·268 grain, which is little more than $\frac{1}{4}$th per cent., arises from the fact, that the estimates were made separately, and in different ways. This water, though containing a considerable amount of organic and inorganic substances, was by no means so impure as the water consumed in many localities. Moreover, owing to the entire absence of matters in suspension, the charcoal was free to act on those merely in solution.

Table 1.—Composition of the Well Water. (First Sample.)

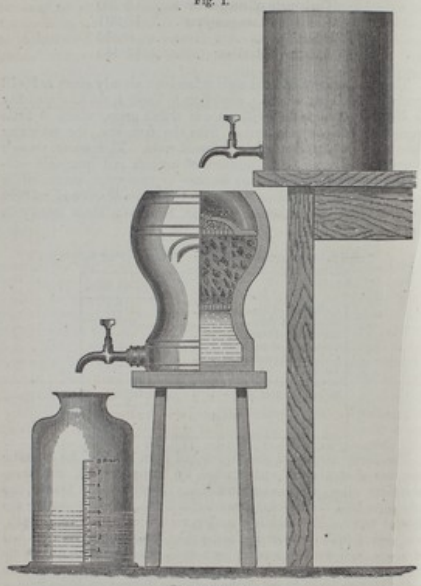
	Grains in a Gallon.
Carbonate of lime	15·144
Sulphate of lime	39·037
Carbonate of iron	trace
Carbonate of magnesia . . .	3·260
Chloride of magnesium . . .	10·391
Silica	0·740
Alkaline chlorides	19·460
Organic matter	10·800
Total . .	98·832

The filter[1] employed, and which had been intended for domestic use, was of stoneware, and divided, by two partitions, into three chambers—the uppermost for receiving the water to be filtered, the middle to hold the filtering material, and the lowest for storing the filtered water. The middle chamber, measuring 5$\frac{1}{2}$ inches in depth, was packed with charcoal to the depth of 5 inches, resting on a bed of sharp, well washed sand, $\frac{1}{2}$ inch in thickness. Both partitions were perforated with small holes, the upper one being provided with a fine sponge, so as to catch the water as it came in drops from a vessel above, and cause it gradually to enter the filtering material. After diffusing itself regularly in its passage through this, the water

[1] In filtering the water, one gallon (occupying four hours in its percolation) a day was passed through the charcoal. The filtering was discontinued on Sundays, as well as during the night.—E. B.

finally issued, from the bottom compartment, at the rate of a quart an hour, and fell into a glass gallon measure, as shown in Fig. 1.

Fig. 1.



Filtering Apparatus.
Scale 1¼ inch to the foot.

Experiments with Animal Charcoal.

The animal charcoal employed was new and freshly burned. It was of the degree of fineness used in sugar refineries, and the quantity of charcoal contained in the filter was 4¾ lbs. in weight.

Twelve gallons of water (sample No. 1) were passed through this charcoal, each of which was afterwards examined as to its hardness, both before and after boiling, the differences representing the amount of carbonate of lime and carbonate of magnesia which the charcoal had not removed. The total amount of organic and inorganic matter contained in each gallon of filtered water was also determined, as well as the amount of oxygen required to oxidize the organic matter not absorbed by the charcoal.

Table 2.

Description.		Quantities in Grains' Weight found in each Gallon.			Quantities in Grains' Weight of Oxygen required to Oxidize the Organic Matter in One Gallon of Water.	Quantities in Grains' Weight removed from each Gallon of the Waters.	
		Organic.	Inorganic.	Total.		Organic.	Inorganic.
Original Water.		10·80	88·30	99·10	0·0116	..	..
Water passed through the Filter.	1st gallon .	4·80	35·70	40·50	0·0091	6·00	52·60
	2nd „ .	6·00	45·00	51·00	0·0091	4·80	43·30
	3rd „ .	8·40	55·65	63·45	0·0100	2·40	33·25
	4th „ .	10·65	63·20	73·85	0·0100	0·15	25·10
	5th „ .	10·70	67·60	78·30	0·0116	0·10	20·70
	6th „ .	10·71	73·11	83·82	0·0116	0·09	15·19
	7th „ .	10·83	75·90	86·75	0·0125	..	12·40
	8th „ .	11·15	76·05	87·20	0·0134	..	12·25
	9th „ .	11·65	76·40	88·05	0·0183	..	11·90
	10th „ .	11·73	78·22	89·95	0·0158	..	10·08
	11th „ .	12·05	79·22	91·27	0·0122	..	9·08
	12th „ .	12·35	79·50	91·85	0·0122	..	8·80

From an examination of Table 2 it may be seen, that so large a quantity as 52·60 grains of inorganic matter, that is, slightly more than 59½ per cent. of that found in the original water, was removed from the 1st gallon of water that passed through the charcoal. The quantity of inorganic matter removed from each gallon was rapidly less at first, amounting in the 6th gallon to 15·19 grains, or about 17½ per cent. of that found in the original water. Afterwards the quantity removed each time decreased less rapidly, amounting in the 12th gallon to 8·80 grains, or nearly 10 per cent. of that found originally. Thus, the quantity of inorganic matter removed, from being more than 59½ per cent. in the 1st gallon, became less than 10 per cent. in the 12th gallon, the actual amount removed being 190·14 grains from the first six gallons and 64·51 grains from the next six gallons of water.

Of the organic matter found in the original water, 6 grains were removed from the 1st gallon, 4·80 grains from the 2nd, 2·40 grains from the 3rd, and only 0·15 grain from the 4th gallon that passed through the charcoal; that is, on the original quantity, a per centage approximately of 55½, 44½, 22½, and 1½ respectively.

The quantity of organic matter removed from the 6th gallon was only 0·09 grain; that is, less than $\frac{1}{10}$th of a grain, or $\frac{4}{5}$ths per cent. of that found in the original water; and here the power of the charcoal to remove organic matter evidently became exhausted; for immediately afterwards it commenced to part with a portion of what it had previously taken up. For instance, in the 7th gallon there is an increase of 0·05 grain of organic matter, or nearly $\frac{1}{2}$ per cent. on that found in the original water; and, with a steady augmentation, this increase continued, so as to amount to 1·55 grain, or 14$\frac{1}{2}$ per cent. on the original quantity, in the 12th gallon. Thus, of the 13·54 grains of organic matter removed by the charcoal from the first six gallons of water, 4·98 grains were given back to the next six gallons.

The conclusion to be fairly drawn from the foregoing is, that had these experiments been carried a little further, it would have been found that all the organic matter removed in the first instance by the charcoal would have been given back again. Another observation to be made on the information contained in Table 2 is that, judging by the figures in the column headed "Quantity, in grains' weight, of oxygen required to oxidize the organic matter in one gallon of water," the charcoal had no oxidizing effect on the organic matter; and therefore it had not the same effect on the organic matter in this water that, according to Stenhouse, it exerts on putrescent organic substances.

TABLE 3.

Description.		Degrees of Hardness.		
		Before Boiling.	After Boiling.	Lost by Boiling.
Original Water		50·50	33·00	17·50
Water passed through the Filter.	1st gallon	9·45	9·45	0·00
	2nd "	18·26	15·15	3·11
	3rd "	27·47	23·68	3·79
	4th "	32·89	29·10	3·79
	5th "	36·37	32·10	4·27
	6th "	39·53	33·00	6·53
	7th "	41·85	33·00	8·85
	8th "	42·17	33·00	9·17
	9th "	42·87	33·00	9·87
	10th "	44·85	33·00	11·85
	11th "	46·55	33·00	13·55
	12th "	46·55	33·00	13·55

Table 3 shows the degrees of hardness, both before and after boiling, of the original water, as also of that passed through the animal charcoal; the degrees of hardness lost by boiling indicating, in the case of the original water, the amount it contained approximately of the carbonates of lime and of magnesia; and, in the case of the twelve filtered gallons, the amount of the carbonates of lime and of magnesia which the charcoal had not removed. Evidently, from the 1st gallon all the carbonates were removed; from the 2nd gallon a few grains less; and from each succeeding gallon still less—that is, 17·50 grains from the 1st gallon, and only 17·50 less 13·55, or 3·95 grains, from the 11th and 12th gallons. From the first portion of the filtered water, not only were the carbonates of lime and of magnesia removed by the charcoal, but also some of the sulphate of lime and chloride of magnesium; to estimate the exact amount of each of which was not considered necessary. It is also worthy of remark that, after the 5th gallon, the charcoal evidently ceased to remove any of the sulphate of lime or chloride of magnesium; but, unlike the organic matter, so far as the experiments went, no portion of these salts was given back to the seven gallons of water that were afterwards passed through the charcoal.

EXPERIMENTS WITH WOOD CHARCOAL.

The wood charcoal was packed in the filter exactly as in the case of the animal charcoal; however, being specifically lighter, the quantity employed was slightly less than 2$\frac{1}{4}$ lbs.

TABLE 4.

Description.		Quantities in Grains' Weight found in each Gallon.			Degrees of Hardness.
		Organic.	Inorganic.	Total.	
Original Water		12·85	92·90	105·75	55·63
Water passed through Filter.	1st half-gallon	17·75	117·33	135·08	41·55
	2nd "	19·08	101·88	120·96	46·57
	2nd gallon	15·26	100·55	115·91	48·29
	3rd "	15·35	92·75	108·10	52·31
	4th "	13·35	92·50	105·85	54·16
	5th "	12·95	92·20	105·15	54·90

By referring to Table 4, it will be seen that, at first, the wood charcoal acted on the water in such a manner as to increase its natural amount, both of organic and inorganic matter. This action ceased, as regards the inorganic matter, at the 3rd gallon; after which, the wood charcoal commenced to have a removing effect; but not until the 5th gallon did the wood charcoal cease to increase the natural amount of organic matter in the water.

The hardness of the water was but slightly affected by the wood charcoal.

So far the wood charcoal had an injurious effect. Had the trial of its action been carried farther, most probably it would have been

found, that both organic and inorganic substances are removed by wood charcoal, though to a less extent than by animal charcoal; for, the five gallons of water, passed through the wood charcoal, seemed to have been just sufficient to wash out those substances that were imparted to the water, and which interfered with its removing power. However, as these experiments on wood charcoal, as far as they went, were not attended with satisfactory results, they were discontinued.

Experiments with Peat Charcoal.

The peat charcoal, which was packed in a filter as already explained, weighed a little less than 2 lbs.

The result of the experiments with peat charcoal is given in Table 5, and as the action of both the wood and peat charcoal was almost identically the same, the remarks made on the former may be considered applicable to the latter.

Table 5.

Description.		Quantities in Grains' Weight found in each Gallon.			Degrees of Hardness.
		Organic.	Inorganic.	Total.	
Original Water		12·85	92·90	105·75	55·63
Water passed through Filter.	1st half-gallon	13·50	108·08	121·58	64·48
	2nd "	14·89	115·12	129·92	77·36
	2nd gallon	16·65	90·43	107·08	56·00
	3rd "	14·75	83·25	98·00	52·21
	4th "	13·45	82·10	95·55	50·19
	5th "	12·85	81·25	94·10	49·74

Experiments on Animal Charcoal with some of the Well Water, treated with Permanganate of Potash, slightly in excess, previous to its Passage through the Charcoal.

Twelve gallons of the water, treated with permanganate of potash, were passed through some fresh animal charcoal, the same in quantity, and of the same degree of fineness, as that employed in the first instance. The object aimed at was to try whether, after oxidizing, by means of the permanganate of potash, the organic matter contained in the water, previous to its passage through the charcoal, any organic matter would be subsequently found present or not in the filtered water. The result obtained, as may be seen by referring to Table 6, was, that organic matter was present, and apparently in the same quantity as before the water was treated with permanganate of potash. But whether it was in the same condition or not, the Author is unable to say; for, as before stated, by the aid of chemistry, no positive distinction can be made between

the different kinds and states of oxidation of the organic matter in waters.

Table 6.

Description.		Quantities in Grains' Weight found in each Gallon.			Quantities in Grains' Weight of Oxygen required to Oxidize the Organic Matter in One Gallon of Water.	Quantities in Grains' Weight removed from each Gallon of the Waters.		Degrees of Hardness.
		Organic.	Inorganic.	Total.		Organic.	Inorganic.	
Original Water.		14·25	94·54	108·79	0·0152	..	..	56·35
Water passed through Filter.	1st gallon	7·66	41·77	49·43	0·0122	6·59	52·77	13·35
	2nd "	—	—	—	—	—	—	—
	3rd "	—	—	—	—	—	—	—
	4th "	10·15	75·72	85·87	0·0366	4·10	18·82	41·16
	5th "	—	—	—	—	—	—	—
	6th "	—	—	—	—	—	—	—
	7th "	—	—	—	—	—	—	—
	8th "	14·65	83·20	97·85	0·0427	..	11·34	48·16
	9th "	—	—	—	—	—	—	—
	10th "	—	—	—	—	—	—	—
	11th "	—	—	—	—	—	—	—
	12th "	15·35	88·51	103·86	0·0305	—	6·03	49·70

The decolorization of the permanganate of potash by organic matter cannot certainly be deemed a reliable test as to the quantity of organic matter; but, in these experiments, the permanganate was very useful, as a means of determining whether the organic matter contained in the water underwent oxidation or not in its passage through the charcoal.

Of the twelve gallons of water passed through the charcoal in this set of experiments, the 1st, 4th, 8th, and 12th gallons only were subjected to examination. The quantity of inorganic matter removed from these was 52·77, 18·82, 11·34, and 6·03 grains respectively; that is, on the original quantity, a per centage of $55\frac{1}{2}$, $19\frac{3}{16}$, 12, and $6\frac{1}{4}$. Of the organic matter, 6·59 and 4·10 grains respectively, that is, on the original quantity, a per centage of $46\frac{1}{4}$ and $28\frac{3}{4}$, were removed by the charcoal, from the 1st and 4th gallons.

Soon after passing the 4th gallon through, the charcoal manifestly lost its power to remove more organic matter; for, to the 8th gallon it gave up 0·40 grain, and to the 12th gallon 1·10 grain of the organic matter removed in the beginning; that is, on the original quantity, a per centage of $2\frac{3}{4}$ and $7\frac{3}{4}$ respectively.

Not the least useful object gained by these last experiments has been a most unquestionable confirmation of those in the first series; for the quantity of organic and inorganic matter removed, by a

given amount of animal charcoal, corresponds very closely in the two sets of experiments.

From the foregoing it has been seen how the power of nearly 5 lbs. of animal charcoal to remove organic matter became completely exhausted by the percolation of six gallons of water; and that, afterwards, the organic matter removed at first was given back again—a fact sufficient in itself to contradict the general statements made as to its removing power; to demonstrate how very little indeed can be done by this filtering substance, even on a small scale, towards the purification of water, and to show the delusion under which a large portion of the community has laboured with regard to its efficacy.

As the question of an abundant supply of good water to towns is one that involves a large expenditure of money, it cannot be a matter of surprise that it should be under discussion for a considerable time before the adoption of any particular scheme. Meanwhile, the epidemic which has so recently left these shores may again return. With a view, then, to check its ravages in ever so trifling a degree it would be worth while to experiment on various materials which are believed to possess the power of removing organic matter; but to obviate false conclusions, and in order that such experiments may be practically useful, they should be systematic. However, as there appears to the Author, particularly since the completion of his recent experiments, no reasonable hope to expect that, by chemical agency, bad water—especially on a large scale—can ever be purified to the extent required for drinking purposes, he thinks that the public mind should be given more than heretofore to the great question of supply; and, as people value their lives, they should, above all things, in their choice of a source, not be too much influenced by distance, but be willing to undergo the necessary expense of securing the object of their search, not only in abundance, but in the greatest purity.

It was announced that the Discussion upon this Paper would be taken at the first meeting of the next Session.

November 12, 1867.

JOHN FOWLER, President,
in the Chair.

No. 1,183 (Supplement).—"Experiments on the Removal of Organic and Inorganic Substances in Water." By Edward Byrne, M. Inst. C.E.

Among the many substances that have been recommended as filtering materials, the most prominent, besides charcoal, are those termed magnetic carbide, and silicated carbon. Believing, therefore, that the subjection of these substances to a similar set of experiments to those on charcoal, already described in the Author's original Paper,[1] would be a matter of some interest, both a magnetic carbide and a silicated carbon filter were procured from the agents appointed for their sale.

Having first washed them with distilled water, 8 gallons of pump water were passed through the former, and 12 gallons through the latter, at the rate of 1 gallon in four hours,[2] with the results given in Tables 7 and 8; which exhibit, moreover, the amount of hardness, before and after boiling, as obtained by Dr. Clark's process.

Table 7.

Description.		Quantities in Grains' weight found in each Gallon.			Degrees of Hardness.		
		Organic.	Inorganic.	Total.	Before Boiling.	After Boiling	Lost by Boiling.
Original Water . .		16·55	87·52	104·07	51·80	36·50	15·30
Water passed through Filter.	1st gallon . .	14·60	84·35	98·95	50·40	36·30	14·10
	2nd „ . .	13·90	84·22	100·12	50·40	36·30	14·10
	3rd „ . .	..	..	..	..	..	..
	4th „ . .	15·77	85·65	101·42	51·10	36·70	14·40
	5th „ . .	..	..	..	..	..	..
	6th „ . .	16·78	87·40	104·18	51·80	37·05	14·75
	7th „ . .	..	..	..	..	..	..
	8th „ . .	16·75	87·37	104·12	51·80	37·05	14·75

[1] *Vide ante*, p. 3.

[2] In filtering the water, one gallon (occupying four hours in its percolation, a day was passed through the filtering materials. The operation was discontinued on Sundays, as also during the night.—E. B.

TABLE 8.

DESCRIPTION.	Quantities in Grains' weight found in each Gallon.			Degrees of Hardness.		
	Organic.	Inorganic.	Total.	Before Boiling.	After Boiling.	Lost by Boiling.
Original Water . .	16·55	87·52	104·07	51·80	36·50	15·30
Water passed through the Filter. 1st gallon. .	18·75	52·20	70·95	26·60	21·00	5·60
2nd ,, . .	18·25	73·70	91·95	42·70	31·80	10·90
3rd ,, . .	..	..	..	..	..	..
4th ,, . .	15·65	84·00	99·65	50·80	36·30	14·50
5th ,, . .	..	..	..	..	..	..
6th ,, . .	14·85	86·25	101·10	51·50	36·50	15·00
7th ,, . .	..	..	..	..	..	..
8th ,, . .	15·70	86·25	101·95	51·80	36·80	15·00
9th ,, . .	..	..	..	..	..	..
10th ,, . .	15·65	88·79	104·44	52·70	38·20	14·50
11th ,, . .	..	..	..	..	..	..
12th ,, . .	15·90	90·10	106·00	53·90	39·70	14·20

The excess of organic matter found in the first and second gallons of water that passed through the silicated carbon filter (Table 8) over that contained in the water before filtration, may have been owing to the presence of some extraneous matter in the filtering material that still remained, but which, however, was completely washed out before the passage of the sixth gallon.

From an examination of Table 7 it occurs that, from a gallon of water that at first passed through the magnetic carbide filter, nearly 2 grains of organic and 3½ grains of inorganic matter were removed; but, after the 5th gallon, there was no removal of either one or the other.

Apparently, the magnetic carbide does not possess the property of softening water unless to a very trifling extent, for even in the 1st gallon the reduction in hardness amounted to little more than 1½ degree, and in the 6th and subsequent gallons that passed through the filter, there was no reduction at all.

According to Table 8, the hardness of the original water, by its passage through the silicated carbon, was reduced at first from nearly 52 degrees to about 26½ degrees; but, after the 7th gallon, there was no gain in this respect—on the contrary, by farther filtration, the water became positively harder.

From the 1st and 2nd gallons of water that passed through this filter, 35·32 and 13·82 grains respectively of inorganic matter were removed; the removal of inorganic matter then became insignificant, and in the 10th and subsequent gallons more inorganic matter was found than was contained in the original water. The removal of organic matter from the 4th, 6th, 8th, 10th, and 12th gallons by filtration amounted to 1·50, 1·70, 0·85, 0·90, and 0·65 grain respectively. What might have been the effect of carrying this set of experiments still farther, may be inferred from the result of subsequent experiments, of which mention will presently be made.

In order to ascertain to what extent these substances would, by disuse, recover their power to remove organic and inorganic impurities from water, the experiments were suspended for a period of two months; after which 4 gallons of a fresh supply of water were passed through the magnetic carbide, and 6 gallons through the silicated carbon filter, with the results shown in Tables 7A and 8A.

TABLE 7A.

DESCRIPTION.	Quantities in Grains' weight found in each Gallon.			Degrees of Hardness.
	Organic.	Inorganic.	Total.	
Original Water	12·12	92·40	104·52	51·10
Water passed through Filter. 1st gallon	11·40	91·86	103·26	..
2nd ,, ...	10·55	92·40	102·95	49·35
3rd ,, ...	..	..	..	..
4th ,, ...	11·50	91·55	103·05	49·35

TABLE 8A.

DESCRIPTION.	Quantities in Grains' weight found in each Gallon.			Degrees of Hardness.
	Organic.	Inorganic.	Total.	
Original Water	12·12	92·40	104·52	51·10
Water passed through Filter. 1st gallon	11·80	83·35	95·15	46·90
2nd ,, ...	7·35	90·25	97·60	48·47
3rd ,, ...	..	..	..	..
4th ,, ...	8·75	89·92	98·67	49·00
5th ,, ...	12·75	88·25	101·00	..
6th ,, ...	13·10	89·05	102·15	50·05

According to Table 7A, less organic matter was found in the second than in the first gallon of water that passed through the magnetic carbide; and according to Table 8A, considerably less organic matter was found in the second and fourth (particularly in the second) gallons than in the first gallon that passed through the

silicated carbon filter—an apparent discrepancy which is fully accounted for by the fact that, in each instance, the first gallon of water was passed only once through the filtering material, drop by drop, in the manner explained in the Author's Paper of last Session; whereas, the second and subsequent gallons were passed three times through both of these filters, first, by the slow process just referred to, and afterwards, twice in the ordinary method recommended by the vendors of the filters. The result of this was very striking, especially in the case of the silicated carbon, the effect at once produced being a larger removal of organic matter, but then an almost immediate exhaustion of any removing power these substances may have possessed. In fact, according to Table 8 a, the amount of organic matter found in the fifth gallon was more than half a grain, and in the sixth gallon it was nearly one grain, in excess of the quantity contained in the water before filtration.

The water employed in these and the charcoal experiments was taken from the same well, and it was found to vary but little in its composition at the different times of collection. And as the experiments were carried out under similar conditions, a comparison may be fairly made between them.

It appears, then, that the removing power of the magnetic carbide is extremely feeble, whereas the action of the silicated carbon greatly resembles that of animal charcoal. Of the two, animal charcoal is the more efficacious, especially in its property of softening water, for, by referring to Table 3,[1] it may be seen that the hardness of the original water was reduced from 50½ degrees to less than 9½ degrees, by its passage through the charcoal. This power of softening water, though considerably less afterwards, was so far retained, as to cause a reduction in hardness of nearly 4 degrees in the eleventh and twelfth gallons.

That no inorganic matter was found to be returned by the charcoal may be due to the fact of the experiments not having been carried sufficiently far; but enough has been done to show, that both of these filtering materials (animal charcoal and silicated carbon) quickly lose their power to remove organic matter; and that, if used without frequent rest, they very soon give back a portion of that which had been at first removed, so as to have an injurious effect on the water they may be intended to purify.

To decide, however, the important question, as to whether the organic matter contained in the water, so far as the nitrogen is concerned, had undergone any oxidation by its passage through these substances, the amount of nitrogen in the original water, and in that passed through each filter was determined by the beautiful process which Professor Wanklyn has recently made known. By this, the newest and most delicate test yet discovered, it was found that, for equal quantities of organic impurity, the amount of albuminous matter in the original, and in the filtered waters, was precisely the same, which fact may be fairly considered as a convincing proof, that the organic matter contained in the water had undergone no change by its percolation through these filtering materials.

[1] *Vide ante*, p. 10.

Filtration, when employed for the removal of matter in mechanical suspension, must ever be considered most valuable; but as a means of removing substances in solution it is manifestly useless.

The foregoing experiments on filtering materials, though made on a small scale, were carried out in a systematic manner, so as to render the deductions therefrom safely applicable to cases of far greater magnitude. They will, it is hoped, serve the purpose of pointing out the danger of depending too much on the system generally of filtration, as well as of exposing the inconsistency of bringing home foul water to undergo a delusive method of purification, instead of adopting the proper and only satisfactory plan, of procuring water which is itself naturally pure.

Dr. Letheby stated, that the results obtained by the Author of the Paper did not accord with his own experience and observation over many years; and if it were not that, in the account of the experiments, there was a means of explaining the apparent discrepancies, he should regard them as most remarkable. The water was singularly hard, and did not at all represent what was usually furnished to a community for domestic purposes; for he had never found water supplied by a public company containing from 99 to 109 grains of solid matter per imperial gallon, and with a hardness of about 56 degrees. It also appeared that nearly 11 grains of this was organic matter. But he would ask how that had been determined? Because if it had been estimated by the process of incineration, it afforded no evidence whatever of the existence of such a quantity of organic matter in the water, or of the action of animal charcoal upon it.

Mr. Byrne said, the method he employed was the one to which exception was taken; but it was that which was adopted by experienced chemists, and allowed to be as good as any other at present known.

Dr. Letheby contended that this opinion was erroneous, for the process was not relied upon by chemists. He thought, also, the proportion of oxygen required to oxidize the organic matter, as shown in Table 2, Column 5, proved that there could not have been more than a trace of it in the water. He would say, therefore, that the numbers in Column 2 of that Table were no criterion of the quantity of organic matter present; and that the experiments were not to be relied on.

He agreed with the conclusions of the Author, that if animal charcoal only possessed the power of physically absorbing organic matter, it would give it out again by the process of diffusion when more water went through it. But the action of animal charcoal was of another kind,—it had the power of bringing the oxygen dissolved in the water into chemical union with organic matter, and so of destroying it; this was especially the case when the organic matter was in a state of decay, and in an unwholesome condition. An essential element, therefore, of this change was the presence of oxygen; but the well water in question, although charged with carbonic acid, contained little or no oxygen; for such water rarely, if ever, contained enough free oxygen to effect oxidation of the organic matter; and that explained what would otherwise be a difficult thing to understand, viz., how any water containing a notable proportion of organic matter could pass through animal charcoal without having its organic matter absorbed and oxidized. Again, he had found from his own experiments, that a certain time was required for the oxidation of organic matter by charcoal; that, in fact, the

water must be in contact with the charcoal for 1 minute at least, in order to effect a marked purification.

Now, a cubic foot of animal charcoal, weighing from 50 lbs. to 52 lbs., held within its pores four gallons of water; unless, therefore, the powers of the charcoal were unduly strained, water could not be filtered through it with greater rapidity than four gallons per minute per cubic foot. He did not gather from the Paper at what rate the water, in these experiments, had passed through the filter?

Mr. Byrne replied, at the rate of 1 gallon in four hours, and that the charcoal was 5 inches in thickness.

Dr. Letheby: The question of thickness was of little moment: it was the quantity of charcoal to the quantity of water that was most concerned in the result. The time of contact of the water with the charcoal in the experiment given would then be $2\frac{1}{2}$ minutes, or about the time that animal charcoal would require to effect anything like proper oxidation; but in practice it was found that water could not be forced through a filter holding 80 lbs. of charcoal, so as to be effectually purified, at a greater rate than 400 gallons per day. That was the rate at which the Water Purifying Company guaranteed the action of their filters; and in a working day of fifteen hours the water would be in contact with the charcoal 6·7 minutes on the average. He had used filters of this description for more than a year, and at the end of that time he found that the water, when tested by permanganate of potash, contained little or no organic matter. His own experience, therefore, did not accord with the results brought under the notice of the Institution; and but for the circumstance that the water used in these experiments was of an exceptional character, he should have been unable to reconcile these apparent contradictions. But, although animal charcoal was capable of effecting the removal of organic matter from water, he was not inclined to recommend its use in the manner and to the extent lately suggested. The proposal to filter all the water supplied to the Metropolis through animal charcoal at the sources of supply did not appear to be either a useful or a practicable measure. He did not think $1\frac{1}{2}$ ton of charcoal per million gallons of water, or even 3 tons or 4 tons, as had been stated, would be sufficient to effect any great improvement in the water, for the time of contact would only be from 12 seconds to about a minute. While, then, he did not believe that charcoal could be used in such a manner, yet when applied in the houses where the water was used, and which was for many obvious reasons most convenient, his experience went to show it was not only able effectually to remove and oxidize organic matter, but was unquestionably one of the best safeguards in the hands of the public against those mischiefs which might arise from the presence of organic impurities in water.

Dr. Frankland remarked, that the results of the Author's investigations differed so entirely from those he had obtained himself in similar experiments, that at first he could not at all reconcile the differences. On reading the Paper through, however, there remained no doubt on his mind as to the cause of the discrepancy. The Author had, in fact, evidently been operating upon water which contained only a very small quantity of organic matter, but a large proportion of those ingredients which were derived from the previous oxidation of the organic matters in sewage, viz., nitrates and nitrites, and these gave off a considerable quantity of volatile matter when the solid residue was ignited. The loss by ignition, thus obtained, was shown in the columns of the Tables headed "Organic Matter," but which ought to have been entitled "Organic and other volatile Matter;" as from the Author's examination of the water by the permanganate test, there could be no doubt that three-fourths, or perhaps even four-fifths, of that matter which was represented as organic consisted in reality of the inorganic constituents of nitrates and nitrites. What had been proved was, that animal charcoal, when first applied to water of this character, would abstract from it a large quantity of the nitrates and nitrites along with other salts present in water. But the Author left untouched the question, whether animal charcoal did or did not remove organic matter from water; far less had it been proved that the organic matter was first removed from and then restored to the water. He had himself for some time been engaged in experiments on this subject, and would state a few of the results obtained with animal charcoal as a filtering medium applied to the New River water. An animal charcoal filter, through which the whole of the water used for domestic purposes was passed, had been fixed in his house eighteen months ago: the water passing through it was examined a few days after, when he found, on a comparative analysis of the water, that the amount of solid constituents contained in it was respectively 17·78 grains per gallon before filtration, and 11·60 grains per gallon after filtration. The organic and other volatile matter present in the water before filtration was 0·37 grain per gallon. This was reduced by the animal charcoal to 0·15 grain. The oxygen removed from permanganate of potash by the organic matter was 0·02 grain per gallon before, and 0·005 grain per gallon after filtration. The water was examined again in June, a month after the filter had been in operation, during which the water passed through at the rate of about forty gallons per day. The results were as follows:—

	Before Filtration.	After Filtration.
Total solid residue	15·68 grains	13·70 grains
Organic and other volatile matter	0·64 „	0·21 „
Oxygen removed from permanganate	0·0176 „	0·005 „

Thus, after the lapse of a month, the charcoal was still removing a perceptible quantity of the solid constituents, while the organic and other volatile matter was being removed even in larger quantity than before, inasmuch as it amounted before filtration to 0·64 grain, and after filtration to only 0·21 grain: while the oxygen abstracted from permanganate of potash by the organic matter was reduced from 0·0176 grain to 0·005 grain—less than one-third of the amount previous to filtration.

The experiments were continued in July, with similar results; but the action upon the total solid constituents became less marked each month, although the action upon the organic and other volatile matter was maintained up to the time the water was last examined. The numbers obtained in July were—

	Before Filtration.	After Filtration.
Total solid residue	14·41 grains	13·71 grains
Organic and other volatile matter	0·41 „	0·08 „
Oxygen removed from permanganate	0·0148 „	0·005 „

In September, which was four months after the fixing of the filter, and when about 5,000 gallons had passed through it, an appreciable though very small proportion of the solids was removed, and the organic and other volatile matter, to the extent of nearly one-half, the numbers being—

	Before Filtration.	After Filtration.
Total solid residue	14·26 grains	13·80 grains
Organic and other volatile matter	0·55 „	0·30 „
Oxygen removed from permanganate	0·009 „	0·0045 „

Hence his own experiments on this subject led to totally different conclusions from those of the Author, with regard to the action of animal charcoal upon the organic matter in water. On the other hand, his experiments with vegetable charcoal agreed with those of Mr. Byrne in giving negative results. This kind of charcoal was found to be absolutely inert in its action on organic matter in water.

With regard to the purification of water by filtration through animal charcoal on a large scale, his views did not coincide with the opinion just expressed. He had passed the water supplied to London by the Grand Junction Company through a stratum of animal charcoal 3 feet thick, at the rate of more than forty-one thousand gallons per square foot per day of twenty-four hours, under a head of water of 30 feet. The charcoal was in granules, like coarse sawdust, and was maintained in its place by a perforated plate at the top of the stratum. At that rate rather more than one-half of the organic matter in the water was removed; but on reducing the rate of the passage down to one-half, one-fourth, or one-tenth, the proportion removed was scarcely increased.

There appeared to be two kinds of organic matter in water; one was readily attacked by animal charcoal, whilst the other required an amount of contact with the charcoal which in practice could not be afforded. He did not agree that the filtration of the water-supply of a town through animal charcoal was impracticable. He thought, on the contrary, it was a process that could be readily applied, and that it ought to be carried out by the Metropolitan Water Companies, as it would remove from such water as was supplied to London about one-half of the organic matter contained therein.

Mr. J. F. Bateman remarked, that a good sand filter would allow water to pass vertically at the rate of about 6 inches per hour, or 12 feet per twenty-four hours.

Dr. Frankland said, it was a misnomer to apply the term "filtration" to this operation with animal charcoal: it was rather a passing through. The interstices were so large that the process could scarcely be called "filtration."

Mr. T. Spencer asked Dr. Frankland by what means he ascertained the amount of organic matter present in the water in the experiments he had made, whether by incineration or by permanganate of potash?

Dr. Frankland had determined the amount of organic matter by both processes, though he had since expressed his disbelief in their accuracy for determining the actual amount of organic matter, as the results of his experiments by the permanganate method of testing and by the incineration process did not agree. But the question of the removal of organic matter by animal charcoal did not rest exclusively upon either of those imperfect methods. He had, in fact, recently repeated these experiments with animal charcoal and the New River water, and had determined the carbon in the organic matter directly by organic analysis. By this he found that the organic matter in the New River water before filtration contained 0·217 part of carbon in 100,000 parts of water; whilst after filtration it contained 0·071 part; so that only one-third of the organic carbon was retained in the water after filtration through animal charcoal. The results of this latter analysis, as regarded the abstraction of mineral salts and other constituents, and the alteration of the hardness of the water, resembled those he had already mentioned, in which respect he agreed with the Author, as also in his recommendation that all purifying processes should be regarded as only temporary measures, pending the substitution of a pure for a contaminated supply.

Mr. T. Spencer asserted, that the results of testing the quantity of organic matter in water by the two methods now in ordinary use, viz., incineration and the permanganate process, could not agree, especially if the water contained iron—which nearly all

waters did, more or less. The permanganate of potash method was, in the first instance, greatly lauded, as an easy mode of getting at difficult results; hence many persons who were not chemists adopted it. Consequently large quantities of organic matter were set down as being found in water, but which older chemists, who had gone over the ground before, not only did not find, but knew could not exist. He agreed that the large amount of organic matter, said to be found by the Author in potable water, was really an impossibility, though such would appear to be so in regard to water containing iron, if tested with the permanganate of potash. He had himself, in the course of his practice, analysed specimens of water from most districts in the kingdom, and had never heard of any reliable chemist who had found organic matter existing in a town supply even to the amount of 7 grains per gallon. Therefore he held that there had been some mistake, with regard to the quantity of organic matter set forth in the Tables, probably due to this cause.

With regard to the subject of depriving water of matters it held in solution, the main thing he had sought for, ever since his attention had been directed to the subject, had been to get rid of organic matter only. At the time, such a search was deemed by most chemists to be impracticable. Though some few conceived it possible, by others it was considered impossible, to deprive water of its organic matter without substituting something else in its place. He need hardly say, that when anything was taken out of solution, as a rule, something else had to be supplied to fill up, as it were, the space previously occupied by the substance taken out. He did not say this was strictly so in all possible cases, but it was a practical axiom, with which he thought every chemist would agree. It was not unreasonably supposed, that charcoal had the power of destroying organic matter, because in many instances it partially decolourized the water. It thus came to be recommended as capable of freeing water from organic matter. No doubt charcoal did decolourize water for an hour or two; but when this was observed, it was not ascertained whether the colouring matter was retained in the pores of the charcoal, or destroyed. The Author had shown that the organic matter originally taken from the water in his first experiments was, after a short time, given back to it from the charcoal, by the fact of its existing in the water in greater abundance than it did at first. In other words, some of the water contained more organic matter after it had passed through the filter than it did before filtration. Assuming, therefore, that the experiments were in this respect correct, it showed that the organic matter taken from the water in the first instance was only secreted in the pores of the charcoal, and that when they became full it had no power to take any more, but, on

the contrary, it gave back what it had already taken. The results of the experiments entirely agreed with those repeatedly made by himself. Similar experiments, with like results, were made for Mr. Telford for his report to the Government in the year 1830. In short, the same ground of experiment had been gone over frequently; as it was too much the habit in such cases for one generation to forget what had been done by the previous one, and because the results were negative, they were put down as not having been made. In the abstract of the report referred to, it was merely stated that no substance was calculated to deprive water of any matter it held in solution; but the details of this report showed, that the organic matter was left in the charcoal, just as the Author had found it in his experiments.

As to the power of charcoal and of another substance to deprive water, by filtration, of inorganic matter, according to the results of these experiments, it was found that, at first, the water after filtration not only contained slightly less organic matter, but also less inorganic matter. Now, he had no doubt that, up to a certain point, that was so, as he had himself often found it; but it would be a great calamity indeed, as far as filtration of water went, if such were to continue even for some hours. It was quite true that charcoal, when new, took a portion of the carbonate of lime or magnesia out of the water, though to a small extent only. But supposing, however, it continued to do so even for an hour, the filter would be stopped, by its interstices becoming filled up with chalk. In a word, if charcoal, or so called silicated carbon, or magnetic carbide, continued to take inorganic matters out of water, all these filters would be stopped by a few hours' use. Therefore, with regard to magnetic carbide, or charcoal, or any substance which thus took hardening matters out of water, the whole of the pores would in time be closed, when filtration would cease. Not long ago a letter appeared in 'The Times,' stating that a charcoal filter had been erected at the east of London, by which the New River Company's water was reduced several degrees in hardness, and the organic matter was removed. Now, as he believed both results to be impossible, or, at all events, that neither could continue, he sent for some of the water, and ascertained that it was of precisely the same degree of hardness he had found it to be many years before. He had taken the facts from one of the engineering journals; but as it was suggested that he might after all have been wrong, he tested a fresh sample of the water, and with the same results as at first: not only was there the ordinary quantity of carbonates and of organic matter, but the latter was, if anything, slightly increased.

With regard to the comparative experiments recently made by the Author on silicated carbon and magnetic carbide, every

chemist knew there was no such substance as silicated carbon. He had always insisted upon these filters, when brought forward for public experiment, being opened. He had done so once at the Society of Arts, and on putting a magnet into the interior of a silicated carbon filter, he found the material in it contained a visible percentage of magnetic carbide. The 'Lancet' Sanitary Commissioner, who had also lately made a comparative examination of water filters, found that the magnetic carbide practically took all the organic matter out of water, leaving only the 500th part of a grain in the gallon. In this case also he insisted that the filters should be opened after the experiments, when it was admitted that there was something very much like magnetic carbide in the silicated carbon filter, and that no doubt the whole action of the filter rested upon that material. Therefore the results given by the Author, in regard to the silicated carbon filter, ought to be rejected, unless it had been opened, and a magnet applied to its contents, when if it attracted any substance, it was magnetic carbide beyond all doubt, and to this the filter owed any purifying power it possessed.

Professor Wanklyn said, as to the process of filtration removing nitrogenous matters from water, that Mr. Chapman, Mr. Smith, and himself, had made an examination of the water at Hampton, where one of the Water Companies took its supply, and they found that there were about 15 parts of albumenoid ammonia in every 100,000,000 parts of water. They then took some of the water after it had been filtered by the Company, and found only 5 or 6 parts of the same remaining in it. This showed that the filtration effected by the Company was capable of removing two-thirds of the impurities from the water, while he had heard that they were removed only to the extent of one-half by the carbon filter. It appeared to him that there was no need of the carbon filter on a large scale; for this was a larger removal of impurities than the advocates of the carbon filter claimed. With regard to the analysis of the water given by the Author, all chemists must agree that the Tables could not be relied on, although the determination of the amount of permanganate destroyed might have a relative value. That which was called organic matter was probably carbonic acid and hydrochloric acid. The amount of permanganate destroyed was no indication of the amount of organic matter. Some organic matters took up a great quantity of permanganate, and others very little. The forms of albumen most to be dreaded would probably take very little permanganate.

Mr. Spencer wished to explain, that the permanganate of potash test acted by oxidizing the organic matter. Now, wherever there was iron in water—and there were few waters that did not contain some—the iron existed as a protocarbonate, that was, a carbonate

of iron dissolved by an extra atom of carbonic acid, precisely in the way chalk was taken up and held in solution by water. Suppose a small amount of sulphate of lime or magnesia were added to distilled water, and that a protosalt of iron, even to the extent of half a grain to a gallon, was added also: that water, by testing it in the usual manner with permanganate, would indicate several grains of organic matter. Therefore, with permanganate of potash organic matter was invariably found, whether it existed or not. He, along with others, had sent to chemists samples of distilled water, to which some sulphates were added, and a quarter of a grain of a protosalt of iron, but without a particle of organic matter; and the water had been returned in the report of the analysis as containing some grains of organic matter per gallon. He thought the permanganate test, as a means of detecting organic matter in water, ought now to be discarded.

Mr. Ernest T. Chapman remarked, that he had made a considerable number of experiments with animal charcoal on water containing nitrogenous organic matter, and that the nitrogen of the organic matter was determined by the process adopted by Professor Wanklyn, Mr. Smith, and himself. He was not contented with observing that the organic matter disappeared from the water. He assumed that either the nitrogenous matter must be oxidized, or that it would be found hanging about the charcoal; as no doubt could exist that the amount was diminished by filtration through animal charcoal. He agitated some charcoal in water, and extracted from the charcoal the same quantity of nitrogenous organic matter as had been previously removed from the water. It was evident that this action did not consist in bringing together the free oxygen dissolved in the water and the organic matter, and consequently in converting the latter into carbonic acid, ammonia, and nitric acid. In another experiment he deprived the water of oxygen by treating it with protochloride of tin, and on agitating this water with animal charcoal he found nearly the same reduction in the amount of nitrogenous organic matter, showing that there was no oxidation; and he again extracted the same amount of nitrogenous organic matter from the charcoal that had been removed by it from the water. Animal charcoal was not alone in this peculiar property. In the process known as Dr. Clark's, the softening of the water was effected by the precipitation of the carbonate of lime it contained. If water which had been filtered through sand were softened by Dr. Clark's process, it would be found that at least a portion of the nitrogenous organic matter existing in the filtered water would be removed, and the same amount of organic matter could be extracted from the chalk as had been removed from the water. He had passed water through animal charcoal, and found a reduction in the amount of organic matter; but after a few weeks' use the charcoal was impregnated with organic matter to such an extent as to be useless. Even the agitation of finely divided silica would remove traces of organic matter in water; and no doubt if he had used fine silica he could practically have removed as much matter from the water as by the use of charcoal.

The point he chiefly dwelt upon was, that in filtration by charcoal the organic matter was not oxidized, but was mechanically retained by the charcoal. If that were the case, the question of purifying large volumes of water by charcoal resolved itself into the use of a sufficiently large quantity of charcoal to remove the objectionable matter, and the substitution of fresh charcoal, for after a little while the organic matter contained in it would putrefy, and be dissolved by the water. It was said to be an unfortunate chemical fact, that putrescible nitrogenous matter could not be distinguished from that which was not putrescible; but he believed nitrogenous organic matters of all kinds were putrescible. If water containing any nitrogenous organic matter, together with nitrates and nitrites and carbonic acid, were exposed to the sun, it would acquire a green colour: even in filtered water a green slime would form, and in time give forth an offensive odour; and, when dealing with large volumes of water, that was extremely objectionable in every point of view. What had to be avoided in water was not nitrogenous organic matter of one kind only, but organic matter of all kinds; and until it was established that there were some nitrogenous organic matters which would not putrefy if exposed to the action of air and heat, the only safe course was to avoid all kinds of organic nitrogenous matters in the water used for domestic purposes.

Mr. Hawksley,—Vice President,—was surprised at the statement that water could be filtered through charcoal in mass at the rate of forty-one thousand gallons per day per square foot of area of the charcoal. He fancied there must be an error of calculation; for if it were not so, as water passed through a main pipe at the rate of from 2 feet to 2½ feet per second, to filter all the water required by a large town, it would be only necessary to quadruple the diameter of the main pipe at the end, whatever might be its size, and to fill it for 5 feet in depth with a mass of charcoal. That was perfectly inexplicable, and if it were viewed in another aspect it would be equally so. It appeared from the same experiment, that a foot of charcoal would filter about five hundred times as much water as a foot of sand. But he did not think this subject had as yet been treated in a practical manner. The chemists had given valuable information; but it did not enable them, as engineers, to make waterworks better. Attempts should be made to understand how it was that filters operated; whether the charcoal was necessary or unnecessary; and whether the common and ordinary sand filtration

was sufficient for the purpose. This subject had engaged his attention for more than twenty years; and he had acquired some knowledge of the facts, though it might be impossible, at present, to assign reasons for them. He thought that sand filters operated not only mechanically, but also chemically, and that the chemical changes depended very much upon the particular state of the organic matter in the water, and on the admission of the free oxygen of the atmosphere. The sand filter cleared the water mechanically by the agency of the well-known principle of the attraction of aggregation. When the water descended slowly through the filter, the minute particles of matter suspended in it were attracted by the facets of the sand and adhered there, and the water became clear; and that operation was carried on so rapidly, that scarcely in any filter did the water remain foul for more than a few inches from its surface; and a bed of sand 12 inches thick was just as effective as one of 2 feet or 3 feet. The sand filter also operated chemically, for it actually destroyed organic matter, and deprived water, in which lime was held in solution by the excess of carbonic acid, of part of the chalk, thereby softening the water. He did not lay much stress upon its action upon the chalk, because in that respect, though the operation was similar, it was not equal to that of the carbide filter, which he knew, from experience, to be exceedingly useful, and performed good service in the destruction of organic matter; as, indeed, charcoal did for a time, and all substances which had the power of what was called revivification. In point of fact, any substances which attracted oxygen to the surface and gave it back again to the organic matter, destroyed that organic matter, and rendered the water pure. That was, to some extent, effected by the sand filter; and to a larger extent by the carbide filter, but only under particular circumstances. Hence, although he thought the latter was useful in certain cases, yet for waterworks he considered the ordinary sand filter the best. For the filtration of water for the table, he thought there was no filter which was better than one or other of the two filters to which he had referred, viz., either the combined carbon and sand filter, or the filter of Mr. Spencer. But to show that, after all, none of these substances were absolutely necessary, either for the destruction of organic matter in water, or for clearing it from suspended matter, he would mention a peculiar stone found in Derbyshire, which, he recollected, had been used for filtering purposes forty years or fifty years ago. It resembled fire-stone, and allowed water to pass through it, in one respect slowly, but in this respect tolerably rapidly, and absolutely freed the water from organic matter, at the same time that the impurities in suspension were taken out. That stone would continue to do this for years, and perhaps for centuries, if it were only brushed on the surface, so as to keep the pores open.

With regard to what had been said of nitrogenous substances, there was something very important yet to be learned. It had never been proved that they were injurious to health, excepting they were in large quantities, such quantities, in fact, as did not obtain in any water-supply to towns; and it was uncertain whether assertions of their existence were always reliable. The methods employed to ascertain this were by no means certain; and even if they were, the results professedly obtained were so small in amount, that the substances found might be considered immaterial, and practically harmless. He had studied this subject in a practical way, as an engineer, and he had come to the conclusion that a great deal of nonsense was talked about organic matter in water; in fact, in the course of the discussion an instance had been given of its being found where it did not exist. It would not be nice to adduce instances of human beings liking such water; but where did the horse or the cow go for water but to the horse-pond, which was full of this organic matter? It was brown and foul, so that no human being would touch it, but the horse and the cow went to it by choice, and suffered no harm whatever. Although it was undoubtedly the duty of Water Companies to supply water to the people as pure as it was possible to obtain it, yet the public need not, after the Companies had done their best, be at all afraid of the water they delivered.

But there was something remarkable which he had to show, and that was two bottles of the same water drawn from a deep well far out in the country, and from a depth of 400 feet. The water in one had been filtered through charcoal: that in the other had not been filtered at all. The two bottles had stood upon his chimneypiece, side by side, for three years, and they had both been similarly exposed to light and temperature. The one which had not been filtered through charcoal was as bright as when it came out of the well; but the other, which had been filtered through charcoal, remained bright for twelve months, and then it began to turn a dingy yellow, and had become more and more coloured up to the present time; and he had kept it as a curiosity, watching what happened to it, till now it had assumed the appearance of weak sherry. He could not tell what had caused this change, as he had not examined the water, but he supposed something injurious had been taken out of the animal charcoal; and he was not, therefore, in favour of the use of animal charcoal, especially when it was new.

Mr. Spencer said, eighteen years ago, some experiments had been made at the Rivington Waterworks with the Derbyshire stone, to which reference had been made, when Mr. Hawksley succeeded in 'doubling-up' that stone as a filter in five minutes' use. The same result was also observed with the same stone at

Nottingham, though in that case the result was not so rapid, as the pressure was less.

Dr. Frankland remarked, through the Secretary, that although he had frequently filtered water through animal charcoal at a much higher rate than that previously mentioned, he had nevertheless determined to repeat some of the experiments. He therefore fitted up a tube filter, and passed the Grand Junction Company's water through it, both upwards and downwards. The filter resembled as nearly as possible the one used in his former experiments, except that the stratum of charcoal was 2 inches thinner. The glass tube was 36 inches long, 1·3 inch internal diameter at one end, and 1·44 inch at the other, so that the mean sectional area was 1·474 square inch: this contained a stratum of animal charcoal 34 inches thick. Three experiments were made on upward, and three on downward filtration. The head of water was 19½ feet in the upward filtration, whilst in the downward filtration it was 22½ feet. The following were the results obtained:—

I. Upward filtration: water moving from the narrow to the wide end of the tube.

	Volume of Water delivered per minute.	Rate per square foot per 24 hours.
First Experiment	0·578 gallon	81,312 gallons.
Second ditto	0·609 „	85,673 „
Third ditto	0·636 „	89,471 „

II. Downward filtration: water moving from the wide to the narrow end of the tube.

	Volume of Water delivered per minute.	Rate per square foot per 24 hours.
First Experiment	0·645 gallon	90,734 gallons.
Second ditto	0·638 „	89,752 „
Third ditto	0·600 „	84,407 „

It was thus evident that the rate of filtration mentioned by him, so far from being impossible, was not one-half of the speed at which water could be passed through animal charcoal. Hence it was to be hoped that objections on this score would no longer be urged against the employment of a process of purification at once simple, inexpensive, and, so far as regarded the removal of organic matter in solution, the most efficacious with which he was acquainted.

It would be perceived that the experiments on upward filtration exhibited a constantly increasing flow in each successive trial, while in the experiments on downward filtration the rate was gradually reduced. This phenomenon appeared to him to indicate that, although in these trials the downward was, on the average, more rapid than the upward filtration, yet, in the long run, the latter would have a considerable advantage.

Mr. Hawksley,—Vice President,—did not dispute that water might be made to run through charcoal at the rate just stated; and if a pressure of 19½ feet in the one case, and of 22½ feet in the other, were applied, he thought the rate might have been even greater. But the question was whether any satisfactory chemical effect could be produced on the water, and whether it could be produced from day to day over a long period of time? He ventured to say that was impossible. In this particular experiment the water was made to pass more than a thousand times as rapidly as under the ordinary process of filtration. At the slow rate at which water usually flowed through main pipes, it would require a pipe 12 inches in diameter, with a constant flow of water, to supply a service reservoir for a city of forty thousand inhabitants; and if the results of the experiments were to be accepted, to establish an effectual filter it would be only necessary to add to the end of such a main, a piece of pipe a few feet long and 4 feet in diameter, and to fill it with charcoal; but this was contrary to all experience.

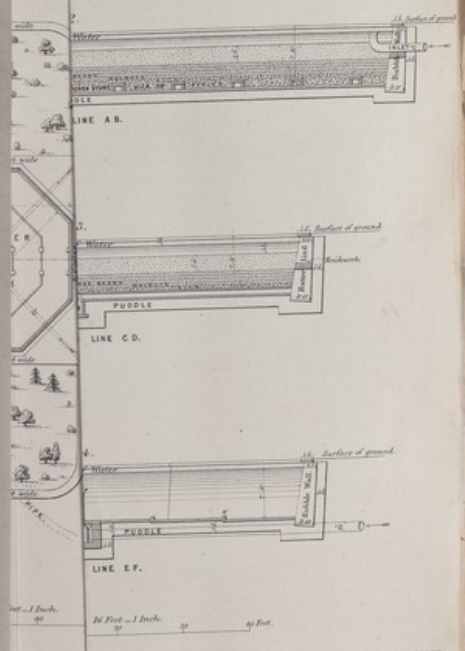
Plate I., Figs. 1—4, represented the filter-beds and the pure-water tank of the Leicester Waterworks. Before filtration, the water held in suspension a perceptible quantity of muddy matter, and was also sensibly brown from a little peat and other organic matter found on the surface of the water-shed from which the water was derived; after filtration the water was completely freed from matters in suspension, and was generally deprived of colouring matter, though in the worst seasons there was sometimes a slight discoloration. Now these were sand filters, and the plan of filtration, though simple, was as serviceable as any system of filtration with which he was acquainted. The water was brought from a large storage reservoir, about 40 acres in extent, into the filter-beds, of which there were four, in separate channels, so that either filter could be taken up and cleaned without disturbing the action of the others; it then passed downwards through the sand and through successive strata of gravel into the drains, and from these by means of pipes into the central pure-water tank. In forming a filter-bed care should be taken that the sand was not fine; otherwise, as was too often the case, the filter would speedily be choked. Coarse granular and silicious sand, resembling small diamonds, was the proper sand for filters. It attracted the particles of matter suspended in the water just as well as the finest sand; it did not readily become obstructed, and it was easy to clean; while fine sand was very difficult to clean. After the sand was cleaned it might be laid down again, and so from time to time over

a long course of years. If muddy water were put into a glass with vertical sides it would be found that the suspended matter not only went to the bottom but discoloured the sides; this arose from the adhesion of the particles of matter suspended in the water within the range of the attraction of the glass. So, in the filter-beds, the water percolated through the sand, and in going through the small passages the suspended matter came within the range of the attraction of the particles of sand and adhered to them, leaving the water clear. In order to make a filter successful it ought to be under the least possible amount of pressure, and not a pressure of 20 feet or 30 feet. To prevent the pressure exceeding a certain limited extent the pipes delivered themselves into a pipe which stood up in the pure-water tank within 2 feet of the surface (Fig. 4). By this contrivance there never could be more than 2 feet of pressure upon the sand, and the water was obliged to go through at a slow rate, amounting to about six hundred or seven hundred gallons per day per square yard of surface. The effect was to produce a water not only free from suspended matter, but which was to a great extent operated upon chemically; he did not mean to the full extent, because unless reagents of some kind or other were employed all the organic matter could not be removed; but there was a very sensible diminution of the organic matter.

In the London waterworks filtration was, in general, well carried out; and the water supply was excellent for general use: it was palatable, free from organic matter, all but in infinitesimal proportion, and was well aërated; and, for all practical purposes, was as good as could be supplied to any city where there were not special manufacturing uses for it.

Soft-water supplies were usually situated near the coal-fields in the northern part of England, and consequently not only by reason of the produce of coal, but also on account of the solvent power of the water and its freedom from what had been improperly called organic impurities, manufacturers were found to resort there. They did not go there because soft water was beneficial to health, but because it was suitable for manufacturing purposes. A different conclusion must, in all cases, be drawn with regard to towns where there was dyeing, or bleaching, or calico-printing, or the manufacture of wool, or anything of that kind, and towns where water had to be supplied mainly if not wholly for domestic use. In the one case it was undoubtedly better to resort to mountainous districts, notwithstanding that the water might be discoloured, to obtain good water for manufacturing purposes. But in those cases where manufactures did not abound, and where the water was used for other purposes, it would be folly to bring in discoloured water when clear water could be had, as such a course always gave rise to violent contentions.

PLATE I.

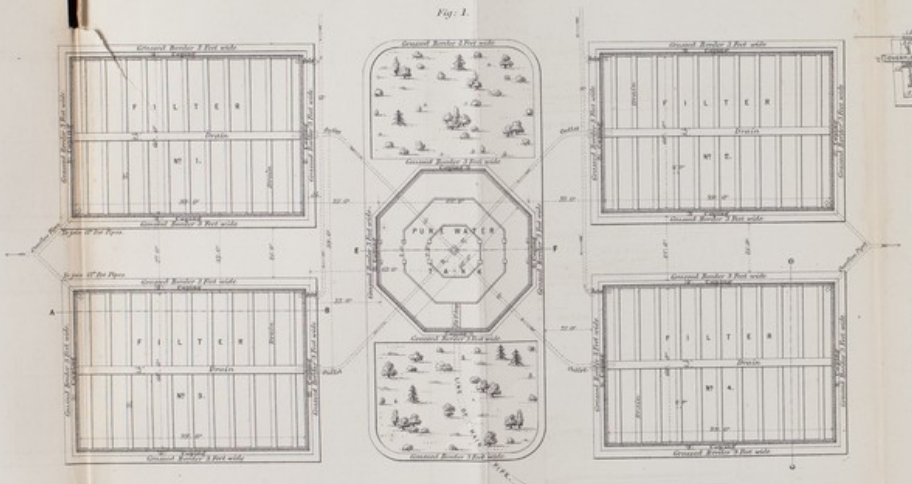


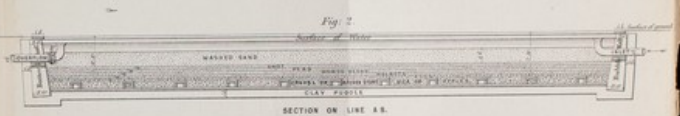
KELL BROTHERS LITHO CASTLE ST HOLBORN

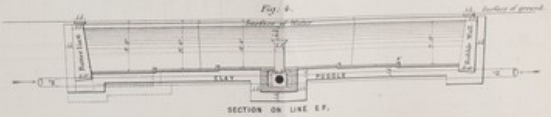
FILTRATION OF WATER.

LEICESTER WATERWORKS.

PLATE I.







T. HAWKSLEY, DELT.

Minutes of Proceedings of The Institution of Civil Engineers, Vol. XXVII. Session 1867–68.

BELL, BROS LITHO^RS CASTLE ST HOLBORN.

With regard to the value of soft waters for effecting a saving in soap and tea, but little water was used for detergent purposes, excepting in manufacturing towns, and only in some of them. In London not one-twentieth of the water distributed to the public was used for detergent purposes; therefore it would be inexpedient to sacrifice the clear and agreeable water, which looked unobjectionable on the table, for that which might save a small quantity of soap.

Reverting more particularly to the subject of the Paper, he would observe that chemical analysis was confessedly a good deal in fault with regard to the assessment of the amount of organic matter in water. The processes used were also those which altered the character of the organic matter; and the chemist did not pretend to discover by the process of analysis the state in which that small quantity of organic matter, which he professed to detect in water, existed. He thought that chemical facts, and all facts within the range of observation, proved that it was impossible that this infinitesimal quantity of so-called organic matter, the character of which was still unknown, could be injurious to health. He considered that so large was the quantity of oxygen existing in rivers and in springs, that under no circumstances could it be possible for nitrogenous matters to exist in them in an injurious state. The names used on these occasions were perpetually being changed. Organic matter was first called by one name, and then by another, and every new name was supposed to indicate a new evil to be overcome; but in point of fact these albuminous matters were old things under new names, and when they were spoken of as being dangerous it was merely begging the question. No one objected to eggs for breakfast, and yet there was ten thousand times more albuminous matter in an egg than there was in all the water drank by a person in a year. And as to animalcules in water, which were said to be so dangerous, there was far more matter of a similar kind in a live oyster. Horrors were painted which had no existence; and it was against these imaginary horrors that he stood up to raise his voice. At the same time he considered it to be the duty of the engineer to supply the public with water in as pure and unobjectionable a state as possible; but, however pure, it would be impossible to supply it in such a state that the modern chemist could not, if he pleased, find some fault with it. The inhabitants of towns supplied with pure mountain water were said to enjoy good health; but it happened that the very reverse was markedly the fact, not in small but in large percentages. Yet this was not because of the water; it arose from the social condition of the populations. In Manchester, Liverpool, Glasgow, and other places supplied with soft waters, both from the nature of the occupations of the people and from the rapidity with which they bred and introduced young life, which was subject to great mortality, the ratio of mortality appeared

unduly heavy. While, according to the reports of the Registrar General, in Sussex and on the east coast of England, where there were no manufactures, and the increase of population was small, the people were long-lived.

Mr. Alfred Smee denied that a small quantity of organic matter in water was immaterial. A small quantity of small-pox matter would infect a large number of persons, and a less quantity of scarlet-fever poison was required to propagate that disease. There were many other poisons communicated by means so subtle that the material agency by which the poison was carried from one person to another had never been discovered, whilst there was distinct evidence that it was so carried. When the great cholera epidemic struck the neighbourhood of Golden Square, Dr. Snow visited every house that was attacked, and in each instance traced the mortality to the use of the water from the pump in Broad Street. He thereupon went to the vestry, declaring that the remedy against cholera in that district was to chain up the pump. When the authorities heard of the simple means he recommended, they were inclined to treat the suggestion with ridicule; but they argued it could do no harm, if it did no good, and when they chained the pump-handle the mortality decreased.

It had been alleged that cows and farm horses preferred to drink water contaminated by sewage, and he could state, of his own knowledge, that if those animals had the choice of clear water and of foul water, they would leave the pure water for the latter. For instance, the water which flowed through Croydon had been habitually taken by some cows. These were attacked with the rinderpest, whilst those around the district did not suffer from it. Nevertheless, it was not only cows but mankind who, in many cases, preferred this particular class of water. Churchyard pumps were resorted to in preference to others; there was something in the taste of the water, probably from the salt it contained, that excited the palate and induced people to drink it in preference to pure water. On the last epidemic visitation of cholera, he recommended the authorities to take off the handle of the pump over the old Roman well in the Bank of England. That well, which was a celebrated one, was derived originally from the gravel; but now there was reason to believe it was supplied from leakages beneath the urinals. It appeared that, when the handle was taken off, some of the people of distinction in the locality begged that they might not be deprived of that water, as it was the only drinking water they enjoyed. He had no hesitation in saying that where tainted water was supplied to the public it was a matter of great moment, and that whenever an epidemic appeared the community must be cautious to do all they could to avoid the use of it.

The next part of the question was the character of the organic matter. This, if like the white of eggs, or a basin of soup, was harmless; but let the soup or white of eggs get into a putrefactive state, and the operation, like the leaven of bread, would communicate its taint far and wide. It was matter in the act of change, and it set up change in contiguous organic matter. The damage done to individuals of every species by the excretæ of the same species was generally recognized by the medical profession; and the doctrine of the harmlessness of changing organic matter was universally regarded as a medical heresy.

Now, what did Boards of Health frequently do? He would rather call them, in many cases, Boards of Death. The Croydon Board of Health formerly took the water which naturally flowed into the stream, passed it through the town and the water-closets, and then poured it in at the top of the River Wandle to poison every person living upon its banks. At one period of an epidemic he thought it his duty to call the attention of the Privy Council to the circumstance, when the inhabitants were warned not to drink the water of the River Wandle. It was only by a series of Bills in Chancery that the residents succeeded in suppressing that nuisance; and it was observed that the Croydon authorities found the greatest difficulty in getting rid of the putrefying animal matter upon the land. He could give a recipe how to test imperfectly-purified water. It might be clear, and bright, and pleasant; but put it into a bottle upon the mantelpiece in a warm room, and in two or three days, notwithstanding the filtering process had removed suspended matter, it would begin to change, and give unmistakable evidence to the olfactory nerves of the presence of putrefying organic matter. Everything tended to show that animal matter in a state of decomposition was to be feared. In seasons of epidemic it was impossible to pass the excretæ of one town to another in rivers, without the danger of propagating disease; and for that reason water ought never to be taken from such a source. Now, if it was matter in a state of change which was injurious, there came the consideration whether the sewage was presented as a totally changed matter in river waters; in other words, whether the sewage assumed a totally different form. Suppose sewage was put upon the ground and absorbed by vegetables, such as cabbages, or was absorbed by weeds in rivers, it was no longer sewage; but, notwithstanding, there were several cases on record which showed that it was not perfectly safe to manure gardens by pumping sewage; under such circumstances, as the plants grew up they would quickly decompose after being cut for use, and would not be as wholesome for food as those manured with sweet and fresh fertilizing matter. But if the organic matter assumed another form, it was really a new substance and harmless. The question of changed matter was

brought forward every month by the Registrar General, and fallaciously estimated as pre-existing sewage, which had caused some persons to be misled as to the wholesomeness of perfectly unobjectionable waters. The matter must be utterly changed before it could be safely used, and that change could be effected on the strata of the earth, by long-continued contact with mould and air. There was reason to believe it was so with regard to chalk. Wherever the water percolated through chalk strata it was deprived of organic matter—perfectly deprived of that changing organic matter which he had referred to as being noxious, and which was converted into nitrites and nitrates. No doubt animal charcoal could do a good deal artificially; but while a great and perfect filter-bed existed in Nature, he held it was right and proper to get for a large town, especially for London, such an amount of water perfectly filtered by Nature as to extract all organic matter from the water, whether in the original or in the changing state. In that way alone could wholesome water, wanting no artificial filtration whatever, be supplied to the community.

Professor Ansted remarked that the question appeared to him to have rather an important geological aspect. It was not for him to touch upon the medical questions that had been discussed; but at the same time he might say that Nature herself was a great restorer, and that she was in the habit of bringing back into a healthy state all those things which, though sometimes called by ugly names, were in themselves only mischievous because it was not known how to deal with them properly. No doubt chalk was a material that purified the water that passed through it; but what rock was there that did not purify water? Every material, no matter what it might be, through which water flowed while beneath the surface of the earth must have some effect upon it; for water was an universal solvent, and could not pass through rocks without depositing some of its contents and taking up others. But he desired to point out what was the nature of those waters which came to the surface from springs. They were not in any case pure waters, in the chemical sense of the word. They were waters which always contained a considerable amount of inorganic matter, and even, in many cases, no small proportion even of organic matter. He spoke now of waters derived from deep natural springs, and rising to the surface highly mineralized. These were known as mineral waters: some of them were not only mineralized, but also contained organic matter to a large extent. The hot sulphurous waters of the Pyrenees were of this kind; they contained organic matter under the name of glairine, which existed in such a state as to involve, when it came to the surface, a peculiar kind of decomposition. Such waters were exceedingly favourable to the rapid growth of confervoid vegetation. They were also perfectly natural, as far as any water could be so, and they had undergone no change by exposure, proceeding, in fact, from the depths of the earth, charged not only with nitrogen, but with matter distinctly organized. Now if these organic substances in a state liable to immediate decomposition were injurious, then these waters would be injurious. On the contrary, however, they were highly sanatory. He might say that all waters which percolated through the earth and came up again in springs were charged with mineral matter, including nitrogen; and if these matters were injurious, where, he would ask, was good water to be found? Water must be got for towns in some way, and there were certain well-known sources from which it could be obtained, and no others. First, there was spring water. In the case of large towns, spring water drawn from wells in the neighbourhood of churchyards might, no doubt, be loaded with decaying animal matter, which was very fatal; but spring water, even when not exposed to those evils, never could come to the surface pure. Spring water, therefore, though one of the most important, and, in some cases, most valuable sources, might seem open to serious objection, and could not be taken without inquiry for extensive use in towns. Lake water was another source, and was partly derived from rain, partly from springs. Nobody would say that lake water, whether from natural lakes or artificial reservoirs, was not liable to receive impurities both animal and vegetable. It might be good, but in its derivation it was no better than others. River water was another. Rivers themselves, like lakes, were derived from springs and rain. They received a large quantity of organic matter, which was necessarily decaying matter, and exceedingly unsuitable for consumption. But no one would assert that lakes were bad sources of supply. Neither could it be thought so for a moment of a river, even when it had received much decaying organic matter. On the contrary, after it had flowed for a certain distance it ceased to retain, in almost all cases, a sufficient quantity of such decaying matter as really to render its waters injurious to health. The whole question was one of observation and fact. He could indeed understand the possibility of theorising on this subject to a large extent, and was aware that those who looked upon matter thrown into rivers as the source of all mischief, seemed to entertain the notion that it must remain there, and never could be got rid of; but he could not understand how chemists and medical men could seriously state that decomposing organic matter entering streams in the ordinary manner was not really got rid of, and that too after a comparatively short time, by mere exposure to air, accompanied by considerable movement. In this respect rivers were better off than lakes, because in the still waters of the latter the organic matter was much longer being got rid of. River water was always in motion; it flowed over the surface, and was constantly disturbed;

fish lived in it, and what did they live upon? They lived upon smaller fish, and ultimately on animalcules. What were these animalcules? They were the contrivances which Nature had adopted to make use of all this otherwise injurious and even poisonous decaying matter. They greatly assisted in rendering running water rapidly pure; and exposure to the air and oxidation did the rest. He believed it to be a simple fact that a river, after passing a town, and receiving the whole of the sewage of that town, ceased to be in a dangerous state a few miles below. He believed this from his own experience, and was certain that river water might safely be used that had had a few miles' exposure to the air, provided, of course, the towns on its banks were not too large or too near together, or the quantity of impurity too great in proportion to the body of the water and the rate of its motion. It seemed to him, therefore, that rivers were the natural sources of supply to towns. They had always been so; and he apprehended, in spite of the feeling occasionally excited, because of the large quantity of impurities sometimes passing into them from towns, that there were, on the whole, no better means of supply than they afforded. He might repeat that all three sources of supply were available; for Nature had yielded water in various ways, and for various purposes, and men might avail themselves of all, according to circumstances. The rain that fell from the sky was not pure, especially in towns; for it contained ammonia, and various substances present in the air; but still soft rain water was very useful. Of the rain that fell upon the earth, one part ran upon the surface, another entered into the rocks. Both were equally useful. Which source should be used in a particular case was a matter which must be decided locally. There were cases in which one kind of water could not be used, owing to local influences. He quite understood the allegation of the existence of impurities in the water supplied to certain towns in particular cases. No doubt this had been so; but then came the larger question, what should be the source of supply to towns, if they could neither use the rain water nor the water from such wells as could be most conveniently sunk? In many cases it could not be considered advisable to use well water in large towns, because such wells were liable to injury; but that towns might not draw their supply from the streams which passed by them, and that the water so conveyed was not capable of being utilised by some simple process of filtration was, he believed, contrary to all experience. Speaking on the subject geologically, and with reference to the condition of the interior of the earth in these matters, he was safe in stating that most of those mineral substances which were regarded as impurities in water naturally belonged to water, and that water was never free from them in the natural state. Water was an almost universal solvent, and in passing through the earth

underwent great changes, parting with some substances, taking up others, and often coming back not in a simple but in a highly mineralized state; useful for certain purposes, but not always adapted for drinking, washing, or manufacturing. The ordinary state, however, of springs, as of lakes and rivers, was no doubt that in which they contained a comparatively small amount of mineral salts; and that ordinary state was the only one engineers had to deal with. The tendency, also, of river water was, by a process of gradual and natural purification, to yield good usable water, occasionally fouled, but almost always recovering itself; and he would say that, so far from any danger being incurred from river water, except under very exceptional circumstances, the idea of such danger might be put aside as contrary to experience, and contrary to the principles of natural science.

Mr. H. Shield exhibited the following Tables, showing the effects of sand and of vegetable charcoal upon water taken from the River Thames at Kingston by the Chelsea Water Works Company:—

Table I.

Results of Filtration through Charcoal in Lumps of the size of a Walnut. Water taken from the River Thames at Kingston. Experimental Filter No. 1. (Page 43.)

——	Original Water used.	After 67 Hours' Action.			After 91 Hours' Action.		
		Comparison.	Amount separated.	Per Centage Ratio of Quantity separated.	Comparison.	Amount separated.	Per Centage Ratio of Quantity separated.
Total residue . .	23·949	23·668	0·281	1·17	22·076	1·873	7·82
Mineral salts . .	22·519	..	..	..	21·618	0·901	4·00
Organic matter .	1·430	0·475	0·955	66·78	0·458	0·972	68·00
Chlorine . . .	1·054	..	..	..	0·973	0·081	7·685
Chloride of sodium	1·737	..	..	..	1·603	0·134	7·714

		After 115 Hours' Action.			After 139 Hours' Action.		
Total residue . .	23·949	23·012	0·937	3·91	23·411	0·538	2·242
Mineral salts . .	22·519	..	..	..	22·440	0·079	3·66
Organic matter .	1·430	0·620	0·810	56·67	0·971	0·459	32·10
Chlorine . . .	1·054	0·885	0·169	16·03	0·973	0·081	9·73
Chloride of sodium	1·737	1·457	0·280	16·10	1·603	0·134	9·8

TABLE II.

RESULTS of FILTRATION through SAND. Water taken from the River Thames at Kingston. Experimental Filter No. 2. (Page 44.)

——	Original Water used.	After 23 Hours' Action.			After 120 Hours' Action.		
		Comparison.	Amount separated.	Per Centage Ratio of Quantity separated.	Comparison.	Amount separated.	Per Centage Ratio of Quantity separated.
Total residue . .	24·578	23·87	0·708	2·88	23·69	0·888	3·613
Mineral salts . .	23·687	22·858	0·829	3·50	23·04	0·647	2·73
Organic matter .	0·8906	1·012	..	..	0·648	0·2426	
Suspended matter	3·569	2·663	0·846	24·109			
Chlorine . . .	0·862	..	..	..	0·671	0·191	22·16
Chloride of sodium	1·420	..	..	..	1·105	0·315	22·11

		After 240 Hours' Action.			After 376 Hours' Action.		
Total residue . .	24·578	22·534	2·044	8·316	22·507	2·071	8·426
Mineral salts . .	23·687	21·517	2·170	9·161	21·698	1·989	8·397
Organic matter .	0·8906	0·917	..	..	0·869		
Suspended matter	3·569	1·88	1·689	46·423	1·584	1·925	54·85
Chlorine . . .	0·862	0·674	0·188	21·8			
Chloride of sodium	1·420	1·110	0·310	21·8			

TABLE III.

RESULTS of FILTRATION through CHARCOAL in Granules. Water taken from the River Thames at Kingston. Experimental Filter No. 3. (Page 44.)

——	Original Water used.	After 72 Hours' Action.			After 120 Hours' Action.		
		Comparison.	Amount separated.	Per Centage Ratio of Quantity separated.	Comparison.	Amount separated.	Per Centage Ratio of Quantity separated.
Total residue . .	24·578	22·13	2·448	9·906	21·644	2·934	11·93
Mineral matter .	23·687	21·375	2·312	9·76			
Organic matter .	0·8906	0·755	0·1356	15·22			
Suspended matter	3·569	..	..	..	3·06	0·449	12·79
Chlorine . . .	0·862						
Chloride of sodium	1·420						

		After 240 Hours' Action.			After 376 Hours' Action.		
Total residue . .	24·578	20·821	3·757	15·28	21·374	3·204	13·03
Mineral matter .	23·687	..	..	..	20·604	3·083	12·34
Organic matter .	0·8906	..	..	..	0·770	0·1206	13·54
Suspended matter	3·569	2·79	0·719	20·48			
Chlorine . . .	0·862						
Chloride of sodium	1·420						

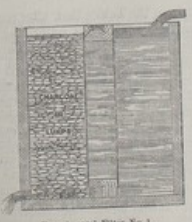
COMPARISON of TABLES I., II., and III.

Amounts of Total Residue originally present in each Case.	Number of Hours' Action of the Filter.	Amount separated in Grains in the Gallon by			Per Centage Ratio of Quantity separated by		
		Sand.	Charcoal in Granules.	Charcoal in Lumps.	Sand.	Charcoal in Granules.	Charcoal in Lumps.
Grains.	Hours.						
24·578	23	0·708	2·868	..	2·88	11·66	
23·949	67	..	..	0·281	..	..	1·17
23·949	91	..	..	1·873	..	..	7·82
23·949	115	..	..	0·937	..	..	3·91
24·578	120	0·888	2·934	..	3·613	11·93	
23·949	139	..	..	0·538	..	..	2·242
24·578	240	2·044	3·757	..	8·316	15·28	
24·578	376	2·071	3·204	..	8·426	13·03	

COMPARISON of TABLES II. and III.

Amount originally present.	Amount separated in Grains in the Gallon.		Amount separated by Per Centage of the Quantity present.	
	By Sand.	By Charcoal.	By Sand.	By Charcoal.
24·578 grains in the gallon .	2·074	3·757	8·426	15·28

The rate of filtration in each of the three filters experimented on was half a gallon per minute; and, as the time each experiment lasted was given in the Tables. it would be easy to calculate the amount of water passed. In filter No. 1 the filtering surface exposed was about 4·38 square feet, the filtration being lateral and descending.



Experimental Filter No. 1.

The sand filter No. 2 had an area of 4 square feet, and consisted of the following materials :—

	Ft.	In.
Fine sand	1	9
Shells	0	1½
Gravel	0	1½
Coarse gravel	0	9
	2	9

Experimental Filter No. 2.

In No. 3 filter the fine sand was replaced by charcoal in granules of about the size of a pea; in other respects it was the same as filter No. 2.

It would be seen from the Tables that, after removing a considerable amount of impuritiy from the water, the charcoal steadily decreased in the efficiency of its operation. The experiments with the sand filter proved that, while sand removed much less of the impurities than charcoal, the effect went on increasing up to the end. The filters were about half the depth of the actual filter-beds of the Chelsea Water Company, so that the results were not so favourable as those effected in the ordinary operations of the Company, which appeared in the monthly report of the Registrar General. The small quantity of organic matter removed by sand in cases where the amount originally present was but small was worthy of attention. Other experiments, however, had been made with water of less purity, taken at Chelsea at different seasons, and the result of these showed that the case was altogether altered when the quantity of organic impurity, originally present, was considerable. Thus 20·46 per cent. were removed from water containing 2·375 grains of organic matter to the gallon, and 66·66 per cent. when 4·05 grains were present. He was of opinion that the action of the sand was not of a chemical nature, but that the attraction of cohesure, or adhesion, exerted on the surface of the sand in contact with the impurities, constituted a physical force sufficient to overcome the weak chemical affinity in virtue of which salts were held in solution, and to cause the exposure to the action of the air, and consequent neutralization of much of the organic impurities. Possibly the portion of organic matter removed was that which was in a state of decomposition, and which alone was noxious to health. He was sorry the results of the magnetic carbide system of filtration had not been given by Mr. Spencer, because he could have shown that sewage matter could be filtered to half a grain of organic matter to the gallon; but he believed the magnetic filter could not be relied upon to remove traces of less than half a grain to the gallon. However, by the use of the magnetic filter sewage water, flowing into a river, could be made tolerably innocuous, even in cases where the sewage was present in such quantities that the operations of Nature could not effect this, and where no means could be devised for intercepting the sewage, and carrying it by a special channel to an outfall of its own. He thought this discussion could hardly fail to prove that the London Water Companies supplied river water of excellent quality, and not what had been in some instances imagined by the public; and a reference to the monthly reports of the Registrar General would fully confirm this view. The report for October, 1867, gave, as the average for the eight Metropolitan Water Companies' supply, ·210 lb. of organic carbon in 100,000 lbs. of water, against ·256 lb. of organic carbon in 100,000 lbs. for Loch Katrine water; and no question had ever been raised about the excellent quality of this last supply.

Mr. G. W. Hemans considered, that there were two questions to be determined. One was whether filtration could be made available to purify foul water; the other was, whether filtering was necessary, and whether the waters which came through the rivers were not already good enough, by the operations of Nature, for general use. With regard to the extraordinary results obtained by Professor Frankland, neither he nor anybody else had hitherto mentioned how often it would be necessary to renew the charcoal for filtering purposes: but on the assumption of the lower rate of speed, he calculated that a surface of 270 square yards of charcoal, 1 yard thick, would be required to filter the daily supply of water to London, estimating it at one hundred million gallons. That would amount to a weight of about 170 tons of charcoal. If he was right in saying that the cost of animal charcoal was £20 per ton, or £15 per ton, supposing it to be changed once a month, which he

thought might be a fair assumption, the cost, at £20 per ton, would be £50,000 a year, and at £15 per ton three-quarters of that amount. But if it turned out that the half minute of contact was wholly insufficient, and that ten minutes of contact were necessary, the expense of filtering with animal charcoal might amount to £400,000, or even £500,000 a year. He thought, in short, that more data were required on this point. Turning to the other subject, as to whether rivers were capable of giving pure water, he thought the public mind would hardly receive or tolerate the idea, that because Nature had provided them they should be used in their present state. In the report of the Rivers' Pollution Commissioners, a description was given of the foul state of the River Thames, of the Aire and Calder, and of the Rivers Lee and Clyde; and as the valley of the Thames delivered the sewage of a million of human beings, condensed within a small space in large towns, it would lead to the very opposite inferences. He thought the more general belief would be, that it was better to procure pure water, of a quality such as no rivers in low populous valleys could furnish, and that if it could not be got in any other way, it must be obtained from mountain sources. The Commissioners on the Pollution of Rivers recommended that every town should be compelled to utilise its own sewage, by the process of irrigation on grass lands, which would produce profitable crops, and would to a great extent deodorise and improve the condition of the water. No doubt that was an excellent remedial measure, which would be largely adopted in this country; still he doubted whether it would remove all the offensive matters in solution in the water, and render it fit for drinking. Besides, he did not think the remedy would be sufficient; but that, in communities like that of London, the ulterior result would be that it would be necessary to have recourse to the rain water from the mountains in its pure condition. It was a mistake to suppose that the rain water collected from mountainous districts was turbid. If there was no foul matter to make the water turbid, it would not be so. The water from the great slate formations of North Wales and Cumberland was not turbid; on the contrary, the rivers there were pure and fine.

Mr. Edwin Chadwick, C.B., begged to make one suggestion. There had been proposed and tried, during the last few years, various methods of water supply for towns. Besides the old methods of river supplies, might be mentioned supplies from the surface washings of cultivated or of uncultivated lands; supplies from springs—gathering grounds from hills—contoured by ditches, led to storage reservoirs;—there had been changes from river to spring-water supplies; from hard-water supplies to soft-water supplies; soft-water supplies from surface gathering grounds, and soft-water spring supplies, delivered direct, without the intervention of storage; and changes from river supplies to artificial springs,

or subsoil collections, by means of agricultural permeable tile drains. There had been the changes in the methods of delivery,—intermittent supplies to constant supplies, changes in the engineering methods, from delivery by stand pipes, in courts or alleys, to delivery within the houses of the poorest classes by constant supply, and connection with water-closets, sinks, and houses. There had also been changes from storage in uncovered reservoirs to storage in covered reservoirs. He submitted, that it would greatly conduce to the advancement of this branch of engineering science, as well as to sanitary science, if there could be a competent examination, by scientific men, free from professional interest or bias, who would compare premises with results, in money as well as in quantity and quality, of the supplies given. In respect to the changes from hard water to soft water, he apprehended that, upon such an examination, if those who had been used to soft-water supplies, such as that of Manchester, were questioned as to their experience of a hard-water supply, as in coming to live in London, for instance—as to the comparative agreeableness of the two in washing, as to the saving in tea, and other soluble matters, as well as in soap, there would be little difference of opinion on the subject, apart even from medical testimony as to the results in improved digestion. It would be found, too, that water of the first degree of purity at its source, frequently became highly impure in consumption from methods of delivery;—that water stored in stagnant open reservoirs had rapid growths of vegetation, then animalcules, then decomposition of animal and vegetable matter, which subsequent public or private filtration only partially removed; that water kept in stagnant butts or cisterns on the intermittent system of supply, near cesspools, or middensteads, or in close courts, absorbed great quantities of the mephitic air of the place;—that water pure at its source, even the purest soft water, delivered by stand pipes in close courts or alleys, and taken up by poor people into overcrowded and foul living and sleeping rooms, and kept standing there in such open vessels as they had, became in a short time offensive to the smell and nauseous to the taste, and fraught with injury to the bodily system;—so that, considering how much the quality of water was dependent on the quality and the quantity of its aëration, it might be said that it depended on the engineering methods of delivery, whether the man in the town was drinking with the water mountain air or sewer air. Hence it would be found that, by defective methods of delivery in cesspool-tainted towns, augmented supplies of pure water had so little effect on death rates. Hence, too, the need of comprising the minor or house deliveries with the main deliveries, under one common sanitary superintendence, and that a public and responsible one. Then again, the effects of some water on various sorts of metal in deli-

very ought to be more carefully examined; and lead piping got rid of, and the use of earthenware pipes, now spreading on the continent, considered. He would observe, that when horses were taken from soft-water districts, as from those of the Surrey sands, for example, where their coats were smooth and bright, on a change to a chalk-water or a hard-water district, their coats became rough and staring, and they were subject to intestinal disturbance. So important was soft water to them, that horse trainers carefully collected rain water from slate roofs, and kept it in deep covered tanks, for the horses to drink, and carried the soft water with them, for the use of the animal at the racecourse. And whatsoever cows did for themselves, having really seldom any choice, what careful cattle-feeders did for them, was to get the best water that could be obtained. As to the instances cited of the effect of tainted springs on cholera in epidemic conditions, life appeared to be depressed, and the power of withstanding noxious agencies reduced, and sometimes the power of these agencies was increased by decomposition. Certain it was that persons then suffered from matters which at other times they bore with impunity. It was so with water. Impurity in water was then most injurious and fatal. This was so distinctly proved to be so as to lead extensively to the popular belief, in cholera periods, that the wells and common drinking waters had been poisoned; and in those epidemic conditions impurities might be said to be poisonous. Chemistry, which had as yet failed to remove completely the matter of sewage held in solution, would, he believed, be found to fail also in the complete removal of other impurities. Well-water might be said to be filtered water, which in towns was certainly dangerous at such periods, and it would be found that the success of the common filters on a large scale was very far from what was needed; that was to say, the filtrations of large quantities of water through comparatively small amounts of solid matter. The most efficient filter for the removal of matter in chemical solution, as well as matter in mechanical suspension, had yet, however, to be noticed, namely, filtration through strata occupied by vegetation. This had been brought under his observation by seeing two outfalls from land of the same stratum. From the one outfall the water was the surface washing of cultivated land, from which storm water was running much of the colour and consistency of pea-soup, contributing to the river supply dung and animal matters carried away in suspension. From the other outfall from the same land, subsoil drained, the water was running as clear as crystal; the surface matter carried away in the former being detained in the soil as in a great filter. Common filters of sandy or other soil without vegetation were little more than sieves, removing from water little that was held in solution; whereas in passing through a stratum occupied by vegetation, a great deal, if not the whole of the matter held in solution was removed, as appeared from chemical analysis by Professor Way. Thus water collected from such grounds as the Bagshot sands would be more free from organic matter, if derived from properly adjusted permeable subsoil drains, than if gathered from the surface. The land, subsoil-drained, formed of itself a vast filter through vegetation. The filter was the more perfect if the drains were properly adjusted. They might be made too shallow. If they were too deep, they were apt to derive mineral matter from the ground. Sandy sterile land was excellently fitted for the filtration and collection of water. Some of these land-filters appeared to detain matter brought down by rain, and to yield water absolutely purer than rain water carefully caught. Of course on occupied land even the extensive and superior filter and gathering ground thus constituted might be overborne by heavy overdosing with manure, especially by putrid sewage derived from drains and sewers of deposit, and by irrigation by submersion, where 2 or 3 inches of water were put on at a time, instead of by fresh sewage from self-cleansing tubular drains and sewers, applied in such moderate and repeated doses as to allow full and fair action to the peculiar powers of vegetation in taking up animal and vegetable matter. Where such means were unavailable, considering the cost of private filtrations, as well as of large or public filtration, and the cost of works to take out organic matters from water supplies, and their common imperfection (of which there was extensive experience in London during storm periods), he believed it would be the most economical course to prevent such matters getting into the water; and where water was derived from gathering grounds of granite or slate, or other primitive formations, as proposed, that it would be worth while to strip the rock of the commonly thin covering of peat, or other vegetable matter, and make the surface absolutely bare and clean, and lead the water away in covered channels to covered reservoirs, and from thence direct to the houses; and considering the value of perfect purity in drinking waters, to prepare surfaces expressly to catch rain water. These observations he offered as indications of the points on which close competent examinations should be made on the spots, of what had been done, or attempted to be done, to arrive at impartial and safe conclusions, for the public satisfaction, as well as for the advancement of engineering and sanitary science.

Mr. E. A. Cowper stated that animal charcoal could be reburnt for 20*s.* per ton, and it might be reburnt twenty, or even fifty times over, and still be perfectly good for refining sugar.

Dr. Letheby communicated, through the Secretary, the results of some additional experiments made by him on the purifying and oxidizing power of animal charcoal.

Thinking that an examination of charcoal, which had been in use for some time as a filtering agent, might throw some light on its real function as a purifier of water, he obtained from the London and General Water Purifying Company samples of charcoal from a No. 4 filter, which had been in continual use at a house in St. George's Square, Pimlico, from the month of November, 1865, to the time when the samples were taken out of it for his inquiries —that was for a period of exactly 2 years; and he was informed that during the whole of that time it had been daily filtering about four hundred gallons of the Chelsea Company's water; so that about two hundred and ninety-two thousand gallons of water had passed through it. Now it appeared to be a matter of great importance to ascertain whether the filter still had the power of purifying water, and whether it contained any notable quantity of organic impurity locked up in the pores of the charcoal. He therefore first examined the capabilities of the charcoal as a purifying agent; and he found that when water supplied by the East London Water Company was filtered through the charcoal at such a rate that there was about three minutes' contact, the water was not merely deprived of its colour, as shown by an examination of it in a two-foot tube, but it was also deprived, in the usual way, of organic matter. This he ascertained by the permanganate test, and by distillation with caustic potash. It was evident, therefore, that the charcoal still acted as a purifying agent. He next examined the charcoal for organic impurity; for if it had been removing organic matter from water at the rate of only a tenth of a grain per gallon, it ought to have contained within its pores a very considerable quantity—not less than 4 lbs. of organic matter. Three examples of the charcoal were therefore submitted to distillation with a large excess of caustic potash, and the amount of ammonia obtained from 4 ounces of each of the samples was as follows:—

Charcoal from Top of the Filter	0·321	grain ammonia.
Ditto Middle of ditto	0·162	„ „
Ditto Bottom of ditto	0·240	„ „

Thus showing that the quantity of nitrogenous organic matter in the charcoal was very inconsiderable. What, then, had become of all the organic matter which the charcoal had for 2 years removed from the water? It had evidently not accumulated in the filter, and there was no proof of its having been first absorbed and then set free. To determine this question, he put a known quantity of decaying organic matter into East London water, and filtered it through the old charcoal. In three minutes the organic matter had almost disappeared, and the filtered water contained a notable quantity of nitrite, which must have been produced by the oxidation of the nitrogenous matter which he had put into the water. This effect was tested still further by adding a drop of ammonia to a large volume of water,

and then testing for ammonia, and for nitrite after filtration. As in the last case, the ammonia had nearly disappeared, and nitrite had taken its place. These results showed beyond question that the purifying power of charcoal was not merely dependent on the fixation or physical absorption of organic matter, but also on its power of oxidation; and it appeared to him that two conditions were necessary for the destruction of organic matter in water—first, its being in a state of change or decay, and secondly, the existence of free oxygen in the water. When these conditions were present, he found that even sand would act as a purifying agent, although its power was far less active than that of animal charcoal.

He was not desirous of re-opening the discussion of the effects of organic matter on health; but he could not avoid saying that the different and often contradictory opinions respecting this subject were evidently referable to two causes. One was, that all kinds and conditions of organic matter in water were often regarded as equally hurtful; the other, that the subject was contemplated from very different points of view, according to the habits of the observer. This indistinct and indefinite notion of the nature of organic matter did not permit the common observer to perceive that organic matter could only be hurtful when it was in certain states of change or decay, or when it was endowed with specific powers of morbific action, as in the case of the germs of disease, and perhaps also where, as it would seem, the excrements were hurtful to the animals or vegetables excreting them, but not to others of different species. And in respect of the second cause of error and uncertainty, it was evident that a truly pathological phenomenon could not be understood or clearly perceived by those whose avocations were of a strictly physical or chemical nature. In point of fact, the most mischievous dogmatisms of the present day, as regarded this important subject, were those which were propounded by men who were either ignorant of the laws of physiology and pathology, or who had little else for the basis of an opinion than the uncertain data of so-called statistics.

Mr. Vignoles had been informed by Mr. Lindley, Engineer to the Berlin Waterworks Company, that the water supplied to the inhabitants of that city was derived from the River Spree. Previous to being received into the tank or reservoir for distribution, the water was passed through filters, and was freed from all impurities; but after remaining in the tank for a day or two, the whole surface of the water got covered with confervæ and vegetation of various kinds: the water also lost its transparency, and became so turbid as to resemble the slush of the London streets. This naturally created great anxiety, and the managers of the works thought it necessary to stop the distribution once a week, in order to clean out the tanks. Upon the recommendation of Mr. Lindley, the

tanks for the reception of the filtered water were covered over, and immediately all the above symptoms disappeared, the water remaining in its original pure state. No doubt the covering of the tanks had prevented the contamination of the water; indeed it had long been understood that all tanks for the distribution of water ought to be covered over; but so strong a case as this he had never heard of before.

Mr. J. F. Bateman observed, that the last-mentioned fact accorded with the experience of those who had had anything to do with very pure water. In shallow reservoirs, a confervoid growth, like that spoken of, extensively prevailed, and on its decay, animalcular life sprang into existence, and the animalcules passed into the pipes. His attention was first prominently called to this about twenty years ago, in the case of the Warrington Waterworks, where the water was collected from gentle slopes of cultivated land of the New Red Sandstone formation into a reservoir, after which it was rendered perfectly pellucid by being filtered through sand, and was then passed into a tank not more than about 6 feet deep. Although that water was filtered as well as it could be, it very soon became filled with animalcules, for the separation of which he introduced a copper wire-gauze strainer of eighty strands to the inch; but it was so difficult to cleanse it from the animalcules, that he ultimately resorted to the covering over of the reservoir. This was effected, without emptying the reservoir, by erecting vertical pillars supporting cross beams, on which large flags were placed. As the work progressed, the confervæ beneath the covered parts gradually fell to the bottom; by the time it was finished they had entirely disappeared; and the water had been delivered in a pure state ever since. He considered it necessary that reservoirs should not be less than from 15 feet to 20 feet deep, if they were to remain uncovered, as experience showed that reservoirs of that depth did not generate confervæ. The service reservoirs of the Manchester Waterworks, which were lined with bricks throughout, that they might be cleaned from time to time, were 18 feet deep at one end and 20 feet deep at the other, and, as they were kept constantly filled to within a foot or two, there was never a particle of vegetation on them. They had not been cleaned out for the last sixteen years or seventeen years, nor did they require it, the water was so pure. At Wolverhampton the water was collected from the same geological formation as that at Warrington; the service reservoir at Tettenhall was 15 feet deep, and there was no vegetation in it; but he considered a less depth of water than 15 feet would be liable to generate confervæ in the manner spoken of, and in all such cases the reservoirs must necessarily be covered over.

The animal charcoal filtration, or rather the passing of water

through animal charcoal, seemed, in the results stated, to be most extraordinary to engineers who were in the habit of treating these things mechanically; and he could only say that if these results were true—and they were given by men on whose accuracy reliance could be placed—the process of purifying water might be made simpler, easier, and more convenient than had hitherto been the case. The purification of foul water would be effected, it appeared, if it were passed through a mass of charcoal, and the water, if discoloured, would be rendered clear, and be deprived of organic matter. He should be happy to avail himself of any favourable experience which could be gathered from the use of animal charcoal, and he felt much indebted to the chemists who had discussed the question. For his own part, although in many cases he had adopted filtration, yet in the large waterworks he had more recently constructed, he did not provide filter-beds, nor did he find it necessary to do so. Where water was taken from rivers, sometimes turbid, and always containing more or less foreign matters, and where it was taken from canals or reservoirs, supplied by water flowing from gentle slopes of cultivated land, it was necessary to filter it; and it was also occasionally necessary to filter water taken from shallow lakes. In the case of water taken from the shallow lake of Loch Rutton, for the supply of Dumfries; or in that of Rathmines, near Dublin, where the water was taken from the Grand Canal—a canal notoriously charged with foreign matter, the water was filtered; but at Manchester, Glasgow, Halifax, Blackburn, and many other places, there was no filtration. At Blackburn, filters were constructed in the first instance, but after a time the use of them was abandoned, because it was found that, by the system of decanting and drawing from the top of each reservoir, the water was supplied as pure as if it had passed through the sand filter. The water at Blackburn had been supplied in that way for the last twenty years. In the case of Manchester, the water was, to a considerable extent, separated; for the spring water, as it issued from the bowels of the earth, was conveyed in a separate watercourse, and was either taken direct into Manchester for present use, or stored till the springs fell below that point which was required for the supply, when the water previously stored was drawn upon. The fact had been demonstrated that water of a brownish colour when stored became bleached in the reservoir by exposure to the atmosphere. In the Belmont reservoir of the Boston Waterworks, which was wholly supplied from a district covered by peat, the water came in as brown as porter, but after about 3 weeks' exposure it became comparatively clear, and only slightly tinted. In like manner the value of exposure was shown in the instance of Loch Katrine, the whole drainage ground of which consisted of land covered by a coating

of peat and black earth. The principal streams flowing into that lake, viz., the River Gyle and the Strowan Burn, were at this season of the year as brown as mahogany; and yet the water collected was about the purest that could be seen. At any season, except perhaps in a wet autumn, a sixpence or a piece of white pottery could be seen at a depth of 10 feet, with only a pale straw colour imparted to it. He had recently been there when the depth of the water in the basin at the entrance of the tunnel was from 5 feet to 6 feet, and notwithstanding a considerable amount of rain had fallen, the white pebbles at the bottom showed of a pale straw colour only; but seen in a glass, the water was brilliantly bright. From this it was evident that there were many ways by which water might be purified. He had no doubt many of those present had seen the River Rhone as it flowed into the Lake of Geneva, and the water of that lake as it flowed out. They would also have noticed the condition of the water at the junction of the Rivers Rhone and Arve, about 2 miles below Geneva. The water as it entered into the Lake was largely charged with matters from the abrasion of the ground by the grinding action of the glaciers above, and for some distance after it entered the Lake the discoloration was very perceptible; but the water flowing out at the other end of the Lake was as brilliant, pellucid, and pure a stream as could be imagined, and that water was supplied to the inhabitants of Geneva. Then again, in the Manchester Waterworks there was no filtration; but in all such cases the water, after being decanted off and stored in large reservoirs, was received into service reservoirs 18 feet in depth, and was then strained through a large area of copper-wire gauze. He began with eighty strands to the inch, but that was found to be too fine, and the strainer now used was of sixty strands to the inch, that mesh being sufficient to separate the extraneous matter, and prevent its passage into the pipes.

The mechanical filtration of water, generally adopted by engineers, was by downward filtration through sand. He first studied filtration many years ago at the large print works and bleach works in Lancashire, where one or two million gallons of water were frequently filtered daily through sand for the supply of the works; and having watched the operation, he came to the determination to adopt the principle which was there successfully carried out. It consisted in having a shallow depth of water upon the surface of the sand, and slow filtration. In that respect the system differed from that which obtained in London, where there were 5 feet or 6 feet of water over the sand bed, whereas he never allowed more than 1 foot of water to rest upon the surface of the filter. The total thickness of the strata of the filtering bed was 4 feet. The upper 2 feet consisted of siliceous or quartzose sand, insoluble in water, with the particles as fine as bay-salt. If

not obtained clean it required to be very carefully washed. Below this was a bed of 6 inches of coarse sand or fine gravel, about the size of peas or small beans, the interstices of which were so close that the water in its passage could not carry down any of the sand from above. The next stratum consisted of 6 inches of coarser gravel of the size of Barcelona nuts and walnuts, which supported the upper strata; and at the bottom of all was a rubble foundation of stones of the size of potatoes and turnips; so that the whole system consisted in making the successive layers below the uppermost one so fine only that the material of the several strata should not be displaced. He saw no occasion whatever for the use of oyster shells, which were introduced into the London filters, the great object being to support the upper bed of sand by a proper gradation of the material downwards. He estimated that such a filter in good working condition would pass water at the rate of 6 inches vertically per hour, or seventy-five gallons per square foot of surface in twenty-four hours. This plan of filter was easily cleaned. When a less quantity of water than usual was filtered, the upper surface of the sand bed, which alone caught the extraneous matter, required to be scraped off, and a fresh surface of sand exposed, after which the filter did duty again.

Something had been said with regard to soft water and hard water; but as that did not form part of the subject of the Paper, he would not refer to the question; but he had endeavoured to show that there were several ways of purification which were effectual: these were—decanting in the manner carried out in several waterworks: by separation and separate storage; by the collection of water in large volumes; by deposition and exposure, and by taking the water from the lower end of a lake; and also by mechanical filtration.

Mr. J. A. Longridge thought it was not Professor Frankland's intention to state that water for large cities like London could be taken from the River Thames, or any other impure source, and that after being passed rapidly through a bed of charcoal 3 feet thick it would be perfectly pure. He thought he drew a distinction between the simple mechanical operation of removing matters in suspension and the removal of the more objectionable organic matter in solution; and that it was to the latter operation that he had directed attention. No doubt the mechanical operation was performed best by a large surface and small head of water and a slow process of filtration; and the way in which this was done had been well described in the course of the discussion. But the question arose whether it was necessary to remove the organic matter in solution from the water, and if so, what means should be taken to remove it. He was inclined to adopt the medical testimony on that point, notwithstanding an assertion that it had never been proved

that organic matter in suspension was deleterious. Perhaps the state in which it sometimes existed might not be injurious, but when organic matter became putrescent, it was unquestionably noxious; and engineers were bound to take every possible means of removing it. He did not believe that the ordinary attraction of aggregation would remove matter in solution from water; therefore if the organic matter existed in solution it must be got rid of by chemical action; and he saw no reason why this should not be instantaneous, as it would be accomplished by the simple contact of the particles of water with the chemical agent. Carbon had the power of absorbing gases, and it would absorb large quantities of atmospheric air; and if water from which all mechanical matter had been removed was passed through it, and each particle of water was brought into contact with the carbon, he conceived that the organic matter in solution would be at once oxidized and rendered harmless. It would not remain in the carbon, but would pass off in an innocuous form. The velocity of filtration in Dr. Frankland's experiments was not more than 6 inches per second, and he saw no reason to doubt their accuracy.

Mr. Webster, Q.C., remarked that fair discussion was what every man of science wished for. It had been observed that the great chemistry of Nature was developed in the supply of water; but as no reference had been made to a case which he happened to know was a great success, he trusted he might be allowed to mention it. He had seen the water of the River Severn, brown as coffee, passed through four or five of Mr. Hawksley's filters, and delivered in Worcester as pure as water could be. He called the attention of the Institution to that one fact, that any of the members going to the River Severn might examine how the water at Worcester, properly abused as it had been, when dealt with in the way described and by natural filtration, was brought back to such a state that even chemists themselves could hardly find a homœopathic dose of noxious matter in it. Chemists had given ultimate tests, and it was gratifying to find that by means of filters even the marsh water of the fens of Lincolnshire could be rendered wholesome. It was known that water might be defective from not being deprived of all colour, and yet it might be innocuous to health. But some persons not only desired to have pure water, but also wished it to be colourless. By the use of the carbide filter, after the filtering that had been described, water could be produced in a state fit for the consumption of large towns. That water of a deleterious nature would be found in some places was generally acknowledged; but as it came from the mountains and the bowels of the earth, or from this filter, it would be found in a condition to which no possible exception could be made. It was gratifying to find members of the medical profession and

chemists watching everything connected with this matter so closely; and he was convinced the discussion would have a good effect in reassuring the public mind on the question of water supply of large towns, coupled with the discharge of sewage matter into the rivers. The public might be reminded that there were going on in Nature chemical changes of such a character that pure water might be obtained either by the natural filter of the rocks and strata of earth through which it passed, or by the artificial filtration which science had introduced. By this chemistry of Nature, owing to the slow filtration that went on through these different beds, together with the presence of a large amount of oxygen, these detrimental matters were burnt out by the oxygen of the atmosphere by a slow yet sure process, by which an entire removal was effected of injurious matters in solution as well as those in suspension.

Mr. Lewis Oldrick regretted that neither chemists nor engineers had, up to the present moment, discovered how to determine whether the organic matter found by analysis in water was decomposed, and consequently deleterious to health, or not. A protest had been raised against the general belief that organic matter in water was dangerous; but he feared this would be calculated to mislead, and to be misunderstood, if not qualified. No doubt milk and live oysters, consisting chiefly of organic matter, were partaken of without harm, but the organic matter was not decomposed; if it were, it would be dangerous. Again, what could be more deceptive than a glass of clear water? As a proof of the correctness of this assertion, he would mention the Aldgate pump in the City, the water of which was much sought after for drinking purposes, because it was bright, sparkling, and cool, and of an agreeable taste. But the coolness and brightness were both derived from decaying organic matter, by which the water was impregnated while percolating through the adjoining graveyards; and according to Dr. Letheby's analyses, this very water contained 127 grains of impurities in the gallon, and out of these from 5 grains to 6 grains were decomposed organic matter. He would also mention the pump in Broad Street, Westminster, as an example of the dangerous condition of water apparently good but unfiltered. During the cholera epidemic a lady, becoming alarmed, removed from the neighbourhood of Westminster to Hampstead; but unfortunately, being fond of the pump-water she had been in the habit of drinking, she sent for water from the celebrated pump in Broad Street, and she was the only person in Hampstead who died of cholera. Out of seventy-three persons who died during the first days of this epidemic, it was proved that sixty-one had been drinking the water of the pump; and it was also remarked that in the same street, which received its water-supply from two different sources, on one side the

people died in large numbers, and on the other side very few died. These facts proved that it was of importance to use efficient means to remove organic matter from water before using it for drinking purposes.

It was equally a mistake to suppose that the air could not pollute water. During the last cholera epidemic there were three cisterns at the London Hospital. The cistern at each of the wings supplied good water; but the water from that in the centre of the building was contaminated with organic matter. At first there was no apparent reason why the water, which was supplied from the same pipe, was so different; but it was found that the centre cistern was placed in the ventilating shaft in such a manner that the emanations from the cholera patients passed it, and the impurities were absorbed by the water. However, on placing an animal charcoal cistern filter, of Mr. Danchell's construction, in each of the tanks, agreeable and wholesome water was at once obtained. House cisterns placed above water-closets got impregnated with the foul air; yet, from some unaccountable whim, builders, as a rule, placed the water-cisterns in this position. At the present time the water was filtered at great expense to the Water Companies, then brought by miles of mains and delivered into the cisterns, which were often placed where it was impossible to clean them, or, if this was practicable, the servants generally neglected them, and they got into a dirty condition; and that water, which had cost thousands of pounds to filter, by the time it was drank was in a foul and filthy state, not fit for a human being. Would it not be better to obtain the water effectually filtered at the moment it was drawn off for use, thus escaping the possibility of its acquiring fresh impurities after having been once filtered? This could be done by applying cistern filters, such as the one exhibited by Mr. Danchell.

With regard to the speed of filtration, about which a question had been raised, he believed Dr. Frankland intended merely to show the extreme of speed at which water could be passed through the filter; just as in the case of testing the speed of marine engines; they were worked at their highest power over the measured mile, and showed an amount of efficiency which was not attained afterwards. In practice it was easy to regulate the quantity of water passed through the filter, according to the requirements of the case.

The Author of the Paper had stated that the filter, after a certain time, was not to be depended on; but he had forgotten to give any hints as to when the filter ceased to act correctly. He would therefore draw the attention of the Meeting to a water-testing apparatus, which, though little known, was both simple and ingenious. By means of this apparatus, every householder could, without chemical knowledge, test the water which his filter produced; and as all the tests were made dependent upon the appearance presented by the water after the addition of one or other of the test fluids, it was not only useful to the householder, but also to the engineer, who did not possess the knowledge of a chemist; as it would be more convenient to use it when there was a question about the quality of water, than to go to the expense of employing an analytical chemist. The tests were as follows:—

1. For ammonia. 2. For decomposed organic matter. 3. Negative test for lead; *i. e.*, whether it was possible for the water to contain lead. 4. Positive test for lead; *i. e.*, whether the water did contain lead. 5. For carbonate of lime or carbonic acid. 6. For sulphate of lime or sulphuric acid. 7. For iron. 8. For chlorine or chlorides. 9. For phosphates. 10. Auxiliary test to No. 8; more refined. By these tests, where doubt existed as to the efficacy of the filter, impurities in the water could readily be detected.

There was another apparatus for softening hard water for manufacturing purposes which had not yet been mentioned: it was invented by Mr. Danchell, and was simply a practical application of Dr. Clark's process of reducing the hardness of water by the addition of lime.

Mr. Heisch was not prepared to take part in the discussion, not having been present at its commencement; but there were one or two points on which he would say a few words. One was with respect to the filter which had been last referred to. Filters of that description were fitted to all the cisterns at the Middlesex Hospital, under the direction of "The London and General Water Purifying Company," whose inspector attended, and fixed the sizes suitable in each case. The filters were allowed to remain for a certain time, but in consequence of complaints of a want of water, the Committee determined on having them removed. Notwithstanding this deficiency of supply, the water that did come through did not appear to be improved. He analysed it several times, and in no case did it differ from the water that was taken direct from the cistern. He did not mean to assert that animal charcoal was not efficacious: but in this particular instance, the water, he thought, passed too quickly, as far as the removal of organic matter was concerned; while the filter was too slow in its operation to supply a large establishment like a hospital. Nothing could be done in a place of that sort without an apparatus which allowed the filtering to go on very slowly, and provided for the storage of the filtered water, instead of the water being drawn through the charcoal as it was wanted.

With respect to the permanganate test, that was a point which had been examined by chemists for many years; and he was very happy to find that, within the last two years, Dr. Frankland had

come to the same opinion that he had long since formed, that it was not a thing to be depended upon. Nearly twenty years ago he made experiments, in conjunction with his colleague, Mr. T. Taylor, with different kinds of organic matter. To put the thing as strongly as he could, he placed a grain of urea—the nitrogenous principle, so to speak, of urine—into one portion of water, and a grain of sugar into another, the quantity of water being exactly the same in both cases; and the sugar decolourized forty times the quantity of permanganate of potash that the urea did. Therefore he did not think it was a test that ought to be depended upon. It was a useful one in some respects, particularly if notice were taken of the time required for decolourizing, after having ascertained that there were no inorganic matters in the water which produced decolouration; but it was a gratuitous assumption to assert that there was no deleterious matter in the water when little decolouration was produced by the permanganate of potash.

Mr. C. E. Austin communicated, through the Secretary, an account of a filter, or strainer, erected some years ago for the Russian Government at St. Petersburg, by Mr. Bryan Donkin, for the purpose of straining the water of the River Neva, and rendering it sufficiently pure to be used in the manufacture of bank paper. The water of the River Neva was what was generally termed soft water; but it held in solution a large quantity of matter extracted from decomposing vegetable substances, which would by chemists be probably called organic. The strainer was made up of several troughs, placed one above the other in the manner of steps. Each trough, forming a step, was divided longitudinally by a partition, which did not reach the bottom, into two compartments, the inner one of which was covered with wire gauze, and received the water as it fell from the step above, and the outer one of which contained the horizontal-lipped orifices through which the water escaped as it flowed to the step below. The total area of wire gauze was about 420 square feet, and its mesh admitted fifty strands to the inch. The conduit from the pumps which supplied the water communicated with the upper step, and the lower was superposed to one of four sand-and-gravel filter tanks, each containing an area of 588 square feet of filtering surface. The water ran down the conduit from the pumps, and filling the highest or first step, flowed over its lip and fell into the second step through the gauze covering of the inner compartment. From the second step it overflowed and fell through the gauze covering of the third, and, filling that step, it descended in like manner through the gauze and troughs of the fourth and fifth steps, whence it escaped into the filter tanks, and, passing downwards through the filtering materials, arrived at the deep wells in which it was stored for use. One hundred thousand cubic feet of water were filtered in ten hours.

The fall of the water from step to step was 2 feet, and it should attain in that fall an average velocity of about 3 feet per second. It flowed over the horizontal lip of each step in a sheet about $\frac{3}{4}$ of an inch in thickness, which was reduced in falling, and again expanded by contact with the gauze to about the same dimension. The utilized length of each step was 17 feet 6 inches; and thus, of the whole area of gauze, amounting to 420 square feet, the water occupied in its passage only 4·4 square feet, falling four times through a gauze area of 1·1 square foot. The water entered the first step in a perfectly pellucid state, but before it had passed through two sheets of gauze it became turbid, and deposited a black scum on the wires, which required constant cleaning, so great was the quantity of deposit. In the first tank the water was partially covered with a black scum of froth, sometimes more than an inch in thickness, and a thin scum, having a metallic lustre, appeared on the surface of the water in the second reservoir. He had not analysed this deposit, but to all appearance it was similar to that thrown to the surface of foul water in general during its natural process of purification, which was in this instance accelerated, partly by continued exposure to the atmosphere, and partly by the impediment to the grosser particles caused by the repeated passage through the gauze. Now here, again, a perceptible chemical effect was produced by a mechanical action, undoubtedly very similar to that of the passage of water through sand: the sand, however, retained in its mass the whole of the separated matter, whilst the gauze left it to appear on the water in the form of scum.

All that had been said during the discussion on the effect of mechanical filtration tended to show that substances in a state of what was called solution were really in no other elementary form than that of a minute division of particles in suspension. What was known about natural filtration would lead to such a conclusion; for constantly recurring instances evinced that, where there was no reason to believe any chemical reagents could exist, foul water, subjected to the mechanical action of continued attrition, in its passage through natural beds of rock and sand, was thereby rendered completely pure. In these cases, when no action could be attributed to chemical affinity, there was every right to infer that the purification of the fluid was produced by the gradual relative retardment and collocation of particles of matter of various gravities and forms; the motion, by the attrition of the filter, being abstracted soonest from those which were heaviest and roughest, whilst the most subtile retained their motion longer, leaving the others behind. There was no reason to believe that the purifying effects of irrigation on sewage arose from any other cause than this mechanical action; but its advantage over other processes consisted in the use of a more extended surface for filtration and exposure to

the atmosphere, which undoubtedly produced a relatively greater effect. The constant growth of the crop absorbed the matter deposited, and thus its intrinsic action rendered the surface fit for the reception of successive deposits.

Mr. Byrne observed, that there were various opinions held as to the best method of estimating organic matter in water. Considering the unsettled state of this question, it could not be wondered at that Dr. Letheby, in his water analyses, should still adhere to the incineration process, controlled by the permanganate test; but it seemed strange that, on this particular occasion, he should have attempted to decry a system which, it was well known, he had himself invariably adopted. Dr. Frankland, too, had employed the same system in arriving at many of the results which he had quoted in opposition to those given in the Tables. Of course the loss of weight by ignition was due, not only to organic, but to other volatile matter —a fact fully recognized in the Paper; but, as the water dealt with in these experiments contained neither nitrites nor ammoniacal salts, in any appreciable quantity, the volatile matter had been spoken of as consisting of organic matter and nitrates. According to the researches of some chemists, salts containing one or other of the alkalies for a base were either not absorbed at all, or very slightly so by animal charcoal.[1] In fact, charcoal had been employed to remove organic matter from solutions of nitrate of potash, for which purpose it would not have been suitable if the nitrate of potash itself were also absorbed. This tended to prove that, of the amount lost by ignition, the larger portion was probably due to organic matter, and not to nitrates. It must be admitted that the water used in these experiments, like any other natural water, contained organic matter; and it would be seen, by looking at the 5th column of Table 2, that the permanganate of potash was deoxidized by something in the water, both before and after filtration. There was no protosalt of iron present; and, as nitrates and chlorides could not effect this, the deoxidation must have been due, almost entirely, if not completely so, to the organic matter itself. It was, therefore, a mistake to suppose that the question of removing organic matter, by means of animal charcoal, was left untouched by these experiments. There was no doubt that animal charcoal absorbed organic matter; but the chief question now was as to the extent that it would do so, as to whether any of the organic matter so absorbed would be given up again, and whether it underwent oxidation, or not, by means of the charcoal. A liquid would not dissolve an unlimited quantity of a solid, were the latter ever so soluble in that liquid. Substances also combined chemically in definite proportions by

[1] *Vide* Translation by Ronalds and Richardson of Knapp's "Chemical Technology," vol. iii., pp. 442 and 443.

weight. It would, therefore, be indeed surprising, if a given quantity of charcoal were not limited as to the amount it was able to absorb of any particular substance; and, as it acted merely by surface attraction, if the quantity of the substance absorbed were not exceedingly small as compared with that of the charcoal itself. The process of refining brown sugar afforded a striking example of this fact: to remove the minute quantities of colouring matter existing in the sugar, a large quantity of charcoal was required, and, after all, the removal was only partial, as the second and third crops of crystals obtained from the sugar solution purified by charcoal, and which were technically called 'pieces' and 'bastards,' were always brown. The water used in his experiments contained a larger amount of salts in solution than was generally the case in water supplied to towns, but the waters of some metropolitan wells were still more highly charged with salts. Moreover, although he believed that, had the water dealt with contained a small, instead of a large amount of salts in solution, the charcoal would have been effective for a longer period, both in the removal of organic matter, and in reducing the hardness of the water; yet the performance of Dr. Frankland's filter did appear incomprehensible. Any reduction in the hardness of the water must have been the result of a corresponding removal of certain salts; so that, according to Dr. Frankland's statement, in a much shorter time than that during which the filter was said to have acted, the charcoal would have absorbed an amount of salts almost equal to itself in weight, and its pores would have been choked, long before which all action of a removing nature must have completely ceased. An account had been given by Mr. Shield of some experiments, on the action of sand and charcoal as filtering materials, made under the direction of Mr. Simpson (Past-President Inst. C.E.), with the co-operation of the Assistant Chemist of the London Government School of Applied Science. According to these, sand, as a remover of organic matter, though inferior to charcoal at first, was found to be, comparatively speaking, permanent in its effects. The experiments recorded in Table No. 1 (page 41), which was the most satisfactory as regarded charcoal, would be sufficient for consideration. The original water contained 1·430 grain of organic matter in the gallon. After sixty-seven hours', ninety-one hours', one hundred and fifteen hours', and one hundred and thirty-nine hours' action, beyond which the experiments had not been carried, the quantities removed were found to be 0·955 grain, 0·972 grain, 0·620 grain, and 0·459 grain respectively. The charcoal had been tested under favourable circumstances, for the water dealt with contained but a small amount of organic matter, and on this the charcoal had been allowed to exert almost all its removing power, inasmuch as there was little or no absorption of inorganic constituents to interfere with its action. Nevertheless,

the amount of organic matter removed from being 68 per cent. on the original quantity, after ninety-one hours' filtration, was reduced to about 32 per cent. after forty-eight hours' further filtration. This result was not different from what he had been led to expect from his own investigations; but it was far from according with the views of those who proposed to effect the purification of a metropolitan water supply by adopting a rate of filtration about five hundred times faster[1] than that employed in the experiments just described, and by using the charcoal for six months without renewal or burning.

With regard to the time of contact necessary between charcoal and water in the process of filtration, in order that one should exert its full effect on the other, there was a curious difference of opinion between Dr. Letheby and Dr. Frankland; for, whereas the former insisted on the necessity of a slow rate, the latter considered that the object sought for would be equally well attained by a rapid rate of filtration. In the experiments recorded in the Paper, the filtration had been carried on at a much slower rate than what Dr. Letheby considered sufficient, as his observations induced the belief that this would be attended with advantage. It was admitted by all chemical philosophers that time was necessary for chemical action—in other words, that the completion of a chemical action was not instantaneous, the time required varying with the substances. The experience of sugar refiners, who of all manufacturers employed charcoal on the largest scale, was opposed to some of the views expressed as to the action of charcoal. The refiner was well aware that unless he allowed the sugar solution to pass slowly from the charcoal cistern, it would not be decolourized to the full extent, because time was required for the charcoal to exert its due effect. Besides, Professor Galloway, of the Royal College of Science, for Ireland, considered, from an extensive experience respecting the action of charcoal, that it was a serious error to suppose that the mere reburning of charcoal, after six months' use in the supposed purification of water, would render it as capable, or nearly so, of absorbing substances as at the commencement. The salts of lime, which it would have absorbed, must seriously interfere with its action; and, before burning the charcoal, these would have to be removed by acid and washing.

As the behaviour of permanganate of potash was not the same with different kinds of organic matter, it could not be used for the purpose of quantitative analysis; but as, when dealing with one and the same kind of organic matter, it might be fully relied on, it was very useful as a means of comparative estimation.

[1] Upwards of 80,000 gallons per square foot in 24 hours, as compared with half a gallon per 4·38 square feet in 1 minute.

The experiments, of which the results were given in Table 2 (page 9), were made with water collected at the same time and place; so that there was no difference in the condition of the organic matter it contained. By comparing the 2nd and 5th columns of this Table, it would be seen that, just as the first few gallons of filtered water contained less organic and other volatile matter than that found in the water before filtration, so was the amount of oxygen required to oxidize those quantities. When an equal quantity was found both in the original and filtered water, the amount of oxygen employed was the same; and when the quantity of organic and other volatile matter, in the filtered water, was in excess of that contained in the water before filtration, the amount of oxygen required to oxidize it was greater; so that the actual quantities of organic matter, whatever they were, might, without involving any appreciable error, be considered proportional to the figures in column 2. It could not be said that this proportion held good merely as long as it did not indicate an increase of organic matter in the filtered water, over that contained in the water before filtration; on the supposition, that the increase in quantity might be apparent only, and simply owing to some irregularity in the action of charcoal on nitrates. The fact that the residue of the seventh and subsequent gallons of filtered water became darker on ignition than that of the original water must be considered as indicating not only a worse state, but an increased quantity of organic matter. Upon examining the 5th column of the Table referred to, this would be found to be a matter of certainty; for, as the organic matter of these waters required more oxygen for its oxidation than that of the water before filtration, the quantity of organic matter itself must have been greater.

If the water employed in these experiments had been free from salts in solution, no doubt the charcoal would have continued to remove organic matter for a comparatively long period; and, possibly, after losing its removing power, there would have been no giving up of that which had been removed. But the water contained salts of lime and of magnesia, both of which were absorbed by the charcoal, probably with greater avidity, and certainly in a much larger quantity, than the organic matter. Again, as the surface attraction of animal charcoal for the former was greater than it was for the latter, after a while, when it could no longer act in absorbing them together, there was a displacement or giving up of organic matter, to make way for the salts; just as, by elective affinity, one substance might be displaced from its combination in order to make way for another. Dr. Letheby had asserted that animal charcoal acted on organic matter in water by bringing it into chemical union with the oxygen dissolved in the water, and thus destroying it; and that the passage of any water through this

material, without having its organic matter absorbed and oxidized, could only be owing to the want of sufficient free oxygen in the water to effect that oxidation. But the figures in the 5th column of Table 2, indicating, as they did, a varying amount of oxygen consumed, were at variance with such a statement; while the result of Mr. Chapman's experiments on animal charcoal must lead to a contrary conclusion. He had agitated some animal charcoal in water, and afterwards extracted from it the same quantity of organic matter as had been removed from the water. His experiments served to prove that its action did not consist in bringing the free oxygen dissolved in the water and the organic matter together, so as to convert the latter into carbonic acid, ammonia, and nitric acid—in fact, that the organic matter, instead of being oxidized by the charcoal, was merely absorbed, and mechanically retained within its pores. Dr. Letheby's subsequent communication, giving an account of recent experiments of short duration, could not be considered in the least to affect Mr. Chapman's statement, which was in accordance with established facts; for it was well known that organic alkaloids, and other substances, when absorbed by charcoal, could afterwards be dissolved out of it, actually unchanged. It was therefore submitted that the deductions to be drawn, with respect to the action of animal charcoal, as a filtering material, were, that it had not the oxidizing effect hitherto generally imagined, and as it did not act chemically, but simply by surface attraction and absorption, its removing effect became weakened by use, and finally ceased altogether. Further, that the time during which it could exert a removing effect depended not only on the quantity of water passed through, and the rate at which it was passed, but also on the nature of the water itself. If the water were exceedingly hard, the surfaces of the charcoal would become quickly coated, and its pores partially filled, by the absorption of those salts that produced hardness. As this must interfere with its action on other substances, its property of softening water was manifestly detrimental to it as a remover of organic matter: from which it followed that its effect on organic matter, at all times very limited, was greatest when the water dealt with contained the least amount of salts in solution. Lastly, as the surface attraction was not equally great for all substances, after a time some of those previously absorbed were in part displaced to make room for others which were more powerfully attracted. It was, probably, owing to this displacement that a portion of the organic matter at first removed was afterwards given up again.

As allusion had been made to the filtering substance termed 'Magnetic carbide,' he begged to say that the result of his experiments was not in accordance with what had been stated regarding the theory of its action, for the favourable indication of the residue, upon ignition, observed in the first few gallons of filtered water, was of short continuance. After a time it assumed a darker colour than that of the unfiltered water, besides which, according to Professor Wanklyn's and Mr. Chapman's test, the filtered water itself was found to contain as much albuminous organic matter as the water before filtration. Much had been said respecting the value of sand, and its suitability as a material for filter beds. Mention had also been made of how water might be freed from organic matter by Dr. Clark's process, but at the expense of its flavour. However, nothing had been elicited in the course of the discussion calculated to change his views with regard to the action of animal charcoal and filtering materials in general. He therefore felt justified in repeating that, as the use of filtration was very limited, and as all purifying processes should be regarded as mere temporary measures, pending the substitution of a pure for a contaminated supply, in his opinion the public ought cheerfully to undergo the necessary expense of procuring water not only in abundance, but in the greatest purity.

Mr. Gregory, Vice President, in closing the discussion, remarked that Mr. Byrne scarcely needed the assurance that the members fully appreciated the Paper he had brought before them, not only as an instance of an engineer devoting his attention to a scientific question of great interest to the profession, but also from its having led to a discussion which would leave much valuable information on record. The Institution always hailed the presence and co-operation of those who made exact science their study, and who, as on this occasion, had aided the discussion by their experience. If the practice of the engineer was not so exact as that of the experimental philosopher, and the minute analysis of the chemist appeared unnecessarily precise to the engineer, who dealt with larger figures and general results, it was well that even ideal perfection should sometimes be held up to the view of the practical man, like the stringent conditions of a specification, which might not always be followed to the letter, but which were maintained as a standard of excellence.

LONDON:
PRINTED BY WILLIAM CLOWES AND SONS, STAMFORD STREET
AND CHARING CROSS.

REPORT

OF THE

ARMY SANITARY COMMISSION

ON

METHODS OF ESTIMATING THE MORTALITY IN INDIAN PRISONS.

The Commission having been requested to obtain for the Government of India the methods in use for calculating the death rates in English and French prisons, with the view of arriving at a uniform register and account of the mortality in Indian prisons, placed themselves in communication with the Home Office and with the French Government through the medium of the Foreign Office.

And they have now to report the results of their inquiry as follow :—

1st. As regards English prisons,—from the peculiar circumstances of the management of these prisons no uniform method of obtaining the mortality is in use.

2nd. As regards French prisons,—they find that there is a uniform method of record of the following kind :—

a. In all prisons there is a register of deaths.

b. All deaths are besides entered in the medical records of the prison.

3rd. The deaths in prisons are reported to the central administration in a sheet sent to the director of each establishment, and thus the numbers are checked and entered in tables intended to show the deaths in each prison and also in the prisons collectively. Besides which the deaths appear in the annual medical reports of the prisons.

4th. In order to obtain the prison population on which to calculate the mortality, the following methods are adopted :—

a. The admissions of the year are added to the remaining prisoners on the last day of the preceding year, the dismissals from all causes, including death, are de-

ducted from this sum, and the remainder is the prison population on the last day of the year.

b. To obtain the mean prison population of the year the sum of all the days of imprisonment of all classes of prisoners is divided by the number of days in the year. The quotient gives the mean prison population.

5th. Periodical reports are published on prison statistics containing the mortality of each prison and for each class of prisoners, and there is also a periodical medical report giving the diseases and the deaths from each disease.

6th. But as the published reports did not appear to the Commission to contain all the information which it was desirable to ascertain, they communicated with the Registrar General of England, who kindly afforded his aid in framing a method of obtaining the statistics of gaol mortality of such a nature as to give uniform results comparable with those obtained for the general civil population. This method, drawn up by Dr. Farr, is much superior to any at present in use, and is accompanied by the necessary forms. We have appended it to this report, with the view to its being adopted in all prisons at home and abroad.

J. Hope Grant, Q.M.G., and President.

Douglas Galton, Assistant Under Secretary of State for War.

John Sutherland.

T. G. Logan, Inspector-General of Hospitals.

Edward Belfield, Deputy Director of Works, War Office.

Proby T. Cautley, Member of the Council of India.

J. Ranald Martin, Inspector-General of Hospitals.

Robert Rawlinson, Local Government Act Office.

J. J. Frederick, Secretary,
Army Sanitary Commission,
War Office, 20th April 1866.

Uniform Method of determining the Mortality Rates of Prisoners in Gaols.

To determine the rate of mortality among prisoners in gaols, so as to admit of its comparison with the rate of mortality among other classes of the population, the following rules should be observed:—

1. The investigation should be annual.

2. The prison register should be kept so as to include all the required facts, such as (1), name; (2), age, as far as it can be ascertained; (3), state of health at the date of entry, and disease, if any; state of health at the date of discharge, and if sick at date of discharge the disease to be recorded.

3. From this register the daily number of prisoners in gaol could be taken, and the *sum* of the *daily numbers* (say 39,162) divided by the *days in the year* (365) would give for quotient the *average number of prisoners* (say P = 107). This would be useful as a check on dietaries, and in other ways.

The deaths (= D) *in the year*, divided by the average number of prisoners (P) would give the rate of mortality per annum $\left(=\frac{D}{P}=m_1\right)$. Thus, if P = 1,000, and D = 80, then $\frac{D}{P}=\frac{80}{1{,}000}=\cdot 08=m_1$. Multiply m_1 by 100, and we have the rate of mortality per cent. per annum = 8·0.

Example.

Take 300 as the average number of prisoners of the age 20–25, and 15 as the deaths in a year, then—

As 300 : 15 :: 100 : 5

100

300) 1,500

5 = annual rate of mortality per cent. at age 20–25.

The same method is applicable to the determination of the mortality among prisoners of any particular age.

4. The deaths per cent. out of a given number passing through the gaols can be also determined. Thus, if out of

10,000 going through the gaols 80 die, then $\frac{80}{10,000} = \cdot 008 = m_2$. Multiply m_2 by 1,000, and we find that 8 in 1,000 prisoners entering die in the gaols in an indefinite time.

Put A for annual admissions, then if the annual discharges, including deaths, equal A, we can determine the mean term of residence by this rule: *Divide the mean population* (P) *by admissions to obtain mean term of residence in years or fractions of a year.*

Example.

$\frac{P}{A} = \frac{250}{1,000} = \cdot 25$ year $= \frac{1}{4}$ of a year, or multiplying 365 by $\frac{1}{4} = 91$ days.

5. To show how length of imprisonment affects the rate of mortality, the prisoners should be classified in the form shown in Table 1.

Where there is little fluctuation in the admissions and discharges the rate of mortality in each period of imprisonment can be determined from the facts in such a table (1). Thus, if we divide the year's deaths in the first month of imprisonment by the average numbers living in that month of imprisonment, the mortality in that month is determined. The same method is applicable to the second, third, and other months, or to years.

6. Again, by taking the total numbers discharged as the basis, a useful table in the form shown in Table 2 may be constructed, showing out of a given number entering how many remain one month, two months, three months, &c. in gaol.

7. It would be desirable also to show the average numbers on the sick list (S), as reported daily or weekly by the medical officer in charge. Thus the numbers sick divided by the mean population would give the average sickness rate, which being multiplied by 100 would be the proportion of constantly sick to every 100 prisoners.

8. Again, the number of cases of sickness occurring in the year (C) should be recorded, and these cases divided by the mean population would give the morbility rate, which being multiplied by 100 would give the cases of sickness per annum to every 100 of the gaol population.

9. Where it is possible, the sickness and the mortality from the principal diseases should be shown. (*See Form of Registrar General's Weekly Return*, Table 4.)

Other matters of some importance may be discussed, such as (1), the sickness and mortality in the several months of

the year; (2), in the several seasons; (3), under different dietaries; and (4), different kinds of labour or punishment.

W. Farr.

General Register Office,
1866.

Table 2.

Period of Imprisonment complete.	Prisoners remaining.	Total discharged.	Prisoners discharged. By Death.	By Expiration of Term of Imprisonment.	By Transfer to another Prison.	By Escape.
0 and under 1 month	49	256	3	200		2
1 month - "						
" 3 "						
" 6 "						
" 9 "						
" 1 year						
" 2 "						
" 3 "						
" 4 "						

In another Table the proportions remaining may be shown to 1,000 entering the prison. The 1,000 in Column 2 would be placed against 0 in Column 1.

...ons ways at the ...st in Col. 1.		
	sound ealth.	

...ne mean ...missions to obtain mean term of residence in years or fractions of a year.

Example.

$\frac{P}{A} = \frac{250}{1{,}000} = \cdot 25$ year $= \frac{1}{4}$ of a year, or multiplying 365 by $\frac{1}{4} = 91$ days.

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Other matters of some importance may be discussed, such as (1). the sickness and mortality in the several months of

TABLE 2.

Period of Imprisonment complete.	Prisoners remaining.	Total discharged.	Prisoners discharged.				
			By Death.	By Expiration of Term of Imprisonment.	By Transfer to another Prison.	By Escape.	By Discharge or Pardon on the Ground of Sickness.
0 and under 1 month	49	226	3	200		2	51
1 month - -							
2 " - -							
3 " - -							
6 " - -							
9 " - -							
1 year - -							
2 " - -							
3 " - -							
4 " - -							

In another Table the proportions remaining may be shown to 1,000 entering the prison. The 1,000 in Column 2 would be placed against 0 in Column 1.

Table 3.

Annual Rate of Mortality at the respective Ages, 1866.

Ages.	Average Numbers living.	Deaths.	Rate of Mortality per Cent.
Under 15 - -			
15—20 - -			
20—25 - -	*900*	*15*	*3*
25—30 - -			
30—35 - -			
35—40 - -			
40—45 - -			
45—50 - -			
50—55 - -			
55—60 - -			
60—65 - -			
All ages - -			

Table 4.

Form of Registrar-General's Weekly Return.

Deaths in London, from All Causes, Registered in the Twenty-fourth Week of the Year 1866.

Class.	CAUSES OF DEATH.	In the Week ending Saturday June 16, 1866. (Mean Temperature 58·2°.) Deaths of Persons of the Ages					
		ALL AGES.	Under 20 Years.	20 and under 40.	40 and under 60.	60 and under 80.	80 Years and upwards.
	ALL CAUSES	1370	705	215	193	224	33
	SPECIFIED CAUSES	1364	701	214	192	224	33
	(Classes.)						
I.	ZYMOTIC DISEASES	359	291	28	22	16	2
II.	CONSTITUTIONAL „	254	73	95	60	23	3
III.	LOCAL „	530	215	69	98	144	15
IV.	DEVELOPMENTAL „	160	100	8	4	34	14
V.	VIOLENT DEATHS	61	22	23	8	7	1
	(Orders.)						
I.	1. Miasmatic Diseases	324	269	23	16	15	1
	2. Enthetic „	13	9	3	..	..	1
	3. Dietic „	21	12	2	6	1	..
	4. Parasitic „	1	1	..	..	..	..
II.	1. Diathetic „	36	2	4	15	13	2
	2. Tubercular „	218	71	91	45	10	1
III.	1. Diseases of Nervous System	164	81	11	21	48	3
	2. „ of Organs of Circulation	71	2	13	29	27	1
	3. „ of Respiratory Organs	214	111	20	27	51	5
	4. „ of Digestive Organs	49	15	7	16	10	3
	5. „ of Urinary Organs	19	2	7	4	5	1
	6. „ of Organs of Generation	7	2	3	..	2	..
	7. „ of Organs of Locomotion	2	2	..	..	..	..
	8. „ of Integumentary System	4	2	..	1	1	..
IV.	1. Dev. Diseases of Children	42	42	..	..	..	..
	2. „ of Adults	8	..	7	1	..	..
	3. „ of Old People	46	..	..	..	32	14
	4. Diseases of Nutrition	64	58	1	3	2	..
V.	1. Accident or Negligence	46	19	16	5	5	1
	3. Homicide	4	3	1	..	..	..
	4. Suicide	11	..	6	3	2	..
	5. Execution	..	..	..	..	..	..
	Violent Deaths not classed	..	..	..	..	..	..
	Sudden Death, cause unascertained	4	2	1	1	..	..
	Causes not specified	2	2	..	..	..	..

† Order 2, comprising Violent Deaths in Battle, is omitted as inapplicable to the civil population.

DEATHS in LONDON, from ALL CAUSES, Registered in the TWENTY-FOURTH WEEK of the Year 1866—*cont.*

Class.	CAUSES OF DEATH.	In the Week ending Saturday, June 16, 1866. (Mean Temperature 58·5°.) Deaths of Persons of the Ages					
		ALL AGES.	Under 20 Years.	20 and under 40.	40 and under 60.	60 and under 80.	80 Years and upwards.
I.	ORDER 1.						
	1. Small-pox	39	32	5	2	..	..
	2. Measles	80	79	1	..	..	..
	3. Scarlatina	31	29	2	..	..	..
	4. Diphtheria	8	7	1	..	..	..
	5. Quinsy	3	2	..	1	..	..
	6. Croup	11	11	..	..	..	..
	7. Whooping-cough	71	71	..	..	..	..
	8. Typhus (and Infantile fever)	40	13	9	10	8	..
	9. Erysipelas	4	2	1	..	1	..
	10. Metria	3	..	3	..	..	..
	11. Carbuncle	1	..	..	..	1	..
	12. Influenza	..	..	..	..	..	..
	13. Dysentery	2	2	..	..	..	..
	14. Diarrhœa	20	15	1	..	3	1
	15. Cholera	3	2	..	1	..	..
	16. Ague	1	1	..	..	..	..
	17. Remittent fever	1	1	..	..	..	..
	18. Rheumatism	5	1	..	2	2	..
	19. Other *Zymotic* diseases	1	1	..	..	..	..
	ORDER 2.						
	1. Syphilis	9	7	2	..	..	..
	2. Stricture of Urethra	1	..	1	..	..	..
	3. Hydrophobia	3	2	..	..	..	1
	4. Glanders	..	..	..	..	..	..
	ORDER 3.						
	1. Privation	2	1	..	1	..	..
	2. Want of Breast-milk	9	9	..	..	..	..
	3. Purpura and Scurvy	5	2	1	1	1	..
	4. Alcoholism { *a* Del. Tremens	..	..	..	..	..	..
	4. Alcoholism { *b* Intemperance	5	..	1	4	..	..
	ORDER 4.						
	1. Thrush	1	1	..	..	..	..
	2. Worms, &c.	..	..	..	..	..	..
II.	ORDER 1.						
	1. Gout	3	..	..	2	1	..
	2. Dropsy	11	1	1	5	3	1
	3. Cancer	19	1	3	8	6	1
	4. Noma	..	..	..	..	..	..
	5. Mortification	3	..	..	..	3	..

DEATHS in LONDON, from ALL CAUSES, Registered in the TWENTY-FOURTH WEEK of the Year 1866—*cont.*

Class.	CAUSES OF DEATH.	In the Week ending Saturday, June 16, 1866. (Mean Temperature 58·5°.) Deaths of Persons of the Ages					
		ALL AGES.	Under 20 Years.	20 and under 40.	40 and under 60.	60 and under 80.	80 Years and upwards.
	ORDER 2.						
	1. Scrofula	11	8	2	1	..	..
	2. Tabes Mesenterica	15	12	2	1	..	..
	3. Phthisis	170	31	85	43	10	1
	4. Hydrocephalus	22	20	2	..	..	..
III.	ORDER 1.						
	1. Cephalitis	15	15	..	..	..	..
	2. Apoplexy	40	6	4	10	20	..
	3. Paralysis	29	2	2	6	17	2
	4. Insanity	1	..	..	..	1	..
	5. Chorea	..	..	..	..	..	..
	6. Epilepsy	10	3	4	2	1	..
	7. Convulsions	48	48	..	..	..	..
	8. *Brain Disease, &c.*	21	7	1	3	9	1
	ORDER 2.						
	1. Pericarditis	1	..	1	..	..	..
	2. Aneurism	..	..	..	..	..	..
	3. *Heart Disease, &c.*	70	2	11	29	27	1
	ORDER 3.						
	1. Laryngitis	6	4	1	1	..	..
	2. Bronchitis	112	48	4	18	38	4
	3. Pleurisy	4	1	1	1	..	1
	4. Pneumonia	78	55	12	3	8	..
	5. Asthma	2	..	..	..	2	..
	6. *Lung Disease, &c.*	12	3	2	4	3	..
	ORDER 4.						
	1. Gastritis	3	1	..	1	1	..
	2. Enteritis	2	1	1	..	..	..
	3. Peritonitis	3	..	1	1	1	..
	4. Ascites	4	1	..	1	..	2
	5. Ulceration of Intestines	2	..	1	1	..	..
	6. Hernia	2	1	..	1	..	..
	7. Ileus	3	1	..	1	1	..
	8. Intussusception	1	1	..	..	..	..
	9. Stricture of Intestines	..	..	..	..	..	..
	10. Fistula	..	..	..	..	..	..
	11. *Stomach Disease, &c.*	7	3	..	1	3	..
	12. *Pancreas Disease, &c.*	..	..	..	..	..	..
	13. Hepatitis	5	..	1	4	..	..
	14. Jaundice	4	1	1	..	1	1
	15. *Liver Disease, &c.*	12	2	2	5	3	..
	16. *Spleen Disease, &c.*	1	1	..	..	..	..

DEATHS in LONDON, from ALL CAUSES, Registered in the TWENTY-FOURTH WEEK of the Year 1866—*cont.*

Class.	CAUSES OF DEATH.	In the Week ending Saturday, June 16, 1866. (Mean Temperature 58·5°.) Deaths of Persons of the Ages					
		ALL AGES.	Under 20 Years.	20 and under 40.	40 and under 60.	60 and under 80.	80 Years and upwards.
	ORDER 5.						
	1. Nephritis	..	..	..	..	..	..
	2. Ischuria	..	..	..	..	..	..
	3. Nephria (Bright's disease)	9	1	4	3	1	..
	4. Diabetes	3	1	1	1	..	..
	5. Stone	1	..	..	..	..	1
	6. Cystitis	2	..	..	..	2	..
	7. *Kidney Disease, &c.*	4	..	2	..	2	..
	ORDER 6.						
	1. Ovarian Dropsy	..	..	..	..	..	..
	2. *Uterus Disease, &c.*	7	2	3	..	2	..
	ORDER 7.						
	1. Arthritis	1	1	..	..	..	..
	2. *Joint Disease, &c.*	1	1	..	..	..	..
	ORDER 8.						
	1. Phlegmon	..	..	..	..	..	..
	2. Ulcer	4	2	..	1	1	..
	3. *Skin Disease, &c.*	..	..	..	..	..	..
IV.	ORDER 1.						
	1. Premature Birth	24	24	..	..	..	..
	2. Cyanosis	1	1	..	..	..	..
	3. Spina Bifida	3	3	..	..	..	..
	4. Other Malformations	1	1	..	..	..	..
	5. Teething	13	13	..	..	..	..
	ORDER 2.						
	1. Paræmia	..	..	..	..	..	..
	2. Childbirth (*see* Metria)	8	..	7	1	..	..
	ORDER 3.						
	1. Old Age	46	..	..	..	32	14
	ORDER 4.						
	1. Atrophy and Debility	64	58	1	3	2	..

DEATHS in LONDON, from ALL CAUSES, Registered in the TWENTY-FOURTH WEEK of the Year 1866—*cont.*

Class.	CAUSES OF DEATH.	In the Week ending Saturday, June 16, 1866. (Mean Temperature 58·5°.) Deaths of Persons of the Ages					
		ALL AGES.	Under 20 Years.	20 and under 40.	40 and under 60.	60 and under 80.	80 Years and upwards.
V.	ORDER 1. (ACCIDENT OR NEGLIGENCE.)						
	1. Fractures and Contusions	24	7	9	4	3	1
	2. Wounds	..	..	..	..	..	..
	3. Burns and Scalds	4	3	..	..	1	..
	4. Poison	..	..	..	..	..	..
	5. Drowning	11	3	6	1	1	..
	6. Suffocation	4	4	..	..	..	..
	7. Otherwise	3	2	1	..	..	..
	ORDER 3. (HOMICIDE.)						
	1. Murder and Manslaughter	4	3	1	..	..	..
	ORDER 4. (SUICIDE.)						
	1. Wounds { Gunshot	1	..	1	..	..	..
	1. Wounds { Cut, Stab	2	..	2	..	..	..
	2. Poison	..	..	..	..	..	..
	3. Drowning	3	..	1	1	1	..
	4. Hanging	4	..	2	1	1	..
	5. Otherwise	1	..	..	1	..	..
	ORDER 5. (EXECUTION.)						
	1. Hanging	..	..	..	..	..	..
	Violent Deaths (not classed)	..	..	..	..	..	..
	Sudden Deaths (Cause unascertained)	4	2	1	1	..	..
	Causes not specified or ill-defined	2	2	..	..	..	..

NOTE.—Cases of "rheumatic fever" are classed with "rheumatism;" of "hæmorrhage" and "abscess" with the diseases of the organs affected. As "stricture of the urethra" is almost invariably the result of gonorrhœa, it is classed as 1.; 2.

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Printers to the Queen's most Excellent Majesty.
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[5126.—50.—8/66.]

Dr E. A. Parkes, F.R.S. with best regards & heartfelt thanks from his friend
A. P. Stewart

THE

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SANITARY REFORM.

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AND

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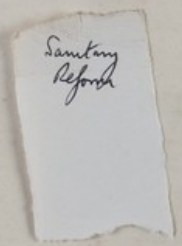

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The following Papers were in substance brought before the Social Science Congress at Manchester, in October, 1866.

THE MEDICAL ASPECTS OF SANITARY REFORM.

THERE are special seasons in our history—whether personal, national, or social—which invite us to pause, and look backward as well as forward; to reckon up the gains and losses, the wise and the false moves of the past; and, by the light of experience, both past and present, to forecast and lay plans for the future. Such a season in our sanitary history is the present. The Lord President of the Council stated to a deputation that waited upon him in the month of July, for the purpose of urging, among other things, the consolidation of our sanitary laws, that the late government thought it better, after mature deliberation, to defer the work of consolidation till next session, when it would probably occupy the attention of Parliament. The consolidation of a number of statutes is very much like the stereotyping of a book, giving permanence and the stamp of authority to all uncorrected errors, which often pass from mouth to mouth as accepted and recognised truths, till some voice from the grave, in the shape of a posthumous diary or correspondence, proclaims their falsehood to another generation of readers. My object, therefore, in this paper is to inquire briefly what have been the substantial results of our sanitary legislation, what great principles have been embodied in it, and accepted, at least in theory, by the community at large; and what, looking forward to the consolidation of our health laws, are the mistakes to be corrected, and the objects to be not only desired but striven for by all who take an interest in the health of the people. It is not that I have much that is new to say on a nearly threadbare subject, or that I can hope, in my mode of saying it, to emulate my betters, who have spoken and written so well upon the public health from time to time during the last twenty years. But I have thought it possible that a new voice speaking on an old and hackneyed topic might arrest some whom the familiar accents of

old acquaintances had failed to impress, and stir to action; and encourage the veteran labourers in this good cause by the assurance that there are others who not only wish them "God speed," but are anxious to lend them a helping hand. And with the view of eliciting a thorough discussion of this vital question, my friend Mr. Edward Jenkins and I have arranged that I should present the medical, and he the legal, aspects of our sanitary laws.

The laws of health, and the disastrous results of disregarding or transgressing them, though comparatively new to the public, have long been a subject of deep interest to the profession to which I have the honour to belong. Here is a striking and instructive passage, published rather more than a hundred years ago by a great master in the art of healing:—"From this view of the causes of malignant fevers and fluxes, it is easy to conceive how incident they must be, not only to all marshy countries after hot seasons, but to all populous cities, low and ill-aired, unprovided with common sewers, or where the streets are narrow and foul, or the houses dirty; where fresh water is scarce; where jails and hospitals are crowded and not ventilated, or kept clean; where, in sickly times, the burials are within the walls, and the bodies not laid deep; where slaughter-houses are likewise within the walls, or where dead animals and offal are left to rot in the kennels or on dunghills; where drains are not provided to carry off any large body of stagnating or corrupted water in the neighbourhood; where flesh meats make the greatest part of the diet, without a proper mixture of bread, greens, wine, or other fermented liquors; where the grain is old and mouldy, or has been damaged by a wet season, or where the fibres are relaxed by immoderate warm bathing. I say, in proportion to the number of these or the like causes concurring, a city will be more or less subject to pestilential diseases, or to receive the leaven of a true plague when brought into it by merchandise,"* —a passage which exhibits well the noblest aspect of medicine, making earnest, though often thankless and unheeded efforts for the prevention of disease.

Seventy years passed away, and a visitation of pestilence came, before the principles thus clearly and decisively set forth by Sir John Pringle in the middle of last century began to awaken the attention of the public. And such was the effect of the epidemic of 1832 that, though the spasmodic and almost frantic efforts made by the panic-stricken populations ceased with the departure of the unwelcome visitant, the impression made on not a few thoughtful minds, by the sickening glimpses they had had of "the lowest deep" of British society, could not be effaced, and prompted them to enter upon a life-long career of active beneficence that has already conferred lasting benefits upon the entire community. In some places, as in Exeter, the history of which during the visitation of the cholera has been graphically and impressively written by Dr. Shapter, the immediate result was a great improvement in the sanitary arrange-

* Pringle's "Observations on the Diseases of the Army," 6th edition. London, 1768; p. 324.

ments of the city, especially as regards water supply. It was then that the era of sanitary legislation commenced, thus affording a striking illustration of the truth of Hecker's remark, "that great epidemics are epochs of development, wherein the mental energies of mankind are exerted in every direction." We have reason to be thankful that during the last thirty years there has been a large and steady increase in the numbers of our sanitary reformers. Few in comparison with the great mass of the nation, but still in themselves a host, there are scattered over the face of the counties, and congregated in considerable numbers in our large cities, men of broad and enlightened views, who thoroughly comprehend the close and reciprocal relations that subsist between dirt, disease, drunkenness, pauperism, and crime, and who have long done their utmost to promote the adoption in their respective neighbourhoods of right sanitary opinions and effective sanitary measures. And the result is seen in the great and growing attention accorded by the legislature to all questions bearing upon the public health.

Parliament has not neglected its duty in this matter. While I concur in the feeling now becoming very wide-spread, that the tone of our sanitary legislation has of late years been rather timid and apologetic, I maintain that Parliament has been, till lately, far in advance of the national sentiment on matters relating to the public health. Let us glance at what has been done since 1832. Beginning in the following year, with the case of the factory children, as if to intimate that the Imperial Parliament would succour and relieve the oppressed at home as well as in the West India colonies, they prohibited, in 1834, the cruel and murderous practice of employing climbing boys for sweeping chimneys; in 1840 and 1841 they passed the Act to extend the practice of vaccination; and in 1842 they declared illegal the employment of women and children in mines and collieries, the horrors connected with which inhuman system were exhibited by the noble author of the measure† in terms of indignant eloquence, which awoke a responsive echo in every corner of the realm. About this time appeared that remarkable series of volumes‡ on the sanitary condition of the labouring classes, for which we were indebted chiefly to Mr. Chadwick, and which, revealing as they did an almost incredible state of matters in our crowded centres of population, were read by multitudes with a strange and eager interest, and formed the basis of our subsequent legislative enactments. The first attempts to obtain the assent of the legislature to the recommendations of the Health of Towns Commissioners, were the Town and House Drainage Bills of Lords Lincoln and Normanby, and the Health of Towns Bill introduced by Lord Morpeth, in 1845. These attempts, though unsuccessful, contributed, not less by the

* Hecker's "Epidemics of the Middle Ages;" Sydenham Society's Translation, p. 177.

† Lord Ashley.

‡ "General Local Reports on The Sanitary Condition of the Labouring Population of Great Britain," July, 1842.

opposition than by the attention and sympathy which they awakened, to the success of similar measures in after years.

Then followed, in rapid succession, the Acts for Promoting the Establishment of Baths and Washhouses, both in Great Britain and Ireland, in 1846; the Towns' Improvement Act in 1847; the Public Health, the Nuisances' Removal, and the City of London Sewers'* Acts in 1848; the Metropolitan Interments Act in 1850, followed in 1853 by a similar Act for the whole of England,† the Act to Encourage the Establishment of Lodging Houses for the Labouring Classes,‡ and the Common Lodging Houses' Act in 1851; the Metropolitan Water Act in 1852; the Smoke Nuisance Abatement (Metropolis) Act, and the Act to Extend and make Compulsory the Practice of Vaccination, in 1853; the Merchant Shipping Act, with its stringent provisions for the preservation of the health of our merchant seamen, in 1854; the Diseases Prevention, the Metropolis Local Management, the Metropolitan Buildings, and the Nuisances' Removal Amendment Acts, in 1855; and the Public Health Act, 1858, which abolished the General Board of Health, and vested its powers in the Privy Council. Since then there have been added to the statute book the Acts for the purification of the Thames in 1858 and 1866; the Nuisances' Removal Amendment Act in 1860; the Act for preventing the Adulteration of Articles of Food and Drink in the same year; the Acts (passed in 1860, 1861, and 1864) which included under the provisions of the Factory Acts women and children employed in bleaching and dyeing works, in lace factories, and in the manufacture of earthenware, of lucifer matches, of percussion caps and cartridges, of paper staining and of fustian-cutting;§ the Vaccination Amendment Act in 1861; the Act for the Seizure of Diseased and Unwholesome Meat, and the Alkali Works Act, in 1863; the Sewage Utilization Act in 1865; the Labouring Classes' Dwelling Houses Act, and the Sanitary Act, in 1866.

Let us attempt to condense into a few sentences the great principles embodied in this vast mass of legislation. They are as follows:—That the employment of women and children in laborious occupations for which they are physically unfit, is physiologically as well as politically and morally wrong; that the sanitary state of our large towns, and the condition, physical as well as moral, of our labouring population, are matters of imperial interest, which we cannot with impunity neglect; that various diseases, which prevail among us, either epidemically or endemically, and are attended with a high

* In section 91 of this Act is the only definition of a common lodging-house, which existed for many years. The common lodging-house Acts contain none!

† Between 1850 and 1891, not fewer than *eight* Burial Acts passed through Parliament.

‡ Very little use has been made of this admirable measure.

§ See "Extension of the Factory Acts." By H. S. Tremenheere. *Soc. Sc. Transactions* 1865; pp. 291-294.

mortality, depend wholly or in part on neglect of the laws of health and disregard of the common decencies of life, and are in great measure preventible by a few simple precautionary measures; that a sufficient supply of pure air and water is essential to health, and therefore, that the overcrowding of workshops, dwellings, and schools, the contamination of the air by smoke or other irritating foreign particles, by noxious gases, the product of organic decomposition, and by chemical fumes, and the pollution of water by sewage and other refuse should, as fruitful sources of disease, be prevented; that the establishment of baths and washhouses, and the erection of suitable dwellings for the labouring classes should be encouraged; that efficient drainage should everywhere be promoted, but that the conversion of streams and rivers into common sewers is a monstrous perversion of the gifts of Providence and a great public wrong; that the practices of conveying persons smitten with contagious or infectious disorders in hackney carriages, and of retaining the decomposing remains of the dead in the crowded abodes of the living, are full of peril, and therefore to be discouraged; that with the view of discovering and removing such evils as affect directly or indirectly the health of the community, medical officers of health and inspectors of nuisances are needed, the latter not to wink at the continuance of nuisances, but to ferret them out and drag them to the daylight, the former to report from time to time the results of inspection and inquiry to the proper authorities, with such suggestions as may seem to him best fitted to remedy existing abuses; that it is the duty of local authorities to take cognizance of and remove all nuisances and impediments to the public health, and to promote such measures as may be conducive thereto; that, in the event of the local authority declining to act, any inhabitant of any parish or place may complain to a magistrate, who shall proceed as if he were the local authority, with a view to the abatement of the nuisance complained of; and finally, that, in the event of a local authority making default in providing its district with sufficient sewers or water supply, complaint may be made to a Secretary of State, who shall inquire and proceed in the matter as he may see fit; in other words, that every facility shall be given to the inhabitants for compelling the local authority to perform its duty. Let us note in addition, that since 1858, we have had in the Privy Council a Public Health Department, which presents us annually with a volume full of interesting and important material, and exercises a summary jurisdiction in times of epidemic visitation.

When I have said that for the authoritative recognition and sanction of all these principles, so pregnant with potential benefits, we are indebted to the legislature, I have surely said enough to defend it from those, and they are many, who would lay upon its shoulders the chief blame of our sanitary deficiencies. It is a matter of great moment to have the stamp of legislative approval affixed to the great principles and doctrines for which sanitary reformers have long contended; and if the country had taken the thirty or forty times repeated hints offered them by Parliament, how very different would

our sanitary condition have been at this good hour! But when I have said this, I have said all that is due to the Parliaments and Governments of the last thirty-five years. Somehow or other we are apt to look to our law-givers not for hints, but for laws. If the principles recognized and sanctioned by them are thoroughly sound, we have a right to expect that, if not at first, they will sooner or later carry them out to their logical consequences—*i. e.*, enforce them. Of all the Acts I have recited, five only, so far as I know, can boast of a complete or fair measure of success. The Factory Acts are, I believe, thoroughly effective; women and children are no longer employed in mines and collieries; intramural burials are a thing of the past; the Metropolis Water Act has doubtless saved a multitude of lives; and the sanitary organization of the Metropolis approaches more nearly to the ideal of sanitary reformers, than that of any other large town in the kingdom. In all of these cases the legislature has not only had the courage to say "you shall," instead of "you may," but has made obedience to its injunctions a necessity. On the other hand, the Chimney Sweepers' Acts,* the Smoke Nuisance Acts, the Vaccination Acts, and the Merchant-shipping Act, as regards the prevention of scurvy,† though penal in their provisions, are all more or less failures for want of being duly enforced; and, as we all know, the Sanitary Acts proper are in great measure a failure. Why? Simply because they are suggestions rather than laws. So much is this the case, that, as Mr. Rumsey points out in a very able paper published in this months' (October, 1866) *Journal of Social Science*, the Local Government Act has been adopted by many small places, with the express intention of evading the Highway Acts, and without any intention of carrying out the other. And Mr. Simon, in his Eighth Report, lately published,§ narrates the case of several parishes in the Malling Union, which were infested with typhus and diphtheria, and threatened with cholera, were drinking polluted water and overspread with all sorts of nuisances, but could not obtain the improvements which they earnestly desired on account of the dogged obstructiveness of the Board of Guardians, who successfully bearded the Health Department of the Privy Council, Sir George Grey, and the law-officers of the Crown, declaring that "they did not consider the 5th Section of 23 & 24 Vict., c. 77, to be imperative, and they therefore declined to appoint a committee under it." So much for permissive legislation! Let us glance at some of its other developments.

The basis of all effective local operations in health matters must be full, accurate, and trustworthy information. This may be procured in various ways, and from various sources. It may be sought for and

* *Soc. Sc. Transactions*, 1864, p. 591.

† "On the Health of Merchant Seamen." By J. O. McWilliam, M.D., *Soc. Sc. Transactions*, 1861, p. 509; also *Soc. Sc. Transactions*, 1862, p. 544; and "Report of the Liverpool Committee on the 'Health of Merchant Seamen.'" By Rev. S. A. Steinthal, p. 555.

§ Eighth Report of the Medical Officer of the Privy Council, pp. 23-25.

made known by local authorities, by local associations, or by public spirited individuals, or failing any or all of these, by the Health Department of the Privy Council. Throughout our sanitary laws—which we cannot yet properly call a system or code—three things are tacitly assumed, viz., 1. That to the local authority (the meaning of which very complex term will be explained by Mr. Jenkins,) belongs the duty of caring for the health of its constituents. 2. That the local authority will neglect that duty, and 3. That the local authority must not be expressly enjoined to do its duty. Of these three postulates, it is hard to say which is the more essential to the right understanding of our subject. One thing is very clear, that Parliament, which at first prescribed no remedy for the obstructiveness of local authorities, has of late years found it necessary, in each successive Act, to arm the individual householder or inhabitant with more extensive powers, till, in the Sanitary Act of 1866, it is provided that a single complainant may call a recusant corporation to account for its default before one of Her Majesty's principal Secretaries of State. In this way, and also by empowering the Privy Council * to institute sanitary inquiries and report the results thereof annually to Parliament, the legislature, with a becoming jealousy of anything like undue interference with local self-government, has long been endeavouring to create a public opinion in favour of sanitary reform, and so to direct it as to overcome the sluggishness and prejudice of niggardly and self-complacent "bumbledom" both in town and country. Some places, as, for instance, Liverpool and Leicester, have for many years enjoyed the services of able, energetic, and judicious medical officers of health; and other towns—such as Birkenhead, Bristol, Doncaster, Dundee, Edinburgh, Glasgow and Leeds—have more recently recognized the necessity of appointing such officers, with active and intelligent sanitary detectives under them, and have shown themselves ready to lend a hearty support to their officials in the discharge of their disagreeable and arduous duties. But if they be otherwise minded—and we shall presently see how often they are so—the law, beyond the limits of the Metropolis, while suggesting the propriety of appointing, acquiesces in the non-appointment of medical officers of health; and since 1860, the injunction of the Nuisances' Removal Act, 1855, to appoint inspectors of nuisances, has actually been withdrawn!

Before inquiring what has been done by public bodies, let me mention a few of the contributions which individual or private effort has made to our sanitary knowledge. Before 1849, the late Dr. Snow was conspicuous for his advocacy of the opinion that cholera is propagated by the use of pump-water, which in large towns is usually contaminated by surface drainage. The eager pertinacity with which he urged his views, in season and out of season, was amusing to some and irksome to many. But after the memorable and very fatal out-

* Public Health (Privy Council) Act, 1858, secs. 5 and 6.

break of the disease in Albion Terrace, Wandsworth*—a genteel row of detached houses occupied by professional men and tradespeople—his reasonings found more patient and respectful listeners. Not that the evidence in favour of his theory was perfectly conclusive—for, though the spring which supplied these houses with water was polluted by the bursting of the drain common to all of them, another hypothesis referred the outbreak to the removal, from the house where the first death occurred, of a heap of horribly offensive rubbish which had been slowly accumulating for two years. But though the probabilities, as between air and water, were thus pretty evenly balanced, the idea that Dr. Snow's views might possibly be true was firmly fixed in the public mind, and many who, like myself, could not admit their being proved, were tacitly of opinion that they were highly probable. That there was some connexion, more or less intimate, between the water supply of towns and the spread of cholera, was further forced on the minds of many by Dr. Shapter's statements regarding Exeter in 1832, then one of the cities worst supplied with water and most severely visited, and the same city in 1849, when its water-supply was admirable, and it was almost exempt from the disease. The same immunity was observed in various towns, *e. g.* Bath, Birmingham, Cheltenham, and Leicester, which "were supplied with water quite uncontaminated with the contents of sewers." These and other circumstances combined to give weight to Dr. Snow's conclusion, that "the sanitary measure most required in the Metropolis is a supply of water for the South and East districts of it, from some source quite removed from the sewers."

The results of his laborious investigations into the connexion between the water-supply and the death-rate from cholera in the various districts of London, were made public in November and December 1851.† It appeared that the cholera was very much more severe on the south side of the Thames than on the north. The water of the Chelsea Company, though taken from the Thames at Chelsea, where it was very foul, was much purer than that of the Lambeth, Vauxhall and Southwark Companies, because, having till a short time previously had "to supply the Court and a great part of the nobility, they had large and expensive filters, and also very capacious settling reservoirs, in which the water is kept for a considerable time before its distribution;" whereas the other companies filtered the water supplied by them very imperfectly through coarse gravel, and allowed no time for subsidence. The mortality in those districts supplied by the Chelsea Company, though great, was considerably less than in those supplied by the other companies. The General Board of Health, in their report presented to Parliament in 1850, select, "out of great numbers" from all parts of the kingdom, the outbreak of diarrhœa in Hackney, and of cholera in Windmill Square, Shoreditch; in

* *Medical Gazette*, new Series, Vol. ix.: 1849. pp. 468 to 504; also, Snow on Cholera, 2nd edition: 1855, pp. 25-30.

† "Report on the Epidemic Cholera in 1848 and 1849," pp. 59-62.

Rotherhithe; in Horsleydown; in Waterloo Road, Lambeth; and in Hope Street, Salford, as "proving the influence of the use of impure water in predisposing to the disease."

The subject was at length brought before Parliament, and a law enacted, as we have seen, in 1852, compelling the water companies to make arrangements for conveying the water from above Teddington lock. Already in 1853 the death-rate from cholera in the district supplied by the Lambeth Company, which alone had completed its works and brought its supply from Thames Ditton, was little more than one-half the Southwark and Vauxhall death-rate. The house to house inquiry undertaken by Dr. Snow in the Lambeth, Vauxhall, and Southwark districts in the autumn of 1854,* brought to light the startling fact, that out of a total of 1,510 deaths, 1,224 occurred in houses supplied by the Southwark and Vauxhall, and only 93 in those supplied by the Lambeth Company. In other words, "while a death from cholera had occurred in one house in every 28 supplied by the Southwark and Vauxhall Company, a fatal attack of cholera had occurred in only one out of 251 houses supplied by the Lambeth Company," showing a mortality "just nine times as great in the houses supplied by the former company as in those supplied by the latter." And now it was found that the death-rate in the Chelsea district, which had previously presented so favourable a contrast to that of the southern districts, was very large when compared with the Lambeth rate. In short, it was very clear that the extraordinary diminution of the mortality in a district abounding in unwholesome influences, and hemmed in on every side by districts ravaged by cholera, from which it had itself suffered frightfully in 1849, had more than a casual connection with the pure water supplied by the Lambeth alone of all the water companies. Even more striking was the immunity enjoyed by single tenements supplied by this company, while all around the pestilence was busy and terribly fatal. The evidence collected in the same year (1854) by this indefatigable inquirer as to the origin of the frightful outbreak in the Golden Square district in the month of September, was such as to compel the assent of the most incredulous to the proposition that it was mainly attributable to the contamination of the water of the Broad Street pump-well, the favourite source of supply in that neighbourhood. What was then matter of doubt, or wonder, or disgust to multitudes, now forms an almost unchallenged article in our sanitary creed, of which the Metropolis Water Act was one of the earliest expressions, as the yearly growing interest in the question of water supply for our great towns is its natural and gratifying result.

But while thankfully acknowledging our obligations to Dr. Snow, who spent much time, and strength, and substance, in conducting this great inquiry, I cannot admit that cholera spreads only by being swallowed. That the gaseous emanations from unremoved cholera

* *Medical Times and Gazette*, New Series, vol. ix., pp. 365-6, 1854.

discharges in privies, mines, etc., are a very frequent cause of the extension of the disease, seems to me established beyond dispute by the facts stated in a series of letters * from the pen of that accomplished and sagacious physician, Dr. W. Budd, of Bristol, who has established as strong a case for prompt measures of isolation and disinfection as has Dr. Snow for an abundant supply of pure water. This is not the fitting place for discussing the question whether water contaminated by ordinary sewage may, under varying conditions which we cannot as yet accurately define, produce only slight indigestion, or a diarrhœa more or less severe, or a destructive outbreak of dysentery, typhoid fever, or Asiatic cholera. I merely remark that, even in the case of the Broad Street pump water, there was, as Dr. Snow admits,† no evidence to prove the presence of choleraic matter, though the presence of organic impurities was abundantly evident. "Mr. Eley . . . had long noticed that the water became offensive both to smell and taste, after it had been kept about two days. . . . Another person had noticed for months that a film formed on the surface of the water, when it had been kept a few hours."

As, however, I have been led, in illustrating the results of individual effort, to consider the morbific influence of water contaminated by sewage, I cannot dismiss the subject without citing some striking facts which I have gleaned from public documents, or from my own experience. In July, 1849,‡ "the privies of a number of houses in Silkmill Row, Hackney, were pulled down," and the four cesspools which were substituted for them were situated respectively at the distance of one, three, five, and twelve yards from "the only well which supplies with water twelve houses containing 85 inhabitants." The water, which a fortnight later began to be offensive, was thereafter rendered "as thick as thin soup" by the admixture of sewage. Of the 85 inhabitants 22 wisely avoided the water and escaped disease, while 46 of the remaining 63 "were attacked with severe diarrhœa, one of them approaching cholera." There was no question here of cholera discharges in the cesspools, for the "row" had been and remained free from the epidemic.

"Jacob's Island,"§ a portion of the parish of Christ Church, Bermondsey, contains between 300 and 400 houses, and is surrounded by a tidal ditch or millstream, which receives the contents of the sewers and drains of all the drained houses, besides the refuse of the neighbouring houses and the contents of their privies, and was the

* *Association Journal*, 1854, pp. 929, 950, 974, 1152, under the signature "Common Sense;" 1855, pp. 207, 283, signed "W. Budd."

† On "The Mode of Communication of Cholera." By John Snow, M.D., Second edition, 1855. Churchill, p. 52.

‡ "Report of General Board of Health on the Epidemic Cholera of 1848 and 1849," p. 60.

§ Mr. Grainger's "Report to the General Board of Health on the Cholera of 1848 and 1849." (Appendix B.) p. 92.

sole source of the water supply of 150 houses. Many of the inhabitants were in the habit of using it for cooking, and had even drunk it unboiled during the heat of summer. Such being the case, need we wonder that "dyspepsia, cachexia, a peculiar 'sickness of stomach,' and irritable bowels are at all times very prevalent;" that in 1832 and 1849 the earliest fatal cases of cholera occurred close to this ditch, and that in the latter year diarrhœa was universal, and cholera carried off 61 victims.

Dr. Acland's statements* regarding the water supply of Oxford are singularly interesting and conclusive. "The southern parishes," he says, "suffered in 1854 nearly twice as much as in 1832, but only a sixth more than in 1849. The water supply was bad; some of the wells were foul to a degree; one stank; some were dry; and the city water, wherever distributed, was unfit for use at such a time." 'In 1832 there were, out of 174 cases in all Oxford, in the parish of St. Clement's alone 74 cases of cholera, and in 1849 only three. During the former epidemic the inhabitants had filthy water from a sewer-receiving stream, and in 1849 from the springs of Headington, conveyed thither,' with the like results as in Exeter soon after 1832. 'In 1854, out of 194 cases, but 18 occurred in St. Clement's; a proportional increase which would tend to show, what indeed we have various other evidence of, that the water supply, though it may be one mode, is not the only mode of conveying the cholera poison.' The case of the county gaol, one of the few prisons in which cholera has prevailed, is peculiarly instructive. It is not far from the city prison, 'is admirably managed' by attentive humane officers, and has an accomplished practitioner for its surgeon, yet has been visited during each epidemic with diarrhœa and cholera, from which the city prison has always been exempt. In the county gaol there were three cases of cholera in 1832, and 14 in 1849; and in 1854, during the fortnight which preceded the inquiry into the state of the water supply on the 29th of September, 'there had occurred 20 cases of choleraic diarrhœa, and five cases of cholera, of which four were fatal.' That branch of the river which flows near the gaol, passes through the Castle Mill, above which it is dammed up for the mill-head. The water, when the mill is at work, forms a brisk stream in the mill-tail, which becomes a nearly stagnant pool when the mill is not working. Into this pool, already much contaminated, the sewage of the prison was conveyed by a drain, within 10 feet of the mouth of which 'the supply pipe sucked up the contents of the pool for the prison use.' With the water thus obtained, 'the soup and the gruel, important articles in the weekly diet, were made.' The pipes were immediately cut off, and only three cases of choleraic diarrhœa and one of cholera (none being fatal) were reported during the rest of the epidemic."

This Oxford episode occurred during a season of epidemic visitation, and remarkable for drought and intense heat: here is another

* Memoir on the Cholera at Oxford in the year 1854. pp. 39, 51, 52.

which occurred in the depth of winter. Few Londoners can have forgotten the great snow-storm of January, 1866. A partial thaw was succeeded by a very sharp frost, and that again on the 11th of January by a gale of wind, another heavy snow-fall, and an exceedingly rapid thaw. The outlet of the large Knightsbridge sewer, being then very small, was soon choked up, and the contents overflowed through the traps into the areas and kitchens of many of the neighbouring houses. Several families drew their supply of drinking water from a favourite private pump hard by. On the 14th it was slate-coloured and smelt offensive; but as on the 17th it looked and smelt perfectly pure, most of the members of the various households again partook of it freely. That night all who had used it were seized with more or less violent diarrhœa, in one case profuse, with obstinate vomiting, closely resembling cholera, and followed next day by extreme and helpless prostration. Those who did not make use of it escaped. The water, when tested with nitrate of silver, was found, notwithstanding its seeming purity, to be "highly charged with organic matter—in fact, with sewage." The well was pumped dry, after which the water was twice tested, and found free from organic impurities.

My next and concluding instance illustrates very strikingly one mode in which typhoid fever may be propagated, and perhaps originated. I agree with my distinguished friend and late colleague, Dr. Murchison, that this very fatal form of fever commonly arises from the emanations of cesspools and sewers, and am disposed to admit that the discharges from typhoid patients, which Dr. Budd regards as highly infectious, and indeed the only medium of infection, may in certain circumstances propagate the disease. Here, however, was neither cesspool nor sewer gas; nor does it appear likely that in the first instance there was any typhoid patient to produce the specific poison*—but simply the admixture of ordinary sewage with the drinking water, which, partaken of by the inmates of a large establishment, produced a frightful outbreak of typhoid or enteric fever. At Bishopstoke in Hampshire, where a small number of the intelligent residents have for some time been struggling resolutely, but as yet vainly, in favour of a system of sewerage, which the vestry and the Winchester board of guardians consider a needless luxury in a place containing 500 or 600 inhabitants, there was in May, 1866, a ladies' boarding school, which contained 28 inmates, and had up to that time had a perfectly clean bill of health. During the previous nine years, at all events, there had not been such a thing as a case of fever in the establishment, which has no cesspool in or near it, the sewage having long been conveyed by a pipe drain into the Itchen. The water was obtained from a spring on the premises, was

* The mother of one of the servants was ill in the village, before the outbreak, of a low fever, said not to have been typhoid; but she states positively that neither before her illness, nor during her convalescence, was she within the school. There was no other case of fever in the neighbourhood.

always filtered before being used, and had been analysed not long before, and found quite pure. The circumstances connected with this analysis are singular and very interesting. I state them in the words of my friend, Dr. Parkes, of Netley, who "saw three of the young ladies frequently," and certifies them all to have been "cases of very severe and unequivocal typhoid fever." "An officer at Netley," writes Dr. Parkes, "being about to place two daughters at this school, made a careful inspection of the building. At the end of it, he said to the schoolmistress, 'I like everything connected with your school, but one thing. I have found out that your drain pipe runs close to your well.' (It was only three feet distant.) 'The lady replied that as the well water was perfectly good, she did not think it could be so, or at least that no harm had ever resulted. Major ——— replied, 'I have heard so much at Netley of the dangers of such an arrangement that I don't like it.' Before placing his daughters there, he obtained some of the water, and I had it analysed for him; it was quite pure. Subsequently he obtained some more, and this was also analysed and found to be quite pure. Major ——— sent his daughters to the school; both had the fever which afterwards broke out, and one of them died." One of the young ladies fell ill and continued so for a week, when she seemed to get better, but felt weak and was easily fagged. She was again attacked on the 20th of June, and had a very severe illness. A second fell ill on the 27th of May, and died on the 27th of June. Between the date of her seizure and the beginning of July, not fewer than 18 out of the 28 inmates were successively attacked. The last case, after an illness of about six weeks, also died on the 18th of August. In two other cases, (*i.e.*, in four out of eighteen) the disease likewise proved fatal. What could be the origin of so severe, and so thoroughly localised, an outbreak of enteric fever? About the 7th of June the water was noticed to have a nasty taste, and from that day its use was discontinued. A careful examination showed that, owing to heavy rains, there had been a subsidence of the soil beneath the drain pipe, which had given way, so as to permit the sewage to escape and gradually to soak through the intervening three feet of earth, till a free run was established between the drain and the well, the water being now found, on re-examination, to contain a large amount of organic impurity." An instructive commentary on the proposal which was at one time made, that those who live at the top of the rising ground on which the village is built, and at some distance from the river, should sink pits for their sewage through the clay, and let it "lose itself," as the phrase is, in the gravel! But what if, instead of losing itself, it should find its way into the springs, and so poison the whole water supply of the neighbourhood? There are many things in heaven and earth not dreamt of in the philosophy of vestrymen and parish surveyors; and one of these is that "out of sight," though "out of mind," does not always mean out of existence.

To return from this long, but far from needless digression, Dr. Snow

is by no means a solitary instance of self-devotion to the cause of sanitary improvement. So far back as 1833, Mr. Robert Baker, the factory inspector, then a public-spirited citizen and councillor of Leeds, led the way in exhibiting the monstrous evils, for which, more recently, Dr. Greenhow and Dr. Julian Hunter* in their official reports, and Mr. James Hole, in his deeply interesting work on "The Homes of the Working Classes,"† have held up Leeds and its obstinately obstructive authorities to the wonder and reprobation of the United Kingdom. I regret that I have not had the advantage of perusing Mr. Baker's earlier reports‡ on the condition of the great industrial metropolis of the West Riding of Yorkshire; but it is highly instructive—as showing for how long a period in this nineteenth century a proved and criminal neglect may be resolutely persevered in, notwithstanding the wholesale destruction of life and morals occasioned thereby—to compare his very able and exhaustive report in 1842§ with the statements of Dr. Greenhow in 1858, of Dr. Julian Hunter, in 1865, and of Mr. Hole in 1866. I make no apology for giving in parallel columns the following savoury extracts, which I request my readers carefully to peruse, that they may understand the enormity of the evils which are often shielded from view by the convenient plea of "the right of self-government." I am happy to think that the picture is now, or will soon be, one of the past, as the recent appointment of so resolute and able an officer of health as Dr. Robinson, affords a guarantee that the local authorities are now at length in earnest about the purification of Leeds.

BAKER in 1842.

"Along the line of these two wards, and down the street which divides them, and where this sewer has recently been made, numbers of streets have been formed, and houses erected, without pavement, and hence without surface drainage, without sewers, or, if under-drainage can be called sewers, then with such as, becoming choked in a few months, are even worse than if they were altogether without. The surface of these streets is considerably elevated by accumulated ashes and filth, untouched by any scavenger; they form nuclei of disease exhaled from a thousand sources. Here and there stagnant water and channels so offensive that they have been declared to be unbearable, lie under the doorways of the uncomplaining poor; and

GREENHOW in 1858.

"Leeds is of course traversed by certain principal streets; but these are fewer than is common in other great towns, and the interspaces between these principal roads are occupied by dense complicated congeries of narrow and often ill-kept streets and courts, which have but seldom been adopted as highways by the municipal authorities, are often in a very foul state, and, according to Mr. Sanderson, the local inspector, are neither kept in order nor cleansed at the public expense. Many of these by-streets are neither paved nor drained, and very often they are so imperfectly channelled, that surface water remains stagnant on them until dried up by the influence of the sun and wind. Sometimes these streets have no outlet at the further end, being

* "Second and Eighth Reports of the Medical Officer of the Privy Council," 1859 and 1865.

† "A Chapter on Leeds." pp. 123-144.

‡ In 1833, 1838, 1839, and 1840, referred to by Mr. Hole, p. 123 *et seq.*

§ "Local Reports on the Sanitary Condition of the Labouring Population of England and Wales, 1842," pp. 348-409.

privies so laden with ashes and excrementitious matter as to be unuseable, prevail, till the streets themselves become offensive from deposits of this description; in short, there is generally pervading these localities a want of the common decencies of life." (*Local Reports*, 1842, p 352.)

Of one noted *cul-de-sac* he says, "the name of this place is the Boot and Shoe Yard, in Kirkgate, a location, from whence the Commissioners removed, in the days of the cholera, 75 cart loads of manure which had been untouched for years, and where there now exists a surface of human excrement of very considerable extent, to which these impure and unventilated dwellings are additionally exposed." p 353.

"The contractor for the street sweepings, who is the treater with the Commissioners of Public nuisances in Leeds, absolutely rented and rents, or did rent a very few weeks ago, a plot of vacant land in the centre of North East Ward, the largest ward, in point of population, of the whole township of Leeds, and containing the greatest number of poor, as a depôt for the sweepings from the streets and markets, both vegetable and general, for the purpose of exsiccating and accumulating till they could be sold as manure and carried away. So noisome were these exhalations, that the inhabitants complained of their utter inability to ventilate their sleeping-rooms during the day time, and of the insufferable stench to which both by day and night they were subjected. "A great many of the privies of the cottages are built in small passages, between clumps of houses which are different properties; others, with the ash entrance open to the public streets; and others at a little distance from and open to the front of the houses; whilst some streets are entirely without. The inhabitants, to use the language of an old woman of whom inquiry was made, says that 'they do as they can, and make use of the streets as the common receptacle.' These remarks apply in particular to three streets of Leeds, which contain a population of between 400 and 500 persons, where there is not a useable privy for the whole number." p. 356.

in fact mere *culs de sac*; more frequently they communicate one with another, so as to form a complicated labyrinth of very imperfectly ventilated little streets and courts. Houses in such situations are very commonly indeed built back to back, and even when not so they are often destitute of windows in the rear, and possess no efficient means of thorough ventilation. The streets of Leeds have in fact been laid out and the houses erected according to the caprice or interest of their owners, without reference to the health, comfort and convenience of the inhabitants, or to the fact that they were destined to form integral parts of a great town. The courts of Leeds are rarely spacious and airy, are sometimes entered through covered passages, and are by no means always clean, but more frequently are unpaved and in bad condition. Privies are almost universal, and are, from their position in relation to dwellings, the most prominent sanitary defect of the town, water closets being unknown among the poorer classes. As is common in other manufacturing towns, a single privy usually serves for several families. The situation of the privies is often most objectionable; in many of the smaller streets they are placed beneath inhabited rooms; in others they are sometimes placed against the walls of houses, or so near to them that the effluvia are felt within doors, and infect many of the courts and smaller streets. Although certainly not the exclusive cause of diarrhœa, yet upon the whole that disease has been the most rife and most fatal in streets where the privy nuisance prevails in an aggravated form."—"Second Report of Medical Officer of Privy Council," 1859, p. 134.

HUNTER in 1865 and 1866.

"To the eye of an inspector who had just left Newcastle and Sunderland, and who in the same week visited Sheffield, Leeds, in August, 1865, presented a surprising sight, bringing to remembrance the condition of many English towns of twenty years ago, but finding hardly any standard with which to be compared in the present state of any great town. Thousands of tons of midden filth filled the receptacles, scores of tons lay strewn about where the receptacles would receive no more. Hundreds of people, long unable to use the privy because of the rising heap, were depositing on the floors. A few dawdling carts, under command of Mr. Sands, the corporation officer, and subject to no inspection, unless Mr. Sands be taken to be inspector of his own duties, would, after many applications, relieve the middens of such inhabitants as could, by peremptory manner or by influence obtain a hearing. Even then the relief was most imperfect. In one instance the scavenger reported a receptacle as emptied, yet twenty tons of stuff were removed when a second visit was insisted on. The pressure of these enormous weights was so great that liquid ordure had been seen, after penetrating the ground, to be forced up around the hearthstones of neighbouring cottages. The officers of the union complained to their board no less than 3,500 times, in about two years and a half, of distinct instances of neglect.

"The force employed in cleaning, which had been last spring forty-five carts, had been reduced to thirty, and with an excess of delicacy, badly agreeing with the universal neglect, no removals were made except by night. Such carts as were employed only carried the midden filth to a deposit in the town, by the water side, except a few by which some railway trucks were loaded. At this deposit stood thousands of tons of midden filth needlessly waiting for removal by boat or cart for consumption; 7,000 tons stood there at one time this year, and yet the quantity at this moment found to be necessary is and need never exceed one hundred tons. Boxes which receive closet manure from manufactories are here emptied in large numbers, and though both at the original receptacles and at the deposit itself a

HOLE in 1866.

"To crown the imperfect construction of these dwellings, they are placed in immediate contact with privies and cesspools, which, although seldom noticed by the inhabitants, are utterly intolerable to a stranger. Then, again, the supply of privies is quite inadequate for the ordinary requirements of decency, and many of them are under bedrooms. p. 127.

"'On Sunday mornings,' says a woman, 'the neighbours have to watch and wait for a chance of getting into the conveniences!' In one of the above streets the privies have pigsties beside them! How intolerable the stench, particularly in hot weather, the reader may conceive. p. 128.

"Owing to a recent increase of fever and of the death-rate, meetings to consider the sanitary state of Leeds have been held in every ward, at which clergymen and others cognizant of the facts agreed in showing that there was serious neglect; that numerous ashpits were filled to overflowing in immediate proximity with the houses of the poor, and that gully-holes in the streets had been closed up for months.

"'We saw,' says one of the visitors in Hunslet, 'places that had been full for weeks, not of ashes, but of fluid matter, up to the seat, so that the women in the houses said they had to empty everything into the streets. In one yard, consisting of twenty-six houses belonging to one landlord, there are two privies only, and an open drain down the centre. A school of sixty boys adjoins the privies, and the ashpit is only about four feet high. In another yard, belonging to the same landlord, there are thirty-two houses to two privies, and the yard itself is saturated with disgusting matter." p. 129.

"We can point to numerous pigsties which have existed more than thirty years, in close proximity to dwellings in the very centre of the town, and which still flourish as redolent as ever." p. 130.

deodorizing powder was freely used, the place emitted a strong fecal stench, doing its best to warn the corporation of the mischief they were doing." (Eighth Report of the Medical Officer of the Privy Council, p. 234.)

"The orifice of the midden was even in large highways often turned to the street, and often unprotected by any door. There were properties without any privies or ashpits at all, yet quite within the town.

"On the 26th of May, 1866, the justices ordered the removal of the Waterloo depôt; the town clerk appeared to beg delay." p. 236.

Happily, as we shall see, the "ancient reign" of the pigs and piggeries in Leeds has now been effectually disturbed, and we have been lately reminded, by a letter in the *Times** from Dr. Fowler in reference to the state of privies in the City of London, that Leeds is not the only place where urgent and oft-repeated complaints and remonstrances are unheeded by the local authorities.

What has been done for Leeds by those gentlemen to whose labours I have referred, has been done for Oxford by Dr. Acland, whose memoir on the Cholera in 1854† is indeed an exhaustive treatise on the then unwholesome condition of that renowned seat of learning. I shall have occasion again to refer to the interesting information with which he has lately favoured me as to its present state and prospects. Dr. Shapter's volume‡ and supplement have thrown much light on the history of the cholera at Exeter, and of the sanitary measures adopted with such encouraging success in consequence of its frightful ravages in 1832. Dr. J. C. Hall has from time to time contributed much valuable information on the state of Sheffield and the diseases prevalent there. Mr. Rendle§ and Dr. Horace Jeaffreson‖ have given us precise and highly important facts regarding the principal fever haunts of London, and the mode in which they are dealt with by vestries. Dr. Tyacke has been unwearied in his efforts to stimulate the local authorities of Chichester, and Dr. Edward Wilson, failing any vigorous and comprehensive measures on the part of the Town Commissioners, has supplied us with numerous and authentic details regarding Cheltenham in his elaborate and very able paper read before the British Association for

* September 17th, 1866.

† "Memoir on the Cholera at Oxford in the year 1854, with Considerations suggested by the Epidemic." By Henry Wentworth Acland, M.D., F.R.S., F.R.G.S., &c. Churchill, 1856.

‡ "History of the Cholera in Exeter in 1832." Churchill, 1849.

§ "London Vestries and their Sanitary Work." By W. Rendle. Churchill, 1865. "Fever in London: its Social and Sanitary Lessons," 1866.

‖ Letters in *Times*, April 14, September 7, 1865, January 3, 27, March 5, 1866. See also leaders, April 15 and September 7, 1865, January 3, 5, 1866

the Advancement of Science in 1864.* Of the abundant labours of my friend Mr. Rumsey, also of Cheltenham, and one of our highest authorities on all matters connected with "State Medicine," it would be superfluous in me to say a word in commendation. Gloucester and Newcastle-upon-Tyne are likewise fortunate in having each an accomplished and able medical reporter. Dr. Washbourn, in the former city, has drawn up and published at his own cost five annual reports "On the Sanitary Condition of Gloucester and its Vicinity;" and Dr. Philipson, to whom I am indebted for much help heartily given, has for several years published the result of the returns sent to him by the members of the Northumberland and Durham Medical Society, in a report, which appears every two months, of the prevalent diseases of Newcastle and the whole surrounding district. As regards Manchester, the only ground of hope for future sanitary reform would seem to be the existence of its justly celebrated sanitary association,† which has for a long series of years been collecting, and classifying, and publishing in weekly, quarterly, and annual reports, which are models of their kind, a mass of details of the highest value in relation to the health of Manchester and Salford. And not only so, but they have long been endeavouring (my distinguished friend, Mr. Thomas Turner, the president, frequently taking part,) to inculcate sound sanitary and social doctrines among the working population, by courses of lectures admirably fitted to promote the end in view. They have also, from time to time, applied themselves to the more herculean task of stirring up the local authorities to the discharge of some of the more obvious responsibilities devolving upon them, as the guardians of the health of the great and prosperous community, which, by a pleasant fiction, they are presumed to govern for its good. The very striking and valuable paper entitled, "Remarks on Some of the Numerical Tests of the Health of Towns," by Messrs. Arthur Ransome and William Royston, was published by that Association in 1864; and to its honorary secretary, Dr. John Edward Morgan, we owe the very interesting and instructive paper read at Sheffield last year,‡ on "The Danger of Deterioration of Race from the too Rapid Increase of Great Cities." Though some may be inclined to fear that the *vis inertiæ* which has so long and so pertinaciously withstood such well-directed efforts, must be invincible, we cannot resist the conviction that, in the unabated vigour with which this admirable association maintains its protest against official neglect and incompetency, we have the pledge of an ultimate and complete victory.

If the zeal and energy of a few private individuals singly and in combination, and of associations, have thus been applied, with so considerable an aggregate result, to the increase of our knowledge,

* Since published as a pamphlet—"Sanitary Statistics of Cheltenham." Longmans, 1865.

† The Manchester and Salford Sanitary Association.

‡ *Soc. Sc. Transactions*, 1865, pp. 427 to 449. Since published by Longmans in a separate form.

and the establishment on a solid basis of the principles that should guide us in our endeavours to improve the public health, much larger contributions to our knowledge and progress have been made, first by Mr. Chadwick and his reporters throughout the country in 1842 and 1843, and during the last nine years by the medical officer of the Privy Council and his staff of very able assistants. Here we have another force *ab extra* brought to bear on the sluggishness of local bodies. After the first visitation of the cholera, the mop and pail, which had for a time been much in requisition, were by common consent laid aside, and the whole nation fell asleep in the midst of yearly-accumulating abominations, until, in the general and local reports on the sanitary condition of the labouring population of Great Britain, Mr. Chadwick and his fellow-workers held up the mirror to a multitude of foul spots both in town and country, and produced an impression of incredulous horror, which the lapse of a quarter of a century has not entirely obliterated. But it was not till 1858 that the foundation of our present system of annual reports was laid, in a small but very remarkable Blue Book,* which consists mainly of a report by Dr. Headlam Greenhow, "On the Different Prevalence of Certain Diseases in Different Districts of England and Wales," with an introductory report by Mr. Simon. The very valuable reports made in subsequent years, according to the terms of sections 5 and 6 of the "Act (1858) for vesting in the Privy Council certain powers for the protection of the public health,"† on diarrhœa, diphtheria, lung diseases, typhus, typhoid fever, and small-pox, by Dr. Greenhow, Dr. Burdon Sanderson, Dr. Buchanan, Dr. Seaton, Dr. Julian Hunter, Mr. Radcliffe, and others, have amply confirmed the soundness of the principles set forth in the preliminary papers, and have from time to time placed in the pillory, for the edification of the public, some of the more incorrigible offenders. That good has been effected by this wholesome practice of publicly recording the chief sanitary events of each year, of investigating on the spot the circumstances which have preceded and accompanied local outbreaks of epidemic and infectious disease, and of laying the result before Parliament, it would be absurd to deny. And that this work has been well and very ably done by Mr. Simon and his assistants, will, I apprehend, be universally admitted. Yet the benefit accruing therefrom has consisted much more in the collection and diffusion of authentic information, than in the communication of any decided impulse towards sanitary improvement among the great masses of the population, where preventible disease slays its annual myriads. I wish to speak guardedly on this subject, notwithstanding the special inquiries I have instituted, because I observe that Mr. Simon,‡

* "Papers relating to the Sanitary State of the People of England." Presented to both Houses of Parliament, by command of Her Majesty, 1858.

† 21 & 22 Vict., cap., 97.

‡ Eighth Report of the Medical Officer of the Privy Council, for 1865. pp. 18, 19.

speaking of Dr. Buchanan's investigations into the state of "places in which, for some considerable number of years, proper works of drainage and water supply have been established, or particular sanitary regulations been in force," expresses the hope that he may be able, in his next report, "to state conclusions which may be permanently valid as to the practical fruit of our best tested sanitary improvements."

Still it is impossible, while reading those very interesting and instructive records of local sluggishness and preventible mortality, to banish from one's mind the express terms of the "Diseases' Prevention Act, 1855," under which, as confirmed by "the Public Health Act, 1858," the Privy Council exercises its present functions in health matters. "Whenever (sect. 5) any part of England appears to be threatened with, or is affected by any formidable epidemic, endemic, or contagious disease, the Lords and others of her Majesty's most Honourable Privy Council, or any three or more of them, may, by order or orders to be by them from time to time made, direct that the provisions herein contained for the prevention of diseases be put in force," &c. And section 6 goes on to provide that they "may issue directions and regulations for the speedy interment of the dead; for house to house visitation; for guarding against the spread of disease, and affording to persons afflicted by or threatened with such epidemic, endemic, or contagious diseases such medical aid and such accommodation as may be required." These ample powers were plainly conferred, if words have any meaning, with the view of enabling the executive not only to prevent the introduction of epidemics from without, but to root out, if possible, those formidable and destructive diseases which have so long dwelt or are begotten in the homes of our people. They have, however, been directed so exclusively against those rare visitants, the alarm of whose approach is in itself a warning to make ready, that they are generally supposed to have no force against our bosom-vipers, which have a vested right to sting to death as many as they list, or as the "liberty of the subject" thinks proper. If cholera threatens us, if yellow fever comes to one of our seaports, if a single case of cattle plague or sheep-pox appears among our herds or flocks, forthwith "my lords" wake up into a state of preternatural activity, hourly telegrams flash to and fro, and voluminous orders fill the pages of the *Gazette*. But with the departure of these intruders the wonted quietude returns, as if there were no "formidable epidemic, endemic, or contagious disease" within our borders worthy to engage "my lords'" attention! Yet true it is that strong men and healthy women—"the breadwinners" of the nation, as Dr. Trench truly remarks—are "dying like rotten sheep" by thousands, after a fortnight's illness, of typhus, of typhoid, and of small-pox; and we think we have done our duty when we have held an inquest on the hecatombs of dead! For several years typhus has been raging epidemically in London; and in Greenock, in the west of Scotland, so virulent has been its type, and so great the mortality occasioned by it, that a special inquiry, conducted by so able an observer as my

friend Dr. Buchanan, was reckoned necessary by the Health Department of the Privy Council.* As regards London, the statements of Dr. Horace Jeaffreson and Mr. Rendle, which recal, as they exactly tally with, my experience in the Glasgow fever hospital thirty years ago, show that its principal haunts are well known, and leave no doubt that by the timely removal of the sick, and by emptying and thoroughly cleansing and limewashing the tenements where it has fixed its abode, this demon of our great towns might be effectually exorcised. Recent experience in Bristol, as I shall show, goes to establish the same position. Let it then be clearly understood that the means of greatly diminishing, if not of putting a stop to the ravages of typhus are within our reach; that the Privy Council has full power to put these means in force for the public good and the preservation of life from wholesale destruction; but that, nevertheless, the Privy Council declines the responsibility of saving the lives of the lieges, against the will of interested landlords, and the prejudices of the local authorities! Placed in this light, the phantom of "vested rights" assumes a very hideous aspect; and the *inertia* of the Privy Council seems to ordinary minds both inexplicable and inexcusable. Their function, it would appear, is calmly to watch the progress of the slaughter which they might prevent, and then "to point the moral" which dead tongues cannot enforce, and to "adorn the tale" which the victims of official prudery cannot tell. The Home Secretary, again, who is empowered by the Sanitary Act, 1866, to interfere, if he sees fit, on complaint made to him of the default of any local authority, will doubtless, as a general rule, see fit *not* to interfere, and will leave matters to right themselves.

Having thus glanced at what has, and what has not, been effected by individual and combined local effort, and by public departments under the Crown, let us next inquire what has been done by the local authorities themselves, to whom, as we have seen, belongs the duty—which they must not be enjoined to fulfil—of caring for the health of their constituents. To such an extent has the policy of non-interference been carried, that outside of London the appointment of medical officers of health is entirely optional; and since 1860 the authorities of places under the Nuisances Removal Act are left free to appoint or not, as they may think fit, even inspectors of nuisances. Before that date their appointment was obligatory.

The fruits of this suggestive and marvellously inconsistent policy are precisely what might have been expected. In the absence of any official returns on this important subject, I first consulted what professes to be a quasi-official work, published by Knight and Co., viz., "The Union, Parish, and Health Officers' Guide for 1865." There I found that of 570 places under the Local Government Act, 1858, and the Public Health Act, 1848, with populations varying from 214 to 200,000, fifty seem to have no inspectors of nuisances;

* Eighth Report, &c. pp. 209-220.

153 have each one; 16 have two; and four have three inspectors of nuisances; while in 347, one man holds the double office either of surveyor and inspector of nuisances, or of inspector and collector, or unites in himself all the three offices of surveyor, inspector, and collector. It struck me as strange that small places with not more than 800 inhabitants should have two inspectors, while large towns, such as Brighton, Bradford, Merthyr Tydfil, Nottingham, Portsmouth, and Sunderland, with populations varying from 50,000 to 106,218, have no more than two; and yet more strange that Preston, with 86,000, Bristol with 154,000, and Sheffield with 200,000 of a population, should have only one! And what is *one* among so many? I found also that in 92—one-sixth of the 570 places enumerated—officers of health had been appointed, and it struck me as very strange that 63 of these held office in places whose population was under 10,000, while only 29 remained for towns with large populations; and 111 towns with populations varying from 20,000 to 200,000 had no officer of health at all. These results, obtained with much labour and expenditure of time, seemed to me too startling to be trustworthy; and the Privy Council reports contained scarcely a syllable in reference to this subject, on which one would think they ought to contain the fullest and most accurate information. I accordingly sought a check in the "Municipal Corporations' Directory," a work very recently published, and containing much useful information; but I found, after a very careful examination, that while every other officer, however insignificant, is thought worthy of insertion, medical officers of health scarcely ever appear, not even those in the metropolis being inserted; and inspectors of nuisances are very often awanting. I enter into these details for a special reason, viz., to demonstrate the necessity of having an annual Parliamentary return of all these officers, of the population and extent of the districts under their supervision, of the duties devolving upon them, and of the salaries paid to them. Such a return would shew us at a glance which places we should take an example from, and which, again, should be made examples of, and would form an indispensable preliminary to sound and comprehensive legislation.

Baffled in the quarters to which I have referred, but considering it essential to have thoroughly accurate and trustworthy information on a subject of so great importance, I felt that I must myself undertake this parliamentary inquiry, and commenced correspondence, as my distinguished friend Mr. Rumsey did before publishing his work on "State Medicine," with some of the many friends whom I have the privilege of knowing in London and throughout the country. I also ventured to apply to not a few to whom I must have been entirely unknown, in the hope that the freemasonry which exists among those who have a common object and end in view would not only excuse my boldness, but respond to my appeal. The result proves that I was not mistaken, for in only one case out of more than a hundred have I been disappointed of a return; and these have generally been prompt, always clear and cordial, and often full. The

best thank-offering I can present to those who have so kindly trusted me is to gather up and exhibit some of the fruits of this inquiry.

And first, as regards the metropolitan district, which, as having been for eleven years under the compulsory provisions of the Metropolis Local Management Act, many reckon a pattern to be held up for the imitation of the whole country. How far this impression is warranted by facts, let the tabular statement in Table I., compiled from the most authentic sources, bear witness.

Let me endeavour, as briefly as possible, to extract the full meaning of this table. And first about the double column for population. After carefully constructing my table and striking my averages from the local returns, I found, on comparing them with the Registrar General's Summary for 1866, that the discrepancies in particular districts were so great as to necessitate the entire reconstruction of my table. Though the general result is not much affected thereby, I have exhibited the two returns side by side, as showing most conclusively how important it is that the health officers and the Registrar-General should compare notes together, so as to ensure accuracy in the local death-rates.

The metropolitan district, with a population of above three millions, has 47 medical officers of health, or, on an average, one to 64,500; or, deducting the population of Woolwich, which has no health officer, one to every 63,630 inhabitants. According to the Registrar-General's statement of the population, there is one to 64,638; or, excluding Woolwich, one to 63,630. This general average, however, gives no idea of the immense disparity existing between the districts both in extent and populousness; for while, at the one end of the scale, there are three with scattered populations of 4,000, 7,500, and 10,000 respectively, there are three at the other end with dense populations of 163,000, 191,000, and 211,000. The number of inspectors of nuisances for this enormous and rapidly growing population is nominally 100; in the proportion, after deducting Mile End and Woolwich, from which I have no returns, of one to 29,000 inhabitants. Nominally, I say, for it must not be forgotten that the whole time of one, and most of the time of eleven others, is occupied in doing work unconnected with sanitary matters. If, then, we reckon these twelve as equivalent to five efficient inspectors of nuisances (a very liberal allowance), we have not more than 93 inspectors for the three millions of inhabitants, and the 78,800 acres of area, of the metropolitan district; or one to 31,300 inhabitants. But here, again, the disparity of the districts is immense; for while two sub-districts, with populations of 4,000 and 10,000 respectively, have each the services of one inspector under the control of the medical officer, St. Marylebone and St. Pancras, with their widely extended areas, and with populations respectively of 163,000 and 211,000, have each of them only two; and the services of two half-inspectors are available for Greenwich with 97,000, and Shoreditch with 136,000 inhabitants! In some

districts, viz., Shoreditch (which has declined to take up the Sanitary Act, 1866), Streatham and Putney, the sub-inspectors engaged during the prevalence of cholera, under the orders of the Privy Council, have been discharged. In Hampstead, Wandsworth, Clapham, and Battersea, one of the two then engaged for each sub-district has been retained for a time; while, in Camberwell and in Chelsea, the local boards have had the good sense to retain the whole staff of inspectors, a measure which is producing the most satisfactory results. In Chelsea, Dr. Barclay informs me, the inhabitants have already discovered that the removal of nuisances by the vestry officials is a reality, instead of a sham, as has too commonly been the case when ordinary dustmen have been charged with its execution.

As regards the performance of the work assigned to them, one great outstanding fact stamps the character and spirit of the Metropolitan Medical Officers of Health. Their union—for most of them belong to it—in a society which meets weekly for discussion and interchange of information on all subjects of general and present interest to the health of the community, has made them a power in the State, of so considerable influence, that recalcitrant vestrymen, scandalized at the spectacle of the servants presuming to take counsel together, and to dictate to their masters, have repeatedly threatened them with censure or dismissal. It is very plain that these gentlemen, who, in addition to the fatigues of their daily practice, thus voluntarily undertake so serious an additional burden, in the interest not of themselves but of the public, are thoroughly in earnest in the work they have in hand; and the presumption is strongly in favour of an efficient discharge of the duties of the office, so far as that depends on their personal efforts, and is consistent with the exigencies of private practice. But the officer of health, even if unencumbered with the cares and distractions of an extensive and laborious practice, is neither an Argus nor a Briareus, with a hundred eyes to spy out and a hundred hands to remove the nuisances of his district. The inspector of nuisances is, or ought to be, the right hand of the officer of health, to whose usefulness, if he be backed by the local authority and aided by a thoroughly efficient staff of inspectors, it would be rash to set limits.

If, however, the local authorities, acting as if the officer of health were to be his own inspector, decline to appoint more than one sanitary inspector for districts containing 30,000, 60,000, 80,000, 100,000, 120,000, or even 136,000 inhabitants; if, moreover, they render that one inspector independent of the officer of health, or, acknowledging his partial responsibility to that gentleman, so burden him with other duties that anything like efficient inspection of nuisances becomes an impossibility—what is the conclusion we are forced to draw? Plainly, that, whoever may be in earnest about the removal of nuisances and the improvement of the public health, such local authorities are not so. I cannot better exhibit the full force of the evidence afforded by this table as to the utter inadequacy of the inspection to which many of the most crowded and unhealthy

districts of the metropolis are now subjected, than by quoting the following very instructive passage from Mr. Rendle's paper on "Fever in London: its Social and Sanitary Lessons."

"In the next parish to mine are 8,603 farmed houses, and but one inspector. In May, 1865, according to a return I have, the City of London, St. Pancras, Marylebone, Lambeth, Islington, had each but two inspectors; St. Leonard's, Shoreditch, only one. Of course it is impossible to do the work, and get rid of the fever-producing causes in this way. I have vestry lists of cases for sanitary improvement. With one inspector, who gave part of his time to sanitary work, average of two lists of places requiring work to be done, 31. After the appointment of one additional inspector, average of two lists, 315 cases. Lambeth is now seriously debating on the appointment of two additional inspectors; so is St. Pancras."

It appears, from the returns furnished to me, that the "serious debates" spoken of by Mr. Rendle have issued in the appointment of one more inspector for Lambeth, which has now three to its 176,000 inhabitants, while St. Pancras, with its 211,000, and St. Marylebone, with 163,000, have still only two a-piece. In Islington, however, on the earnest representation of my friend and former colleague, Dr. Edward Ballard, the able and energetic officer of health for that district, two have lately been added. In London proper, including "East London, West London, and London City," of the Registrar-General's Summary, there are eight, of whom five look after the town districts, and one takes charge of the shipping, while two are set apart for the inspection of meat, slaughter-houses, and common lodgings, the whole staff being entirely under the direction and control of so accomplished a chief as Dr. Letheby. Whitechapel is also provided with four inspectors, under the able superintendence of my friend Mr. Liddle. Bethnal Green, Bow, Hackney, Limehouse, Poplar, St. Giles and St. George's, Bloomsbury, and St. James's Westminster, have each three, though in Limehouse they are burdened with many other duties, and in several other districts their time is chiefly occupied about the streets and roads. Of Camberwell, with its four, and Chelsea with its seven inspectors, I have already spoken. The latter is, in this respect, the model district of the metropolis, for while some of the outlying sub-districts, with extensive areas and rapidly growing populations, have one inspector to from 4,000 to 9,000 inhabitants, it alone has one inspector to every 9,000 of its population. With such a staff it is not wonderful, as Dr. Barclay expresses it, that nuisances are not only inspected but removed; while Mr. Rendle's experience shows that with one—or a part of one—inspector to a population of 55,000, the apparent freedom from nuisances arises from their not being looked for. The excellent practical result of this policy in whitening the outside of the sepulchre, while the "dead men's bones and all uncleanness" are festering within, is well understood and acted on throughout the country. It is, I am informed on unquestionable authority, a common practice for local authorities throughout England to appoint a

relieving officer inspector of nuisances for an extensive district—his duties as a poor-law official being more than sufficient to occupy his whole time—and to give him a few pounds at Christmas, in consideration of his important services in hiding from the public gaze those evils against which he is supposed to wage a war of extermination. I have already hinted that one of the most ingenious devices for neutralizing the influence of the officer of health is to make the sanitary inspector wholly, or in great part, independent of his control. I invite special attention to the fact that in not fewer than fifteen districts or sub-districts of the metropolitan area, this most faulty arrangement prevails. When such are the relations between them, it depends entirely on the inspector whether he shall co-operate heartily with the health officer, or treat his wishes and suggestions with systematic neglect. It is difficult to imagine a system more likely to produce a dead lock in the working of the sanitary machinery than this.

I very much regret that, owing to the absence of a full return from that district, I am unable to complete this valuable and suggestive table by filling in the number of inspectors employed in the extensive and densely populated parish of Mile End Old Town. Woolwich, it appears from the Registrar-General's summary, is still without an officer of health. I conclude, therefore, that the sanitary concerns of its 47,363 inhabitants are still in a double sense *overlooked* by a single officer, who is supposed to be at once surveyor and inspector of nuisances.

Before dismissing the sanitary arrangements of the metropolitan district I must offer a few remarks in reference to the salaries paid to the medical officers of health. These vary from £50 to £600. It is a fact worthy of special record, that not less than eight out of forty-seven able and highly educated gentlemen receive £50 of annual salary for discharging the duties of the highest sanitary office under the local boards of this great metropolis! The salary of one of these gentlemen, and that of another in a neighbouring district, were originally £75, but were reduced to £50. The former is still on the reduced allowance, while the latter has been lately reinstated in his original salary. Yet another, with the oversight of a population of 30,000, spread over an area of about 5,000 acres, receives seventy guineas (£73 10*s.*) for a year's labours. So that ten out of the forty-seven medical officers of health of the metropolitan district are at this moment in receipt of salaries at and under £75 per annum! The grand total expended annually on officers of health in this vast capital, with property assessed at an annual value of above fifteen and a quarter millions, is under £8,000. The average salary of the whole forty-seven is £168 16*s.* But deducting six who receive from £300 to £600, and whose united salaries amount to £2,250, the average annual remuneration of the remaining forty-one is exactly £139 16*s.* 7*d.* In Bethnal Green and St. Martin's-in-the-Fields, sums of £150 and £105 respectively have been voted to the officers of health for their valuable services during the late epidemic

of cholera; but a proposal recently made to vote £100 to my friend, Mr. Lord, for his labours during the late outbreak of cholera at Hampstead, was negatived.

But it is not only the salary of the officer of health that is dependent on the goodwill, or the whim, of the local board. He holds his office during their good pleasure, and the very efficiency with which he performs his duties may be an unpardonable sin in the eyes of a majority of his masters. His statements of fact may touch the interests of some, his suggestions of remedies may excite the displeasure of others, his unwelcome enunciations of great principles may create a general commotion; and if the soundness of his position cannot be assailed by reasoning, passion may suggest—as it has before now suggested—a reduction of salary, or a threat of dismissal, as likely to bring the offender to his senses. Even when no such unseemly exhibitions of temper are made, the simple plan is to let the report and suggestions of the health officer lie unheeded on the table. It would be curious and instructive to know how often the valuable results of long and laborious inquiries have thus been quietly shelved, to the detriment of the public, and in defiance of the intentions of the legislature. I am well aware that in some—perhaps not a few—instances, a very different spirit prevails, and the local authority gives a hearty support to its officer of health. But the undoubted fact that it is often otherwise proves the absolute necessity of a change of measures, if our sanitary progress is not to be indefinitely checked by the passive resistance of ignorance and unreasoning prejudice. What these measures are I defer pointing out, until I shall have given a summary of the evidence I have received from many large towns in England, and from a few in Scotland and in Wales.

I have received returns from 59 towns, with populations varying from 8,000 to 483,000, seven only having less than 20,000, and thirty-one having from 40,000 to 483,000 inhabitants. Indeed fourteen of the latter group have above 100,000, and two more respectively 97,800 and 96,800 inhabitants. It will be seen, from these figures, that, though many towns from which I could have wished to obtain information do not appear in my tables, those which are contained in them include a very large proportion of the principal towns of the kingdom, and give a fair representation of our actual sanitary condition. Of the entire number 51 are in England, four in Scotland, and four in Wales. The best guarantee I can give of the trustworthiness of my information is to record the names of those gentlemen who have so kindly furnished it.

Town.	*Reporter.*
Aberdare.	Mr. David Davies, O. H.
Aberdeen.	Dr. Ogston.
Bath.	Dr. R. W. Falconer.*
Birkenhead.	Mr. C. G. Mott, chairman of Health Committee, and Dr. M. K. Robinson, late O. H.

Town.	*Reporter.*
Birmingham	Dr. Alfred Hill, Borough Analyst, through Mr. Watkin Williams.
Bradford	Clerk of Board of Guardians, through Mr. Wm. Dunlop.
Brighton	Mr. J. Cordy Burrows.*
Bristol and Clifton	Mr. David Davies, O. H., through Dr. Henry Marshall.
Cambridge	Dr. P. W. Latham.
Canterbury	Dr. Alfred Lochée.
Cardiff	Dr. H. J. Paine, O. H.
Carlisle	Wm. B. Page, through Dr. Goodfellow.
Cheltenham	Mr. H. W. Ramsey and Dr. Wilson.
Chester	Mr. John D. Weaver.
Chichester	Dr. Tyacke.
Derby	Dr. Wm. Ogle.
Devonport	Mr. Paul W. Swain.
Doncaster	Mr. Francis C. Fairbank, O. H.
Dundee	Dr. Robert Cocks.
Edinburgh	Dr. Littlejohn, O. H., through Dr. Warburton Begbie.
Exeter	Mr. P. C. Delagarde.
Gateshead	Dr. Wm. Robinson, O. H. through Dr. G. H. Philipson.
Glasgow	Dr. Wm. T. Gairdner, O. H.
Gloucester	Dr. Washbourn.
Greenock	Dr. Wm. J. Marshall, through Rev. John McFarlan
Grimsby	Mr. H. M. Leppington.*
Halifax	Through Mr. W. Dunlop, of Bradford.
Hastings and St. Leonard's-on-Sea	Dr. Blakiston, F.R.S.
Hereford	Mr. C. Lingen.
Hull	Dr. Henry Munroe.
King's Lynn	Dr. John Lowe.
Leeds	Dr. M. K. Robinson, O. H., late of Birkenhead.
Leicester	Dr. John Barclay, and Mr. Moore, O. H.
Lincoln	Clerk of Local Board, through Mr. R. S. Harvey.
Liverpool	Dr. W. S. Trench, O. H.
Maidstone	Dr. John W. Woodfall, J.P.
Manchester	Sanitary Association, through Mr. Arthur Ransome.
Merther Tydfil	Mr. Thomas J. Dyke, O. H.
Newcastle-upon-Tyne	Dr. G. H. Philipson, and clerk of Public Health Committee.
Newport (Monmouth)	Dr. Benj. Davies, O. H.
Northampton	Dr. John M. Bryan.
Norwich	Mr. Wm. Cadge.
Nottingham	Dr. Tindal Robertson.
Oxford	Dr. H. W. Acland, F.R.S.
Paisley	Dr. Richmond, O. H., through Dr. Wm McKechnie.
Plymouth	Dr. Cookworthy, and Mr. J. H. Eccles.
Portsmouth	Mr. H. Burford Norman.
Reading	Mr. T. L. Walford, O. H., through Mr. George May, Jun.
Salford	Sanitary Association, through Mr. Ransome.
Sheffield	Dr. John Charles Hall.
Shewsbury	Dr. Styrap.
Southampton	Dr. Wiblin.
South Shields	Mr. Leonard Armstrong, through Dr. Philipson.

Town.	*Reporter.*
Stafford	Dr. Henry Day.
Sunderland	Dr. Yeld, O. H., through Dr. Philipson.
Tynemouth	Mr. Procter, chairman of Sanitary Commissioners, through Dr. Headlam Greenhow.
Wolverhampton	Mr. E. J. Hayes, Town Clerk.
Worchester	Mr. H. W. Carden.
York	Mr. W. D. Husband.*

Of the fifty-nine towns here enumerated eighteen only have regularly appointed and permanent officers of health. In five others appointments have lately been made under pressure, but only for periods of two or three months, and with temporary salaries attached to them. I place these towns, as giving no guarantee for the permanence of their present arrangements, in a separate group (A. Table II.) Group B again represents those local authorities who have, some of them many years ago, others very recently, "put their hands to the plough and are not looking back." A glance at the column which tells when the office was instituted is in itself very instructive. Of the twenty-three towns included in both groups, nine had officers of health before the commencement of 1864, while in eight of the remaining fourteen they were first appointed between April and August, 1866. So true is it that great epidemics are epochs of sanitary development, the threatened visitation of cholera having been the efficient cause of almost all of the recent appointments. But in some of these towns the development is marked apparently by a hesitation which bodes ill for the permanency of the recent reform, and certainly by a notable amount of caution and thriftiness—virtues which are supposed by some to have their favourite abode to the north of the Tweed, but which seem to flourish well in some parts of England. For instance, Lincoln, Maidstone, and Oxford, moved solely by the fear of a visit of the cholera, have each appointed an officer of health for three months; Maidstone, as if to remind him that he is a tenant-at-will, at a salary of 10s. 6d. a day, Oxford at fifty guineas for three months' service, while Wolverhampton, more openhanded, rewards two months' hard labour with £50. Lincoln and Reading, on the other hand, cannily decline to commit themselves by fixing any salary at all. The meaning whereof might be interpreted in all these cases to be, that the departure of the cholera will be the signal for a retrogade movement, and a contented subsidence into their former blindfold security—and dirt. But Dr. Acland writes to me words of good and hopeful augury concerning Oxford. After mentioning various evils which call loudly for redress, *e.g.* the deficient drainage, the pollution of rivers by sewage, and the insufficient water supply, he proceeds:—

* These four gentlemen, eminent in their profession, have all held the office of Mayor in their respective towns, with the sanitary condition of which they are thoroughly conversant.

"But all these and many other evils, such as whole streets with cesspools and wells adjoining, will now be abated. After many years' battling, public opinion is aroused, and the Sanitary Act has come just in time to clench its decisions. The Local Board has been this summer very active. Disinfectants have been largely applied in all directions during this summer by the medical officer Dr. Child, under the advice of Professor Rolleston. I make no doubt, but that in a few years, with the help of the Sanitary Act and with the co-operation of the university and the city, all that is to be desired will be effected. But it has been a tardy process here as elsewhere." All honour to those—foremost among them Drs. Acland and Rolleston—who have fought the long battle. Let us hope that the tardy victory is near, but act as if it were still far distant. So likewise in regard to Wolverhampton, respecting which I have received full and interesting details from Mr. E. J. Hayes, the able and judicious town clerk, to whom, if only he were armed with despotic powers, one would gladly see entrusted the sanitary organization of the chief town of "the black country." Nowhere are the defects of our health laws more clearly or succinctly pointed out than in his letter to Sir George Grey, dated 15th Sept., 1865, and printed nearly entire by Mr. Hole in the appendix to his work.* And with a view to the removal of the nuisances which abound in Wolverhampton, and the adoption of comprehensive measures of sanitary reform, a searching inquiry is about to be instituted (6th Oct., 1866), "through the aid of a staff of gentlemen visitors, in order to procure a 'sanitary house-to-house return' upon the important questions of overcrowding, water-supply, drainage, ventilation, and other matters." The schedule printed for the use of the visitors is so complete and so instructive a document, that I would fain have availed myself of the permission spontaneously given me by Mr. Hayes, and reprinted it for the guidance of those who elsewhere are endeavouring to promote the health and wellbeing of their respective neighbourhoods.

I am indebted to my friend Dr. Fleming, of Birmingham, for a copy of the *Birmingham Daily Post* (June 21, 1866), which contains a most valuable and striking article on the death-rate in the various towns of the black country, and enables me to add some information, which I had almost despaired of obtaining, regarding their sanitary condition. If this, the ninth of the series, be a sample of the other articles, I would earnestly suggest their publication in a separate form, as an important contribution to our public health literature. "Here," writes the reporter, "is the average death-rate of the several towns named, for the years 1851-60, with their mean population and gross mortality." I add another column, shewing which of them have, and which have not, officers of health.

* "Homes of the Working Classes, pp. 190, 195."

——	Officer of Health ?	Population.	Deaths.	Ten Years' average Death-rate per 1,000 living.
Wolverhampton	Yes.	52,442	16,195	30·88
Dudley	No.	41,468	10,999	26·52
West Bromwich	No.	38,193	10,421	27·28
Tipton	Yes.	26,871	7,183	26·73
Walsall	No.	25,804	6,713	26·01
Bilston	No.	23,945	7,311	30·53
Willenhall	No.	21,299	5,663	26·58
Wednesbury	Yes.	18,124	4,628	25·53
Oldbury	Yes.	15,118	4,091	27·06
Darlaston	No.	12,100	3,672	30·34
England and Wales				22·24
Birmingham				24·90
These ten Towns.....				27·74

One or two remarks in reference to this table. There was no officer of health in Wolverhampton when this account of these towns was published; and here is the report of Oldbury:—"It is in a filthy condition—has no sewerage, keeps pigs, hugs a pestilential brook, and empties its privies into public places. *It has a medical officer of health, whom it is trying,* after a nine months' trial, *to get rid of.*" West Bromwich "has a bad supply of water, has not yet banished pigs; and *it buries its dead in the centre of the town!*" Bilston, famous in the annals of the cholera, both in 1832 and 1849, has now a death-rate "within a fraction as large as that of Wolverhampton, exceeding West Bromwich by three, Dudley by four, and all England by eight. Its lower quarters reek with abominations." "Tipton is the model town of the Black Country. It is naturally the worst situated for health in the whole district. Yet its death-rate exceeds Dudley only by a few hundredths. The reason is that it has a complete system of deep sewerage and a medical officer of health, and is wonderfully well looked after sanitarily." As regards the populations, again, the numbers, it will be seen, vary very remarkably in the different tables. Thus, in Table II, group A, the population of Wolverhampton is stated, according to the Municipal Corporations' Directory, at 63,985 in 1866; whereas it is stated by the Birmingham reporter as 52,442; and in the table from the General Register Office (Table IV.) as 126,902. This last, as explained in the *Daily Post*, "deals only with registrars' districts." What appears as Wolverhampton includes—besides the town of Wolverhampton—Bilston, Willenhall, Wombourn, Kinfare, and Tettenhall; including, doubtless, "a larger proportion of healthily than of unhealthily-housed population." It appears, however, from the small

death-rate for the five years 1860-65, in the Somerset House Table IV., that there has been a marked improvement during that period over the whole registration district, though, in the absence of the returns from the sub-districts, we cannot tell where that improvement has been greatest.

This writer's summary of results gives in few words a striking picture of the actual condition of this important cluster of towns. "But taking the Birmingham average (24·90) for the black country towns, and adding the three lives already arrived at," (by allowing a larger mortality for the much larger population of Birmingham,) "it would appear that ten persons in every thousand of the inhabitants of these towns, die from preventable causes. Nor is this to be wondered at, when we consider that only three of them (including Walsall) have any system of sewerage: that only a like number have a medical officer of health; that only one (Tipton) has both; and that as to one of those which have a system of sewerage (Bilston), the town is shamefully neglected. It seems a dreadful thing to contemplate that, while the black country towns are on the whole healthily situated, and while their trades are not in the main injurious to health, their death-rate should still furnish something like *five* per thousand to swell the general rate of the rural districts, which stand at something like 18." Dr. Julian Hunter mentions,* as an indication of good intentions, that "the byelaws of Dudley provide for the duties of an officer of health, should one be appointed," and that "the duties are described at considerable length." Of Swansea also he reports (p. 189) that, "they had formerly the services of an officer of health, but on his resignation some years ago, the appointment was not filled up. The services of this officer were much valued, and regret was expressed by some of the inhabitants that the office had been abolished."†

The aggregate yearly amount expended in payment of medical officers of health by the 18 towns in group B., with their 2,057,561 inhabitants is £3,612 12s. giving an average salary of £190 2s. 9d. But, as £2,350—or nearly two-thirds of the total amount—is made up of the salaries of *four* of the nineteen, there remains to be divided among the other fifteen £1,262 12s. which gives an average of £83 3s. 3d.! Or if we deduct £2,750, which represents the salaries of *six* of the nineteen, the remaining thirteen have a miserable

* Eighth Report, &c., p. 181.

† In answer to inquiries recently made, (April 1867), I find that Oxford, Reading, and Wolverhampton have all discharged their officers of health; Maidstone, I believe, has done likewise: Lincoln alone retains her medical adviser, but without a fixed salary, preferring to pay him by the job, or as they more euphoniously put it, according to work done by him! So then we have medical officers of health in 19 out of 59, or, if we add the other nine black country towns, in 22 out of 68 large towns in England, Wales, and Scotland. I find also that, owing to the illness of the gentleman who undertook the organization of a staff of visitors, the house to house visitation in Wolverhampton has been delayed, though not abandoned.

residuum of £862 12s. to be divided among them, giving to each an average salary of £66 13s. 8d. But this is not the whole truth, for the variations are much greater than in the metropolitan district. On the one hand, the good town of Aberdare is not ashamed to offer twelve guineas annually, which means five shillings a week, or eight pence halfpenny a day, for looking after the health of 35,000 inhabitants. Nor does Paisley blush to give £20, or seven shillings and eight pence of weekly pay, for attending to the sanitary interests of 48,000. On the other hand, Liverpool has shown that it appreciates and knows how to reward ability of the highest order, by lately increasing Dr. Trench's salary from £750 to £1000 per annum. It would be interesting to know which of these masters is the more exacting. Most likely, judging from ordinary experience, those who reward their faithful servants with half the pay of a common day-labourer. Alongside of these beggarly allowances, let me place the following extracts as to "the duties and qualifications of officers of health," from the "Instructional Minute of the General Board of Health," dated December 20th, 1855:—

"He will make himself familiar with the natural and acquired features of the place, with the social and previous sanitary state of its population, and with all its existing provisions for health;—viz., with the levels, inclinations, soil, wells, and watersprings of the district; with its meteorological peculiarities; with the distribution of its buildings and open spaces, paved or unpaved, of its burial grounds and lay stalls; with the plan of its drains, sewers, and water-supply; with the nature of its manufacturing and other industrial establishments; with the house-accommodation of the poorer classes, and the facilities afforded them for bathing and washing; with the arrangements for the burial of the dead; and with the regulations in force for lodging-houses and slaughtering-places, for the cleansing of public ways and markets, and for the removal of domestic refuse. * * * He will invite communications relating to the sanitary wants of the district, * * * take the best means in his power to become acquainted from week to week, and, in times of severe disease, from day to day, with the deaths and sicknesses in his district; and he will inquire to what extent they have depended on removable causes. With the assistance of such officers as the Local Board may empower him to direct and superintend, he will without intermission see to the wholesomeness of his district; * * * inquire as to the cleanly, wholesome, and weatherproof condition of houses; * * * examine from time to time the drinking-waters of the place, and observe whether provisions are offered for sale in any damaged and adulterated state that is hurtful or illegal. He will occasionally visit all burial-places, * * * and will habitually observe the slaughtering-houses of the district, and other industrial establishments which are liable to emit offensive (especially animal) effluvia. He will report to the Local Board weekly, annually, and at such intervening times as may require it."

"For the proper performance of these duties, special qualifications

in science are required. These lie in pathology, including vital statistics, and in chemistry, with natural philosophy:—

"in *pathology*, because this science implies an exact study of the causes of disease in their relation to the living body,—a study of what they are, and how they act, and why they seem to vary in operation:

"in *vital statistics* (properly a section of pathology), because, by analysing the composition of various death-rates, and by learning how the pressure of particular diseases differs under different circumstances of climate, season, dwelling, age, sex, and occupation, definite standards of comparison are gained, without which the officer of health could not estimate the healthiness or unhealthiness of the population under his charge:

"in *chemistry* (including the power of microscopical observation) because without such aid there can be no accurate judgment as to impurities of air and water, dangerous impregnations of soil, or poisonous admixtures in food * * *:

"in *natural philosophy*, because many nuisances are traced, and many questions as to ventilation and over-crowding are answered by its laws; further, because by its aid the officer of health studies the atmospheric changes, and learns the climate of his district—important steps in proceeding to speak of its diseases; and finally, because natural philosophy in conjunction with chemistry renders him competent to report on many manufacturing processes alleged to be hurtful to health, and on the sufficiency of such means as are employed to reduce the evils ascribed to them."

And all these accomplishments—embracing more than half the circle of the sciences—for five shillings, or seven-and-eightpence a-week! "Admirable Crichtons," it would seem, are to be had cheap nowadays. But Aberdare and Paisley at all events allow their officers of health to engage in private practice, and, by the salaries which they give them, virtually tell them that their sanitary duties need not occupy more than a fraction of their time. It is not always thus—witness Southampton. The story of the sanitary achievements of this prosperous and rapidly-growing seaport is far too instructive to be dismissed with a passing allusion. Southampton was one of the first (having been anticipated only by Liverpool and Leicester) to appoint a medical officer of health—the office having been instituted in 1850, when that admirable and much enduring public servant, Mr. Francis Cooper, was chosen as officer of health and sanitary inspector (the latter being the genteel designation of an inspector of nuisances), with the modest yearly salary of £150. Most likely he would not have undertaken such laborious duties for so inadequate a remuneration, had he not been permitted to devote to private practice the remnants of time that were not absorbed by official engagements. If so, he was not long of discovering how incompatible with private practice was the fearless denunciation of abominations, in the maintenance of which some of his employers in the Town Council had a vested interest; and at length, in the ruin of his practice, which might possibly have been

improved by a judicious reticence, he found how expensive it is to keep a conscience. And if, at the outset, he expected that a zealous discharge of his duties would soon secure for him an increase of salary, he must have been cruelly disappointed, for it was not till he had toiled for thirteen years, that his salary was raised to £200. In the autumn of 1865, as all the world knows, Southampton was visited with "an outbreak of cholera, and" I quote Dr. Wiblin's words, "poor Cooper's great energies were taxed beyond endurance. He was called to every form of nuisance that existed in the town; he had to appear before magistrates to give evidence to prove that stinks and abominations did actually prevail, although neither he nor they could remove the most formidable and pestiferous privy abominations which abound here. Borne down by the multiplicity of his duties, and the want of support in carrying them out," he quickly succumbed to an attack of the pestilence, the further spread of which he was resolutely striving to prevent. A clear official homicide; after perpetrating which the Council met and passed a resolution of condolence, which was duly forwarded to his bereaved and sorrowing family. I have not called it a murder, for it was done in ignorance and not with intent to kill; but the ignorance was such as should be accounted criminal; and the heartless treatment that led to the untimely death of so valuable a public officer not only verifies the maxim that "corporate bodies have no conscience," but shows most strikingly the need of an efficient check on the wrongheadedness and parsimony of local authorities. The concluding sentence of Dr. Julian Hunter's report on Southampton * addresses itself to us like a voice from Francis Cooper's grave, and embodies the matured experience of a man who was worried to death in the conscientious discharge of the duties of an underpaid and thankless office. "The inconvenience," writes Dr. H., "of combining the prosecution of nuisances, with private medical practice, as indeed with any private business at all, was almost daily apparent, and Mr. Cooper thought better results would be got by a combination of towns to support a medical officer who should have no other engagement, and who would be entirely free from local influences." How was the lesson improved by the Town Council?

During the prevalence of the epidemic, not only were the Sanitary Committee unbounded in their liberality, and profuse in their expenditure, both on the medical attendants and on those smitten with the pestilence, but the Mayor (Mr. Emanuel) and Mr. Alderman Stebbing were unwearied in their personal efforts, visiting from house to house during sixteen or seventeen hours of the twenty-four, administering to the wants and comforts of the sick, and solacing the inhabitants of the most suffering districts. Then came the question of appointing a successor to Mr. Cooper. It was resolved to separate the offices of Officer of Health and Inspector of Nuisances, and to advertise for a gentleman to fill the first office, who should be debarred from private

* Eighth Report of the Medical Officer of the Privy Council. Appendix, p. 184.

practice, and receive the annual salary of £150! It will scarcely be believed that the post has been accepted on these terms by a highly educated and accomplished gentleman, who is thoroughly up to his work, and discharges his duties (his detractors themselves being witnesses) with singular ability. At the same time, as if in studied and bitter mockery of the medical and other learned professions, the council appointed, as inspector of nuisances, with a salary of £100 a year, "a man without education or any special qualification, and quite independent of the officer of health." If Dr. MacCormack has no respect for himself and for the profession to which he belongs, if he courts a repetition of the insults to which he has been subjected by the Town Council, and if he covets the melancholy fate of his lamented predecessor, he will retain, on its present footing, the menial office he has so injudiciously accepted. Let us note, however, that the mortality of Southampton (see Table IV.), which had increased from 23 to 24 per 1,000 between 1850 and 1861, has declined to 21 per 1,000 during the five years 1860-65. But there is no reason why, with its advantages of situation, it should not show even a lower death-rate.

Happily there is another side to the picture. There are towns scattered here and there throughout the kingdom, in which much has been done by the civic authorities to improve the public health. I need not refer to Croydon, which has been so often mentioned of late years as a model in its sanitary arrangements, except to express my surprise that it has no officer of health. Those who wish for detailed information will find it in an interesting pamphlet, in which my friend, Dr. Westall, has published the results of his ten years' experience as a member of the Local Board of Health*. Nor can I say anything of what has been accomplished in Coventry, Huddersfield, Leek, and Macclesfield, in all of which, especially in Leek, the improvement has been very palpable, as I know of no correspondent to whom I can address myself in these and in many other towns. My space forbids me to do more than supplement the statements of my table by a few brief notices of special circumstances connected with some of the towns enumerated in it.

It will be observed that only *four* towns besides Southampton have engaged officers of health for sanitary work alone. Birkenhead gives £350, Edinburgh and Leeds £500, and Liverpool £1,000 of annual salary. Birkenhead will probably find it a judicious economy to give a more liberal allowance: for though the Sanitary Committee have found, in Dr. Baylis, an able successor to Dr. Robinson made ready to their hands, they may learn, as the demand for health officers becomes greater, that Birkenhead is but a training-school for the rest of England. "In Birkenhead," writes Dr. Robinson, "the authorities delegate to their medical officer of health full power to

* "The advantages to be derived from the adoption of the Local Government Act, as exemplified in Croydon." Ridgway, London, 1865.

act according to his judgment, an advantage of no small moment; for when municipal bodies cripple and thwart their health-officer, his usefulness is seriously undermined and curtailed." I shall speak presently of Dr. Robinson's experience in Leeds.

In the city of millionaires across the Mersey, with its frightful death-rate which has attracted so much attention of late years, the officer of health is and has long been one of the most important of its public men. The respect due both to the late Dr. Duncan and to Dr. Trench for their own high qualities has been naturally enhanced by the signal services they have rendered, in a town where so many of the producing causes of deadly epidemics are at work with an activity and intensity unsurpassed—if even parallelled—in any other town of the United Kingdom. The officer of health is there not only a reality, but a power in the commonwealth. I do not mean to assert that all has been done that might have been done—very far from it—or that the sanitary committee have adopted and carried out all the recommendations of Dr. Trench and his eminent predecessor, and of their zealous fellow-workers, Mr. Newlands, the borough engineer, and Mr. McGoween, the late town clerk, whose loss to Liverpool cannot but be a great gain to Bradford. But the officer of health is in Liverpool recognised by the civic authorities as their official adviser, whose opinion is asked and listened to with deference in all matters relating to the public health; and having proved himself worthy of their confidence, he has been entrusted by them with very large discretionary powers, which he has exercised with great tact and judgment in furtherance of the views of the health committee and the provisions of the sanitary Acts. The problem of the excessive death-rate of Liverpool* is one which concerns the whole nation, and which has been carefully investigated by the "mortality sub-committee," whose report, and the evidence on which it is founded, form one of the most instructive and painfully-interesting volumes that has appeared for many years. "The result of the inquiry (Report, p. ix) is the conviction, supported by a mass of evidence, that the proximate causes of the increased death-rate are intemperance, indigence, and overcrowding; these two latter being generally found in the train of intemperance, although all three act and re-act on each other as cause and effect. . . . The evidence abundantly shows that the vice (intemperance) is alarmingly prevalent among the labouring population, and that its wretched victims and their families sink rapidly into squalid poverty, resulting in overcrowding and its attendant evils. Liverpool has also this peculiarity, that it has a greater amount of unskilled labourers in proportion to its population than any other

* In the table furnished by Dr. Farr (Table IV.), we find the following figures:—

	Death Rate per 1000 *living*:—		
	1841—50.	1851—60.	1861—65.
Liverpool	26	33	36
West Derby	26	23	26

town, for whom employment is uncertain and wages small and irregular." It should also be remembered that multitudes of its comfortable and opulent citizens reside not only out of Liverpool, but out of Lancashire, thus greatly diminishing in Liverpool the proportion of the class among whom the death-rate is smallest, and greatly lessening the death-rate of Birkenhead, Claughton, Oxton, Egremont, New Brighton, &c. I insist very strongly on these important facts, because I have been asked, with an air of triumph—What is the use of your medical officer of health, when, in spite of him, you have such a death-rate? Just so; it *is* in spite of him; but without him, thoughtful men will be disposed to inquire, might not the twenty-five years' average have been forty-five instead of thirty-five? The resolution adopted by the corporation, in accordance with the recommendations of the sub-committee, to spend £250,000 in "breaking up the masses of crowded dwellings by driving thoroughfares through and across them to let in the light and the air," and so to encourage the construction of decent dwellings for the labouring classes, shows a disposition to follow the example set on a much larger scale by the Glasgow authorities, and cannot fail to influence beneficially the health of their constituents.

Dr. Littlejohn occupies in Edinburgh a position exactly corresponding to that of Dr. Trench in Liverpool, and meets with hearty co-operation on the part of the authorities in all his endeavours to improve the sanitary condition of the city, the death-rate of which was in 1859 as low as 21·09, and in 1862 as high as 26·65, the average for five years being 24·15 per 1,000. The advantage of having officers of health set apart exclusively for sanitary work is very manifest in the reports of Dr. Trench and Dr. Littlejohn, which embrace not only the chief causes of excessive mortality, but the death-rate of different ages, seasons, districts, and even streets, indicating the chief haunts of so-called "zymotic" diseases and the measures most likely to be useful in lessening the preventible mortality. It is quite clear that very few gentlemen largely engaged in private practice can command the leisure necessary for fully recording their sanitary experience, and deducing the lessons to be derived therefrom. In his paper "On the Cleansing Operations of Edinburgh," read before the Social Science Association in 1863,* Dr. Littlejohn gives an interesting account of the system which has been in use since 1839, for the immediate removal of all solid refuse, not only from the streets but from all the houses. The inspector of cleansing has under him eight district overseers or assistant inspectors, and 135 scavengers, each of whom has his own beat. The old town and the poorer districts of the new are visited twice, but the greater portion of the new town only once a day; so that "all accumulations of filth are thus prevented for a longer period than a few hours, and the refuse thus collected is sold as manure, so as to yield a revenue to

* *Soc. Sc. Transactions*, 1863, p. 513.

the city." "This mode of cleansing, which needs only the simplest machinery, puts £7,000 per annum into the local treasury," and "from a report presented to the Town Council in 1859, it appears that from Whitsunday 1839 to Whitsunday 1859—a period of twenty years—830,000 tons of solid refuse were collected from the streets and sold for £158,000."

Those who have perused my quotations regarding the condition of Leeds do not need to be informed that Dr. Robinson, in repairing thither from Birkenhead, undertook a task of no ordinary magnitude; and most men would have recoiled from the prospect of grappling with unparelleled privy abominations, piggeries by hundreds, noisome slaughter-houses, the gigantic smoke nuisance, and an average death-rate of 30 in the 1,000. The work has been bravely begun, and the incidents of the struggle will be historic. The long-denounced piggeries were selected as the battle-ground, and Leeds was for some time convulsed with the mighty strife! We have all heard of "learned pigs," but it was reserved for the West Riding of Yorkshire to bring to light in 1866 the new portent of political pigs. Thoroughly alarmed by the decisive blow aimed by Dr. Robinson at their vested rights, the pig-owners of Leeds, with the double view of averting their impending fate, and of turning the tables upon their adversary, formed themselves into a "Pig Protection Society," summoned indignation ward-meetings—at some of which members of the Town Council declaimed in favour of this form of liberty of the subject—and commenced an active canvass for the purpose of turning out from the council all who would not pledge themselves to vote for the dismissal of Dr. Robinson. And when the case came before the sitting magistrates, there was not wanting high medical testimony in favour of the salubrity of pigstyes, for my friend Mr. Nunneley "defied any person to say that the pig was worse than any other animal, and he believed that if it was kept clean it was no greater nuisance than a man. He kept a pig upon his own midden for sanitary purposes, and if anybody would try the experiment, they would find it to be a benefit, as he did." After this opinion—backed by that of Mr. Jessop, who considered that the effluvia from a pig were not more injurious than those from a human being—little wonder that another witness reached the climax by declaring that, after three years' experience, "he believed the effluvia to be more beneficial than otherwise!" Nevertheless, the magistrates, after a second hearing, found that pigs could not be kept in a town without being a nuisance, and a source of injury to the public health, and ordered their removal. The Recorder, however, before whom the cases were brought by appeal, gave an order, not for the eviction of the pigs, but for the daily removal of the manure, for the full enforcement of which a separate inspector would be required for every pig-sty. Still the result has been the extermination of many from objectionable localities, and a great improvement in those which remain. Thus far "the crusade against the pigs."

In three particulars the officers of health in Leicester, Bristol,

and Glasgow agree. They are not required to give up the whole of their time to their sanitary duties; they are all zealous, able, and thoroughly efficient; and they all receive miserably inadequate salaries. Mr. Moore, who has served Leicester faithfully and well for above seventeen years, has £100, and Mr. Davies and Professor Gairdner have each £200 a year. But the authorities, if they pay their officers shabbily, give them their confidence and support in the execution of their arduous and often invidious functions. Mr. Davies holds his appointment, which is a temporary one, under the Town Council as the Board of Health for Bristol, and was chosen by its health committee, who call him their "medical inspector," as they "object to the appointment of a medical officer under the Act." So thorough is the confidence reposed in him, that he has received no instructions, and is allowed to do his work in his own way; any point requiring a professional opinion is referred to him; and the magistrates shew every disposition to forward the views of the health committee and their officer, when proceedings are taken. That these have been often instituted since Mr. Davies's appointment, during the epidemic of typhus in February 1865, will appear from the following instructive extract. "A temporary fever hospital having been erected by voluntary contributions, I insisted on the removal of every typhus patient, or his isolation in such a manner as not to be dangerous to the health of others. All infected rooms were fumigated with chlorine by men under my direction. All infected clothing was destroyed. All privies in the infected district were flushed and disinfected with chloride of lime. New privies ordered to be erected where necessary, only two houses being allowed to use one privy. Every person removing from an infected house was watched for a considerable period. In three months typhus in its epidemic form was eradicated. It was originally introduced here from Ireland in April, 1864. All defective drains were remedied, dirty houses informed against, and cleansed at the expense of the landlords. All pigs that we could find were removed from the city by notice, or where necessary by proceedings before the magistrates. Cases of overcrowding were reported. Nuisances arising from manufactories where injurious to health have been proceeded against, but *much remains* to be done under this head." Mr. Davies's italics shew that on this point he is at one with a writer in the *Quarterly Journal of Science* for October 1866, though he justly complains of the selection (in an article in the number for July) of the mortality returns for a single week in March, when, owing to the extensive prevalence of measles, whooping-cough, and capillary bronchitis, the death-rate of Bristol rose to 40 in the 1,000: a sensational artifice unworthy of a writer in a scientific journal. The truth is, as the writer admits in his October article, that while the death-rate of some very poor and overcrowded localities in the Hotwell Road and the neighbourhood of the basins is high, that of Bristol generally is very moderate, while Clifton is often as low as 6 or 7 in the 1,000. It will be seen from Table IV. that Bristol is one of those towns which exhibit a steadily

decreasing death-rate during the last 25 years, while that of Clifton is rather on the increase.*

Still, beyond a doubt, Bristol neither looks nor smells wholesome. The odours that greet the stranger on his arrival, or while walking the streets, from all sorts of factories, but especially from slaughter-houses, tanneries, bone-boiling and tallow-chandlers' establishments, and from the fœtid waters of the floating harbour, give evidence the reverse of welcome how much room there is for improvement. Mr. Davies does his part by keeping a daily journal of his own work, which is read every week to the health committee; and by meeting his inspectors every morning to receive their reports and give his instructions. What he has done for the prevention of the spread of cholera, and with what signal success, is well known in Bristol through the public prints, and by the rest of the world through the deeply interesting article of Dr. W. Budd on "The Asiatic Cholera in Bristol in 1866."† Those who know how abundant are his labours and how great his expenditure of time, will more than share his doubts whether he—though assuredly Bristol—is a gainer by his tenure of office on the present terms. His fellow-workers of "The Sanitary Mission," Mrs. Norris and her companions, of whose unwearied exertions during the presence of the cholera he has sent me—and Dr. Budd has also given—a most interesting account, deserve the warmest thanks of their fellow-citizens, and the imitation of others throughout the country.

It is pleasing to know that in Glasgow a similar spirit manifested itself, and under the guidance of Dr. Gairdner has been turned to good account, in prospect of a visit of the cholera, and that hundreds have offered themselves for the work of house to house visitation. Glasgow differs from all the other towns of which I have spoken, in having one principal medical officer of health, and under him four district medical officers (one of whom is surgeon to the police force) as medical assistants or inspectors, who do not receive fixed salaries, but are paid according to the services required of them. Dr. Gairdner informs me that this arrangement answers well, as these gentlemen have an intimate knowledge of the diseases prevalent, and especially of the fever haunts, in the districts of which they have the oversight. Their employment under the health officer is a happy instance of the adaptation of a useful agency, which had been long in existence, to our modern sanitary requirements. Dr. Gairdner, occupying as he does a position of great eminence among scientific men, is naturally consulted and listened to with great deference by the enlightened authorities of the commercial metropolis in Scotland, and may almost be said to wield at will its great resources for the reduction of its very high death-rate; for the eradication, if that be possible, of the endemic typhus, which so often bursts into sweeping epidemics that carry off thousands of yearly victims; and for the radical reform of the loath-

* See p. 48.

† *British Medical Journal*, April 13, 1867.

some wynds and vennals where that indigenous pestilence is bred and perpetuated. For the purpose of improving out of existence these proverbial plague-spots, the authorities have obtained an Act of Parliament,* which "extends over ten years," and enables them to expend £1,250,000 in the purchase of bad property, after the removal of which the ground will be disposed of and new buildings erected, under the admirable provisions of the Police and Improvement Act. An example worthy of imitation by Manchester and other large towns, where the accommodation for multitudes of the labouring-classes is of the worst description. The account drawn up by Dr. Gairdner† of the visit he paid, along with the Lord Provost, Baillie Raeburn, and Mr. Carrick to Paris, in June 1866, is full of interesting and suggestive materials bearing on the reconstruction and proper regulation of large towns. Another document of great public interest, and a most important contribution to our "fever literature," is the Report,‡ by Dr. Russell, of the City Fever Hospital, which was constructed on the most approved plan under the eye of Dr. Gairdner. It embraces many valuable suggestions on diet, nursing, construction, arrangement and ventilation of hospital buildings, treatment of patients, and management of convalescents, besides a thorough analysis of the statistical results. The growing filthiness, however, of the noble river, which is one of the great sources of the wealth of Glasgow, is a standing menace to the health and lives of the vast and rapidly increasing population that lines its banks, and an offensive nuisance for many miles of its seaward course.

Dr. Julian Hunter, in his report on Cardiff,§ remarks that "Dr. Paine has the confidence both of the poor people and of the bench of magistrates, so much that the first seldom require anything more than his advice to move them to whatever is necessary, and the latter are disposed to accept his opinion as conclusive on all health matters which come before them." This wise and prudent counsellor has received £40 a year (in all £520) for the invaluable services he has rendered to the 33,000 inhabitants of Cardiff since 1853. Dr. Davies, (Newport,) is paid, as he justly remarks, "less than any inspector of nuisances," and for the miserable salary of £50 he visits overcrowded houses and lodging-houses, examines unwholesome food and meat, "gives medical attendance to the police, and attends to the ordinary duties very much to the satisfaction of the authorities."‖ Mr. Dyke has commenced his duties with exemplary ability and zeal, for £60 a

* Glasgow City Improvement Act.

† Notes of Personal Observations and Inquiry in June, 1866, on the City Improvements of Paris, &c. Presented to the Magistrates, &c., of the City of Glasgow, 2nd October, 1866.

‡ Report of the City of Glasgow Fever Hospital, from 25th April, 1865, to 30th April, 1866. By Dr. James B. Russell, Physician and Superintendent. Presented to the Magistrates' Committee of the Board of Police, by Dr. Gairdner, and ordered to be printed, 16th August, 1866.

§ Eighth Report, &c., p. 123.

‖ Eighth Report, &c., p. 158.

year. Mr. Barter's services are valued by the corporation of Bath at £25 more than those of the borough inspector; and Mr. Fairbank, after two years of conscientious and very efficient labour, finds that his practice has suffered by his accepting the appointment of officer of health for Doncaster.

Have I not adduced sufficient evidence to establish the necessity of a government check on the appointment, remuneration, and dismissal of officers of health, and the expediency, both for their own interests and for those of the public, of making them independent alike of local caprice and of private practice? But if the need of a central authority to regulate the action of not a few of those who have availed themselves of the permission to institute that office be great, how much greater the need of legislative interference to enjoin the appointment of health officers on those who construe the Act as giving permission *not* to appoint them. Fully alive as I am to the force of Mr. Rumsey's arguments* against having officers of health for small districts, and to the difficulties in the way of a satisfactory adjustment of many small towns and country districts with scattered populations, I cannot see that either the arguments or the difficulties apply to towns with populations of 30,000 and upwards. I do not see why parliament should not at once empower the Privy Council to enjoin their appointment in all such cases, reserving for future decision the question of enlarging the districts by including outlying smaller towns, or neighbouring country parishes, where such a measure might seem desirable. In many cases the registration districts might be at once adopted; and the longer I consider the subject, the more am I inclined to accept Mr. Rumsey's suggestion, that "registration districts are the best areas for local sanitary administration," as promising the most satisfactory solution of this difficult problem.

Of the 36 towns which have no officers of health (Table III.), in only 11 is the population under 30,000, while in 25 it ranges from 31,000 to above 380,000, thus:—

Under 20,000	...	...	...	...	6
Above 20,000 and under 30,000			...	...	5
„ 30,000	„	50,000	...	...	10
„ 50,000	„	100,000	...	...	7
„ 100,000	„	200,000	...	...	5
„ 200,000	...	...	...	...	3
					36

Birmingham and Manchester being two of the last three, with populations respectively of 338,868 and 380,887. In Aberdeen "a medical officer of health should have been appointed some time ago, with a salary of £200 a year, but from some differences between the

* "Comments on the Sanitary Act, 1866," &c. Reprinted from Journal of *Social Science* for October, 1866.

candidates it has been postponed, Dr. Ogston being temporarily appointed." In Birmingham, the assistance of the able borough analyst (Dr. Alfred Hill) is occasionally called in by the Borough Inspection Committee. In Cambridge, the appointment of a health officer has been strongly urged on the sanitary committee, but the proposition did not meet with favour. In Cheltenham, the appointment has been negatived, chiefly on the plea that it would frighten the public. As regards Derby, Dr. Ogle thinks "that perhaps the sort of work that is already being done (house to house visitation and isolation of infectious cases) is as much as the people would submit to, and that it is almost better not to have a health officer until the public feel the necessity more, and would be willing to pay him better. Looking ahead to the time when such officers will be considered at least as necessary to the public *body* as a solicitor is to protect the public *property*, would it not be well that such a one should be the registrar, and the vaccinator" (*query*, the inspector of vaccination?), "and that returns of disease, at any rate from parochial medical officers, should be sent to him?" Devonport has "only just (October, 1866) accepted the Local Government Act, many of the most important provisions of which will no doubt be enforced in the course of the next twelvemonth." In Exeter, fears are expressed—and probably with justice if he were entirely dependent on the local authorities—that he would be under the pressure of the trading classes. In Gloucester, "local prejudices prove too great obstacles." In Hull, some of the parochial medical officers are occasionally employed by the guardians as medical inspectors of nuisances; but there is no proper sanitary organization of the town, which seems (from Table IV.) to be losing the high reputation it gained under the enlightened and active mayoralty of Mr. (now Sir Henry) Cooper, as the death-rate has risen during the last five years, in Hull from 25 to 26, and in Sculcoates from 22 to 24. The authorities in Manchester not only doggedly resist, but actively oppose the appointment of a health officer, and the adoption of other measures calculated to improve the sanitary state of the town. In Northampton, "the matter has been urged on the town authorities, but owing to a false economy nothing has been done." In Nottingham, the inspector, who is a valuable officer and does his work well, naturally considers and represents as needless an officer whose appointment would render his position less important, and diminish his salary. "The town council," writes Dr. Hall (September 25, 1866), "of a town like Sheffield, with 210,000 inhabitants, not having appointed an officer of health is matter of regret. All large towns ought to be obliged to appoint such an officer. Sheffield has not been so healthy for years as during the last four months. The death-rate has been (on an average each month) about 22 to 24 to each 1000, instead of 32 to 34, as it was last year. I attribute this in a great measure to the constant heavy rains having kept our drains and water courses free from filth. It is contemplated to keep our sewage out of our rivers." A reference to Table IV, shows a steadily increasing death-rate in Sheffield

itself, and for Ecclesale Bierlow, a recent decrease from 23 to 21 per 1000. In Tynemouth the authorities "have been deterred by the expense," and in York, says Mr. Husband, "the corporation have long been talking of appointing a medical officer of health, but have made talking serve." With such a situation and great capabilities of improvement, the death-rate of York should not exceed 19 or 20 in the 1000. Mr. Husband, after referring to the Leeds pig battle, asks the pertinent question, "Does not this shew that the medical officer of health should be appointed by Government, and be thus independent of the ratepayers who court the nuisances?" I have reserved Stafford till the last, for the purpose of giving the subjoined companion pictures, in illustration of its sanitary progress.

STAFFORD IN 1849.

"In that town, as I learn through the kindness of Dr. Harland, there is not a single sewer, and the liquid refuse from the houses runs down the channels on each side of the streets. It is common at the poorer houses to have holes dug in the ground to allow the waste and refuse water and drain into it. The town is built on a bed of sand, and water is everywhere found at 8 to 10 feet below the surface, and the whole of the inhabitants have pumps convenient to their dwellings. Dr. Harland says he has no doubt that in many cases the refuse liquid must percolate through the sand and get into the pump water, and he has known some instances in which the filthy surface-water was allowed to get into the wells." Dr. Snow, *Med. Gazette*, N. S., vol. ix. 1849, p. 926.

STAFFORD IN 1866.

"The sanitary condition of Stafford is so little thought of, and all the arrangements connected therewith are so primitive and imperfect, that, without referring to any one else, I can give you all the information you seek for. First, there is no officer of health, and only one inspector of nuisances. Until very recently, this officer was a policeman; *now*, a man who is a cooper and collector of rates is employed, and he is said to discharge his duties in a very inefficient manner. The drainage is all on the surface, and the odour therefrom, at times, disgustingly offensive. The water supply of the whole town is obtained from wells, many of them in close proximity to receptacles of filth; and I am in the habit of saying, partly in joke, but principally in earnest, that the persons living at No. 6 drink the water that is *made* at No. 7."

As regards the lessons to be drawn from Table IV., I cannot enter on the deeply interesting subject of the relation between death-rate and density of population. With the materials before them, many of my readers will doubtless pursue that investigation for themselves. I can but present in the most striking and compendious form, as in the following triple list, the answer to the question, what progress has been made during the last quarter of a century?

In 18 districts, then, out of 58 included in Table IV., we have a decreasing death-rate. In eight, viz., Bristol, Cheltenham, Newport, Oxford, Plymouth, East Stonehouse, Stoke, and Portsea, the diminution, which is notable, has been going on over the whole period; while in ten it has taken place only during the last five years, having previously been either stationary or increasing. Four in the second column, viz., Aston (Birmingham), Maidstone, Newcastle, and York, have maintained throughout uniform average death-rates respectively of 21, 23, 27, and 24 in the 1,000. In eleven, though less than in

Decreasing in 18 Districts, viz.:—	Stationary in 20 Districts, viz.:—	Increasing in 20 Districts, viz.:—
Bristol.	*Aston.*	Clifton.
Cardiff.	** Bath.	Cambridge.
Cheltenham.	Birmingham.	Chester.
Chichester.	* Bradford.	Gloucester.
Derby.	* Brighton.	Grimsby.
Gateshead.	** Canterbury.	Halifax.
Merthyr Tydfil.	** Carlisle.	Hastings.
Newport (Monmouth.)	* Doncaster.	Headington.
Nottingham.	** Exeter.	Hull and Sculcoates.
Oxford.	** Hereford.	Leeds.
Plymouth.	** King's Lynn.	Leicester.
East Stonehouse.	*Maidstone.*	Lincoln.
Stoke Damerel.	** Manchester.	Liverpool and West Derby.
Portsea Island.	*Newcastle-on-Tyne.*	Northampton.
Ecclesale Bierlow.	Norwich.	Sheffield.
Southampton.	** Reading.	South Shields.
Sunderland.	** Salford.	Stafford.
Wolverhampton.	** Shrewsbury.	Worcester.
	** Tynemouth.	
	York.	

* Higher than in 1841-50, since which stationary.
** Lower than in 1841-50, since which stationary.
Those in *Italics* have been absolutely stationary since 1841.

the first ten, it has been stationary during the last fifteen years, at such rates as 21 (Hereford), 22 (Bath, King's Lynn, and Reading), 23 (Canterbury, Carlisle, and Tynemouth), 24 (Exeter), 25 (Shrewsbury), 26 (Salford), and 31 (Manchester); while in three, the death-rate of the last fifteen is higher than that of the first ten years. In four of the third column, viz., Grimsby, Halifax, Northampton, and Sheffield, the death-rate has been steadily increasing over the whole period; while in the remaining sixteen the rise has taken place (in Leicester, Liverpool, and West Derby to a notable extent,) during the last five years.

The general result, then, appears to be that in 18 out of 58 populous registration districts in England and Wales, the mortality is decreasing, while in 49 it is either stationary (in most cases at needlessly high rates) or increasing. But it must always be borne in mind that the mortality of the registration districts does not give us that of the sub-districts. In some instances, as in the case of Wolverhampton, already referred to, it may be too low; in others, as in the case of Clifton, which is made responsible for the high mortality of "some of the poorest and densest portions of Bristol,"* much too

* Dr. Edward Wilson's "Sanitary Statistics of Cheltenham," p. 45; also "The Sanitary Statistics of Clifton," by J. A. Symonds, M.D., F.R.S.E., *Transactions of British Association, &c.*, for 1864, p. 176.

high. One great advantage likely to flow from the appointment of highly qualified medical officers of health in all districts, rural as well as urban, would be the increased accuracy of our information in regard not only to the mortality, but to the diseases, both of districts and sub-districts throughout the country.

After the observations I made on the subject of inspection of nuisances in the Metropolitan districts, my remarks on Tables III. and V. shall be brief. The twenty-three towns in Table II. (to which Table V. is supplementary), with temporary or permanent officers of health, and an aggregate population of 2,220,407, have103 ordinary inspectors or sub-inspectors, *i.e.* on an average one to 21,557 inhabitants. But if we deduct Leeds and Liverpool, their joint population of 710,085, and their staffs of inspectors amounting to 63, there remain only 40 for the other 21 towns, which have a population of 1,510,322, *i.e.* one inspector to 37,758; while Leeds has one to every 10,818, and Liverpool one to 11,498 inhabitants, exclusive of meat and common lodging-house inspectors. We must also remember that in Edinburgh, Glasgow, and Dundee, not only are there special market, slaughter-house and lodging-house inspectors, but the services of the police force, with all the local knowledge they possess, are at the command of the health officer and his men, when necessary. In all, except *six* of these towns, the inspection is reported as being either "efficient" or "very efficient," considering the small number generally employed, and the other duties which too often occupy their time and distract their attention from their sanitary work. In Bristol, for instance, Mr. Davies writes:—"I meet all the inspectors every morning at the office at 11 a.m. Through them I am daily informed of the state of the general health, &c., &c. They are taken as a rule from the detective constables, who are favourably known to the Watch Committee, many of whom are on the committee of the Board of Health. The only qualifications are ability to write a good hand, and a character for general shrewdness and integrity. They are all very able men, and know every body and everything in the city within their duties; and so sharp that nothing escapes them. Being experienced detectives, each has his circle of informants. They work excessively hard, and are not numerous enough."

In the 36 towns in Table III., with an aggregate population of 2,601,165, (or deducting Salford, about which I have been unable to obtain any information, 2,489,760), there are 59 inspectors of nuisances, *i.e.* one to 42,200 inhabitants. I am aware that there is one inspector-in-chief for Manchester, but do not in the least know (though I have made repeated attempts to discover) the number of his staff of sub-inspectors. Rumour asserts that they are very far from efficient, and that nuisances of the most noisome kind are fostered, instead of being summarily put down, by the corporation. But we know from their admirable reports, that the members of the Sanitary Association have voluntarily and gratuitously carried out for many years, both in Manchester and Salford, a system of inspection and a registration of disease and mortality, of unequalled excellence—an example which

ought to stimulate the authorities to a wholesome rivalry, but which seems rather to impress them with the idea that they are thereby relieved from all responsibility. If so, they need to be reminded, that to possess such information as is regularly furnished to them by the Sanitary Association, and not to act upon it, is to incur the responsibility and the guilt of wholesale homicide. If we allow 8 inspectors for Manchester and Salford, we shall then have 67 for the entire population of the 36 towns, *i.e.* one to 38,823 inhabitants. The metropolitan average, which we considered exceedingly defective, is one to 29,100. In 15 of the 36 the inspection is reported efficient, in four tolerably so, in eight doubtful or more than doubtful, and in four decidedly bad. It will be observed that, as in the metropolis, some of the inspectors have other duties to attend to, so that the inspection of nuisances is nearly or altogether nominal. Another point which calls for remark is the frequent employment of the police as sanitary inspectors. It is one thing to select men from the police force for their shrewdness, tact, and local knowledge, and to set them apart for sanitary work alone; and quite another to make the inspection of nuisances a department of police. In the former plan, the one object in view is thoroughly efficient sanitary inspection by men highly qualified, and well remunerated, for that special work; while the chief recommendation of the latter is probably the saving of expense. The services of the police are as a general rule underpaid, and their duties are sufficiently burthensome without the addition of a task which requires for its satisfactory performance the undivided energies of a separate staff. Besides, it is worthy of consideration, whether the identification of sanitary improvement with the force which is chiefly occupied in the prevention and repression of crime, is not calculated to prejudice the minds of many against the health-measures they are employed to put in execution.

The inspection of lodging-houses I have described in some instances (*e.g.*, Bristol and Bradford) as "indulgent." By this phrase I mean that, owing to the great want of proper accommodation for the labouring-classes, the authorities are reluctantly compelled to refrain from instituting proceedings against over-crowding, for fear—or rather from the certainty—of increasing the mischief in other quarters. I can do little more than indicate the evil, which, not in Bristol and Bradford only, but in the metropolis and in most of our large towns, is one of the chief hindrances to any effectual amelioration of the sanitary condition of the masses. In Manchester, the state of many of the registered lodging-houses is positively loathsome. One night, about ten o'clock, I sallied forth with several friends, under the protection of two police officers, and after spending nearly an hour in visiting the low public-houses, and mingling in the crowds of sots and desperadoes that filled them, we devoted a couple of hours to an inspection of a considerable number of lodging-houses. In all of them the atmosphere was foul and stifling, and in many the floors were so encrusted with dirt, that they seemed not to have been washed for months. In single room, six, eight, or ten beds, about two feet apart, contained

as many couples, some of them of both sexes, and not unfrequently a close examination detected one or two little heads protruding from the foot of a bed, the rest of which was occupied by the parents. Some of the children—these, probably, who had not long breathed the polluted atmosphere of these dwellings—looked plump and fairly healthy; but we saw others vainly trying to extract sufficient nourishment from the shrivelled breasts of half-tipsy mothers, while their ghostlike frames, and weird, haggard looks that made one shudder, told a sickening tale of slow starvation, and of long years of suffering crowded into their few months of existence. In the dim light, we often stumbled over heaps of ragged garments swarming with all sorts of vermin, and found that in these police-inspected haunts, where water was as scarce as air, the personal filth was in perfect keeping with the moral pollution of the migratory inmates. One other picture I extract from a deeply interesting report (sent to me by Dr. Marshall) on "Workmen's Houses in Greenock." The following is a summary of a table of sanitary statistics obtained from a house to house visitation, conducted by working men in 1863. "Thirty-two persons are living in apartments having less than 50 cubic feet of air! A supply so scanty, that it is difficult to understand how suffocation does not follow. 542 persons have less than 100 cubic feet. 1,179 persons have under 150 cubic feet. 3,437 persons have under 450 cubic feet, living and sleeping in a condition actually dangerous to life. But the result by far the most appalling is this, that out of 3,749 persons whose cases have been examined, not a small proportion, not a-half, but *the whole*, with the insignificant deduction of 57 individuals, are living and sleeping in habitations in which health cannot be maintained, and in a state the inevitable result of which must be that the springs of life must dry up, and may perhaps entirely fail. This is not the worst of it. Seven hundred cubic feet of air is enough for a grown person, if it be pure; but if it has wandered into the room from between the high gables of back lands (*i.e.* tenements)—if it have passed over noxious ashpits, and over courts and entries destitute of sewerage; if it be already poisoned before it has filtered into the deadly crowded sleeping places, how much is the evil aggravated? Now, it is to be remembered that this is not the picture of the worst parts of Greenock, of dens of misery to which the rest of the dwellings form a contrast; but it is the worst and the best taken together, where working men dwell. It is a faithful picture of how the working men in Greenock live. All the more trustworthy that it is drawn by themselves. . . All that has been said relates to physical health. What is to be said as to moral health, when the overcrowded dwellings do not admit of even a separation between the sexes?" The corrected death-rate was 39·0 in 1863, and 38·0 in 1864, as stated by Dr. Buchanan,* to whose admirable "Report on Epidemic Typhus at

* "Eighth Report of the Medical Officer of the Privy Council." Appendix pp. 209-225.

Greenock" I refer those who desire further information, as to the condition of this populous and thriving seaport of the West of Scotland.

If we multiply by the hundred these two dark but faithful pictures, we shall have some faint idea of the extent to which overcrowding and its accompaniments of indecency, immorality, and disease prevail throughout the kingdom, many rural districts rivalling in unwholesomeness, both physical and moral, the worst parts of our crowded cities, regarding which Mr. Hole makes the following just remarks: * "The statements are not true of one, or of a few large towns, but of all. Whenever the sanitary state of any place comes to be investigated, the same revelations appear. Whether in the large towns of England, Scotland, or Ireland—such as Liverpool, Birmingham, Leeds, Glasgow, Edinburgh, or Dublin—there is the same complaint of overcrowding among large portions of the population, the same mingling of the sexes in one common room, where sleeping, cooking, eating, washing, have all to be performed, the same shutting up of the population in courts and back streets, and the same recklessness of human health and of all that ennobles life and makes it worth having." And the evil, far from being stationary, is yearly increasing. "I could tell you much," writes Mr. Davies from Bristol, "concerning the evils of overcrowding on the morals of the poor, and the re-action of this on the classes above; on the unchastity and incest which arise from it; on the established fact that sound morals have their physical conditions as well as sound bodily health; on the alarming extent of infanticide; on the increase of prostitution; on the growing materialism and separation of classes in large towns; on the evils arising from new modes of trade, &c., &c. By so doing, I should tire both you and myself, for the subject is anything but an inviting one." In Carlisle, the accommodation is "very varied—some very bad, but not nearly so much so as in many of the larger towns." In Chester, "the lodgings are chiefly small and in closely confined districts; they are under the Lodging House Act of 1851; there has been no attempt to start model lodging-houses. The inspector is now re-adjusting the numbers allowed by the Act, so as to reduce their overcrowded state. He proposes to have a minimum allowance of 300 cubic feet for each adult." In Doncaster, "houses are scarce and dear, and lodging accommodation bad and deficient." In Dundee, "very deficient, as in all manufacturing towns." In King's Lynn, "there is an abundance of small tenements at very moderate rents, but as a rule they are too crowded, and ill-ventilated, and not well cared for in the matter of privies." In Leeds, where, as we have seen, the system of back to back houses, and the want of privy accommodation have long been among the leading nuisances complained of, "the question of overcrowding is one difficult to deal

* "Homes of the Working Classes," p. 22. *See* also "The Danger of Deterioration of Race," &c., by John Edward Morgan, M.A., M.D., Oxon; *Soc. Sc. Transactions*, 1865, p. 427. Also in pamphlet form. Longmans, 1866.

with until house accommodation is provided on a more extensive scale than at present. There are a few model lodging-houses of which the working classes avail themselves." In Liverpool, "the lodging-houses, like the ordinary dwellings of the working-classes are, as a rule, very badly constructed. There are only four model lodgings in the town, and these are only capable of accommodating 429 lodgers. The number of registered lodging-houses of all descriptions amounts to 1,250. There are one chief and four sub-inspectors of lodging-houses. Besides the inspectors of lodging-houses, there are four inspectors to discover cases of overcrowding in houses not registered as lodging-houses; they are called inspectors of sub-let houses. During the last year the convictions were, for—

"Overcrowding	25
"Mixing Sexes	14
"Not Registering	27
"Not Exhibiting Tickets	7
"Not Applying for Tickets	4
"Not Washing Floors	12
"Not Sweeping Floors	28
"Not Lime-washing Rooms	7
	"124."

In Maidstone, "during the hop-picking, immense numbers of the lowest population from London resort here and to the district in general, and are packed closely together. At times they suffer fearfully from cholera and other diseases. They are better looked after than they formerly were, and no time is lost in remitting them to their homes when their work is done." In Merthyr Tydfil, "as a rule, overcrowding takes place among the Irish; otherwise rare among the Welsh. Number of lodgers in Welsh cottages two, *i.e.* one bed." Newcastle, as fully detailed in Dr. Julian Hunter's report,* "contains a sample of the finest tribe of our countrymen, often sunk by external circumstances of house and street into an almost savage degradation." The lodging accommodation is very deficient, and in certain localities, especially near large manufactories, they are at a premium, and sub-letting is resorted to in order to reduce excessive rents. Newport (Monmouth) is "very much overcrowded; the accommodation for the existing population is quite inadequate. Eighteen prosecutions were instituted last year for overcrowding, owing to which we suffered," writes Dr. Davies, "from an epidemic, or rather endemic of typhus, which caused 110 deaths; and if Christison's estimate of the mortality from typhus (viz. 1 in 10) be correct, it must have attacked 1,100 people. The 35th section of the Sanitary Act, 1866, has just been adopted in the town at my advice; but much good cannot be done till more houses are

* Eighth Report of Medical Officer of Privy Council, pp. 50, 145, 157.

built for the working classes. To work this section on anything like a large scale would necessitate turning out half our population into the streets. All, therefore, that can now be done is to select some of the worst fever nests, and endeavour to diminish the overcrowding of them. Owing to the difficulty of obtaining land for building, and the high ground-rents demanded, there seems to be no inducement for speculators to build more workmens' houses, which is our greatest want at present." In Northampton there is "a great deal of overcrowding, and in villages, three beds frequently in a room." In Norwich, "the working classes live principally in small cottages, or old tenements, and in rooms; many of the latter are let ready-furnished. A large number of these dwelling-places are *Corporation property, and are of a very inferior description.* The new dwellings recently built and in course of erection on the outskirts of the town are much better. There are only six registered common lodging-houses in Norwich, but there are 613 public-houses (besides beer-houses), nearly all of which receive lodgers, on account of the small number of the registered houses." In Portsmouth, "lodging accommodation for the working classes is very bad; in some other parts of the borough fairly good; but vast numbers of small houses have been built in all parts without any due regard to the making and lighting of streets, paving, or drainage; and many parts of the borough are in a disgraceful condition." In Sheffield, most of the artizans "have a house of their own, and those who live in the suburbs have frequently a garden. The average number of inmates to each house is rather more than five, and many of these dwellings either front the street, or open into moderately-sized yards. There is probably less of the confined alley and narrow *cul-de-sac* in Sheffield than in many manufacturing towns. A good deal has been done of late years to the sewers and surface drains of the town, but still much requires to be done to improve the sanitary condition of the inhabitants. The working classes appear but little aware that they have a duty to perform as well as the authorities," and "do what the authorities may, their efforts will be far from successful, if a nidus of morbific effluvia be permitted to remain in almost every part of the confined courts in which the houses of some of our artizans are placed, and who, on opening their windows with the forlorn hope of purifying their small habitations with the breezes of summer, get instead a mixture of gases from dunghills, ashpits, and night-soil—or what is even worse, because more insidious, from earth which has become impregnated with organic matter imbibed long before, and which now, though comparatively clean and dry, emits a poisonous vapour."* In South Shields "accommodation is difficult to get, old houses and alleys are consequently overcrowded; proceedings rarely taken, though much needed." In the old part of Sunderland accommodation is very limited—"back to back in

* "The Effects of Sheffield Trades on Life and Health," &c., by John Charles Hall, M.D., *Soc. Sc. Transactions*, 1865, p. 384. Also in pamphlet form. Longmans, 1865. 2nd edition, p. 5.

hundreds of instances," says Dr. Julian Hunter, "so arranged that no out-door place could be found where even the public could build privies." In the remaining part of the borough, however, the dwellings are very good. Proceedings have been taken against several parties for overcrowding during the two years preceding Midsummer, 1866.

Mr. Hole gives a most interesting account of what has been and is being done to remedy this alarming defect in our social economy. But while he does justice to the efforts of my old and much valued friends, Mr. Henry Roberts and the Rev. Dr. Begg, I miss from among the names of those he has mentioned as the pioneers of this great national enterprise, the late Rev. Dr. Gilly, of Norham, who nearly thirty years ago, if I mistake not, first drew public attention to the evils of the "bothy" system in the northern counties of England; and the Rev. Charles (now Canon) Girdlestone, whose "Letters on the Unhealthy Condition of the Lower Class of Dwellings, especially in Large Towns," published in 1845, did much to make known the results of the inquiries of the Health of Towns Commission, and to awaken an interest in the efforts then beginning to be made for the improvement of the condition of the labouring classes. I am happy to see, from his recent denunciations (in the *Times*) of the scandalous state of the cottages of agricultural labourers in various parts of the country, that long familiarity with this gigantic evil has not lessened his abhorrence of the physical and moral degradation that directly flows from it, or the zeal that prompts his earnest and persevering efforts for its removal. The following extracts from the returns and other documents that have been furnished to me, will be both interesting and encouraging.

In Aberdeen, "several gentlemen have taken up the subject of houses for the working classes; and there is one company at least now making up as quickly as they can for the several hundred miserable old houses knocked down for railway purposes." In Birkenhead, where "the proceedings hitherto taken under the Nuisances Removal Act, have mostly been satisfactory, there is plenty of good cottage accommodation to be had at present, and all new cottages are erected under regulations similar to those of the model bye-laws. They are regularly inspected by the inspector of nuisances, and are all in excellent order." In Bradford, where the building bye-laws are admirably fitted to secure well-constructed and well-aired dwellings for the labouring population, "the authorities are not able to enforce the law against overcrowding for want of sufficient houses. But two large blocks of houses are in course of erection by means of subscription, but intended to be self-paying. These buildings are designed as models. Accommodation of this kind has been very deficient, and it is hoped that the experiments now being made will lead to more extended efforts." In Gateshead, "the older portions of the town are very bad, the houses generally being ill-constructed, ill-ventilated, and, as a rule, overcrowded. A very large number of houses consisting of two storeys, designed for two families, have recently been built, and the erection of others is going on with in-

credible rapidity; but the demand for these houses far exceeds the supply. The houses consist of two rooms on the ground floor and three on the upper, each tenant having a separate entrance, and one ample yard common to both. The yards are paved and well drained. Some have watercloseta; generally, however, ash-pits and privies. The streets are not less than 40 feet wide. There are seven common lodging-houses in Gateshead, licensed for 206 persons. These are regularly inspected, and the Act strictly enforced. They are exceedingly clean and well kept, and may serve as models to the tenement houses in their vicinity. It is exceedingly rare to meet with a case of infectious disease in them; and during my tenure of office, I have not met with a single case of fever in one of them. Four of them are in Pipewellgate, and although, in my opinion, not what lodging houses should be, yet the rigid enforcement of sanitary measures suffices to prevent infectious disorders, although in the surrounding tenement houses zymotic disease is rarely if ever absent, nor ever will be, until the same law is applied to tenement property as to lodging-houses."

We have already seen what sweeping changes are contemplated by the Glasgow Town Council under their new Police and Improvement Act. Dr. Littlejohn* gives two striking "specimens of what will become of your courts and closes, should proprietors be allowed to run up skeleton houses of the most ricketty description and faulty sanitary construction. Both are inhabited by the very poor; but Birtley Buildings is a refuge for some of the worst characters in the town. Each room is small and overcrowded, the passages are dark and ill-ventilated. On all sides you have vice in its most repulsive forms. With an Inspector of Buildings, armed with sufficient powers, such monstrosities in dwellings for the poor would never have been permitted. Tried by any standard, they are faulty in the extreme. A similar plea cannot be urged in their behalf as may be put forth for older houses in the city—that at first they were inhabited by a better class and were not overcrowded, but have sunk gradually into their present condition. Birtley Buildings and Crombie's Land, on the other hand, are modern structures, built specially for the poor, and with an eye to a large rental; hence the small ill-ventilated rooms, and their great deficiency in sanitary comforts." Such were the worthless dwellings built by unprincipled and short-sighted speculators for the "well-to-do industrious workman," who left them to the occupancy of the dregs of society as soon as substantial comfortable quarters were provided elsewhere. Such are the houses of which 16 have been built in various parts of Edinburgh between 1851 and 1864. Some of these I have inspected with great pleasure; but what interested me even more deeply was the thoroughly successful experiment of Dr. Robert Foulis, who showed how much may be accomplished by a single individual and at a moderate outlay, in providing accommodation for the poorer classes,

* Report on the Sanitary Condition of Edinburgh, p. 33.

who cannot afford to pay the average yearly rent of £6 or £7 charged in the model buildings. "He took a close in the Grass Market,* gutted it, cleaned it thoroughly, and repaired it, in on expensive manner, but in such a way as to afford comfortable housing for the poor. This close, the Warden's Close, No. 139, has thus been reclaimed. It is placed under such supervision, that the inhabitants are taught cleanliness, and should a new comer not be susceptible of the lesson, after a patient trial, he quickly leaves. To this hour the close in question stands out an oasis amidst the wretchedness and filth that is to be met with in other closes of that well-known locality. Had this example been followed by our philanthropic citizens who have subscribed so handsomely to the various building schemes, some of the worst localities in the Old Town might have been renovated, crime and pauperism rooted out from them, and the workmen comfortably housed in situations possessing a good exposure and a healthy site. A more admirable situation for such buildings than the district of the Canongate, can hardly be seen anywhere, whether altitude, exposure, or drainage facilities be taken into account." How much has been done in London in the way both of improving old, and of building new houses, by the various societies which have been established during the last 25 years,—foremost among them the Metropolitan Association for Improving the Dwellings of the Industrial Classes, and the Association for Improving the Condition of the Labouring Classes—is well known to many not only in London but throughout the kingdom. Equally well known and appreciated are the achievements of Mr. Alderman Waterlow and the Peabody Trustees, in the Metropolis; of Mr. Titus Salt, at Saltaire; of Mr. Akroyd and the Crossleys at Halifax; and of the Freehold Land Society, under the direction of Mr. James Taylor, at Birmingham. So gratifying has been the success of Mr. Crossley's efforts during the past 15 years, that he has recently erected another lodging house, and Mr. Hole announces† that, "acting upon the example set by Mr. Akroyd, nine gentlemen constituted themselves a 'Society for the Erection of Improved Dwellings.' As opportunity has offered, they have purchased small plots of land in different parts of Leeds, and erected houses thereon, at prices ranging from £150 to £200 per house, including land and all expenses. By building a lot together, the land, materials, legal charges, architect's commission, and other expenses, were reduced much below what they would have cost if erected by an individual. A working man is thus able to obtain a cottage at cost price. He is expected to provide one-fifth of the purchase money, and the remaining four-fifths is advanced to him by the building society at 4½ per cent. The building society is repaid (both principal and interest) by a contribution equal in amount to what he would ordinarily have to pay in rent for a similar house, spread over a period of thirteen years and a half." ‡

* Dr. Littlejohn's Report, p. 40. † Page 87.

‡ On this subject see "The Prevention of Pauperism, and Suggestions for a Mode of Supplying Cheap and Healthy Dwellings, &c.," by Dr. Hawksley.

In Newcastle-upon-Tyne, a sub-committee was lately appointed by the Public Health Committee, "to inquire into the number of houses in the borough let as tenements; their water supply, ventilation, ashpit and privy accommodation, and drainage; the number of their occupants, and the cubic space allowed for each; to ascertain to what extent, amongst what class, and under what conditions, zymotic diseases have been most fatal during the past twelve months; to consider the cost of such diseases to the community; and report on all these matters, and generally upon the sanitary state of the borough, and the means of improving it, but especially upon the advisability and practicability, under the direction of the corporation, of opening up new streets in crowded districts; for sweeping away old dilapidated and unhealthy dwellings, and of erecting in their stead better and healthier houses and lodging-houses for the labouring classes; the committee to meet daily until the inquiry is complete."* In Plymouth, "some few cottages have been built for the working classes, in the north-eastern part of the town, as a private speculation;" and in Reading, Mr. Walford informs me that the accommodation is "good, and that there is a model lodging-house where the charge is threepence a night." In Worcester, as stated by Sir Charles Hastings,† a company, which was formed to purchase the whole of the worst part of the town, raised a sum of £10,000, effected the purchase, and after having cleared away all the old houses, built houses on the old sites on an improved plan. The change for the better in that part of the town was most remarkable, "though it had not answered in a pecuniary point of view. In place of the miserable, vicious, and degraded population which used to inhabit that locality, they had there a population useful as artizans, setting a good example to the poor, and a credit to the city."

From what has been stated in the foregoing pages, it is clear that, while the proportions of *this* social evil are enormous, the energies of the nation are gradually being directed to its removal, and that the adoption by the legislature of judicious measures of encouragement would tend greatly to stimulate the efforts of local reformers. Any enactment likely to prove beneficial must provide for the granting of government loans on easy terms; must facilitate the acquisition, with a good title, of such low house property as the owners shall decline to improve; and must likewise provide for strict government inspection of all new works undertaken and executed by local authorities or associations. I therefore cordially concur in the following suggestions of Dr. Acland: "I think a government inspector ought always to inspect the execution of works when the government sanctions the borrowing of money; and the inspector should publish his reports and certificates. The

* This sub-committee, appointed in October, has, I believe, presented its Report, which is now (May, 1867) under consideration.

† *Soc. Sc. Transactions* 1860, page 722; and 1864, p. 58.

inspection should be real, and be made during the execution, and before instalments are sanctioned, just as an architect certifies to work done. This will hinder bad work. There is no work which requires more careful execution than drainage works. Improvements in details have been made by Clark, of Carlisle, and others, of which many local contractors and surveyors might be entirely ignorant, but which inspectors with large experience might know and require."

My returns in regard to slaughter-houses are very imperfect, owing to my not having made inquiry regarding them in many of my earlier schedules of queries. But I find that in Aberdare, Birkenhead, Cardiff, Dundee, Edinburgh, Greenock, Newport, Paisley, and Reading, the arrangements are either on the whole or quite satisfactory. In Birkenhead, Edinburgh, Greenock, Newport, and Paisley, as also, I believe in Cardiff, no private slaughter-houses are allowed; and in Aberdare, Dundee, Paisley, and Reading, where they are permitted, notwithstanding the existence of admirably conducted public abattoirs, they are under special regulations, the infringement of which exposes them to heavy penalties. In Newcastle, where "they are all within the town, slaughter-houses have been erected by the corporation since the cattle disease regulations have been in force, adjacent to the cattle market; charge 1s. for each beast slaughtered. The cattle market is seven acres in extent. There is still a large number of slaughter-houses in various parts of the town, in courts and yards, surrounded by dwelling houses." * In Aberdeen, Gateshead, Leeds, Doncaster, and South Shields, the erection of public abattoirs out of town has been, as in London, talked of for some time, and will, it is hoped, soon be carried out, for in some of those towns, as also in Bristol, many of the private slaughter-houses, though licensed, are very offensive. Is it a subject of congratulation, or the reverse, that we are beginning—only beginning—to act in this matter, on the principles so clearly propounded by Sir John Pringle more than a hundred years ago?

We now come to consider the drainage and water supply of these towns:—

TOWN.	DRAINAGE.	WATER SUPPLY.
Aberdeen . .	"Good in the principal streets; either indifferent or altogether wanting in the second-rate and worst streets. A thorough and efficient drainage is being carried out under a recent Act."	Admirable and very abundant. 6,000,000 gallons of the purest water brought into town daily, from a distance of 21 miles, by the New Water Works, in the hands of the Corporation.

* The arrangements in Chichester, as in Stafford, seem to be of a very primitive kind: a cattle and pig market being held fortnightly in the streets; and between 200 and 300 pigs being kept in the city.

TOWN.	DRAINAGE.	WATER SUPPLY.
Aberdare . .	——	"Plenty, and of the best quality; in the hands of the Water Works Company."
Birkenhead .	"On the whole, good."	"Generally abundant and good; supplied from works the property of the town, pumped from wells in the new red sandstone."
Birmingham .	"A very elaborate system of deep drainage, not yet quite completed."	"Very variable to poorer districts."
Bradford . .	"A general system of drainage has been laid down under the Public Health Act, plans having been submitted and approved by the Government officer. The work is being proceeded with as rapidly as possible, the worst parts of the town having precedence."	"Complete throughout the town as far as service by the Corporation is concerned; and officers are making house to house inspection in the poorer districts to see that every house is supplied. Presentment was made to the committee of above 100 houses (recently), which had not taken the supply. Supply enforced under the Public Health Act of 1848, as amended by Local Government Act of 1858."
Brighton . .	"Very deficient. Of 42 miles of streets and thoroughfares, only about 13 have intercepting drains; but a complete system of drainage is now commenced, the cost of which will be, when complete, £200,000."	"Excellent and abundant, from springs a mile from town, dip being from the well to the town, so that no contamination can take place."
Bristol . . .	"Over 100 miles of drains, emptying into a tidal river. 50 miles of those drains made during last ten years, all well ventilated."	"Abundance of excellent water supplied by a private company from the Mendip Hills. Some courts are still short of water, or supplied by pumps of a suspicious character. This subject is now under the consideration of our committee, and some notices have been served on landlords."
Cambridge	"Actual drainage of town good, but principle bad. All into the Cam."	"Abundant and pure; water courses in streets, keeping both them and sewers clean."

TOWN.	DRAINAGE.	WATER SUPPLY.
Canterbury. .	"Just now in a transition state. We hope it may be well done eventually."	"For the poor mainly by taps situated at various parts of the town. For these, however, we are indebted to our forefathers, *i.e.* it is a very old provision."
Cardiff . .	"Now very efficient; commenced in 1855, first system completed in 1856."	"First obtained from river Ely; latterly an additional supply has been obtained from springs connected with the north range of hills, about five miles from Cardiff. Supply to small houses, at 2d. per week, abundant."
Carlisle . . .	"Very good."	"Insufficient and unclean. Obtained from river Eden, which river receives the drainage of several considerable towns above Carlisle; of Penrith, with a population of 7,000 to 8,000; Brampton, 2,000 to 3,000; Appleby and several others."
Cheltenham	"Very good. Above 25 miles of public sewerage in hands of Commissioners, intercepting; but much still in private hands. (See Dr. Wilson's Sanitary statistics of Cheltenham, pp. 8-11.)"	"In a transition state—supplied by water company chiefly from the Chelt; other sources of supply under consideration. Severn rejected, owing to its impurity, containing 28 grains of solid matter in the gallon, 4 of which were organic. Supply to poorer districts, bad."
Chichester.	"Cesspools in a porous, gravelly soil, and surface drainage. Corporation will not undertake deep drainage works."	"From wells sunk in the gravel near cesspools, which pollute them, so that in numerous instances the water is turbid and filthy, yet the people in many cases drink it as long as they can, and then perhaps apply to a neighbour for some that does not smell or taste so bad. It abounds in animalculæ."
Derby . .	——	"Constant and plenty of it, but there is a good deal of pump water used in the old houses."

TOWN.	DRAINAGE.	WATER SUPPLY.
Devonport . .	"Extremely imperfect in many parts of the town; in some absolutely none, except by surface gutters."	"Very good. 24 miles of running stream brings it to the reservoir. It contains a grain and a-half of potash in the gallon; generally paid for by landlords. Kept in tanks or water-butts. Several families depend on one supply."
Doncaster . .	"Good, but bad place for outfall; not into the Don, but into the 'River Don Navigation,' and so to the Trent."	"20 pumps in streets; supply good, but hard water; rest obtained from river Don, which receives the sewage of Sheffield, Rotherham, Masborough, and other towns, containing in all about 300,000 inhabitants."
Dundee . . .	"Perfect."	"The defect in the poorer districts is that the water is not brought into their houses, although wells are contiguous to them. The better class of workers have water in their houses."
Edinburgh . .	"Where completed, excellent. House-drainage in many poor districts very imperfect; in some, impossible. (*See* Report, p. 76-90.) Untrapped gully-holes, and water of Leith, often very offensive."	"No wells allowed to be used. Supply by water company, who are bound by General Police and Improvement Act to introduce water into all houses. In 1863, 31·12 gallons daily for each inhabitant. When the new springs have been added to present resources, the daily supply will be 39 gallons per head."
Exeter . . .	"Every part is completely sewered, but there are legal difficulties in compelling a communication with private houses."	No return. Good, I believe, since 1832, since which water has been uncontaminated by sewage.
Gateshead	"Until the last 18 months, very little more than one-third of the borough was properly drained; latterly, however, drainage works have been pursued with great vigour; expected to be complete or nearly so in a year."	"By Newcastle and Gateshead Water Company; bad and dear, besides very precarious, as Gateshead has no reservoirs independent of those on the Newcastle side of the river; any accident to the pipes crossing the Tyne would deprive Gateshead of its supply. In the poorer

TOWN.	DRAINAGE.	WATER SUPPLY.
Gateshead . . *(Continued.)*	——	parts of the town, where, from want of yard space, it it has been necessary to erect waterclosets, the want of pressure and the dearness are very great evils, and have rendered sanitary progress much more difficult than it would have been."
Glasgow . .	"Generally very good, but into the river, the state of which is very bad."	Admirable, from Loch Katrine; the model of the whole kingdom. Supply constant. Distribution improving yearly.
Gloucester . .	"Good; three-fourths of the city drained."	"Not continuous. One ordinary tap supply to each court in poorer districts."
Greenock . .	"Good main drains in nearly every street. In some streets, the proprietors of tenements have not yet communicated with the common sewers."	"The supply for the poorer districts is by public wells, and confessedly very deficient."
Grimsby .	"Of a temporary character only."	"By Water Works Company. The Local Board of Health have not adopted compulsory powers of supplying the poorer districts, which is much needed, as the wells there are seriously affected by the sewage. The Local Board have issued notices for persons to give information and lodge complaints."
Halifax . .	"Good."	"Abundant in poorer districts."
Hastings . .	"Good and effective, at least in the Health of Towns district, having cost nearly £20,000 a few years ago, but the outlets interfere with the bathing, and occasionally smell badly. To remedy this, the Board have determined to remove the outlets a long distance from the town. The contract is signed for £26,000, and the work is commenced. The	"The poorer districts are well supplied with water."

TOWN.	DRAINAGE.	WATER SUPPLY.
Hastings . . *(Continued.)*	Commissioners of St. Leonard's, are also on the eve of doing the same on the West side for £6,000. The deodorization of the fluid part of the sewage, and conversion of the solid into guano, is about to be tried on a large scale—by heat. Bone dust is added, to supply the deficiency of phosphates."	
Hereford . .	"Good—very good."	"Pretty general, not compulsory, nor unlimited."
Hull . . .	"The east district is well supplied with main drains; the west also rapidly progressing."	"All the districts of the town are well and amply supplied with good water."
King's Lynn .	——	"Constant and pure to whole town, except in the case of many old houses, which are supplied with water that is allowed to run into underground tanks. This water is often rendered impure, from the close proximity of the privy vaults and cesspools. In some instances the former are placed almost on the top of the water tanks."
Leeds . . .	"Exceedingly deficient in many districts; but the pollution of streams is very great."	From the Wharfe; abundant, but much contaminated with the sewage and refuse of various towns.
Leicester . .	"New and good."	"Good and ample for the poor."
Lincoln . .	——	"By water company; poor supplied at a reduced rate."
Liverpool . .	"160 miles of sewers, the cost of construction about £281,600."	"Not constant, but is put on twice daily. The average number of hours during which it is on is from six to eight."
Maidstone . .	"Improving, but our rivers are abominably misused and polluted by sewage and refuse from paper mills, gas-works, &c."	"Better than it was, but to the poor still very deficient."

TOWN.	DRAINAGE.	WATER SUPPLY.
Merthyr Tydfil	"A system of drainage was commenced in November, 1863, and is now in progress."	Under the Board of Health since November, 1861; unlimited supply, only three degrees of hardness, free from organic impurity, for an annual payment of twenty-pence per head. (Report on Sanitary Condition of Merthyr Tydfil for 1863, pp. 14—18.)
Newcastle . .	"14 miles in extent, arterial, into river Tyne; no provision for utilization of sewage."	"Not much to complain of. Reservoirs cover 143 acres, holding 530,000,000 gallons. The corporation pay annually £200 for water, for public grants, urinals, and water closets, and are at present collecting information with a view to proceedings against owners of property who do not provide a proper supply."
Newport . .	"Excellent."	"Constant and plentiful, even in poorer districts."
Northampton.	"No return."	"Not by any means complete in poorer districts, being partly from water companies, and the remainder from wells, all of which when analysed have been found to contain a great quantity of organic and animal matter; quite unfit for drinking."
Norwich . .	"No return."	"To poorer neighbourhood by pumps and taps; is for the most part very good. The landlord is obliged to lay on water to cottages, if it can be procured at the rate of 2*d.* per week."
Nottingham .	"Main sewers made by the Highway Committee; private sewers under Sanitary Committee."	"A stand-pipe in each court, with water at high pressure day and night."
Oxford . . .	"Into the rivers. The Cherwell was, till lately, unsullied by drainage. It is now unfit for bathing."	Intermitting; no reservoirs; question of new works referred to Mr. Bateman, C.E.

TOWN.	DRAINAGE.	WATER SUPPLY.
Paisley . . .	Into the river, which is much polluted by it.	"Good, to all inhabitants alike; from hills to south of town."
Plymouth . .	"For the most part good."	"Intermittent; for *one* hour daily in some parts of the town, and for *two* hours on alternate days in others."
Portsmouth .	"Generally bad, but a thorough system of drainage is being carried out, at a cost of £100,000."	"For the most part in the hands of a water company, and is adequate to all demands. The poorer tenements are not well supplied, as it is left to the landlords, who charge their tenants about a penny a week per tenement, when they put on the water. The supply is practically uninterrupted."
Reading . .	"At present, cesspools—complete drainage about to be carried out."	"Good and constant, at high pressure."
Sheffield . .	"A good deal has been done of late years to the sewers and surface drains of the town, but still much requires to be done."	By water company, from an elevation of 1,200 feet above the sea level, conveyed in iron pipes into the town, very pure, 4 grains only, to the gallon, of mineral and organic matter. (Dr. J. C. Hall, *Soc. Sc. Transactions* for 1865, p. 585.) supply to all parts very good.
Shrewsbury .	"Wretched; into the Severn. About to carry out an extensive system of sewerage, at a cost of £30,000 or £40,000."	"From the Severn for domestic purposes; drinking water from a spring some distance from town. General water supply to poorer districts very insufficient."
Southampton .	"*Médiocre.* After spending about £20,000 sixteen years ago, it is now contemplated to spend £10,000 more."	"Supply ought to be unlimited (from the Itchen), but is extremely deficient both for poor and rich. Engines too small; others of greater power in course of construction. During the cholera epidemic the poor were shockingly neglected; they had not enough to cleanse their persons, much less to wash away sewage, &c."

TOWN.	DRAINAGE.	WATER SUPPLY.
South Shields.	"Pretty complete now."	"Very good; from Sunderland and Shields water works."
Stafford . .	"All on the surface, odour at times disgustingly offensive."	"From wells much contaminated by drainage."
Sunderland .	"A most complete system of drainage."	"Ample, and excellent in quality."
Tynemouth .	"The main drainage is very good, but a large number of houses in the oldest part have neither yards nor water-closets."	"Very deficient both for houses and closets, in the oldest part of the town."
Wolverhampton	"The natural drainage good, but main drainage imperfect. A plan has been approved by the Secretary of State, and a thorough system is in contemplation."	"Ample supply to poorer districts is insisted on."
Worcester .	"Perfect."	"Good to poorer districts."

If the foregoing summary is encouraging, as indicating progress in many of the towns enumerated, surely the tardiness of the operations now in hand is fitted to awaken our astonishment. It is very remarkable that in large towns, such as Aberdeen, Birmingham, Brighton, Canterbury, Gateshead, Hull, Leeds, Merthyr Tydfil, Portsmouth, Shrewsbury, and Wolverhampton, the authorities should only now be carrying out, or about to commence, systematic drainage works; and still more so, that in Chichester, Devonport, Grimsby, Reading, and Stafford, the arrangements are wholly, or for the most part, so primitive that the whole soil and the surface wells are becoming continually more impregnated with organic impurities. The pollution of the rivers, again, by the sewage and refuse of Bristol, Cambridge, Chester, Doncaster, Glasgow, Leeds, Maidstone, Manchester, Newcastle, Oxford, Paisley, Sheffield, and Shrewsbury has become a gigantic evil, towards the removal of which the attention and efforts of sanitary reformers should be unceasingly directed.

As regards water supply, while in some places, as in Aberdeen, Cardiff, Glasgow, Merthyr Tydfil, and Sheffield, the arrangements are perfect, and, while in many others they are very satisfactory, it appears that in Birmingham, Cambridge, Canterbury, Dundee, Gateshead, Gloucester, Hereford, Liverpool, Northampton, Norwich,

Nottingham, Oxford, Plymouth, Southampton, and Shrewsbury, there is either no house-supply at all, or that it is sadly deficient, in the poorer districts. In many of these towns, it will be observed, the poor are dependent on pumps or taps, one being often made to serve for a whole court containing a large population—a most defective and objectionable arrangement. But I question whether any part of any town in England will be found in a much worse condition than a district of Kensington, with a return of which I have been favoured by my friend Dr. O'Bryen. It contains 99 houses, with 302 rooms and 970 inhabitants, who are supplied with hard water from three pumps, but receive the company's soft water, when it is on for an hour daily, from leaking butts and cisterns, in pails or pitchers, in which it is kept standing in the close rooms till it is used. No other supply of soft water is available during the remainder of the twenty-four hours, the water in the cisterns being polluted by the gases from the closets above which they are placed. Seventeen houses in one court have each a closet, but with a very insufficient water supply; while the remaining 82 have 41 closets, a number of them so filthy as to be unfit for use, and only fifteen cisterns and four water butts, containing, after deducting waste, 2,942 gallons—the whole supply, exclusive of pump water, both for domestic purposes and flushing of closets. The entire supply for all purposes to the 99 houses (deducting waste) is 3,611 gallons. The allowance to the 970 inhabitants, at the minimum rate of 15 gallons, should be 14,550 gallons daily. During the prevalence of cholera a few stand pipes were provided, but these have since been removed. It is nearly two years since a committee of the vestry, after very careful examination, gave in their report, recommending the enforcement of stringent measures against the owners, but the vestry, though often urged to act, have as yet done nothing in the way of compelling landlords to provide a sufficient supply of water. The magistrates, when applied to by the vestry to compel landlords to comply with the notices served upon them, have uniformly refused, on the ground that vestries have power, under the Act 25 & 26 Vict. c. 102, to execute the works themselves and recover the costs. Rather than incur the risk, they prefer leaving matters in the disgraceful condition I have described.

In Chichester, Greenock, Grimsby, Northampton, and Stafford, the pump-water, which is consumed by the greater part of the inhabitants, is much contaminated with organic impurities. In Carlisle, Chester, Doncaster, and Leeds, the whole supply is drawn from rivers which receive the sewage of large populations. The case of Doncaster merits special notice. "Our only supply of water," writes Mr. Fairbank, "is from the river Dun; 18, 12, and 11 miles respectively up this river, stand Sheffield, Rotherham, and Masborough, besides many populous villages. Into this river these places all send their sewage, so that our water is well fecalized before we get it. In July, I heard Dr. Letheby swear on the Four Gospels, before the Lords' Committee, that the sewage of Sheffield (a town

containing 216,000 souls) was so far oxidized before it got to Doncaster, that it could do no harm here; so we go on drinking it, and some people rather like it." If so, the tidings communicated to me by Dr. Hall, that the Sheffield authorities think of keeping the sewage out of the rivers, will not be altogether welcome to some of the inhabitants of Doncaster. *De gustibus non disputandum.* But this doctrine of the speedy conversion, by oxidation, of the sewage and refuse of 300,000 human beings, and of multitudes of animals, clean and unclean, into perfectly innocuous material, has a very suspicious look, especially when placed alongside of Professor Frankland's statement,* that even boiling does not destroy the noxious properties of cholera discharges, when these are diffused in water. The oxidation theory may be true, to the extent alleged by Dr. Letheby, but its probable *laissez faire* results are not pleasant food for thought, nor, I apprehend, for wholesome fish.

With a few striking facts in reference to the propagation of infectious disorders, I conclude this too lengthened paper. In no department of our social economy has the liberty of the subject held more uncontrolled sway than in this death-haunted region of epidemic and infectious disorders. From "my lords" of her Majesty's Privy Council, as we have seen, down to the snuggest parish vestry in the land, there seems to be a prevailing disposition, like Izaak Walton with his worm, to "handle them tenderly as though we loved them." The means for limiting their ravages are in our hands; the discovery of the agent that gives effectual protection against the most deadly and loathsome of them all is one of the hygienic glories of England; yet the United Kingdom is the chosen *habitat* of typhus, and the mortality from small-pox is greater in the country of Jenner than in any other country of Europe. We know that the prompt isolation of persons smitten with infectious diseases, and the emptying and cleansing and lime-washing of those dwellings which furnish a steady—often a perennial—supply of such cases, will assuredly prevent their multiplication; yet though in almost every town from which I have received returns, cholera hospitals were being provided, and "disinfectants," such as quicklime, chlorides of lime and zinc, carbolic acid, sulphate of iron, and McDougall's powder, were being liberally used, in only a very few have any systematic efforts been made to limit the prevalence of communicable disease. We have already seen how thoroughly and speedily successful were the measures taken in 1865 to arrest the spread of typhus in Bristol; and in Birkenhead, the energetic proceedings of Dr. Robinson were followed in the same year by a remarkable diminution in the mortality from contagious diseases. In his first report (for 1864), speaking of scarlatina, he says, "means should therefore be devised to check the progress of this epidemic by early isolation of the sufferers; and before the convalescent is again permitted to enter into the society of

* *Times*, Sept. 5, 1866.

the healthy, copious ablutions, together with the use of disinfectants, should be resorted to; and those clothes which cannot be purified by washing, &c., should be exposed to a dry heat of 206° Fahr. The interesting experiments of Dr. Henry and others have clearly shown the value of dry heat as a destroyer of the specific poisons which produce contagious diseases.* The Health Committee of Liverpool, acting under the advice of their intelligent medical officer of health, are taking the initiative steps towards providing a public building for the purpose of washing, disinfecting, and exposing to dry heat the clothes of those who have suffered from contagious diseases, and I trust that, attached to the fever wards about to be built in connection with the Birkenhead union, a similar provision will be made." This suggestion has been acted on. In his report for 1865, he gives the following summary of sanitary operations during the year:—"Pigs were removed from 62 places where the keeping of them was a cause of nuisance to the neighbourhood; 124 privies have been converted into water-closets; 21 pits of stagnant water were drained; 2,451 nuisances arising from obstruction of drains, defective traps, &c., were reported by the inspector, and proceedings taken to remedy the same; 4,827 houses, containing 19,263 apartments, were visited with a view to improving their sanitary condition; 1,043 lime-washing notices were served upon the occupiers of dirty houses, and attended to by them; 25 cellars, used as dwellings, were vacated; 70 overcrowded houses had their numbers reduced; 37 persons were convicted before the magistrates of offences against sanitary laws, and penalties amounting in the aggregate to £18 10s. inflicted." That the sudden fall exhibited in the following table is in some degree owing to these precautions, it is only reasonable to infer.

Deaths from	1864.	1865.
Small Pox	121	37
Scarlatina	81	37
Measles	76	21
Typhus (including Typhoid Fever)	71	63
	349	158

The other towns which have either fever hospitals or fever wards for the isolation of the patients are Carlisle, Derby, Edinburgh, Gateshead, Glasgow, Greenock, Hull, Leicester, Maidstone (at union

* See an excellent paper "On the Disinfecting Property of Heat," in the *Soc. Sc. Transactions* for 1864, by Dr. Shann of York, pp. 556-563.

infirmary three miles from town), Manchester, Newcastle, and, I believe, Sunderland. Liverpool, besides fever wards attached to the Workhouse Infirmary, has another fever hospital available for other classes. In Glasgow, where the enforcement of strict police regulations in common lodging-houses, and the early removal of patients to one or other of the hospitals, have made a decided impression on the endemic typhus, there are not less than five fever hospitals—one at the Royal Infirmary, the City of Glasgow Fever Hospital under the magistrates and town council, and three others under the parochial boards. "There is also a regular service of disinfection and a special washing-house for the clothes of infected persons. This is done without charge, on the order of the medical officer." In Liverpool "a disinfecting apparatus on Henry's principle was erected in the north district, and ready for use in February 1866; another is ordered for the south-end of the town." In his report for 1858, Mr. Moore states that he was led, in consequence "of the rapid extension of scarlet fever, measles, &c., in their respective neighbourhoods, whenever these diseases appeared in them," to institute special inquiries into the state of the 'Dames' schools, in Leicester. It turned out that in eleven of them the cubic space for each child varied from 26½ to 58½, though in only two did it exceed 42 cubic feet. In two, each had only 26½, and in two others 28½ cubic feet, an allowance suggestive of suffocation to the tiny pupils. Since then the dames' schools have been frequently visited, and placed under regulations which are strictly enforced, very much to the advantage of the health not only of the children but of the town. In 1864, when 104 persons died of small-pox, he vainly repeated a recommendation he had previously made, that an institution should be provided for the reception of small-pox cases, which are excluded from the fever-house, and must be treated at their lodgings, with the certain result of an extension of the disease to others in the house and surrounding neighbourhood. In Edinburgh, there is, in the bye-laws for common lodging-houses, a special provision "that in case of fever, cholera, or other contagious, infectious, or epidemic disease occurring in such lodging-house, whether to any lodger or to any other person residing or being in such house, the keeper of such house who shall neglect or omit forthwith to give notice thereof to the superintendent of police, in order that the nature of the complaint may be ascertained, shall, for every such neglect and omission, be liable in a penalty not exceeding forty shillings." The result is seen in the following statement (p. 36 of Dr. Littlejohn's report): "It is certainly remarkable that, of the 103 cases of death from fever (in 1863) not one occurred in these the poorest and most crowded houses in Edinburgh. . . . Of course the overcrowded state of their population renders them the hotbeds of disease in epidemic years, and when cholera and fever were raging, these houses attained an unenviable notoriety. Were not unusual facilities presented in Edinburgh—the seat of a medical school—for the speedy treatment of the sick, and the removal of cases of infectious disease to our noble charity, the Royal

Infirmary, a single case of fever allowed to run its course unwatched in such tenements would spread contagion all sides, and the district mortality would be greatly increased." Such, however, is the case in most towns throughout the kingdom. The general reply to my inquiry as to the isolation and conveyance of persons ill of infectious disorders is, "no attention is paid to the isolation of such patients."

"There is another mode* of mediate communication, the mere mention of which excites astonishment at the apathy that permits the continuance of a practice by which a large amount of preventible disease is occasioned. I allude to the common practice of conveying patients, known to be labouring under or convalescing from highly contagious disorders, in hackney carriages. That this is the mode of infection in cases which every now and then startle the fashionable world, *e. g.* the death by small-pox of a distinguished Italian diplomatist about two years ago (1860), is in the highest degree probable. At a small reunion of medical men the summer before last (1861) in the house of my friend Dr. Cotton, one of the company detailed the following instructive case which had fallen under his notice some weeks before. It was suggested by the mention of the sudden death, from small-pox, of Mr. Henry Gray, of St. George's Hospital. The gentleman in question hailed a cab, and told the cabman to drive to a certain number in a fashionable west-end street. He went in to see his patient, but found his services no longer required. She had died of small-pox. When he came out, the cabman, who had been struck by the closed window-shutters, asked if there was any one ill within? My friend replied in the affirmative, and ordered him to drive to another address. He had given him his fare, and was about to leave, when the man, to his surprise, asked if any one had died in the last house they had been at? An affirmative reply elicited the involuntary exclamation, "Oh! Lord," and the explanation that, on a certain day, having just put down a small-pox patient, he was hailed by a lady, whom he had conveyed to the house where she now lay dead." Was this, I ask, a case of "justifiable homicide?" In my opinion it should be made a felony. A society has been formed in London for the provision of ambulances for infectious cases, and has already been very successful in its operations; but so far as the vestries and local boards are concerned, the enabling clause of Acts 1860 and 1866 may be said to have been quite inoperative. Here is the result of my inquiries as to the arrangements in other towns :—

Aberdeen. "Three litters at call when wanted."

Birkenhead.—"One special carriage for conveying infectious cases was provided some years ago, but another one was added six months ago on account of the approach of the cholera. I cannot learn any case where a cab-driver has been convicted of conveying

* I quote from one of my lectures on medicine, as delivered at the Middlesex Hospital in October, 1862.

infectious cases. When they have been observed doing so, it has been found they have used 'unlicensed cabs,' alleged by them to be used for that purpose only. We have a hackney carriage bye-law, as follows :—'The driver or owner of any such carriage shall not knowingly carry or convey therein any person afflicted with any infectious or contagious disease, or any dead body.' The penalty for so doing is 20*s*."

Bradford.—"A van is kept at the workhouse for the purpose. Cab owners are prosecuted if they allow their cabs to be used for conveyance of persons ill of infectious disorders."

Bristol.—"The different boards of guardians have each an ambulance for the removal of infectious patients."

Carlisle.—"One at the Fever Hospital."

Chester.—"Fever cases are taken into the infirmary and paid for by the parishes at the rate of 1*s*. per day. The infirmary provides a sedan chair for the conveyance of the sick. Small-pox is *not* admitted."

Derby.—"No doubt cabs are employed; but many are brought in a hand-fly, which is to be had on application at the hospital."

Doncaster.—"We hire an old one. Ordinary cabs are not used here, as far as we know, for any one suffering from a contagious disorder. We should not allow it, but proceed under our bye-law against any one so using a public cab."

Dundee.—"Two conveyances specially so used, and for nothing else; cabs may be used also at times."

Edinburgh.—"A special vehicle is provided. No cabs allowed to be used."

Gateshead.—"The guardians have one carriage for the removal of fever cases."

Glasgow.—"Several vehicles for the conveyance of such cases."

Greenock.—"Fever cases can be conveyed by a special cab, the property of the infirmary. There is also a sedan chair used only for infectious diseases."

Hull.—"We have no separate carriages for the conveyance of fever cases. I think there is a sedan at the workhouse occasionally used."

Leeds.—"There is only one conveyance for the purpose of removing infected persons; this is supplied by the guardians of the poor."

Leicester.—Liable to a penalty not exceeding 40*s*. under following bye-law: "No carriage licensed by the local board shall be used for conveying any corpse, or any person who is ill of fever, or of any infectious or contagious disease."

Liverpool.—"Separate carriages—one for typhus, and one for small-pox cases—were provided in November, 1864. They are kept at the public offices, where there is a night watchman, and they are hired by contract. No charge is made for their use. These are quite independent of the fever and small-pox carriages kept by the vestries for the use of paupers. At the commencement of the cholera epidemic, another carriage was provided for cholera patients."

Maidstone.—"One for taking people to the 'union' three miles from town, a stout prejudice existing against the admission even of typhoid fever into the West Kent Hospital."
Manchester.—"The fever hospital has special conveyances at its service."
Newcastle.—"One carriage for the removal of infectious cases is provided by the fever hospital authorities; no other in the town."
Newport.—"No carriages provided by the town, but the guardians of the poor have a species of litter for conveying persons to the workhouse hospital."
Paisley.—"One ambulance is attached to the infirmary for this purpose."
Reading.—"A Bath chair is employed."
Sunderland.—"A carriage is kept solely for the conveyance of persons ill of infectious disorders."

So that some provision is made—and in Birkenhead, Bradford, Bristol, Doncaster, Edinburgh, Glasgow, Leicester, and Liverpool it is very effectual—against the admitted evils that flow from this inexcusable infraction of the laws of health, in 24 of the 59 towns regarding which I have made special inquiries, and also in the metropolis. But in the remaining 35, the liberty of the subject to keep up this dance of death is absolutely unchecked, except in Stafford, where cabs, which are used for the conveyance of all other sick people, are forbidden to take undoubted cases of small-pox. In the name of common sense, of humanity, and, above all, of economy, that god of our idolatry, what hinders that the provision of special means of conveyance for infectious cases should be made compulsory on all local authorities, and that the prohibition, under a penalty, of their conveyance in public carriages, known by experience to work well in those towns where it is in force, should be made universal throughout the kingdom?

In Liverpool alone, so far as I can discover, have any steps been taken towards providing proper receiving-houses for the dead. "Since the passing of the Public Health Act, 1866," writes Dr. Trench, "the council have ordered the erection of two mortuaries. A protestant gentleman, Mr. Hutchinson, is about to erect, at a probable cost of £5,000, a mortuary *Chapel* for the Roman Catholics."

A few words in conclusion on convalescent institutions. It is now nearly fourteen years since I projected, and repeatedly discussed with the late Admiral Percy, then chairman of the Walton Convalescent Institution, a plan for collecting statistics from the London Hospitals, Infirmaries, and Dispensaries, in order to shew the urgent need of a great effort to increase, at least tenfold, the convalescent accommodation for the metropolis. To my great regret I was prevented, by lack of leisure, from carrying out my intentions. Since then some progress has been made. In establishing the institution at Seaford, the Marquis of Townshend and his fellow-workers have conferred a great boon on the sick poor of London; several of the large hospitals are, I believe, providing accommodation in

the country for their convalescents; and Mrs. Gladstone is setting an example worthy of all imitation by social reformers throughout the country. My returns on this subject are not complete, as I neglected to put the question to some of my correspondents. But I find, from Dr. Fleming, that Birmingham is now providing itself with an establishment capable of containing 40 inmates; Carlisle has its seaside institution at Silloth; Dundee, Edinburgh, and Glasgow have each a convalescent home, and steps are being taken to provide one for Paisley. In Greenock, "there was, during a late epidemic, a convalescent house for fever patients, but it is now disused." The Newcastle-upon-Tyne Convalescent Society have lately issued their seventh annual report,* which gives a very gratifying account of the increasing usefulness of their convalescent home at Marsden. In Liverpool, there are "no public convalescent institutions; but one has been established by private beneficence in Everton." Mr. Joseph Adshead, in a paper to which I listened with much pleasure at Glasgow in 1860,† announced that he would "shortly submit a plan for a convalescent establishment for Manchester and the surrounding district," but I am informed that his enlightened proposals have not yet been carried into effect. From 23 towns I have received the answer, that nothing has been done in the way of providing such institutions; but Bath, if it has none for itself, is a convalescent establishment on the grand scale for "multitudes of halt, withered, and impotent folk," who repair thither from all parts of England, and often find the healing they had elsewhere sought in vain.

The time, I trust, is not far distant, when a convalescent home will be reckoned an indispensable adjunct to every large town in the kingdom. It would enormously increase the influence for good of our hospitals and dispensaries. The object is so purely beneficent, that it should engage the sympathy and the liberal support of all well-wishers of the sick poor. The wealthy cannot bestow their largesses; the benevolent, whether wealthy or not, their good words and willing gifts; nor the active philanthropist his most earnest efforts, on a truer charity, or one more fruitful of good results. Nor could the guardians of the poor apply a portion of their funds in any way so likely to yield a large remunerative return, not only by improving the public health, but by effecting a permanent reduction of the rates, as in contributing towards the erection or support of convalescent institutions. "Ample funds," to adopt the concluding words of a pamphlet I published in 1849,‡ "would thus be provided for the supply of certain health-giving remedies, of which the medical attendant well knows the value, but for want of which dispensary practice is too often a solemn mockery. Of these I might instance several,

* The Eighth, for 1866-67, has just reached me.
† *Soc. Sc. Transactions* for 1860, p.726.
‡ "Sanitary Economics, or our Medical Charities, as they are, and as they ought to be." By A. P. Stewart. M.D.

but I content myself with directing special attention to the facilities that would thereby be afforded, for sending to the country or the coast such patients (and their name is legion) as are pining away for want, not of drugs and elegant prescriptions, but of nature's balmy breath, which never fans the fevered cheeks, or braces the withered frames of the myriads who yearly sink unnoticed from their dark and plague-haunted dwellings into an 'ever yawning and never satisfied grave.'"

The results, then, of eighteen years of sanitary legislation is that we have in the metropolis a large staff of able and active but underpaid officers of health, whose recommendations may be adopted and enforced, or passed by in silence, or rejected with contempt, according to the temper or interests of the different vestries or local boards; that the great majority of the towns throughout the kingdom have no medical officers of health, and that, in those which have them, their remuneration is, with three or four exceptions, shamefully inadequate; and that their position of dependence on the local authorities is such as often to make them comparatively powerless for good, especially when, as sometimes happens, the authorities are interested in the perpetuation of the abuses which their sanitary officers seek to remove. We find also, that the appointment, as is commonly the case, of a single inspector of nuisances, where there ought to be a dozen or more, serves rather to conceal than to bring to light and remove the evils, both physical and moral, so prevalent in our large towns; that both in the metropolis and elsewhere their numbers are, with a few memorable exceptions, so small as to make the discharge of their duties a hopeless task, and that in not a few instances they are burdened with other duties that occupy the most of their time; that, as a rule, the rural districts, which require it nearly as much as the towns, and our ports and harbours * which require it even more, are virtually without any inspection at all; that the great and growing deficiency of lodging accommodation for the labouring-classes necessitates overcrowding, while it prevents the enforcement of the laws enacted for its abatement; and that, owing to the non-appointment of the officers charged with its execution, or the appointment of incompetent ones, the Act for the seizure of diseased and unwholesome articles of food is too commonly a dead letter. We find, moreover, that in many districts the death-rate is increasing, and that, owing to the neglect of vaccination and other sanitary measures, and the very general conveyance of infectious cases in public carriages, the ravages of small-pox and typhus are in many places alarmingly great; that the main and house drainage of many towns is still in a very unsatisfactory state; that the pollution of our streams and rivers is a crying abomination; that the water supply to the poorer districts, both of the metropolis and of other towns, is exceedingly defective; and that, except in a few towns, the work of providing convalescent accommodation for the sick poor has not yet been begun. From all this we conclude that—

* *See* an admirable article in the *Times* of Sept. 26, 1860.

1. We require a thoroughly efficient administrative department of government for the superintendence of all matters relating to the public health, and the enforcement of the law on recusant local authorities.

2. The appointment of officers of health, not only in towns, but in the country, and for our ports and harbours, should be compulsory; they should be independent of the local authority, their appointment, the amount of their salary, and their dismissal being subject to the approval of the central department; and should exercise a general supervision of such districts as may be agreed upon.

3. The inspectors of nuisances should always be under the control of the officers of health, and should not be burdened with other and inconsistent duties. Their appointment should in every case be compulsory.

4. There should be an annual return to Parliament of all officers of health and inspectors of nuisances, of the population and areas of their respective districts, of the salaries paid to them, and of the duties they are required to discharge.

5. As a general rule, the officers of health should be specially trained and set apart for that work alone, and be remunerated accordingly, out of the municipal funds or county rates, aided from the consolidated fund.

6. The isolation of those sick of infectious disorders should be enforced by their early removal to—

7. District hospitals or refuges to be provided by the local authorities.

8. The conveyance of such cases in hackney carriages should be everywhere prohibited under a penalty, the same to be strictly enforced against offenders.

9. Carriages for the conveyance of such cases *must* be provided by the local authorities.

10. Disinfecting apparatus for clothes and bedding must likewise be provided by local authorities.

11. We urgently need a well-considered Act, which shall facilitate the acquisition of low house property, and shall empower the government to grant loans on easy terms, on the security of the new buildings, to those who shall undertake to provide wholesome dwellings for the labouring population.

12. The supply of gas and water should be taken out of the hands of private companies, and entrusted to public and responsible bodies, in the interest of the consumer.

13. It should be made lawful for Boards of Guardians to apply a portion of the rates to the providing of convalescent accommodation for those who require, but cannot procure it.

14. A strict government inspection should be made during the progress of all works, for the execution of which the government sanctions the borrowing of money, and before instalments are sanctioned, the inspector's reports and certificates being published.

SANITARY QUERIES.

1. Town?
2. Population { According to last census / estimated?
3. Medical Officer of Health?
4. Date of appointment?
5. When was office first instituted?
6. Salary, increased, diminished, or stationary?
7. Area of district?
8. Duties required of him?
9. If allowed to practise?
10. Inspectors of Nuisances { Ordinary staff? / Duties? / Salaries? / Extraordinary?
11. Under the control of the officer of health?
12. Inspectors of common lodging-houses?
13. Inspectors of markets and slaughter-houses?
14. What qualifications, if any, required of these various inspectors?
15. If chosen from the police?
16. Discharge of duties efficient?
17. Seizure of unwholesome articles of food, to whom confided? Convictions frequent?
18. Drainage { Main, thorough and general? / House, efficient? / Intercepting? / Into rivers, or sea?
19. Water { Whence obtained? / Quality? / Supply constant? / " if intermitting, how often on, and for how long daily? / " to poorer districts, by wells, pumps, stand-pipes, butts? / " If in houses, at what charge? / " by Water Company, or in hands of local authority?
20. Early isolation of persons sick of infectious disorders?

TABLE I.

Metropolitan Health Officers and Sanitary Inspectors.

DISTRICT.	Medical Officer of Health.	Salary.	Population. Local Return.	Population. Registrar-General's Summary.	Ordinary Inspectors.	Under Medical Officer, or Not.
		£				
Bermondsey	Dr. W. Parker ...	130	66,000	64,310	One	No.
Bethnal Green	Dr. T. Sarvis... ...	100 {£150 for cholera service.	116,574	110,289	Three	Yes.
Bow	Dr. Woodforde ...	150	45,000	With Poplar	Three... {A chief and two sub-inspectors.	Yes.
Camberwell	Dr. J. S. Bristowe ...	200	84,000	81,818	Four ... Two only till last July.	Chiefly.
Chelsea	Dr. A. W. Barclay ...	200 Nominally £150 ...	63,000	65,957	Seven .. {A chief and six sub-inspectors.	Chiefly.
Clerkenwell	Dr. Griffith	100	65,700	63,957	Two	No.
Fulham	Mr. F. J. Burge ...	150	40,100	48,657	One	Yes.
Greenwich	Mr. H. N. Pink ...	150	90,000	97,473	One..... {Has much other work to perform unconnected with sanitary matters.	Only partly.
Hackney (3,929 acres)	Dr. Tripe	350 Much extra work.	100,000	97,120	Three.. {And a clerk. One is lodging-house inspector.	Yes.
Hampstead	Mr. C. F. J. Lord ...	100 {"Gratuity negatived."	22,000	23,557	Two .... {Chief also surveyor. Two sub-inspectors during cholera; one retained.	No.
Holborn	Dr. S. Gibbon.... ...	200	46,317	42,556	One..... Has other work to attend to.	Not entirely.
Islington	Dr. Edward Ballard ...	300, till 1866 £250. ...	200,540	193,648	Four, till lately only two ...	Yes.
Kensington	Mr. Francis Godrich, jun.	200	100,000	85,171	Three	Yes.
Lambeth	Dr. George Puckle ...	300	176,000	174,904	Three	Yes.
Lewisham (and Penge)	Dr. F. E. Wilkinson....	73 10s.	30,000	23,373	Two ....Have other employments	Partly.
Limehouse	Mr. Thomas Orton ...	200 {7½ years ago only £100.	58,000	56,198	Three ..With many other duties	Very partially.
London (Proper)	Dr. H. Letheby ...	600	114,450	East 37,661, West,25,470, City, 39,756 } 102,887	Eight... {Four, general; one, special; two, meat markets, &c.; one, shipping.	Entirely.
Mile End Old Town	Dr. M. Corner* ...	150	85,000	80,695	Two	
Newington	Dr. Iliff, jun.	200	82,200	92,680	One	Yes.
Paddington	Dr. Burdon Sanderson	300	92,000	93,365	Two..... {One of them recently appointed.	Yes.
Sub-districts. Plumstead and Charlton (area above 11,000 acres.) Charlton	Dr. Finch	50 Reduced from £75.	11,000		One, very active....	Entirely.
Plumstead	Dr. A. W. Allinson ...	50	24,000		One	Yes.
Lea and Kidbrooke	Mr. Joseph S. Burton	75 {At first £75, then £50, lately again £75.	10,000	49,000 67,047	One..... {Whole time occupied as assistant surveyor.	No.
Eltham	Dr. D. King	50	4,000		One	Yes.
Poplar	Mr. S. K. Ellison ...	150	48,000	Poplar & Bow 99,762	Three {One chief and two sub-inspectors.	Yes.
Rotherhithe	Mr. Samuel Tilley* ...	150	27,000	28,767	One	Not entirely.
St. George, Hanover Square, Inwards	Dr. Druitt	250	33,000	94,315	One	Yes.
St. George, Hanover Square, Outwards	Dr. Addis	250	60,000		One	Yes.
St. George's in the East... ...	Dr. Rygate*	150	47,779	47,779	Two	"Practically"
St. George the Martyr, Southwark	Dr. H. Bateson ...	150	55,500	57,498	Two {One of them also inspector of sewers.	One entirely, the other partly.
St. Giles, and St. George, Bloomsbury	Dr. George Buchanan	150	54,076	52,226	Three {One of whom is inspector of nuisances, &c.	Two.
St. James's, Westminster ...	Dr. Lankester, F.R.S.	150 {At first £100, then £200, now £150.	35,326	34,155	Three {One of whom is inspector of street nuisances.	Two.
St. John's and St. Olave's ...	Dr. J. N. Vinen ...	100	19,100	18,914	One, with other duties ...	Partially.
St. Luke's, Middlesex	Dr. Pavy, F.R.S. ...	150	58,000	56,710	Two	Yes.
St. Martin's in the Fields ...	Mr. L. J. Beale ...	125 {£105 for cholera service.	21,370	21,370	One, very efficient	Entirely.
St. Marylebone	Dr. J. Whitmore ...	400	165,000	159,871	Two	Yes.
St. Pancras	Dr. Thomas Hillier ...	250	200,000	211,825	Two	Yes.
St. Saviour's, Southwark ...	Mr. Robert Bianchi ...	150	39,000	36,422	Two	Yes.
Shoreditch (St. Leonard's) ...	Dr. Robert Barnes† ...	200	130,000	126,836	One {With other duties. Two assistants during cholera.	Partly.
Strand	Dr. Conway Evans ...	150	45,000	40,883	One	Entirely.
Sub-districts. Wandsworth (area between 11,000 and 12,000 acres) Wandsworth	Dr. G. E. Nicholas ...	50	13,400		Two, chief also surveyor ...	‖ One sub-inspector, chief not.
Clapham	Mr. J. MacDonogh ...	50	24,000		Two, chief also surveyor ...	‖ One sub-inspector, chief not.
Battersea	Dr. W. Connor ...	50	23,000	78,900 82,979	Two, chief also surveyor ...	‖ One sub-inspector, chief not.
Streatham	Mr. D. C. Noël ...	50	11,000		One, also surveyor	‡ No.
Putney	Dr. R. H. Whiteman .	50	7,500		One, also surveyor	‡ No.
Westminster	Mr. Bernard Holt ...	100	65,600	68,268	Two	Partly.
Whitechapel	Mr. John Liddle ...	250	78,000	76,386	Four	Entirely.
Woolwich	None	.....	47,363	47,363		
		£7,980 10s.	3,031,895	3,037,991	109	
			O.H. to 64,508	*O.H.* to 64,638	1 *I.* to 28,995 or (Reg.-Gen.) 29,109.	

* Dr. Corner and Dr. Rygate have succeeded the late Mr. J. H. Freeman, who held both appointments; and Mr. Samuel Tilley is the successor of the late Dr. Murdoch, in Rotherhithe.

† Dr Sutton is now health officer in Shoreditch, in place of Dr. Robert Barnes, who resigned at Christmas.

‡ In each of these districts, during the prevalence of cholera, *two* sub-inspectors were employed. One has been retained for a time.

‖ The *one* sub-inspector employed in each of these districts while cholera prevailed has been discontinued.

TABLE II.

TABLE II.

Towns with Officers of Health.

A. RECENT AND TEMPORARY APPOINTMENTS. (See foot note at p. ~~525~~ 34.)

Name of Town.	Medical Officer of Health.	Salary.	When First Appointed.	Allowed to Practice.	Population.	Inspectors.	Chosen from or Assisted by Police.
Lincoln	Dr. Harrison	Not fixed	For 2 months in July, 1866	Yes	22,979	One	No.
Maidstone	Mr. George Elgar	10*s.* 6*d.* per day ...	„ 3 „ August, „	Yes	24,277	One	Superintendent of Police.
Oxford	Dr. Gilbert W. Child ...	£52 10*s.*	„ 3 „ August, „	Yes	27,560	One ... (Surveyor with much private business.)	No.
Reading	Mr. T. L. Walford	Not fixed	Under Privy Council Orders July, „	Yes	25,045	One	Superintendent of Police.
Wolverhampton	Mr. T. Vincent Jackson ...	£50	For 2 months in August „	Yes	63,985	Two	No.
					163,846	Six.	

B. PERMANENT APPOINTMENTS.

Name of Town.	Medical Officer of Health.	Salary.	Appointed.	Office Instituted.	Allowed to Practice.	Population.	Inspectors.	Chosen from or Assisted by Police.
Aberdare	Mr. David Davies	£ *s.* 12 12	In 1861.	In 1861	Yes	35,000	One	Yes.
Bath	Mr. C. S. Barter	125	April 3, 1866.	„ 1866	Yes	52,528	One .. Salary £100 a-year.	Yes.
Birkenhead	Dr. Baylis*	350	May, 1866.	Jan. 1864	No	53,300	One ... (Two or three labourers under him.)	No.
Bristol	Mr. David Davies	200	Feb., 1865.	In 1865	Yes	167,228	Five	Yes.
Cardiff	Dr. Paine	40	In 1853.	„ 1853	Yes	33,000	One ... (with assistance when necessary.	Yes.
Doncaster	Mr. Francis C. Fairbank ...	50	„ 1864.	„ 1864	Yes	16,406	One	Yes.
Dundee	Dr. Pirie †	105 (and £40 as Police Surgeon)	Jan., 1866.	Jan. 1865	Yes	30,000	Two, and two assistants	When necessary.
Edinburgh	Dr. Littlejohn	500	In 1863.	In 1863	No	170,444	Two	No.
Gateshead	Dr. William Robinson ...	50	April, 1865.	„ 1865	Yes	38,475	One	Yes.
Glasgow	Dr. W. T. Gairdner (and four District Surgeons under him.)	200 (Assistants paid according to work done.)	In 1863.	„ 1863	Yes	400,000	Five or more	Yes.
Leeds	Dr. M. K. Robinson	500	May 17, 1866.	„ 1866	No	227,180	(One, and twenty sub-inspectors)	Yes.
Leicester	Mr. John Moore	100	In 1853.	„ 1849	Yes	72,131	Two	Yes.
Liverpool	Dr. W. S. Trench‡	1,000 (1847 ... £350; 1848 ... £750; 1866 ... £1000)	„ 1864.	„ 1847	No	482,905	(One, and forty one sub-inspectors)	Yes.
Merthyr Tydfil	Mr. Thomas J. Dyke ...	60	October, 1865.	„ 1865	Yes	55,000	Two ... (One extra for cholera epidemic	No.
Newport (Monmouth) ...	Dr. Benjamin Davies ...	50	In 1862.	„ 1862	Yes	25,000	One	Inspector of Police.
Paisley	Dr. Richmond	20	Jan., 1859.	„ 1859	Yes	48,000	(One, and one sub-inspector)	No. When necessary.
Southampton	Dr. MacCormack§	150 (1850 ... £150; 1863, £200 as O. H. & Insptr.)	March, 1866.	„ 1850	No	54,159	One ... (Salary £100 per annum.	No.
Sunderland	Dr. Yeld	50 ... ...)	July, 1866.	„ 1866	Yes	96,805	Two	No.
	Mr. E. A. Maling	50 ... ...)						
		£3,612 12.				2,057,561	Ninety-seven.	

* Successor of Dr. M. K. Robinson, now O. H. at Leeds. † Successor of Dr. Cowper who died of typhus, ‡ Successor of Dr. Duncan.

§ Successor of Mr. Francis Cooper, who was both Officer of Health and Inspector of Nuisances from 1850 till his death in 1865.

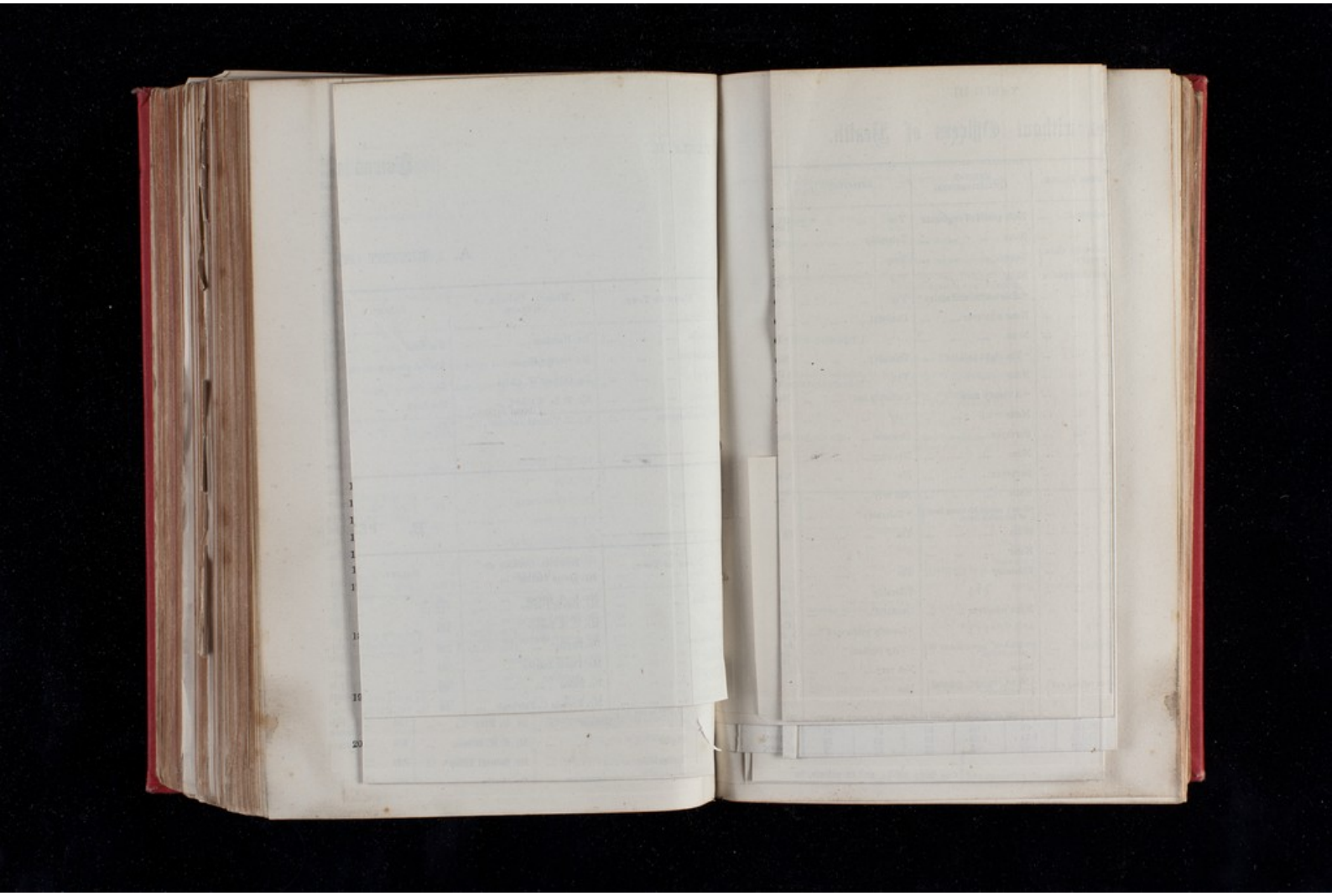

TABLE III.

Towns without Officers of Health.

Town.	Population.	Ordinary Inspectors of Nuisances.	Chosen from Police.	Special Qualifications.	Efficient.	Inspection of Food, &c.	Inspection of Lodging Houses.
Aberdeen ...	73,794	One { Who is also superintendent of Water-works & one assistant. }	Only the assistant... ...	Both qualified engineers	Yes	{ By "inspector of diseased meat." }	By police superintendent and men.
Birmingham ...	338,868	Six One chief and five assistants.	No	None	Tolerably	"Convictions very frequent."	By police, efficient.
Bradford ...	107,459	Two { Ten additional during cholera time. }	No, but aided by them when necessary.	None	Yes	(?)	By sanitary inspectors, indulgent.
Brighton ...	97,750	Three { One chief, one for slaughter-houses, and one for lodging-houses. }	Lodging-house inspector	None	Yes	{ By inspector of slaughter-houses. }	Very efficient; frequent proceedings against overcrowding.
Cambridge ...	26,361	One...	Yes	"Able bodied and active"	Yes	(?)	{ Efficient; proceedings under Act, 1866.
Canterbury ...	22,957	One, a builder	No	None whatever	Doubtful	(?)	.....
Carlisle ...	29,417	One { Superintendent of police, aided by his men. }	Yes	None	(?)	"By police inspector" ...	By police.
Cheltenham ...	40,157	One...	No	"The right politics" ...	Tolerably	None	By inspector of common lodgings.
Chester	31,110	One; formerly a grocer	No	None	Yes	{ By market inspector, seizures rarely needed. }	By inspector of nuisances, tolerably efficient.
Chichester ...	8,059	One { Who is also relieving officer, salary £20. }	No	"A steady man" ...	Certainly not	None	{ By police superintendent, who receives £10 a year for it.
Derby	43,091	One, with occasional assistance ...	No	None	Very	(?)	{ By inspector of nuisances; tolerably efficient.
Devonport ...	64,783	One { Temporary; is also borough surveyor. }	No	Surveyor...	Doubtful...	Occasional seizures ...	"No regular inspection."
Exeter	41,749	One { Some assistants during cholera epidemic. }	No	None	Not very...	(?)	{ By inspector of nuisances, "proceedings always successful."
Gloucester ...	16,512	One, also surveyor	No	Surveyor...	No	None	{ By surveyor and police; accommodation very deficient.
Greenock ...	50,000	One...	Yes	None	Not very...	{ By "inspector of provisions and slaughter-houses." }	By inspector of lodging-houses.
Grimsby ..	16,689	One The superintendent of police.	Yes	{ None; except his being head of the police force. }	"Tolerably"	(?)	{ By superintendent of police; no proceedings taken.
Halifax... ...	38,859	One...	Yes	None	Yes	By inspector of nuisances.	{ Efficient; proceedings against overcrowding.
Hastings ...	26,567	One, who acts under the surveyor	No	None	(?)	(?)	{ Efficient; great improvement of late in cottage accommodation.
Hereford ...	17,682	One. The chief of the police ...	Yes	Efficiency	Yes	(?)	"None at present."
Hull	104,873	Two. Under Board of Health ...	No	(?)	Tolerably	(?)	"By lodging-house inspectors."
King's Lynn ...	16,170	One	No	None whatever	Doubtful...	(?)	Very inefficient.
Manchester ...	380,887	One { I cannot ascertain how many assistants. }	(?)	(?)	"Loosely performed" ...	{ Committee of Sanitary Association. }	By police, nominal.
Newcastle ...	121,640	Two, and two assistants	Three of the four ...	{ "Efficient performance of police duties." }	"Very vigilant" ...	{ By inspector of food, aided by four divisional inspectors of police. }	By "two inspectors, regulations strictly enforced."
Northampton ...	36,405	One, and one assistant	No	None	Not very...	(?)	By inspector of nuisances.
Norwich ...	78,185	One { With no regular staff, but assistance of casual paupers as messengers, and other aid if necessary. }	{ Had served on railway and in police. }	{ None, except general efficiency. }	Yes	(?)	{ By inspector of nuisances, good; no proceedings for overcrowding,
Nottingham ...	85,200	One { Also one food inspector, and one night-soil inspector. }	No	{ "Long acquaintance with duties, and efficiency." }	"Does the work well"...	By meat inspector ...	By sanitary inspector, efficient.
Plymouth ...	62,599	One { With salary of £100, and one sub-inspector. }	Yes	None	Does his duty well ...	Occasional seizures ...	{ Regular house to house visitation, by inspector of nuisances.
Portsmouth ...	108,705	One { The inspector of police, and two sergeants under him. }	Yes	{ "Able and conscientious officer." }	{ "So far as he can, very efficient." }	(?)	Very inefficient.
Salford	112,403	Could not ascertain	(?)	(?)	(?)	{ Committee of Sanitary Association. }	(?)
Sheffield ...	216,620	One { A surveyor, with two, three, or more sub-inspectors. }	The sub-inspectors ...	Surveyor...	(?)	(?)	{ By inspector of police under chief constable. Proceedings taken under Act, 1866.
Shrewsbury ...	23,519	One. A municipal factotum ...	No	Jack of all trades ...	(?)	(?)	(?)
South Shields ...	38,863	One { The town surveyor, and one assistant. }	No	None	{ "No; only reports occasionally a foul ash pit." }	{ By police, occasional seizures. }	"Well attended to by police."
Stafford... ...	12,899	One, a cooper	Last, but not present one	None	No	None	By the police.
Tynemouth ...	36,741	One { The superintendent of police, and one of his men as assistant, at £20 a year. }	Yes	{ One of the most intelligent policemen. }	Yes	(?)	By the police.
Worcester ...	33,259	One { Also inspector of common lodging-houses. }	No	None	Yes	(?)	By inspector of nuisances.
York	40,433	One { Chief constable, assisted by his men. }	Yes	None	Doubtful...	(?)	{ By chief constable, as inspector of nuisances, or a deputy.
	2,601,165	Fifty-nine.					

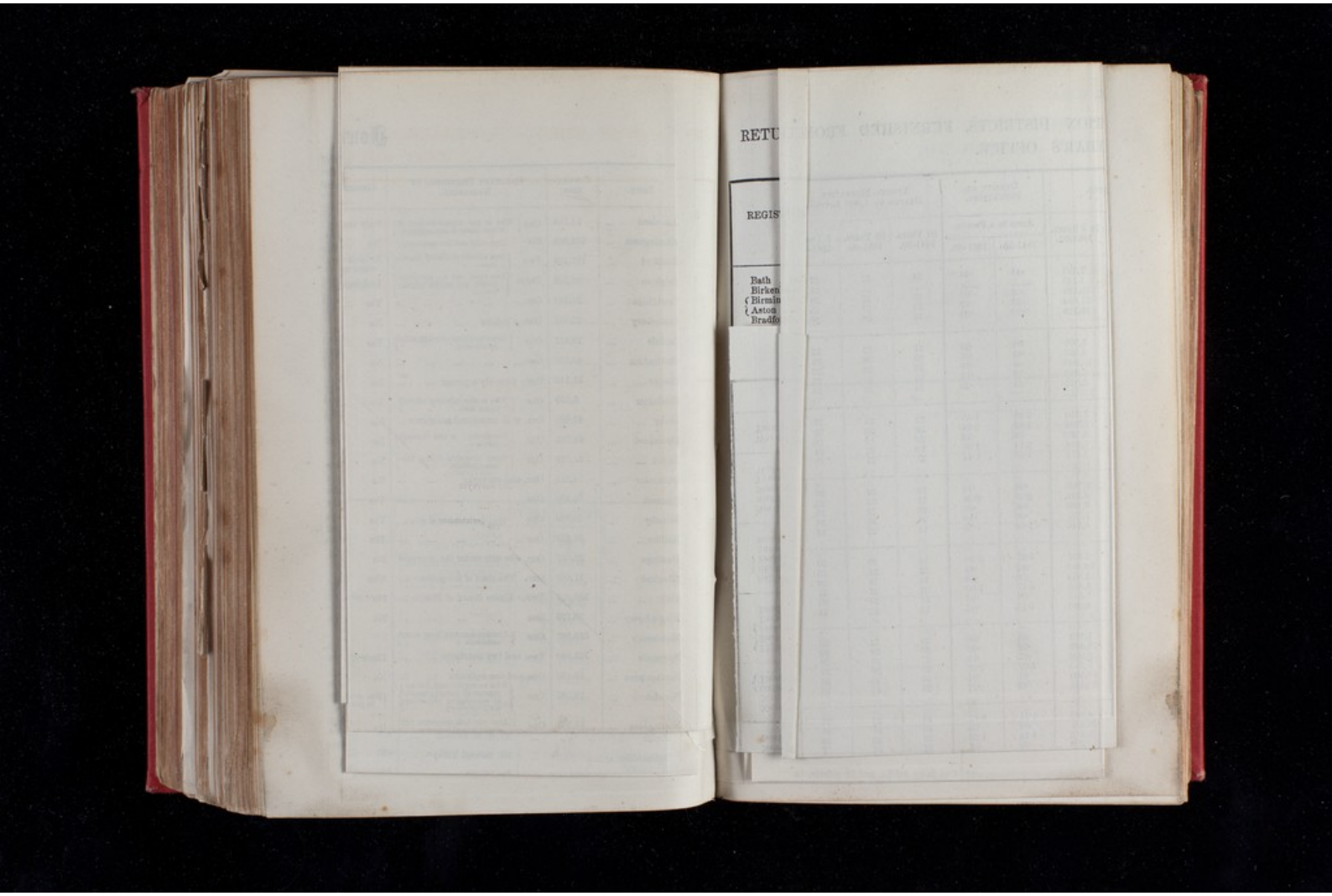
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TABLE IV.

RETURNS OF MORTALITY IN 58 REGISTRATION DISTRICTS, FURNISHED FROM THE GENERAL REGISTRAR'S OFFICE.

REGISTRATION DISTRICTS OF ENGLAND.	Population.		Deaths.		Density of Population.		Annual Mortality. Deaths to 1,000 Living.		
					Acres to a Person.				
	1851.	1861.	In 10 Years, 1851-60.	In 5 Years, 1861-65.	1841-50.	1851-60.	10 Years. 1841-50.	10 Years, 1851-60.	5 Years, 1861-65.
Bath	69,847	68,336	15,224	7,791	·44	·44	24	22	22
Birkenhead	42,189	61,420	.....	7,145	.....	.....	...	...	21
Birmingham	173,951	212,621	51,238	29,389	·02	·01	26	27	26
Aston	66,852	100,522	17,585	11,694	·53	·37	21	21	21
Bradford (York)	181,964	196,475	48,609	26,728	·26	·21	25	26	26
Brighton	65,569	77,693	15,757	9,009	·04	·03	21	22	22
Bristol	65,716	66,027	17,594	8,863	·03	·03	29	28	26
Clifton	77,950	94,687	18,123	10,966	·41	·34	23	20	22
Cambridge	27,815	26,361	5,504	2,988	·13	·13	23	20	22
Canterbury	14,100	16,643	3,517	2,022	·21	·20	24	23	23
Cardiff	46,491	74,575	14,096	7,916	2·98	1·95	22	23	18
Carlisle	41,557	44,820	9,988	5,482	1·82	1·64	24	23	23
Cheltenham	44,184	49,792	8,925	4,737	·59	·53	20	19	18
Great Boughton (including Chester City)	52,950	58,501	12,374	7,243	2·14	1·93	23	22	24
Chichester	14,438	14,775	3,193	1,472	1·59	1·44	21	21	19
Derby	43,684	51,049	11,407	6,106	·08	·06	24	24	23
Doncaster	34,675	39,388	7,978	4,531	3·25	2·94	21	22	22
Exeter	32,823	33,742	7,931	4,196	·06	·05	25	24	24
Gateshead	48,081	59,409	13,876	7,797	·60	·48	25	26	24
Gloucester	32,045	34,950	7,459	4,246	1·09	·96	24	22	23
Caistor (including Grimsby)	34,291	37,517	6,746	3,857	5·97	5·10	18	19	20
Halifax	120,958	128,673	29,398	16,462	·45	·41	22	24	25
Hastings	21,215	26,631	4,348	2,855	·78	·59	18	18	20
Hereford	35,154	39,287	7,811	4,355	4·17	3·90	22	21	21
Hull	50,670	56,888	13,279	7,613	·04	·03	31	25	26
Sculcoates	44,719	51,956	10,763	6,698	1·11	·93	25	22	24
King's Lynn	20,530	16,601	4,048	1,838	·30	·30	23	22	22
Leeds	101,343	117,566	30,325	18,431	·02	·02	30	28	30
Leicester	60,642	68,190	16,366	9,902	·07	·06	27	25	28
Lincoln	42,062	47,063	9,107	5,250	4·07	3·57	21	20	21
Liverpool	258,236	269,742	87,898	49,590	·01	·01	36	33	36
West Derby	153,279	225,845	43,083	33,116	·42	·27	26	23	26
Maidstone	36,097	38,670	8,468	4,662	1·11	1·02	23	23	23
Manchester	228,433	243,988	74,359	39,481	·06	·05	33	31	31
Merthyr Tydfil	76,804	107,105	26,311	13,712	1·74	1·23	28	29	23
Newcastle-upon-Tyne	89,156	110,968	27,388	16,222	·09	·07	27	27	27
Newport (Monmouth)	43,472	51,412	10,532	5,785	2·88	2·32	24	22	21
Northampton	33,857	41,160	9,232	5,622	·07	·56	24	25	26
Norwich	68,195	74,440	17,774	9,450	·07	·06	24	25	24
Nottingham	58,419	75,765	17,890	9,611	·03	·03	26	27	23
Oxford	20,172	20,037	4,161	2,047	·82	1·56	23	22	20
Headington	15,771	17,185	3,814	2,111		·15		22	24
Plymouth	52,221	62,599	13,559	7,355	·04	·03	25	24	22
East Stonehouse	11,979	14,343	3,562	1,887	·04	·03	29	27	25
Stoke Damerel	38,180	50,440	10,163	5,224	·07	·05	26	23	19
Portsea Island (including Portsmouth)	72,126	94,828	19,017	10,243	·12	·09	25	23	25
Reading	22,175	25,876	5,210	2,992	·23	·20	24	22	22
Salford	87,523	105,335	25,076	14,475	·06	·05	28	26	26
Sheffield	103,626	128,951	33,084	19,916	·11	·09	27	28	29
Ecclesale Bierlow	37,914	63,618	11,549	7,796	·60	·41	22	23	21
Shrewsbury	23,104	25,784	6,156	3,439	·81	·74	26	25	20
Southampton	34,098	43,414	9,477	5,068	·09	·07	23	24	21
South Shields	35,790	44,849	9,680	6,061	·48	·38	26	24	25
Stafford	22,787	24,474	5,263	2,893	2·42	2·20	22	22	23
Sunderland	70,576	90,704	20,072	11,512	·19	·15	24	25	23
Tynemouth	64,248	77,955	16,482	9,559	·66	·56	24	23	23
Wolverhampton	104,158	126,902	31,899	16,130	·58	·47	27	28	24
Worcester	27,677	30,969	6,779	3,864	·24	·23	24	23	24
York	54,324	59,968	13,718	7,432	1·84	1·46	24	24	24
	3,652,862	4,319,484	994,245	574,837	.....	.....	26	25	25

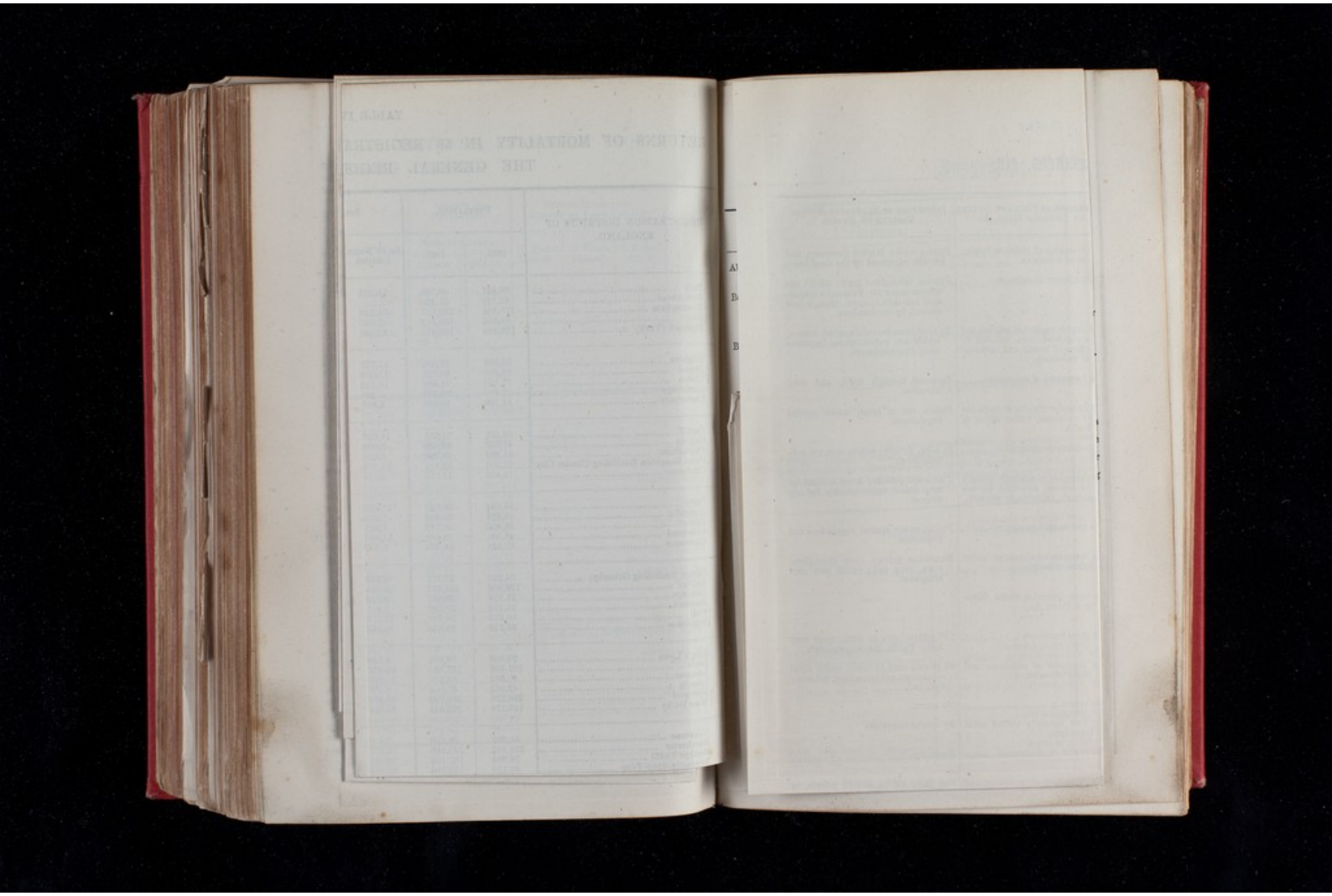

TABLE V.

Inspection of Nuisances, etc.

Town.	Inspection of Nuisances Efficient.	Inspection of Common Lodging-Houses.	Inspection of Food and Seizure of Diseased Meat, &c.	Inspection of Slaughter-Houses, Private or Public.
Aberdare	Yes	By inspector of police as inspector of nuisances.	By inspector of police as inspector of nuisances.	Public, under Market Company, and private, registered by the local board.
Bath	Yes	By inspector of nuisances	By inspector of nuisances.	Private, throughout town; public one offered under Dr. Falconer's mayoralty, but then opposed, though now desired, by the butchers.
Birkenhead	Very	By inspector of nuisances	By superintendent of market and slaughter-houses, assisted by officer of health and inspector of nuisances.	By superintendent of slaughter-houses, which are public, under Improvement Commissioners.
Bristol	Very	By inspectors of nuisances under officer of health; indulgent.	By inspectors of nuisances	Scattered through town, and very offensive.
Cardiff	Very	By inspectors of nuisances under officer of health.	By inspector of police as inspector of nuisances, under officer of health.	Public, out of town, under special regulations.
Doncaster	Yes, though inspector is rather old.	By police superintendent	By police superintendent	In town, private; public ones are contemplated.
Dundee	Yes	By inspector of common lodging houses and assistant. Frequent prosecutions for overcrowding.	By inspector of markets, slaughter-houses, &c., and his assistant; exceedingly efficient.	Public and private; latter licensed by magistrates, under penalty for any offence.
Edinburgh	Very	By senior lieutenant of police; admirably efficient.	By two market inspectors	Public, under special regulations and inspection.
Gateshead	Yes, had previous experience.	By police; strict and efficient	By inspector of nuisances under officer of health.	Numerous private ones throughout town, very bad; public one contemplated.
Glasgow	Very	By Captain Smart and his men; very admirable. (*See* Dr. Julian Hunter, 8th Report, &c.	By meat inspector under Glasgow Police Act.	—
Leeds	Yes	By inspector of common lodging houses; strict and effective.	By meat inspectors	130 private ones in town, some very bad. Public one contemplated.
Leicester	Very	By police; not very efficient	By inspector of nuisances and officer of health.	92 private ones in town, under strict regulations and inspection, but many very bad.
Lincoln	Tolerably	No return	No return	No return.
Liverpool	Very	By one chief and four sub-inspectors of lodging houses.	By four specially skilled meat inspectors.	By special inspectors.
Maidstone	No	Very inefficient, except when cholera threatened.	No return	No return.
Merthyr Tydfil	Tolerably	By superintendent of county police, under Board of Health and officer of health.	By inspector of nuisances and county police under officer of health.	One large public, and 12 private, in town, under police.
Newport (Mon.)	Yes	By inspector of nuisances and officer of health; prosecutions for overcrowding frequent.	Inspector of nuisances, under officer of health.	Public, outside town, at Dr. D's recommendation, 3 years ago. Cost £4,000.
Oxford	No	"Unsatisfactory," by inspector of nuisances.	By market inspector.	—
Paisley	Yes	"Nightly by police"	By superintendent of police as inspector of nuisances.	"None in town, one in suburbs," under special regulations.
Reading	?	By inspector of nuisances	By superintendent of police as inspector of nuisances.	"No new ones allowed in town, except by special licence. Public abattoir outside."
Southampton	No	"Worthy of imitation; it is perfect." 12 houses, recently constructed, answer admirably.	—	—
Sunderland	Yes	By police, under inspector of nuisances and of common lodging houses.	By inspectors of nuisances; "several seizures."	"Within the town."
Wolverhampton	Yes	By lodging house inspectors; "very perfect."	"Frequent seizures made, so that offences are very rare."	By inspectors.

NOTE.—In some places, as in the City of London, where, during five years, 933,016 lbs. of meat have been condemned as unfit for human food; as also in Birkenhead, Birmingham, Dundee, Edinburgh, Liverpool, and Wolverhampton, the inspection of markets is highly efficient. But in many other places it is merely nominal, as might be expected under an Act, the enforcement of which is left by the Legislature to the free will of the local authorities. Hence "in the metropolis," (*Leeds Intelligencer*, Sept. 5, 1866) "outside the city there is no effective supervision, and animals in the most diseased condition may be slaughtered and sold."

21. Special carriages for their conveyance?

22. Public carriages prohibited from taking them under a penalty?

23. Means for disinfection { Of houses and privies? / Of sewers? / Of clothing, bedding, &c.

24. District hospitals or refuges?

25. Fever or small-pox hospitals, or wards?

26. Receiving houses for the dead?

27. Convalescent establishments, in town or country?

28. Nature and extent of lodging accommodation for the working classes?

29. Proceedings against overcrowding under Sanitary Act, 1866, or previous Acts?

30. Slaughter-houses { Public, under local authority? / Private, in what condition, and under what regulations? / Within the town? / Outside the town?

If any of my previous correspondents, or any one into whose hands this pamphlet may fall, can furnish me with additional information regarding the towns I have referred to, or others not included in my enquiries, they will confer a very great favour by filling up this schedule, or any part of it, and returning it signed, to me, at 75, Grosvenor Street, London, W.

A. P. STEWART.

THE

LEGAL ASPECTS OF SANITARY REFORM.

BY EDWARD JENKINS, Barrister-at-Law.

Public health is public wealth. Every person laid aside by ill health is so much subtracted from the power and capacity of the State; and more than this, every person so laid aside is a drain upon the resources of the state. It takes more money to keep him than if he were well; one or more other persons in health are withdrawn from productive operations to expend their strength and time upon his recovery. If one-third of a town, or city, or state, is suffering from disease, there is cast upon the other two-thirds a proportionately greater amount of exertion than would otherwise be required of them, and there is exacted from them a proportionately greater contribution to the general expenditure, while there is less capacity both of work and contribution in the whole community. Time was when this obvious principle was unrecognised, and the state, which made paternal regulations to secure the health of men's souls—the state, which went to war to protect their liberties, and spent lives to save them—wholly avoided any observation of those permanent and subtle causes of danger to the health of the citizens that were likely to exist wherever two or three were gathered together in community of houses or homes. Even in England, where every sort of ill and grievance has been searched out with keen anxiety, while we were emancipating negroes, enfranchising householders, and abolishing oppressive taxations, the public health, a matter one would conceive of super-eminent importance, was neglected. By the course of two or three epidemics, and the philanthropic activity of a few earnest men, the public was fairly frightened into inquiry, and the result of inquiry alarmed the government into action. Since 1847, a succession of statutes has attested the importance assumed by this subject, and virtually the whole of our public health legislation is comprised within the last two decades. This legislation has worked wonders, and, with all its imperfection, was accomplished in the face of indifference and opposition, and has been impeded by the stupidity or neglect of local authorities. The government, obstructed on all hands, has been obliged to do its work in detail, and to carry measure after measure against the protest of what a recent writer on this question terms "indignant Bumbledom."

The Acts which constitute this legislation have been most various in their subjects and extent, and are enumerated in the paper of my friend, Dr. Stewart.

The compass of this legislation proves how vast and numerous were the evils to be remedied; its fragmentary character shows how gradually the public has been aroused to see the necessity of action; and it might have been supposed that after so large and apparently exhaustive a course of enactments, but little remained to be done to make the measures for the preservation of public health perfect and complete. In truth it is far otherwise. The Sanitary Act of the last session was an attempt to redress the imperfections and follies of past legislation—an attempt said to have been the result of many years' consideration—yet we think we shall be able to show that at this moment the whole of our sanitary system is constructed upon a bad basis, and requires both amendment and consolidation.

The number and variety of Acts, of amendments to them, of bodies or persons to whom their execution is committed—the fact that in many important cases the wording of the Acts leaves a discretion as to the execution of their provisions in the local authorities, who generally are disinclined to do anything that involves an addition to the rates, are chief among many reasons for a comprehensive review and amendment. Again, there are sections in local Acts and in general Acts which are collateral, aimed at the same nuisances, but in different words, and with differing remedies. Does "The Sanitary Act of 1866," in an effectual way modify or remove the faults and deficiences of former legislation? Does it grasp the whole subject in a comprehensive way and propound a scheme which is at once feasible and complete? We think not. We think its most ardent propagators will acknowledge that it does not, and that it cannot be accepted as a piece of final legislation. It is eminently suggestive, but in many instances, as we shall see, far from efficient. It makes important advances from a sanitary point of view, but from a legal point of view it continues the errors of previous enactments. We can only hope in the few minutes allotted to us to show in a general way what we conceive to be the main faults of our present system, and we shall endeavour to refer only to those upon which there is likely to be the broadest antagonism.

The most obvious and important deficiency is the absence of a central overlooking power. The bodies appointed in different places to carry out the statutory provisions require to be placed under a capital council, committee, or ministry of public health, exercising over them a salutary supervision, and, in proper cases, endued with power to compel them in a summary manner to do their duty. This

has been objected to as a step in the direction of centralisation which would be injurious to local liberty and fraught with political danger. The distinction must, however, be remarked between *central supervision* and *central administration*. The former is compelling others to do their duty, the latter is doing duty by means of others. In the one case there is a certain amount of independence in the agents, in the latter there is none. This distinction ought to be regarded in assigning its duties to the proposed body. It should also be remembered that the administration of sanitary measures is of national as well as of local importance. Diseases amongst men and cattle, if not stayed in one district, proceed to another. The cholera at Southampton or Liverpool is an event of thrilling interest at London and Birmingham and Bristol, and, unfortunately, experience proves it to be unlikely that local authorities will have sufficient breadth either of patriotism or power to move for anything but self-preservation. Moreover, sanitary administration, to be at all effective, must be of the most summary character. The question of health or sickness to a whole district may simply be a question of hours. Should the local authority be slow in action, the machinery of the law, which works in a methodical order, may only be set in motion when it is too late to remedy the evil. Or, supposing the legal remedy to be specific and speedy—a very rare case—there may be wanting the individual who will be public-spirited enough to take the initiative against the local authority.

In proof of this, we may allude to a case brought before a branch meeting of the British Medical Association on the 26th of January last by Dr. Stewart. "In the autumn of last year he had been in a village in Hampshire in which the drainage arrangements were in the highest degree defective—the only drain being a watercourse. He had obtained the Acts with the view of aiding some of the inhabitants in an attempt to obtain improved drainage; but after reading them had been left in a state of utter confusion, and was only able to arrive at some meaning by erasing the repealed portions of the Public Health Act. Several of the inhabitants were willing to pay two-thirds, or even three-fourths, of the expense of the drainage, if the parish authorities would raise the remainder by a rate. Of this, however, there seemed no likelihood, and the principal obstruction was the surveyor. The Board of Guardians refused to act, and said that any householder might apply to the justices. He (Dr. Stewart) had consulted a high authority, and was told that a *mandamus* from the Court of Queen's Bench was the only mode of obtaining that which was desired. Rather than have recourse to this, those who were desirous of improving the sanitary condition of the place thought it might be better to carry out the drainage at their own expense."

In this instance, as Dr. Stewart has since informed us, the condition of the place, which had six hundred inhabitants, was such as to justify serious apprehensions in the event of the outbreak of an epidemic. The stench from the watercourse was at times unbearable—there

were some houses and stables round which the overflowing feculent matter of dungheaps and *cloacæ* lay in stagnant pools, not only sending up a continual miasma, but being absorbed into the walls of rooms in which human beings were living, eating, and sleeping. Had the place been within the operation of the Public Health and Local Government Acts, there would have been an effectual remedy, but before either of those Acts could be brought to bear upon the district, two-thirds of the owners and ratepayers must have agreed to it. The consequence was that this place, like a great number of large villages and towns in the kingdom, was left to the sanitary provisions of the Nuisances Removal Act of 1855, a measure which we shall presently show to be quite inadequate in the emergencies which arise.

Indeed there is a general complaint against the local authorities. To this complaint it is right to say there are some exceptions—that, for instance, of St. George's Hanover Square, to which Dr. Druitt gives a high character. The local authorities there however are selected from one of the most superior constituencies in the kingdom, and comprise men of position and wealth. St. Pancras is a more distinguished specimen on the other side. Dr. Stewart's Hampshire village is another. Mr. Jabez Hogg says of his parish, that "there is a sanitary committee which has the power of ordering improvements, unless where an expenditure of money is required, in which case the board of guardians must be consulted. He has found, as a member of the board, that the greatest obstruction to sanitary improvements came from educated men, from lawyers." The testimony of Mr. Lord of Hampstead is, "that in Hampstead, which would be supposed to be very healthy, there is much disease from time to time; but the attempts made to prevail on the board of guardians and vestry to carry out the necessary sanitary improvement, are often in vain. What is wanted, is a more coercive power over the local authorities." But the opinions of the most distinguished men are but indifferent in comparison with facts, and these of a conclusive character are readily forthcoming. The most complete sanitary legislation to be found perhaps on any Statute Book, is that relating to the metropolis. The Board of Works may be said to have had accorded to it an almost tyrannical sanitary sway, which is supplemented by powers and injunctions put upon the various vestries and district boards. Here at least we might expect to find a perfect system practically carried out. The recent epidemic has, however, proved that the immense rates imposed upon metropolitan inhabitants, and the great powers conferred upon local authorities, have not secured to London a sufficient sanitary system. Surveyors either forget or omit to do their duty, inspectors are either careless or are not numerous enough to cope with the labours requisite to so vast a field, vestries and boards are either indifferent or incapable, and perhaps even the Board of Works, while executing the great drainage schemes, has been deficient in attention to lesser details. Mr. Humphreys, the able Coroner for Middlesex, whose activity during the recent epidemic entitles him to high honour and gratitude, in a letter to *The*

Standard thus described a few places which he visited in the east end of London.

"I supply a few instances that have come under my immediate notice, even since the advent of the cholera, showing the miserable defects of water supply and drainage, the disgusting condition and arrangements of closets, the total disregard of cleanliness of houses, overcrowding, and removal of putrid vegetable and animal rubbish.

"I will take Bethnal Green.—No. 32, Chilton Street. Tenants say privy blocked up for three months; not rectified for months after complaints made to parish authorities; no water-butts, very insufficient water supply, and that in cellars, and without drains to carry off surplus water; there is also a collection of putrid rubbish in cellar, there being no dust-bin, and smell therefrom most offensive and dangerous; dust very seldom removed; house and others adjoining not whitewashed or cleaned for years.

"No. 7, Thomas Street.—One tenant states his room not whitewashed or cleaned for thirty years. The collector found him whitewashing it one day, and told him it would fetch a shilling a week more when done, and so he should charge him that sum, whereupon he left off, and where he left off is plainly visible.

"No. 9, Vincent Street.—Formal notice given to authorities there; the privy stopped and soaking through the floor three weeks since, not rectified on Wednesday last.

"Old Nichol Street.—Small houses; in one forty-five people, another forty-one; water supply (eighteen gallon cask) alongside privy and dust-bin; no covers to water-butt or dust-bin.

"Sherwood Place.—Here is a yard at back nine feet by eleven feet for use of twenty-two people (*the property of a vestryman*); in centre is an open drain, closet flows through it, sending its stench and filth to the surface; over this open drain the inmates dry their linen; also in this yard an open dust-hole full of decayed vegetable and animal matter; in corner a privy without water, and adjoining it an open water-butt; putting one's hands into the water, pressing the side, a thick, foul, and horrible slime came off, and stuck tenaciously to one's fingers.

"31, Turvill Street.—Family of six in one small room; entrance to yard through cellar; in yard one water pipe for three houses of thirty-seven people, and three large workshops, a very small water-butt between the drain and adjoining privy, which is without water and unstrapped; large collection of putrid vegetable matter and rubbish in yard.

"I could multiply instances to any extent, both in this and other parishes, but fear to occupy too much space. Need I add that cholera and its attendant miseries reign in such localities?"

Another letter from the Rev. Andrew A. W. Drew, incumbent of St. Michael's, Nunhead, is of yet greater significance, as it relates to dwellings recently erected, for the deficiencies of which no excuse whatever can be offered. Mr. Drew, however, appears to have mistaken the powers of the Board of Works, and to have confounded

them with those of the district board. The latter, from Mr. Drew's statement, appears to have neglected or been ignorant of its duty. He says:—

"The following description of houses lately built, and others now building, will answer for itself how far the Board of Works is doing what it professes to do. In this immediate neighbourhood there exists a certain nest of cottages, which bear the most unenviable notoriety on account of being the constant possessors of small-pox, scarlet fever, and other diseases; and to my certain knowledge there has been at least one death from cholera. A description of this nest I will endeavour to give. It consists of four parallel rows of cottages, with a fifth row running across one end of them. The other end is hemmed in by houses of a better class. In row No. 1 there are nine small cottages; these have yards at the back about thirty-five feet long. Row No. 2 (eight cottages) faces the same way as No. 1, and is approached by a narrow mud path. Row No. 3 (eleven cottages) is placed back to back with No. 2. and each has a garden or yard, of the enormous length of twelve feet, so that the backs of the houses in these two rows are twenty-four feet apart. Row No. 4 (eleven cottages) faces No. 3, a narrow court dividing them, while Row No. 5 commands from its upper windows a bird's-eye view of all the others. From one of these windows I looked out a few days ago, and the sight I saw was quite enough to account for any amount of preventible disease. Looking down the space dividing now No. 2 from No. 3, I saw the whole of the water supply for both of them. This was contained in open cisterns, placed immediately over the out-door closets, not, however, that the closets had any benefit from the proximity of the water, but rather because they supplied a convenient resting-place for the sole receptacle for water for all purposes, drinking included. The dimensions of these cisterns were about ten feet by four and one foot deep, and one cistern supplies two houses. Every one of these cisterns was uncovered, but the surface of the water in each was covered with a thick layer of green slime (similar to that seen in stagnant ponds). I am told that this cannot be prevented from accumulating so long as the cisterns remain uncovered. The sanitary arrangements of these cottages are simply disgraceful. They are, it is true, drained, but only into a huge cesspool in one of the gardens, while there is no lack of water, as regards quantity, only of cisterns to hold it; and to crown all, the main drain of the metropolitan system runs within fifty yards of these cottages, some twenty-seven feet beneath the roadway, and yet they are as guiltless of proper drainage as if they were in Honolulu or Kaffraria. You will think this rather a bad state of things already, and that these cottages are too much crowded together; but their owners are of another opinion. In describing row No. 1, I stated that the cottages in that row had gardens thirty-five feet long or thereabouts. This space is now being divided, and another row of cottages erected upon it. Let it be remembered that this could never take place without the consent of the Board of Works, and then let it be understood who is to blame in the matter.

The vestrymen say they can do nothing when the Board of Works has given its sanction to the erection of the cottages; that these being once passed by the surveyor of the Board, the landlords cannot be compelled to cover cisterns, lay on water to closets, or keep their property in habitable condition. I, for one, should like to know why the Board of Works ever sanctioned the erection of these cottages, and why its authorities are allowing others to be built within a few feet of them? I should like to draw their attention to the materials being used upon the new row of cottages. An inhabitant of row No. 2 pointed out to me a heap of stuff within six feet of his door, which stuff he informed me had been taken out of a cesspool. I asked what they were going to do with it, and the answer was 'make mortar of it.' Complaint was made of the stench arising from this stuff, and it was moved a little further off, but it is, I believe, still intended for mortar. Should you be able to give me a corner for this letter, I am sure the working men of this place will be deeply indebted to you, for I am writing in their interest, and making known grievances which they cannot themselves ventilate. The insertion of these particulars, which I could with ease multiply, cannot fail to point out the best cure for cholera—namely, a little energy on the part of the Board of Works in preventing the erection of fever nests and cholera traps such as abound in this place."

Yet more flagrant and startling instances are given by Dr. Fowler, in a letter to the *Times* of September 17th, which we quote at length because of its great importance:—

"Since my appointment as medical visitor about 300 houses have been inspected by my assistant and myself. These houses are tenanted by from one to ten or more families, and some of them are inhabited by nearly fifty people. My daily reports give abundant proofs of (*a*) overcrowding, and consequently filthy rooms; (*b*) filthy, defective, and inefficient privy accommodation; (*c*) foul, defective, and sometimes inefficient water supply; and (*d*) imperfect, defective, and inefficient cleansing of private and public ash-pits, and of public courts, alleys, and bye streets.

"While I candidly admit that since the third week in July much has been done in furtherance of sanitary improvement, I am compelled to announce that, at all events in Bishopsgate, much of this is more superficial than real. Courts, alleys, and houses have been lime-whited. Chloride of lime and carbolic acid have of late been our daily familiars. Nevertheless, in the ninth and tenth weeks of the present epidemic my daily inspections continue to reveal the innate horrors of cholera nests.

"Catherine-wheel Alley leads directly from the main thoroughfare into Petticoat Lane. Scarcely a day has passed without my forwarding a description of this foul place. Pass down it when you will, eyes and nose will be assailed with the sight and stink of scattered heaps of every disgusting species of organic filth. This condition evidently in part arises from the fact that Nos. 4, 5, 6, and 7, Cock Hill, have no dust-bin. The refuse caused by the twenty-eight persons

in these houses is daily thrown into this adjacent alley. At No. 23 in this said alley, on the 28th of July, occurred the first two (and fatal) cases of cholera among Bishopsgate residents. In eight small rooms reside twenty-nine people. The house has no dustbin. On the 15th and 17th of September the condition of its sole privy was most disgusting. It had no water supply. The pan was overflowingly full, the contents, indeed, covered seat and flooring both. These lethal matters were also scattered all over the otherwise sufficiently filthy yard, and even on the different floors of the rooms. The house was, indeed, a most fit palace for the goddess Cloacina. From the cellar of No. 21 the seventeen inhabitants of the house are daily regaled with the fumes arising from the cleaning and preparing of cowheels and tripe. On September 15, at No. 28, lived twenty-four people in six rooms, one of which, on the second floor, was apparently the sole bed-room for eleven human beings. The one privy of this house was in a similar state to the one above described. It had no water supply; neither was there, nor had there been for some time, a single drop of water for the other wants of these two dozen poor. Need I say that I have cases of diarrhœa in almost every house in this alley?

"A similar condition of things obtains in the adjoining cholera and diarrhœa nests—Windsor and Sandy Streets.

"On the 10th of September, at No. 10 in the former, resided nineteen people, and their one privy was unsupplied with water, and so on at No. 9 with its twenty-five tenants, Nos. 11, 13, 8, with its twenty tenants, and No. 2. The same votive offerings to Cloacina were here and there conspicuously present, especially in the privies and yards of Nos. 9 and 13. From these several houses the dust had not been removed for weeks. On the 17th of September these disgusting details were still unrectified. On the 4th of September, at No. 5, Sandy Street, there was only one filthy privy, out of repair, for the use of forty-seven people. On the 11th of September there was neither any water supply nor any privy at all for the accommodation of the fifteen inhabitants of No. 3, Montague Court. In the fifteen houses of this court lived 152 people, and most, if not all, of the privies, were unsupplied with water, were filthy, and were covered with human excreta. In two of these houses girls of fourteen and fifteen were ascertained to sleep in the same bed with their fathers.

"On September 13, at No. 1, Swan Yard, which is a large mews and depôt for carrier's carts, there resided over the several stables fifty-six people, besides the dogs and cats. The six families of twenty-eight people were allotted one waterless privy and one water-tank; to eight other families of twenty-four people were allotted one other privy and one water-tank. The whole yard was in a beastly state. Pools of liquid manure were running from the several dungheaps to amalgamate with a mass of filth in the centre of the yard. One of the dungheaps had not been emptied for three or four weeks, and adjoining thereto was a stinking public privy. The water-tank, which was said to supply only the horses, was uncovered.

and full of animalculæ and vegetable organisms. On September 17, a case of cholera was taken from one of these rooms to the temporary Cholera Hospital in New Street.

"Lamb Alley passes from alongside my house behind the right-hand side of Sun Street. Each day finds its gully-holes and gutters blocked up and reeking with semi-liquid, stinking filth. At No. 3 in this said alley lived, on September 10th, seventeen people, without any water supply or privy accommodation. In six of the houses in Blyth's Buildings (which form a hollow square opening into this alley) resided, on September 10th, seventy-eight people, for whose use there were only two filthy waterless privies. In Clement's Place, another blind offshoot from Lamb Alley, resided, on the same day, in eight small houses, nearly 100 people.

"At No. 6, one room 11 feet by 7½ feet, was the dormitory for three adults and five children. Most of the privies in this place had no water. Two cases of cholera, each fatal in less than twenty hours, were furnished last week from one of these tenements. On the 1st of September, at 65, Sun Street (fronting Lamb Alley), both diarrhœa and small pox were in the house, which literally stunk of sewer gas emanating from the one privy, which, with the uncovered and uncleansed water-butt and house refuse, was in the cellar and practically useless. It was in such a filthy, waterless state, with the old excrement welling up and filling the pan, that no one of the nineteen inhabitants had been able to avail themselves of it for some considerable time. On the 14th of September this house was in the same state. No attention to or alteration of these disgusting matters had been paid or effected.

"Such are some few instances of the present flagrant condition of affairs in my district.

"A retrospect of my earlier inspections would furnish numerous similar details. Day after day have I transmitted the result of my own and my assistant's inquiries to the deputed receiver of these reports. By section 6 of the aforesaid Order of Council it is the duty of the Board of Guardians to, without delay, cause a report of such facts to be made to the nuisances removal authority—*i.e.*, the Commissioners of City Sewers. Some half-dozen repetitions have I in as many weeks sent in of some of the above statements. My very first report was of the filthy and overcrowded condition of No. 140, Bishopsgate Street Without. Although I then stated that 'This house requires the constant supervision of an inspector of nuisances,' its state on the 15th inst. was in the main no better than it was six weeks ago when visited with cholera.

"Although west of the boundary line of the field of the East London Waterworks' mains, the sub-district of St. Botolph, East London district, has (as has been authoritatively stated) suffered severely from the present visitation. During the last week four deaths out of five admissions occurred in the temporary cholera hospital in New Street. There was, indeed, a sudden outburst of fatal cholera in Bishopsgate parish.

"The facts I have delineated perhaps explain this. At all events, they sufficiently show the palpable absurdity of drenching our streets with carbolic acid, and of even lime-whiting the interior of houses, while blots far deeper and more foul are left to poison the physical and moral humanity of our poor."

The medical profession throughout the country concur in the opinion that the local authorities generally need to be overlooked. Dr. Druitt suggests that their powers should be enlarged, but the opinion of his medical brethren is against him. "Is it not a fact," says a writer in the *British Medical Journal*, "that in many places the local authorities are the systematic and bitter opponents of sanitary reform? We are anxious to ascertain in how many instances the wise and beneficent intentions of the legislature are defeated by the passive resistance or dogged opposition of the local authorities, who will not avail themselves of the ample permissive powers which the law gives them; and whether the time has not come when, in the interest of the public, the discharge of duties which is now optional should not be made compulsory—whether in short there should not be some court of last resort, to which the enlightened few may appeal for speedy justice from the ignorance, prejudice or parsimony of the local authorities." The 49th section of the "Sanitary Act" endeavours to provide a remedy for the difficulty to which we have just adverted, and to establish a sort of court of speedy resort in cases of default on the part of local authorities. Should a sewer authority make default in providing its district with sufficient sewers, or in maintaining its sewers, or in supplying water, or should a nuisance authority "make default in enforcing the provisions of the Nuisance Removal Act, &c., complaint may be made to a Secretary of State, who, after due inquiry, may make an order limiting a time for the performance of its duty in the matter of such complaint." The inconvenience of these applications to, and inquiries by Secretaries of State, on subjects quite foreign to their usual duties, and for the due prosecution of which no proper machinery is ready, need hardly be pointed out. If such powers may be intrusted to *them* they may more safely, as well as efficiently, be conveyed to a body selected and endowed with a special organisation for the purpose. Moreover, if the provisions of the Acts are permissive merely, there can be, since the cases will be cases of discretion, no legal "default in enforcing those provisions" which is cognisable by a Secretary of State. The new Act, for instance, enacts that it shall be lawful for nuisance authorities to provide carriages for the conveyance of infected persons, and that the sewer authority may provide district hospitals; it cannot for a moment be supposed that these or any other merely suggestive provisions come within the scope of the 49th section to which we have alluded. The word "duty" implies something which has been enjoined, and not something which has only been suggested.

We may now shortly state who the authorities are. They are differently constituted in the City of London, in the metropolitan districts, in places under the Local Government Act, and in other

places throughout the country. In London the commissioners of sewers are the local authority for carrying out sanitary measures under the City Sewers Act. In the rest of the metropolis, the vestries of the parishes or the district boards formed under the Metropolis Management Acts, are the local authorities. In places under the Public Health and Local Government Acts, the Board of Health for the place, that is, in corporate towns the council, and in other places the town improvement commissioners or an elective board is the local authority. It ought to be observed that the Nuisances Removal Acts operate collaterally or cumulatively with the Metropolis Management and other Local Government Acts, and that there may be found instances of two different enactments applicable to the same cases, with differing penalties for the same offences. Elsewhere, under the Nuisances Removal Acts, the local authority consists of the mayor, aldermen, and burgesses by the council, where a council exists: where there are trustees or commissioners under an Improvement Act, such trustees or commissioners; where none of these, the board of guardians of the poor; and if no such board, the overseers of the poor for the place or parish.

We have thus particularly described the local authorities because of their variety, and we shall hereafter have occasion to mark, that various as they are, they have not had entrusted to them all the details of sanitary administration; a fact from which, as may readily be supposed, no little complication arises.

Properly speaking, however, and generally the real local authority before and we suppose since the recent Act, has been a sanitary committee appointed by the various bodies for the purpose of enforcing the "Nuisances Removal," the "Diseases Prevention," and now the "Sanitary" Acts. The sanitary provisions of other Acts do not ordinarily come within the scope of this committee's powers, and cases under them are referred to the vestry, "which," says Dr. Druitt, "is sure to be a larger, more divided, and less manageable body than the smaller committee which constitutes the usual local authority."

When we come to examine the machinery by which these bodies are to perform their duties, we light upon a curious anomaly. In the metropolis, the local authority *is obliged* to appoint medical officers of health and inspectors of nuisances, but under the Public Health and Local Government Acts the appointment of a medical officer is optional, that of an inspector necessary, while in all other places, with but few exceptions, there is no obligation on the local authority to employ either.

This anomaly is the result of retrograde legislation. Under the Nuisances Removal Act of 1855, the local authority was bound to employ or join with other local authorities in employing a sanitary inspector or inspectors. The Amendment Act of 1860 repealed this provision, and substituted a permission to the guardians of any union or parish not within an union to employ one of their medical officers to report upon the sanitary state of the union or parish. How this

permission has been accepted and taken advantage of by the authorities, we may judge from the important statistics collected by the energy of Dr. Stewart. From these we can form an idea of the nature of that supervision under which a large number of towns existed at a time when the kingdom was exposed to an outbreak of cholera. From these it is not too wide an inference to draw, that two-thirds of England is practically destitute of sanitary control. The importance of this point was earnestly brought to the attention of the government when the Public Health Bill was in committee, but it received no solution at their hands.

We hardly think it necessary to urge, with any lengthened argument, that the power to appoint medical officers, analysts, and inspectors of nuisances ought to be exercised throughout the kingdom. Where the appointment of any of these has been compulsory, as in the metropolis, the valuable services they have rendered the public by bringing scientific knowledge and practical experience to bear upon the multitudinous nuisances of collected population cannot be estimated. Private persons will endure a great deal before they will engage in anything involving expense. To look after these people when they are themselves in fault, or to lend a ready ear to their complaints when they are aggrieved by others, to scent out nuisances and abolish them, is the business of officers and inspectors, and no corner of the country should be unknown to their supervision.

But we have seen that even where these officers have been appointed, they may yet have to contend against the ignorance and stupidity of local authorities. The renowned instance of St. Pancras proves that vestries and boards, composed of tradesmen, or licensed victuallers, or small householders and the like, are not open to the warnings and suggestions of capable officers. The value of a proposition is by them likely to be estimated in the inverse ratio of the demand it involves upon the rates. Under these circumstances, it is essential that the officer should be independent of the local authority. There is less danger in his independence, because he only suggests and reports; but if his appointment is at the will of the local authority, he may be simply their creature, or if not their creature, may suffer from the displeasure with which they view his sanitary activity. The appointment and removal of every local inspector and medical officer should therefore be subject to the approval of a central authority, which is itself responsible to Parliament.

The oversight of the medical officers is, however, but a slight part of that sanitary system, at the head of which we desire to place a ministry or board of health. There is the more extended and important oversight of localities and local authorities. The complaint now is, that unless the statutes specifically ordain that certain things shall be done, the authorities will not do them. Very often the statutes give an uncertain sound, and persons who wish to have a judicial exposition of them must resort to the expensive machinery of the law. The law, in too many cases guided more by the letter than the spirit, refuses to enlarge the meaning of Acts which involve personal

rights, and presents the man who appeals against the sanitary inactivity of a board or vestry witha logical reason for the perpetuity of a nuisance. Two things, therefore, require to be done. *The provisions of the statutes should be enacted plainly and imperatively, and the central authority should employ national inspectors to watch the sanitary condition of the kingdom, to suggest improvements, to report and investigate complaints.*

A few instances will prove the first necessity. The want of plainness in the wording of the Acts often leads to serious perplexity. The metropolitan officers give an example in their "Suggestions." "Section 8 and section 27 of the Nuisances Removal Act (1855) have practically been found to clash. If, in a case of nuisance, *e.g.* offensive odours, arising from a trade accumulation, substances used in a business, &c., a summons be taken out under section 27, it is pleaded that the summons should have been taken out under section 8. On taking one out under section 8, an order is objected to, on the ground that the means adopted are sufficient for the protection of public health, or that the deposit was not kept longer than the defendant required it for the purposes of his business. The latter excuse can never be got over. As to the former, it has to be proved that what causes offensive odour also damages health, and in many cases of offensive accumulations this cannot be maintained in the present state of our knowledge. Again, if an order should by any chance be obtainable, and the accumulation be removed, the offensive matters may be immediately replaced, and being newly deposited, must remain again, so long as the manufacturer has need for them in his business." Again, under section 21 of the Nuisances Removal Act 1855, where ditches are foul or offensive, there is *a discretion* left in the surveyor as to cleansing them.

Under section 22, "Whenever any ditch, &c., used, or partly used, for the conveyance of any water, filth, sewage, or other matter from any house, &c., is a nuisance within the meaning of the Act, and cannot, *in the opinion of the local authority*, be rendered innocuous, without the laying down of a sewer, or some other structure, &c., they shall, and are thereby required", to make and keep it in repair. But by the words italicised, absolute discretion is left to the authorities, for no court would inquire into the reasonableness of the "opinion of the local authority," although the succeeding words are strongly imperative. In none of these instances has the new Act afforded any relief. The manufacturers may still baffle the local authorities by their difficult dilemma, the surveyor and local authorities retain their discretion. It is true, that the 20th section of the Act enacts that "it shall be the duty of the nuisance authority to make, from time to time, either by itself, or its officers, inspection of the district, with a view to ascertain what nuisances exist, calling for abatement under the powers of the Nuisance Removal Acts, and *to enforce the provisions of the said Acts*, in order to cause the abatement thereof." But we have shown "the provisions of the said Acts" to be inadequate, making it optional with the surveyor to clean, and

with the local authority to do structural works, and as it is those provisions which are to be enforced, the new enactment would not, in these instances at least, produce any legal difference.

Let us take another case. The 16th section of the Nuisances Removal Act enacts that when "it shall appear to the justices that the execution of structural works is required for the abatement of a nuisance they may direct such works to be carried out." A case in which the abatement of a nuisance depended upon structural works would be one of strong necessity, yet the Court of Queen's Bench has decided that such an enactment is only permissive, and the justices cannot be compelled by mandamus to direct the works to be done.*

The "Sanitary Act, 1866," is in many of its new and most important particulars permissive. We cannot doubt the intentions of the government in urging its adoption upon Parliament with some earnestness. The threatened invasion of cholera enabled them to exercise a pressure which was judicious, if the Act be considered as a merely temporary enactment, but not so if it should be permanent. It was felt and said at the time of its passage by members of the government that further consolidation and revision were required. We have endeavoured to show what direction any new legislation should take. To a sanitary reformer there is no greater bugbear than a permissive enactment. A suggestion which involves expense to persons interested in that expense is sure, in nine cases out of ten, to be unheeded. We have not far to search in the late Act for such suggestions. The 10th section provides that, "If a dwelling-house within the district of a sewer authority is without a drain, or without such drain as is sufficient for effectual drainage," two cases of vital importance, the sewer authority *may* require the owner to make a drain emptying into one of their sewers; or if no such means of drainage are within a specified distance, then emptying into such covered cesspool or other place, not being under any house, as the sewer authority directs, &c." We have been unable to discover a reason why this should not have been mandatory. If no sewer runs within a practicable distance of a house, the only alternative must be to make a proper cesspool. Why should not the nuisance authority be compelled to see that the house is made habitable by one or the other method? So, as we have already seen, the provision of means of disinfection, of sick carriages, of places for the reception of dead bodies, of sick hospitals, is left to the option of the authorities. Let any one look over the lists, prepared by Dr. Stewart, of the appointment of medical officers, and judge whether it is probable that these latter suggestions will be received and acted upon.

The appointment of national inspectors to act under the central authority, seems necessarily to follow from the existence of that authority. Wide as its powers might be, its presence and observation

* *In re* The Local Board of Health of the parish of Ham, 7 E. & B. 280. 26 L. J. M. C. 43.

could not be everywhere. It would need agents, like those able men who have been employed with such great success by the Privy Council on many occasions—to examine into and report upon complaints (which, under certain restrictions, ought to be easily and inexpensively received)—to suggest and overlook improvements—to investigate causes of disease—whose duty, in fact, it should be to watch the sanitary condition of the whole kingdom. These inspectors, uninfluenced by local prejudices, would be able to return impartial reports upon the action of local authorities and the needs of places. Through them, when there was a conflict of interests, the committee could justly balance the obligations of those interests. This machinery would be simple and comparatively uncostly, and the courts would be relieved of a great burden.

We have now approached in contemplation something like a system. A central authority, with a staff of officers, overseeing and directing local authorities with their officers. But supposing this to be constituted, there would still remain to be remedied the deficiencies and inefficiencies of the laws which this organisation was to put in execution. Some of these we have designated, others we are obliged for the present to avoid. Many have been ably pointed out by Mr. Rumsey in the *Journal of Social Science* for October, 1866. The exclusion of clergymen from participation in sanitary management, the intrusion into sanitary boards of members of water and gas companies, whose interests are naturally opposed to those of the ratepayers, are matters that require redress. More important is the question, whether the supply of water and gas by private companies should not be forbidden, and the consumers be also the makers. This question should be discussed by itself, and perhaps at no distant day we may have it properly treated by some competent member of this Association. But one obvious deficiency we think it needful to mention. All sanitary matters should come within the management of one authority. In administration of laws human, unlike laws divine, "diversities of operations" are obstructive. The common lodging houses Acts are not carried out by the local authority, but by police magistrates and justices. The local authority for the appointment of analysts out of the metropolis, is the court of quarter sessions of every county, and the town council of every borough having a separate jurisdiction.

Such appear to us to be the main faults and needed improvements in our public health laws. With compulsory enactments, and an efficient ministry or board of health, we might see some prospect of the sanitary regeneration of the country. Two things, let us again urge, concur to enforce upon us the necessity of the proposed supervision, namely, the indifference of private persons to sanitary precautions, and the inefficiency of the bodies whose duty it is to watch the public health. The former of these causes will exhibit itself even in cases where only a little personal attention is needed in the pursuit of relief; while that uncertain and expensive machinery of the law, whether in inferior or superior courts, to which we have alluded, and

from which all men naturally shrink, is not always ductile. Its motions are subject to fixed rules; its instructions are settled and precise, leaving no discretion; it is constrained by the inflexibility of words, and drilled into the regiments of logic. The judge dare not ignore the language in extracting the spirit; he dare not stretch his power beyond the dimensions of his office, which is to declare, and not to make the law. Often, therefore, when the whole moral force of an enactment, and of judicial conviction, and of popular opinion, is against some act or thing, that act or thing may exist and be done in spite of all, because it is impossible for the most keen-eyed legislator to forecast every contingency in a world of perpetually-varying combinations, and to prescribe in distinct terms the remedies or penalties for every evil that might naturally be included within the sphere of a law. In most cases that come within the province of legislation it is not of so much consequence that the law should be summary as that it should be sure. The march of criminal justice, and the settlement of civil rights, acquire both certainty and dignity from the deliberation of their process. But there are cases where the benefit of the body social demands a flexible jurisdiction and a summary proceeding—demands even a little temporary or individual injustice for the lasting good of a great number. Some such jurisdiction and process might, perhaps, with great industry and much parliamentary wrangling, be devised for the sanitary security of the kingdom. It might be possible to construct a series of regulations so numerous and so minute that but few and rare instances of ineffectual powers or remedies could occur. Yet there would still stand and face us the two cardinal difficulties—INDIFFERENCE and EXPENSE. The very minuteness and delicacy of our instrument would make men shrink from using it—would be likely to bring about the complication which increases costs. The very summariness which is proved to be essential to the practicability of a sanitary system, would make the judges cautious in their interpretation, the justices hesitating in their orders. To define, therefore, peremptorily the most obvious and important duties of the local authorities,—to give them a fair opportunity of voluntarily pursuing them,—to place over them a body whose office it shall be, not to regulate their actions, but to redress their errors and omissions, and to prosecute at the public, and not at individual expense, those who disobey sanitary enactments,—to give this body a wide discretion with reference to the thousand matters and things relating to public health which legislation cannot provide against,—are the propositions which we now press upon Parliament as the result of our inquiry and argument. The imperfection of the present laws in themselves, and the inadequacy of their practical enforcement, will, during the meeting of this Congress, be sufficiently evidenced. It is needless to appeal to sentiments of fear, of self-preservation. It cannot now be required to be shown that the best preventive of epidemic disorders is constant sanitary vigilance, or even that the truest economy is that which, by a moderate expenditure, reduces the probabilities of disease to a

minimum, not that which neglects until the fatal hour the measures of precaution, and wastes a lavish sum upon means of cure. We cannot touch upon the relations of this subject to the moral improvement of the people. Wretched houses make wretched homes; and while immoral or slatternly habits convert fine dwellings into styes, it is almost as true that dirty and unhealthy habitations transfer a taint to the character and habits of the persons who occupy them. The depressing influences of filth and disease write their evidences on men's manners as well as on their skins; and if the body social and politic is to be sound, the body physical must be healthy too.

On the 2nd of April, a Deputation from the National Association for the Promotion of Social Science waited on, and submitted to, the DUKE OF MARLBOROUGH, President of the Privy Council, the following Memorial:—

The Council of the National Association for the Promotion of Social Science desires to submit to your Grace the following considerations respecting an amendment and consolidation of the laws relating to Public Health.

These laws are numerous and diverse; and, as different subjects of legislative interference arise from year to year, become more complex and more difficult to interpret and apply.

Some of the enactments are general, some local. The provisions of the latter are often of universal value and applicability, and might beneficially be introduced into the former. In other instances there are different enactments relating to the same cases, with different penalties for the same offences. For instance, section 63 of "The Public Health Act, 1848," and section 2 of "The Nuisances Removal Amendment Act," 26 and 27 Vict., c. 117, intended to prevent the sale of diseased meat, and collateral in their operation, impose a penalty; the one of £10, the other of £20, in precisely similar cases. This, of necessity, leads to confusion.

Some important enactments are permissive; indeed this principle very extensively pervades sanitary acts of the greatest importance, and consequently they are seldom acted upon. For instance, section 22 of "The Nuisances Removal Act, 1855," where, when ditches, etc., are a nuisance, it is left to "the opinion of the local authority" to decide whether the nuisance requires a sewer for its abatement; and sections 23 and 24 of "The Sanitary Act, 1866," relating respectively to the provision of means for disinfection, and of carriages for the conveyance of persons sick of infectious disorders; section 27 of the same Act and section 81 of "The Public Health Act, 1848," concerning the establishment of places for the reception of dead bodies; and section 32 of "The Public Health Act, 1848," with reference to compelling a proper provision of closets in factories, are all permissive.

The bodies appointed to administer health laws are not always identical, as it is evidently expedient that they should be. There are natural connections which ought not to be disregarded—*e.g.*, the supply of water with the removal of waste; the large with the small means of drainage. These are under diverse authorities. Without bodies of more general and uniform powers, wider districts, and highly qualified officers of health precluded from private practice, health laws cannot be made fully successful in their operation. "The Sanitary Act, 1866," constitutes sewer authorities, differing, in some respects, from local authorities under other statutes. The Common Lodging

Houses Acts are committed to the management of the police in the metropolis, to Local Boards of Health, to Town Commissioners and Justices in other places. The appointment of analysts rests with the Court of Quarter Sessions in counties, and with the Town Council in boroughs having a separate peace jurisdiction, instead of with the usual authorities for sanitary purposes. Further, this most important appointment is seldom made, as the law merely gives a permission to appoint.

The local authorities are more or less unlearned, and for that reason require plain and specific directions. They are interested in diminishing the rates, unmindful of the probable costliness of their parsimony; and they are, therefore, frequently unwilling to act in sanitary matters, except under compulsion. They are often ignorant of the importance of sanitary precautions, and indifferent to flagrant nuisances, and to the serious consequences arising therefrom to individuals, to others beyond the offending district, and to society at large. Hence the need of a special and central department to stimulate an unwilling or inefficient local authority, to act as a Court of Appeal, to diffuse to all the knowledge obtained from districts that have no connection with each other, to protect individuals and minorities against injustice, and, being possessed of the highest practical knowledge, to construct or sanction bye-laws and local regulations.

The Building Acts, which should at least contain sound rules for insuring due attention to health in the erection of habitations, are very deficient indeed in this point of primary importance. In some few places bye-laws are even now made to serve the purpose. It is undeniable that without some very uniform and stringent additions and alterations to Building Acts (such as that which is now being promoted by the Metropolitan Board of Works), the construction of healthy dwellings, especially for the poorer classes, acknowledged to be required on a very large scale indeed, will most deplorably fail; and the new tenements will doubtless be as bad as the old, or even worse.

The sale of unwholesome and adulterated food calls for very serious attention, and for a much more efficient law. The present law is full of difficulties and defects, is much complained of, and is almost inoperative.

While, therefore, the Acts remain so complicated and multifarious, as are those now in force, it is impossible to hope for an efficient sanitary administration; especially as the principles underlying all true sanitary law are the same, more or less applicable in the same way in all places.

On these grounds the Council earnestly submit, for the favourable consideration of the Government—

1. That the laws of public health require to be revised and consolidated with plain and specific enactments on sanitary matters.

2. That permissive enactments are generally taken to be permissions not to act, and that therefore the most useful provisions should be made peremptory.

3. That the constitution of sanitary authorities should be more uniform; their areas of administration more extensive; their powers and functions more comprehensive; and that some provision be made for the addition of members possessing other and higher qualifications than those now required.

4. That the inefficiency in the administration of the health laws by the local authorities is in part due to the absence of a central power, which could be appealed to without reference to the courts of law, and could by means of judicious advice, and, if necessary, by legal compulsion, cause the local authorities to do their duty.

At the close of the interview, his Grace, declaring his acquiescence in the general tenour of the memorial, expressed a wish to have submitted to him in writing, or print, an epitome of the observations which had fallen from the various speakers. In accordance with this wish the following abstract of what was said has been prepared:—

MR. RENDLE, as one of the secretaries of the Health Department of the Association, in presenting the memorial, acknowledged the great progress

already made in health legislation; but he said that it had up to this time been mainly for special cases and piecemeal, and that hence sanitary legislation had become in some instances contradictory—that various parts of it were out of harmony with each other—sometimes the same provision, with or without difference, being repeated—that much was permissive, which should be obligatory, and as a result there was confusion, with much waste of force, and discouragement in carrying out the Acts. The bodies appointed to carry out were often diverse, occasionally opposed to and hindering one another, and generally more or less unlearned, and requiring clear and specific Acts for their guidance. The great objections now hindering the due carrying out of the Sanitary Acts would for the most part be removed with a better organisation. He instanced the difficulties experienced by boards wishing to carry out the law, and handed in a statement from Chelsea to this effect, which he said was a statement which might be made by almost all other bodies desirous of working the sanitary laws. He pointed out the need of a better provision as to magistrates, the police magistrates having too much to do of a kind very little in harmony with true sanitary legislation, and, consequently, almost generally failing to help willing local authorities by their judgments. The Building Acts were almost without provisions under which healthy habitations might be erected for the poorer people in case unfit places were pulled down under any Artizans' Dwellings Bill, and he gave instances where new dwellings of this class, built, as they usually were, by poor speculative builders, very speedily became as bad or worse in their unhealthy conditions as any of the oldest. The Vaccination Acts were objectionable, because they had always been administered by the Poor Law authorities. People were taught to avoid poor-law help, and this feeling had seriously impeded vaccination, the vaccinators for a neighbourhood being too usually the poor-law surgeons only. Vaccination, of course, did not commend itself to the class of people a little above the poorest. The officer vaccinating certainly should not certify to the success of his own operation. It required a more liberal pay, an inspector who should certify and not vaccinate, and who should care for the lymph and certify as to its fitness for use. The Adulteration of Food Act, he said, was also a failure, and the poorer buyers were not protected. All that he had said by no means exhausted the catalogue of evils in the present sanitary laws of the country.

Mr. Rumsey urged the necessity for the union and consolidation of the central authorities in sanitary matters, which are at present distributed between the Privy Council, the Home Office, the Poor Law Board, and the Registrar-General, producing uncertainty and confusion in local administration. He also pointed out the great anomalies which mark local administration in the provinces, the variety of boards existing under poor-law and local government and Public Health Acts; and the remarkable difference in the area and population of the districts under these several boards, the inhabitants of a district varying from less than a hundred to many thousands. He recommended an improved constitution of local boards with higher qualifications for their members and the extension of areas of local government, so as to provide for an economical and efficient administration of the health laws. He showed how this extension of area affected the appointment of health officers, and urged the necessity for an entirely different system of those appointments which in the provinces were made under the Public Health Acts. He instanced the inspection of factories and work places, especially the extension of the Factory Acts now before the House of Commons, as a reason for appointing a highly-qualified class of officers rendered independent of private practice and debarred from it. He noticed the importance of such independence as regards certificates of health, age, and fitness for labour of the children employed. He also mentioned Mr. Torrens's Bill for dwellings for the labouring classes as requiring the action of a health officer, who ought certainly to be independent of the proprietors and householders of the wretched hovels he might have to condemn. The basis of an improved organisation, he considered, was to be found in the registration division of the country which are identical with the poor-law unions. It is in these districts that the great facts of disease and mortality are recorded; in these, therefore, a scientific officer is especially needed, both to correct and verify those returns, and to apply them to the suggestion of practical remedies. It would be a most false step in sanitary legislation to compel every small local board to appoint its own officer of health on its own terms. He warned the Government against enforcing, or even encouraging the present defective system of these appointments, and urged the importance of making a new organisation of scientific persons the foundation of a truer sanitary reform.

Dr. Lankester said he wished generally to confirm the views expressed by Mr. Rendle. He had taken an interest for the last twenty-five years in sanitary legislation. The great defect in this legislation was its permissive character. Those to whom power was given to act for the benefit of others, might refuse to act for the benefit of their fellow citizens, and there was no power above them to compel their action. He had thus seen successive Acts of Parliament become dead letters in spite of all powers the state had given. What every one wanted who had an interest in the sanitary welfare of their fellow citizens, was some definite law on which they could act. The present position of our legislation was that local boards and authorities, might, if they thought fit, prevent disease and death, but if they did not think fit to do so there was no superior authority to compel them. The deputation was anxious to impress upon the Government the necessity for the consolidation of the present Acts of Parliament, and for placing in the hands of the central authority a power of seeing that they were carried into effect. At the present time various bodies had some kind of control in relation to sanitary legislation. The Privy Council, over whom his Grace presided, had authority in certain things, but this power was limited. By the Act of 1866, the Home Secretary was invested with power, but which at present had exerted little or no effect. Then there was the Poor Law Board, which represents the Boards of Guardians, and gives them the power of supervising vaccination and its practice throughout the country. To show the utter powerlessness of this authority to deal with the subject, it was only necessary to say that upwards of 2,000 persons had died of small-pox in England and Wales during the year 1866. Then, with regard to the supervision of lodging-houses, and the condition of houses, the Chief Commissioner of Police had power to act. Powers of other kinds were given to other bodies, and it was a most difficult thing for an officer of health, in the parishes of London, to know to what authority he was to look to to abate or prevent nuisances injurious to health. What was wanted was a unification of the laws in relation to public health, and a department of the Government having power to act in individual cases. Such a body constituted by Government should have power to compel vestries to do certain things which were obviously necessary for securing the public health. He saw with great pleasure that Mr. Rumsey was present in the deputation, as he had written one of the best books in the English language on the subject of State Medicine, and he knew no one who was more entitled to be listened to by statesmen of the present day than Mr. Rumsey.

Mr. James Beal urged the necessity for some measure of revision and consolidation. The permissive character of the present enactments was a mere loophole by which to avert responsibility. The provision of carriages for the removal of the sick of infectious diseases, and proper hospital accommodation for such cases, was avoided in this way, either to save the expense altogether, or to shift it on to other shoulders. Suggestions emanating from the district officers seldom or ever received proper consideration, and of course were as seldom acted up to. Conflicting interests would often prevent the carrying out of orders already made. The analysation of food or gas may be ordered, but a dead lock came when the expenses of providing apparatus for working it were to be provided. He complained that whilst last session the Sanitary Act of 1866 imposed upon the vestries the duty of providing hospitals for infectious diseases, this year the Poor Law Board had passed through the House, apparently without any concert with the Board of Health, a Bill imposing similar duties on Boards of Guardians. What was wanted was enlarged areas of administration for local purposes, and one central board for

all London, armed with sufficient powers to enforce the action Parliament desired. The conflicting action of departments of Government was a fruitful source of weakness. Let London be placed under one Board of State, Poor Law if they liked, or Home Office, or Privy Council, but not all three, and let the action of the State be simply appellate. He suggested that all the Health Bills and Vaccination Acts should be referred to a draughtsman to consolidate, and so end the chaotic legislation in which they were helplessly involved. He instanced regulations approved by Mr. Secretary Walpole under the Sanitary Act, 1866, for Chelsea; precisely the same were disapproved by the same officer of State for St. James's.

Dr. STEWART drew attention to the want of carriages for the conveyance of persons ill of infectious disorders, and of any effective means for disinfection, and for the isolation of the sick in most of the large towns throughout the country. He also insisted strongly on the absence in many places of officers of health and inspectors of nuisances, to whom was committed the duty of enforcing the act for the seizure of unwholesome articles of food. In London alone was the appointment of officers of health imperative, and he showed that the size and population of their districts varied enormously, as also their salaries, one having as little as twelve guineas, another as much as £1,000 a year. Only in nineteen out of fifty-nine large districts were health officers appointed, and the average of inspection was in London one to 34,000, and in provincial towns one to 42,000, of a population, rendering impossible any effectual inspection or removal of nuisances. And, as if to complicate matters still more, and to prevent any hearty co-operation in carrying out sanitary improvements, the inspectors of nuisances were in not a few instances independent of the officer of health, under whose control they should always be placed.

FAITHFULL & HEAD, Printers, 1a, Princes Street, Storey's Gate, Westminster.

ADDRESS ON HEALTH,

DELIVERED AT THE CONGRESS OF THE

NATIONAL ASSOCIATION

FOR THE PROMOTION OF

SOCIAL SCIENCE.

HELD AT BIRMINGHAM,

OCTOBER, 1868.

BY

HENRY W. RUMSEY, M.D.

President of the Health Department of the Association.

[REPRINTED FROM THE "TRANSACTIONS" FOR PRIVATE CIRCULATION.]

LONDON. 1868.

LONDON:
PRINTED BY W. W. HEAD, VICTORIA PRESS, 83A, FARRINGDON STREET, E.C.

ADDRESS ON HEALTH.

OF all persons, perhaps, members of the medical profession are the most liable to sudden and unexpected demands upon their supposed fitness for rendering help in emergencies, whether affecting the individual or the body corporate.

Thus, even in the brief history of this prosperous Association, it has happened more than once that the chair of the Health Department, in spite of its great attractions, has been left by the force of circumstances without an eligible occupant-elect until the executive committee in their extremity have been driven to send for a doctor.

Yet, in this Society, where each department has so many complicated relations with other departments, it has been wisely judged, and for the first five years it was happily arranged, that some statesman, or legislator, or philanthropist, should inaugurate and guide our proceedings, bringing to the task all that public influence, that knowledge of social interests in general, which are necessary for the success of the sanitary movement, himself in return receiving from the department all that special and scientific information which may be derived from the papers read, and the discussions herein held, and which may thus be influentially applied to public and parliamentary action.

Thus, if we look back at the great advantages which resulted from the sectional presidency, first of Lord Stanley, and then of Lord Shaftesbury—succeeded as they were in turn by Mr. Cowper, Mr. Edwin Chadwick, and Lord Talbot de Malahide,—we may reasonably regret that we have on this occasion failed to secure some one of those public men who are known to be thoroughly conversant with matters of health, and who might have brought us more closely *en rapport* with the leaders of public opinion. In our sixth year,

we reaped the benefit of the practical philosophy of Mr. Fairbairn. The intimate relations which exist between sanitary improvements and the skilful enterprise of civil engineers render it very desirable (if I may be excused for making the suggestion), that this department should sometimes be headed by one of their profession. During the last quinquennium, however, we have had an uninterrupted succession of medical presidents, men of great achievements, acknowledged authorities in preventive and legal medicine, and in the physical sciences.

No wonder that, on such a retrospect, I should have undertaken, very reluctantly, the responsibility which has been committed to me—no wonder that I feel incompetent to sustain the *rôle* of my predecessors in office, and unfit for the honour which has been, I fear unwisely, pressed upon me.

The science of health-preservation is an indispensable portion of the science of human society. Public health, that branch of hygiene which concerns communities, involves the enactment of laws by which the safety of the whole is protected against the errors and neglects of a part. Our department, therefore, has inseparable relations with that for the amendment of the law. Both departments are now concerned in the prospective task of reducing to order and consistency a chaos of conflicting sanitary statutes. Both have called for the appointment of public prosecutors, without whom the most necessary enactments may prove inoperative.

Then, private or personal hygiene might almost come under the charge of our educational section,—so entirely does a hearty obedience to precepts of health—as regards personal habits and conduct—depend on early instruction, good training, and intelligent conviction. Such obedience cannot, in a free country, be enforced by mere police regulations; unless, indeed, under some future Sanitary Act, any very unsavoury man might be defined a "nuisance," and so be brought under the operation of the Nuisances Removal Acts.

Domestic hygiene, again, seems to be something between public and private hygiene. Whilst the sacredness of the family hearth must be kept inviolate, the law may sometimes rightly and reasonably interfere, not only for the protection of neighbouring families, but also for the safety of dependent and helpless inmates. Here we see, in many ways, the connection between this department and that of social economy, especially in questions of labour and industry. How beneficial, for instance, have provisions for the prevention of disease and accidents proved in the regulation of employments! There can be no true social economy where there is no respect for the rights

and the welfare of others, no real education adapted to and accepted by all classes, nor any allegiance to those physical laws which are ordained by God himself for the maintenance of a long, a healthy, a useful, and a happy life.

These objects, as I understand them, constitute the elements of Social Science.

Now, in the Health Department, at all events on this occasion, it seems desirable to confine our efforts principally to matters of *public* health—to their scientific foundations, and to some of their practical aspects and present bearings.

On reviewing the progress of public measures during the past year, I have ventured to select, as the subject of this Address, a group of allied questions of pressing importance and involving, perhaps more seriously than others, the recognition of some first principles of natural science.

No one here need be reminded that the physical surroundings of man, determine mainly his degree of health, vigour, and longevity. Now the philosophers of old recognised four elements of nature, sources of all things and all changes of things, whether beneficent or malignant.

These elements of the ancients—fire, air, water, and earth—may therefore serve me as heads under which to group a few thoughts and suggestions on the relations of man to the facts of his natural and social life.

Fire, I take to include and express heat, of which it is a visible emblem and result. As the burning, purifying, and renovating principle of nature, I shall have to notice it in its action upon the other three—air, water, and earth.

These, when wisely employed, are our best friends, the prime means and necessaries of our existence. Nature, reverently handled, is really our great mother; and not, as a learned physiologist has of late facetiously called her—"a step-mother"—attributing to her paroxysms of malevolent intention.

These, our grand surroundings—air, water, and earth—are however liable to such original disorder, they may each and all assume such forms of danger and destruction, and they may be so abominably perverted by human ignorance and error as to produce, convey, and circulate among us the deadliest poisons. But man is endowed with capacities for observing the facts, noting the conditions, discovering the aberrations and mistakes, determining the right uses, inventing and applying the necessary remedial measures,—so that these primæval elements may be preserved and renewed as our perpetual sources of health and longevity.

I take for granted that action of this kind, on behalf of the

public health and safety, is that of the community, by means of its legislative and executive authorities; and I shall endeavour to shew, by one or two striking examples, under each head, how incorrectly and imperfectly the first principles of science have been acknowledged and applied in some recent enactments of sanitary intention.

I. AIR.—How strange it seems that society, for which man was formed, should be the original cause of his violating that primary natural law which demands purity and abundance of air for his healthy existence!

No sooner, however, is a community formed, and its space of habitation limited by neighbouring populations, than the air which supports it inevitably becomes more or less vitiated. In scattered populations, this continual vitiation of the atmosphere may be remedied partly by atmospheric motion, and partly by the rapid diffusion of gases. Even the insupportable nastinesss of the air of an Esquimaux cabin finds its compensation, if not its cure, in the wide expanse of barren land, open sea, and fields of ice, over which the exhalations of the dirty barbarians are driven and dispersed.

But, in warmer climates, as men congregate, when towns become the centres of active commerce, and the seats of art and manufacture — as the crowd thickens, as every square yard is occupied at increasing cost, and as the average space per head continually diminishes—so does the purifying principle of the air, Oxygen, lose more and more of its power, so does it become less efficient in renewing the blood, "which is the life of man," so is it rendered less capable of burning the carbon and other effete and noxious products of animal life.

Here then, unless sanitary science be boldly and skilfully applied to social existence, the masses deteriorate physically and morally. By degrees they lose the acuteness of those senses, smell especially, with which their Creator has endowed them for purposes of self-preservation. The human form divine degenerates. The less favoured classes sink in the scale of race, dwindle, alter in shape, colour, feature—they grovel, sicken, and die prematurely. By a fatal descent, the lord of creation reaches after, and wallows in, the lowest gratifications, acquires the grossest habits, and manifests the profoundest indifference to, if not deepest hatred of, law—divine and human—social order, purity of life and manners.

Even the wealthier classes, upper and middle, cannot escape the physical injury consequent upon contact with preventable disease and mortality. Such a state of things leaves, too often, a sad impress, moral and social, upon the leading members of a community. The chasm between the classes tends to widen.

In the skilful employment of capital, the workman has been too generally regarded as a mere instrument—which, *as a machine*, can be procured and used at the market price; yet on this instrument, *as a man*, is thrown the sole responsibility of maintaining himself in a state of efficiency, and of bearing the consequences, whatever they may be, of this human crush. Hence has grown up an antagonism of interests, a mutual distrust, which, unless it be removed, by just and liberal measures on the one part, of which there is now some hope, and by a fuller knowledge of the causes and remedies of their condition on the other, will shake the very foundations of society, and shew its apparent prosperity to be but the thinnest crust of glittering matter over an abyss of revolution and ruin.*

May I be permitted now to refer to the physical-science aspect of this question in great towns. And if I venture to allude to facts and phenomena, which are well known to you all, it will be understood that I do so, merely to complete and strengthen my argument.

What, then, is the physical nature of the impurities of town air? I know of no one who has contributed fuller information on this head than Dr. Angus Smith. Yet he, like others, has left much undetermined. *Excess of carbonic acid* is the most discernible injury inflicted by communities of men upon open air, an injury revenged with fatal force upon the aggressors. In nature, as we are told, there are rarely found more than 35 parts of this gas in 100,000 of air. But in the air of great towns are found from 40 to 74 parts, according to the degree of population density, and of fog or atmospheric moisture. In confined air, among lofty structures, the proportion appears to be greater; in rooms said to be well-ventilated, *i.e.*, supplied freely with town-air, the average quantity is said to be about 80 in 100,000; in ill-ventilated rooms and workshops, there have been found from 100 to 700 parts—20 times nature's allowance!

Now, as carbonic acid prevails, the circulation of the breathers is generally observed to slacken, the frequency of respiration to increase, and the nervous power to fail. Much of the phthisis and scrofula of town-populations is doubtless due to an atmosphere overcharged with carbonic acid. Increased temperature, due to season or climate, renders an excess of this gas still more injurious. [Thus, even 1 per cent. may be

* The social and political dangers of neglecting the sanitary condition of the poorer classes have been very forcibly shewn by Mr. Rendle.

endured at a temperature under 50° F., which would be absolutely intolerable at 70° or 80°].

But, if the presence of this destructive gas be more easily acertained and its quantity determined, and if it also tell us something of other gases of decomposition, it by no means reveals the most serious cause of atmospheric vitiation. There is much sulphurous acid in the air of smoky towns; much sulphuretted hydrogen near open sewers; and, worst of all, there are emanations peculiar to decomposing organic matter, especially animal *débris*.

Thus, the air taken from high table-land in the country is said to contain only about one grain of organic matter in 200,000 cubic inches of air, and this mostly of vegetable origin; but air from a cesspool has one grain in only 60 cubic inches—or 3,333 times as much as in nature.

The degrees of organic impurity in town-air vary infinitely between these extremes, in proportion as the known causes of such emanations are allowed to putrefy without prompt removal or disinfection, *e.g.* by means of charcoal in sewer-traps.

Dr. Angus Smith has observed, "We have, in different air breathed by people in the same county, a substance, the amount of which in one case is 22 times greater than in the other, and in air breathed by people in the same town a difference which is as 9 to 22." He adds, "that in the district in which the highest numbers were obtained, there were, in 1855, 4·5 deaths in the hundred."

It is this organic matter in the air which is the most pernicious result of human crowding. It is this which, in the air, as well as in the water, conveys specific germs of disease, inconceivably minute forms, capable of infinite multiplication in the living human body. In this, then, lies the fatal secret of density of population.

These emanations arise, as we know, in great measure, from foul water and from saturated and undrained soil; but, in large proportion also, they are exhaled from living beings—from the lungs of the diseased, from scattered saliva, and from the skins of the unwashed. It was generally supposed that the nitrogenous matter, which has been detected in the condensed vapour expired even by healthy people, came from the lungs But a French physiologist, M. Lemaire, has lately shewn* that in healthy adults it proceeds from the uncleansed mouth, throat, and gums, and the air about them. And he has recorded the very disagreeable fact, that skin-dirt (composed of perspiration, oily matter, and dust), when allowed to accumulate, is found, on examination, to contain myriads of microscopic beings, vegetable and animal (Bacteria and Vibrios), similar to those which he had before discovered in the air collected from the barrack-rooms of the Fort de l'Est.

* Comptes Rendus, Oct. 14, 1867.

The French savant selected, of course, for his experiments, the uncleansed, "*qui avaient*"—says he with the politeness characteristic of his nation,—"*négligé pendant huit et quinze jours les soins de la toilette.*"

In our population, town and country, there are millions who neglect such attentions for as many months or years as this philosopher reckoned days!

You may erect baths and wash-houses, but no Act of Parliament can compel their general use. Much, however, may be done by training the young in cleanly habits.

These cutaneous emanations are dissipated in, and therefore infect, the air. The closer the aggregation of unwashed human masses, the more horrible must be the resulting atmospheric impurity. When, in addition to the floating organic particles which arise from mucous discharges, we note the pulmonary exhalations of phthisical and scrofulous persons, charged with elements of disease, believed by many to be contagious — we may obtain some clue to a source of atmospheric vitiation in dense populations, of which there is not the faintest popular notion.

Those most delicate physiological tests of bad air and of defective oxidation—the blood, bones, and skin of a living child—prove to demonstration, when mere chemical analysis fails to throw light on the case, that town air, even in its best conditions, contains subtle poison, from which the airy upland and the breezy shore are free, and that it also wants some elements of nutrition and purification which the latter supply.

In Dr. Morgan's eloquent words, "A murky mass hangs like a shroud over the city—a dismal list of noxious gases is so intimately diffused throughout the air, that neither can the earth's heat radiate into space, nor can the warm beams of the summer's sun thoroughly dissipate the suspended canopy."*

Although much has been learnt from the study of death-rates, I have, for some time past, scrupled to quote them in support of sanitary *dicta*. With all respect for the Registrar-General and for my learned and distinguished friend Dr. Farr, I find these statistics full of fallacies,—especially in

* Morgan on Deterioration of Race, p. 29.

crowded towns, where the figures give by far too favourable an estimate of that mortality which is strictly due to town life. I need hardly say that the death-roll does not reveal the actual loss of health among town masses, nor does it record the multitudes *disabled* by a host of diseases and casualties, which may not at once destroy life, though they ravage the territory of labour and duty, and levy a most heavy tribute upon produce and property.

For this, we need an official Registration of Sickness attended at the public cost.

"The Rev. Professor Haughton has shewn that, on very simple mathematical principles, the density of a population would be a factor determining the ascent of the curve of increase of an epidemic." This would apply to the case of the distribution of poison by a water company. "I believe," adds Dr. Morris, in his very remarkable essay on Germinal Matter (p. 10), "that bad sanitary state of any kind would be equivalent to greater *proximity*."

All other sanitary appliances and reforms being equally adopted, or equally neglected, it is certain that close proximity of dwellings, over an extensive area, is *per se* a cause of unhealthiness and deterioration of race. For it is not fair to compare a well-regulated town population, having, perhaps, only eight square yards for each person to live upon, with an ill-conditioned dirty population in the open country.

For all this vitiation of air, caused by town life, there appear to be three natural remedies of different value in different cases:—motion of air; diffusion of gases by natural law; the presence or introduction of active oxygen.

Now (1), the mere motion of air, if it be natural motion—*i.e.* wind—is occasional and *variable*, while the generation of morbific causes is *constant*. The remedy cannot be relied on, for the air is often stagnant in circumstances of the greatest danger. The motion of air in towns is impeded by the proximity and height of buildings, probably as much as by insufficient openings in rooms. Nor do we know that, without the admixture of pure air, foul air can purify itself by simple motion. If the motion be artificial, it may be excessive or ill-timed, but of this again.

2. The diffusion of gases is necessarily limited by space, and mainly by superficial space; for, of their diffusion in a vertical direction, *i. e.* into the upper regions of the atmosphere, we know little, and that little does not favour the hypothesis of an effectual change. Gaseous diffusion is also impeded by the very circumstances which impede aërial motion. And these circumstances are most potential in towns.

3. But the presence of active oxygen in sufficient quantity —and sufficiency here means abundance—were that possible in dense populations, would be the real remedy.

Oxygen I take to be the burning and purifying principle of nature, represented by the elemental fire of the ancients. For flame is but luminous combustion. Professor Tyndall has shewn by his curious candle-burning experiments in the Vale of Chamounix and on the summit of Mont Blanc, that the quickness and intensity of combustion, such as takes place in vigorous oxidation, is, in general, incompatible with that brightness of flame which depends on the presence of carbon or other inflammable matter. The purer the air, the less visible is the fire, yet the more effectual the burning.

The proportion, chemically determined, of oxygen in air may not be much altered in towns, though it is sometimes found to be less: but recent discoveries tend to prove that its energy depends on the conversion of a portion of itself into another form, which, when obtained artificially, we call Ozone.

When Cavallo observed that the air which he had electrified had a purifying effect on decomposing organic matter, he laid the foundation of a discovery the future beneficial results of which are incalculable.

The researches of Schönbein—now alas! no more—and subsequent scientific experiments upon this agent, have thrown great light upon its nature. By an electric current, the volume of oxygen through which it passed was found to be diminished to the extent of 8 per cent. Then, Odling and Soret have proved that this condensation is due to the substitution of 16 atoms of ozone for 24 of oxygen. We also now learn that, while ordinary oxidizable substances absorb only the odd eight atoms, restoring the ozonic oxygen to its original condition (though not to its original volume), a substance—oil of turpentine—has been found to absorb the whole of the ozone, which thus destroys itself in attacking its enemy.* Finally, we know that ozone speedily removes dead and decaying matter "by resolving organisms into primitive and innocuous forms." (Day). Men of science have thus arrived, I venture to think, at the entrance of a wide field of practical work with this sanitary giant. Since the most delicate tests fail to detect anything

* A brief historical sketch of recent researches into the nature of Ozone may be seen in the *Medical Times and Gazette*, Oct. 5, 1867. Dr. Day of Stafford, has also contributed a very interesting and exhaustive paper on this subject, to the "Transactions" (Vol. I.) of the St. Andrew's Medical Graduates' Association, and a complete abstract thereof to the *Lancet*, of Jan. 18 and 25, 1868.

like ozone in the air of our crowded towns, we infer that in these places our great benefactor is used up; and that, without his presence and aid, oxygen itself fails to purify.

Richardson some time ago observed that when oxygen had repeatedly passed over dead and decomposing animal matter it lost its power of oxidation.

We may also infer that, in these conditions, deadly germs, carrying specific diseases, or their essences, may float in myriads about us, ever multiplying and safe from destruction, save when, happily for us, that unseen mysterious Ozone rushes down in the track of the lightning-flash, or rides by on the tempest, or gambols in the light spray of the sea-breeze.

There may be yet other substances besides oil of turpentine —an antozonide, according to Schönbein's ingenious theory— which may as effectually annihilate ozone, and may thus be ever at work to cut short our natural supply of active oxygen.

In the growing compression of human masses and animal life, (I speak metaphorically) may there not be evoked a demon of uncleanness and corruption strong enough to quench the spirit of burning and of purification?

Practically, then, the most essential measure of sanitary legislation and administration would be to provide better air than towns now supply to the people. And this object may be accomplished by three methods:—(1) speedily removing all the *débris* of animal life, and everything which by decomposition can corrupt the air; (2) promoting the free circulation of air into every quarter, through every court and alley, into every house, every room, in the inhabited area—in a word, Ventilation;—(3) enabling every person to breathe a sufficient quantity of pure and good air, *i.e.* air having the properties of ozone.

Our sanitary laws if properly carried into effect, which they are not at present, may secure the first object.

The second is a very vexed question. What is sufficient ventilation; and how is it to be obtained? The verdict in each case must depend on circumstances which in different cases are most diverse and complicated; for on the particular temperature of the climate, the season, the house, the workshop, the chamber, depends the demand for the more or less rapid circulation of air. In winter, or at night (exhalations being more readily condensed in cold air), several persons might remain not seriously injured in a room, the atmosphere of which would be dangerously vitiated by one person in a hot summer or within the tropics, when and where the exhaled organic matter is volatilized and thus prepared for quick re-admission into the living body.

The question of temperature is so intimately connected with that of air-circulation, that a long and complete series of scientific observations, in a great variety of places, would seem to be necessary to frame even elementary formulæ of ventilation. If old-fashioned people are more anxious to warm their houses and rooms than to secure purity of air, advanced sanitarians are perhaps sometimes too eager to ventilate without sufficient attention to warmth. Both extremes may be avoided. An authorized allowance of cubic space might be insufficient for healthy existence, without the introduction of currents of air so swift as to injure the weaker inmates of the house. Women, children, and the sick especially, would then be the chief sufferers.

Should any one desire to see what an amount of discrepancy may arise in a controversy on this subject, let him examine the Report of the Commission, appointed by the President of the Poor Law Board, on the Cubic Space necessary for the inmates of workhouses—one of the most useful contributions to the sanitary literature of the past year. If the Report itself sometimes betrays the weakness of a compromise, the memoranda attached to it, containing the views of high authorities and original thinkers, are of immense value. Among these is a spirited discussion between Professor Parkes and Dr. Angus Smith, (mighty men—"*fortemque Gyan fortemque Cloanthum*") in which both have brought forward so many weighty arguments that it would be presumptuous in me to attempt to decide between them. As far, however, as military hospitals are concerned, I think that my friend, the Netley Professor, has established his case.*

But, in crowded cities, the free circulation of pure air is simply impossible. The air outside the house, *i.e.*, the air to be admitted for ventilation, is often, as we have seen, only a few degrees less vitiated than the air to be expelled. The air, which sustains the life of 200 or 300 persons on every acre of a large district (including, for instance, more than a square mile), can never act properly upon effete organic matters; while invading currents of air, from the open suburbs, very rapidly lose their power to oxidize.

Existing legal provisions against overcrowding in single houses and rooms—good as they are and better as they might be—only touch the surface of this tremendous question. Overcrowding, when prejudicial to health, is now defined to be a

* There is a well-reasoned, suggestive, and practical article on "Ventilation and Ventilators," by Dr. Lawson, in his *Popular Science Review* for Oct., 1867. It deserves to be read by every one interested in this matter.

"nuisance," and so brought under legal action. But who is to judge of the danger to health in any particular case, and by what law? Will the same rule apply to every town? May not a degree of room-crowding be tolerable, and perhaps justifiable, in some openly-built town (as we know it to be in the country), which would be pestiferous in a thick population?

Possibly, by some despotic decree, you might succeed in compelling every inhabitant of a vast city to open his windows. Or, in a scientifically-built lodging-house, you might adopt the most approved appliances, the cleverest air-shafts and valves, the best directed currents. But what, I repeat, if the air which you are so studiously circulating is already vitiated, if it has become a disseminator of poison? Again, as Dr. Lankester and others have shewn, if the government formula of 500 cubic feet per head were enforced at once in many districts, the neighbouring parishes would either be more fearfully crammed by evicted emigrants, or the poor wretches must remain homeless vagabonds.

I am thus led on to the third means of obtaining atmospheric purity, viz., the supply of a sufficient quantity of pure air to every citizen.

Hardly anything has yet been attempted in this direction, whether by the Legislature or by private enterprise, except in promoting the formation of public parks, and protecting in some small measure open spaces in the metropolis and elsewhere from invasion by house builders.

That something more ought to be done in this direction can now hardly be a question, and I am happy on this point to be supported by Mr. Simon, who in 1866 advised that where it might be necessary to purchase and destroy the poorer dwellings as unfit for human habitation, the local authority should provide equivalent new dwelling space in the suburbs of the town.*

[Mr. Beggs has well shewn that increased facilities should be afforded by Parliament for the development of Freehold Land and Building Societies; so as to enable the working classes to provide themselves, on the co-operative principle, with extra-urban dwellings.]

It is true that some legal facilities for the purchase of land, *e.g.* power to borrow money of the Public Works Loan Commissioners, have been granted, under the Labouring Classes Dwelling Act of 1866, to local boards and voluntary associations; and it does not appear that the land to be purchased must necessarily lie within the overcrowded boundaries. But I hear that this Act is almost inoperative.

* Eighth Report, p. 17.

Again, the Artizans and Labourers Dwellings Act of the last session is very unlikely to provide a cure for the evils of overcrowding. This enactment—approved by some, but not generally understood—seems to be open to the following objections. The operation of the measure is confined to those places which throughout the United Kingdom (except in the metropolitan division of England) are isolated by town boundaries from the general population of the country. The whole burden and cost of its execution, with its compulsory purchases, demolitions, and reconstructions, are imposed wholly on the most suffering groups of population, and its administration is left to the local authorities of the most crowded localities. The operation of the Act being limited to places containing not less than 10,000 inhabitants, the smaller towns, with the districts under boards of guardians, are under no such responsibility, with regard to labourers' dwellings, as are towns with the specified population.

Yet the reports of the Medical Officer of Privy Council, that of Dr. Hunter especially, prove the urgent necessity for a sweeping reform in the house accommodation of the poorer classes in rural districts.

The extreme of error in this Act is attained by the provision which commits, almost unconditionally, the choice of sanitary advisers in this matter to bodies containing in force the representatives of the owners, tenants, and ratepayers of these places. Thus, duties of no common difficulty in the way of inquiry, report, etc., may be entrusted to ill-informed, dependent, and unlearned persons, although questions of high scientific moment are often involved in such investigations; and therefore the thorough qualification and official independence of the reporters should have been a chief concern of the Legislature. The amendments, good in themselves, made in this measure by the House of Lords do not touch these weighty points. The rights of a life-tenant or owner in fee, the possible injury to proprietary interests, seem to have been considered matters of greater importance. Far be it from me to question or even to doubt the humanity, zeal, and sympathy for the working-classes which actuated the framers and promoters of this enactment. It is, moreover, a great thing to have obtained from the Legislature some recognition of the principle that the dwellings of the poor ought no longer to be left to the chances of uncontrolled employment of capital. So we must hope that this is only a tentative measure, and that the necessary corrections and extensions may be speedily made in an Act which, I confess, appeared to me at first like a great sanitary sham,—and which, even now, unless it be amended, will prove,

as far as it may operate, seriously obstructive to a rational system of sanitary organization.

State governments, concerned only with the immediate interests of trade and commerce, have, inconsiderately or unknowingly, permitted the growth of aggregation, without making any adequate provision for the safety of the thickening populations. On the State, therefore, as I venture to conclude, rests the responsibility of taking the initiative, and in some degree lightening the local burdens, by a really permanent and efficient reform—such as would extend town areas, by a gradual distribution of their poorer classes, over larger surfaces of land. If, by the adoption of this principle, some boundaries of feudal origin might have to be superseded, some antiquated divisions and political restrictions to be removed, the gain to the country might be still greater.

By State aid, I do not mean advances out of the National Funds. The capitalist only requires some security for outlay upon undertakings which, though vast, are really prudent, and ought to be ultimately remunerative. A public guarantee for the payment of moderate interest upon private or corporate advances, or a security upon the county rate, would surely provide more than the required capital, the repayment of which need not be limited to forty years, as it is in the Act to which I have before referred. The benefit of a larger measure would be enjoyed chiefly by the next generation: why, then, should the present be required to bear the whole responsibility? If the creation of a permanent "stock" were undesirable, might not ultimate repayment of capital be limited to a century?

Slow, of necessity, must be such a process of social reconstruction, but every step taken by the Legislature for the better house-accommodation of the poor ought, I think, to keep in view the *enlargement of inhabited areas*.

In reply to some minor objections, still urged against the adoption of this principle,—I would observe that proximity to work and the labour market in these days is measured by time rather than by space. The labourer within a mile of his work may require a quarter-of-an-hour to walk to it. Give him a cheap railway, and he may travel from five to eight miles in the same time; that is, he is practically as near to his work as though he lived within ten or fifteen minutes' walk of it. But, we are told that railways are either wanting or unavailable; that existing companies will not come to terms; and that new companies would not pay.

To all this I reply;—if the wealthy classes are still to be at the mercy of a railway despotism, at all events let the

working-man be freed by some public measure, which would enable him to get quickly out of town, by railway, at a low fare. Let him have at least the option of breathing fresh air, of resting his weary eye upon the green of nature, of scenting the newly up-turned earth, of growing his vegetables, and of housing his wife and children away from town abominations. How long, I ask, is the suburban residence to be solely the luxury of the monied classes?

There can be no doubt of the financial economy of the principle. The weekly railway ticket, plus the rent of a cottage with from five to twenty poles of garden ground, need not equal the present cost of a stifling lodging on a flat of some old house in a dark street, reeking with moral and physical impurity, or amidst heaps of manure in some mews, impacted between the backs of lofty town mansions; nor need it equal the rent of rooms in some vast block of model lodgings. The saving of health, and the prolongation of life, would be clear gains in the financial comparison.

There will always be, I grant, a mass of unemployed labourers, waiters on Providence, who must reside as closely as possible to the labour-markets—to the wharves and docks of great ports. But how much less expensively, and more safely, might this class of labourers be housed on the very spot, if the other class, in constant work and able to leave town for their villages, were no longer to compete for the miserably small living space within the town precincts.

For those who are compelled to dwell in these centres, a greater number of well-contrived blocks, such as are now raised by societies and philanthropic individuals, may be found necessary. But their site, distribution, height, and proximity, should be subject to safe municipal regulations. They should not be allowed either to be erected on improper or unhealthy sites, as they sometimes have been, or to obstruct the free circulation of air.

If the required extension of inhabited area should be practically impossible in the case of London—that huge exception to all known methods of local management—we may surely beg the metropolitans not to interfere to prevent the principle from being carried out where it may be practicable.

Professor Kerr's plan for a simpler and humbler class of dwellings to shelter the lowest of the poor commends itself to public favour. No doubt, when the people are more generally and more rationally educated, when useful facts of elementary physiology are taught in our primary schools, they will not fail to appreciate as they ought the superior advantages of

an out-of-town cottage. I pray that the opportunity may be afforded to them.

Surely, then, we need not speculate upon bringing mountain or sea-air, by enormous pipes, into town centres. We should more wisely, with due regard for existing interests, promote legislative provisions for the judicious distribution of the labouring classes over wider areas of habitation.

II. WATER;—the flowing, sparkling, refreshing, and cleansing element—second only to air as a necessary of life, and bounteously supplied by nature in abundance and wholesome purity—has been long subjected to grievous neglect and outrage. The natural rights of the dwellers upon land to the water it furnishes have been usurped by monopolists, individual and corporate.* That which we might almost call a thing *ferœ naturæ*, has been seized, imprisoned, and sold to those who could afford to buy it; withheld from the poor, yet wasted by its proprietors and consumers.

Then, the original sources of water have been neglected and sometimes suppressed, the channels of its natural flow injured and obstructed, the banks of its courses abandoned to decay from natural causes, and to reckless wear and tear by unregulated industries; while the streams themselves have been deliberately converted into disseminators of poison to the riparian populations.

But before I touch on the injuries which man has inflicted on water, and has been forced to receive back again with ruinous usury, I would remark on the serious and progressive diminution in the natural supply of water, in most parts of this country.

As the land has become more thoroughly disforested and drained, for social and agricultural purposes, the water from springs (whether surface or subsoil), and from ponds and marshes, has, of course, passed more rapidly, off and through the drier soil, into main channels and rivers. Less having soaked into the soil, less rises in vapour, there is less of cloud and mist, and therefore a decreasing rainfall.

Professor Ansted, in a recent masterly essay,† has shewn

* A recent essayist—and a very able writer he is—on the future water-supply of London, speculates on the acquisition of gathering grounds, containing more than 3,000 square miles, and including other watersheds than that of the Thames, from which he coolly proposes to draw, by various crafty expedients, some 250,000,000 gallons of water *per diem*. Of this—their own natural provision—he generously offers to allow the unfortunate dwellers on the land *one-fourth* part, before carrying off as much of the remainder as he can to metropolitan reservoirs!!

† Roy. Agric. Journal, 1866, p. 62; 1867, p. 65.

how universally these changes are progressing in civilized countries, and how important are their effects upon supplies of water. Whether or not, in the coming golden age of science, man will be able to call down rain at will—as has been lately predicted by my accomplished predecessor in this chair—it is certain that man can both diminish the annual rainfall in most places, and can again restore it. Unquestionably he has diminished it, in some regions, to an extent which threatens the safety of great communities.

Yet improvements in agriculture, producing a drier and more tractable soil in plains and valleys, with a thorough drainage of fever-breeding marshes and fens, cannot be otherwise than beneficial to any country—provided the hill sources of water are protected.

The most important measure of redress for the growing evil of which I speak, is to preserve, with more sedulous care, the great natural reservoirs of our water supply, the elevated sponges of those mountain and hill ranges, which are the marks of our watersheds and points of attraction for atmospheric moisture.

These high sources of running water—sources which are too hastily assumed to be perennial, yet which have kept our great rivers tolerably full during the longest droughts—are lessening in produce in many districts. The wild rills, which, within the memory of a generation or two, used to dash and leap down the hill sides, are now, too often, things of the past, only fitfully running, after a storm or long-continued rain. We know both the fact and its cause. The heights, from and under which the streamlets sprang, were once wood crowned. They are now bare. The forest and brushwood of old with their accompanying herbage—which largely condensed the mists floating upon the hill tops, which retained the moisture, allowing it to ooze through porous rocks until held by some impermeable stratum for the service of living creatures, and which checked rapid evaporation from high ground and thin soil exposed to sun and wind—have been felled. On the western ranges, summit after summit has been cleared of wood. The proceeds of the wood sales may not have been dissipated, but much of the hill water—the natural wealth of the region—has disappeared.

These results of forest clearing are yet more manifest in other parts of the world. The diminution of rainfall in the Canary Isles is, perhaps, as apposite an instance as any of those adduced by Professor Ansted. The failure of water in the plains of Central India, from the same cause, has now, we learn, arrested the serious attention of the Indian

Government, and some of the hill sides are to be re-planted.

In this country, the effects of the hill-clearing are felt, not only by agriculturists, but (what is more directly to my point) by those who now endeavour to obtain improved supplies of water for the great town populations, spreading over plains and valleys.

Another cause of the diminution in the flow of streams, as well as of their waste, is the prevailing neglect of their channels and of the ground immediately adjacent. Obstructions of various kinds are permitted to form and grow from the refuse of mines, manufactures, and commercial processes, raising the river-beds with silt and indurated deposits, destructive alike to animal and vegetable life, and subversive of the purifying functions of running water. These evils are accompanied by greater liabilities, both to floods and to water-logged land.

Happily this great subject is now being comprehensively and judiciously handled by the eminent men who constitute the Royal Commission on river pollution, and who are adding to our sanitary literature reports of immense value. Some of their recommendations bearing on sanitary administration deserve most particular attention. Already, we owe to that Commission the Thames Navigation Act of 1866; and we are thus encouraged to hope that every watershed and river basin will in time be brought under a body of able and intelligent conservators.

A scientific administration of the entire valley of the Thames, under this Act, may effect much, if not all, that was anticipated by my friend Dr. Acland,* to whom chiefly, I believe, we owe the origination of measures now in progress for the conservation of rivers. But in mentioning the leaders of this movement, it would be ungrateful to omit one no longer among us, though still living in our hearts—the father of our founder—who contributed to our first meeting (and in this town) an admirable paper on the condition of the Severn. The Thames Conservancy Act is, indeed, a great step in sanitary legislation, for it recognises the necessity of extending the areas of administration, in conformity with the natural topography of the country.

Before passing on to another topic, I would ask whether it might not be advisable by special re-adjustments of local

* Acland on the Cholera at Oxford, p. 114. See also 10th Report of Medical Officer of Privy Council, p. 18.

taxation to encourage the planting and growth of timber on the bare hills of the West and North of Great Britain.

I would also strongly recommend that large reservoirs, for the storage of water at the heads of our principal valleys, should be safely constructed, at the public cost.

The sources of water thus decreasing, do we, as a people, take the greater care of that which Nature still beneficently provides? Just the contrary. Within the last thirty years, almost all the great water-courses of the land have been miserably defiled, and even converted into distributors of disease, by measures of town sewerage contrived hastily and executed unscientifically.

So eager were most of our earlier sanitarians to get rid, at any cost, of human refuse, that, without due consideration of the possible results of the methods adopted on the future water-supply of the people, they advised the pouring of abominations of all kinds into the nearest water-courses—having first rendered subsequent measures for the recovery of what was truly valuable in this so-called refuse almost impracticable, by diluting it with floods of water, both that which had been artificially stored at enormous expense for town distribution, and the natural rainfall.

In vain did physiologists and scientific agriculturists protest, for various reasons, against this rash dilution and wrong disposal of organic matter. The skill and enterprise of our great civil engineers, supported by the energy of leading sanitary reformers, were triumphant. The effete products of manufactures and trades, the animal and vegetable *débris* of towns, mineral detritus, all that comes under Lord Palmerston's celebrated definition of—"Matter in the wrong place"—was to be got out of the way by water-carriage, which was assumed (and not without reason) to be the most expeditious and economical mechanical power for the purpose.

The result of this remarkable movement was, however, that communities have had to encounter a more serious difficulty than at the very beginning of sanitary reform. To glance at some of the perplexities and losses which followed. There were fish in the rivers, good for food, but they might take their chance; so, being deprived by decomposing nitrogenous matter of the oxygen naturally existing in the water, they all perished. There were human communities down the stream, suffering from an increase of sickness and mortality—some in large towns, many in hamlets and villages—who were crying out for drinkable water; well, they were advised to filter the river-water, or to boil and then aërate it; or, if all this were too troublesome and expensive, they might sink wells or

tunnel the nearest hills for a safer supply. No substantial relief or help was afforded them.

But there were also landowners and large occupiers with riparian rights on the land through which these streams, shamelessly converted into open sewers, flowed. And these found their remedy in the old laws of the kingdom, laws which had not become obsolete, prescriptive rights which had not been invalidated by recent sanitary enactments.

Accordingly, Boards of Health (so called) have been restrained by injunctions issued by the Court of Chancery from discharging their refuse into the streams in question. These prohibitions have multiplied; and some places, as Banbury and Tunbridge Wells, have suffered sequestration for disobeying the injunction.

Municipal authorities throughout the country have, therefore, now to choose between leaving their towns undrained in contravention of sanitary enactments, suffering legal penalties for draining them into rivers, or making very costly experiments upon sewage, in the hope of satisfying both liabilities. There is, as a leading journalist says, a "Sanitary Dead Lock." Meanwhile, the inhabitants of both town and country are, in numerous places, calling out for pure drinking water. Water there may be, perhaps in plenty;

> "Water, water, everywhere,
> Nor any drop to drink"

for it has become sewer-water!

Now, excepting certain first-class towns in the north, and especially on the older geological formations, where the water supply is pure and abundant, it is indisputable that the condition of drinking water in most parts of England is deteriorating. Village supplies are very generally scanty and bad. Here, I may digress for a moment, to note the great advantage which might accrue to scattered populations from the use of Norton's American Tube Wells, which economically tap the subsoil strata to a depth of from 10 to 30 feet. Everyone knows how valuable they proved in the Abyssinian expedition. They possess the sanitary advantage of testing the quality of the water issuing at different depths in the same boring: and they may be used, I think, as registers of fluctuation in the level of the subsoil water.

Complaints of town supplies are also on the increase. I may take one instance of many. Scarcely more than a year ago, Professor Frankland reported of the Lincoln supply, that not one of the three samples sent for his examination was fit for domestic purposes, that they were all excessively hard, and

that one was frightfully contaminated with sewage. Even at Croydon, the pet specimen of drained towns and sewage utilization, the water supply is complained of as deficient and intermittent.

In these and other towns where the supply is short and of very indifferent quality, the community has no protection, no redress. The water monopoly entrenches itself behind its statutory rights. The ground being pre-occupied, no rival undertaking has a chance. And there is no law to compel the water-traders to surrender their monopoly on fair terms of sale to the public. I agree with Professor Gairdner that, wherever water has become a matter of private sale or barter, there has been a dereliction of duty on the part of the community, represented by the local authorities.

A constant supply at high pressure is rare in the South of England. Yet Mr. Beggs informs us that there are about 150 towns in this Island which enjoy the benefit of a constant water supply. It has now, therefore, been proved to be practicable. Its sanitary advantages are unquestionable. The entire abolition of cisterns and water butts in houses would be a reform scarcely inferior to the abolition of cesspools. The change by no means involves a loss of water. For instance, in Hull, where half the town is supplied on the intermittent, and half on the constant system, the waste is found to be greater in the former. In Manchester, the adoption of the constant system has resulted in a saving of seven gallons per head daily. Of course, on this system, due precautions must be taken to prevent waste; *e.g.*, by taps and water fittings of the best construction. A recent most useful pamphlet, circulated gratuitously by this Association, contains evidence, especially that of the eminent civil engineer, Mr. Bateman, which settles both the practicability and the economy of a constant water supply.* I have it, on Mr. Liddle's authority, that, in the Whitechapel district, the machines called water-waste preventers have been in operation for some time, and answer perfectly their intended purpose, so much so, that the East London Water Company is desirous of promoting their use.

The relation of water supply to the prevalence of certain

* The case of Glasgow may perhaps be cited by recusant water companies as evidence of the wastefulness of the system. It appears that nearly 47 gallons per head are daily consumed in that city; more probably than in any other place. The citizens of Glasgow ought to be remarkably clean. Perhaps Dr. Gairdner can favour us with some explanation of this apparent anomaly.

forms of zymotic disease is a question far too wide to admit of more than a few cursory remarks. Yet I cannot avoid noticing two very remarkable instances of this connection, afforded by the events of the last two years.

1. After the clear light which has been thrown upon the history of the cholera epidemic in the eastern parts of the metropolis in 1866;—first, by the weekly statements of the Registrar-General, fortified as they were by Professor Frankland's analyses; next, by Dr. Lankester, in his forcible exposition of the effects of the water supply upon cholera in the East of London;* then, with great fulness of detail and accuracy of research, by Mr. Radcliffe, checked as the form of his conclusions was by the cautious logic of Mr. Simon, who nevertheless accepted the substance of those conclusions; and now, lastly, by the luminous and exact records of Dr. Farr;—it is not too much to affirm that the most destructive force of that epidemic was spent upon the precise area supplied by the East London Water Company. We cannot go into the disputed points of that elaborate controversy, for it would not then be fair to ignore the counter statements and arguments of Dr. Letheby and Mr. Orton. But, explain the circumstances and events as one may, there are broad facts which remain undisputed. I need only mention the following.

The deaths from cholera and diarrhœa in the field of this water supply amounted to 89 in a population of 10,000, while in no other single company's field, north of the Thames, did such deaths amount to more than 18 in 10,000. Taking the reported deaths from cholera only, the mortality in the East London Company's field was nine times as great as in the New River sub-districts, and twenty times as great as in the North-Western sub-districts.

"Of the total mortality of 5,915, no less than 4,276"—says Mr. Radcliffe—"occurred in the East district of the metropolis and adjacent suburban districts of West Ham and Stratford."

In those districts, "immediately prior to the outbreak, impure water was known to be distributed over this field of supply. Neither the meteorology of the period, nor altitude, nor the nature of the soil, nor density of population, nor filth, nor the state of the sewerage, nor locality, affords any explanation of the peculiar localization of the outbreak, in the East districts. There is but one condition known which might become

* Quarterly Journal of Science, Jan., 1867.

capable of propagating cholera, common to the whole area of the outbreak, namely, the water supply."*

2. Other most confirmatory evidence of the connection between zymotic disease and water supply is furnished by the outbreak of typhoid fever in 1867, at Guildford. The fatal force of the epidemic fell upon that portion of the population which dwelt on the area supplied by what is there called the "High Service Reservoir." From this tank was distributed on a particular day—such was the horrid fact—actual sewage matter, which, owing to some engineering defect, had leaked into the well supplying the reservoir. "No other condition," says Dr. Buchanan, in remarkable accord with Mr. Radcliffe on the East London cholera, "on careful and detailed inquiry, is at all coincident with the outbreak of fever."

Again, Dr. Stevenson Macadam's report, at our last anniversary, on the relation of disease to the water supply of certain populous places in Scotland, shows plainly enough that the ravages of cholera were coincident in time and place with the use of water from impure wells.

But on this point, as on many others, the reports of the medical officer of Privy Council are full of facts and recommendations, which I cannot now even enumerate; yet all of the utmost significance and value.

Mr. Simon has especially dwelt, with great force, on the moral responsibility and legal liability of water companies, and has pointedly suggested that the distribution of fouled water by a local board or water company is a proper case for judge and jury on a claim for damages, by any of the persons injured by its malfeasance.

He is of opinion that, whatever latent liability of this kind may exist in our law, explicit legislation is required. If loss of life or health be clearly proved, there can be no reason why claims for compensation should not be made upon a company of water purveyors, or upon a board of health (acting either as water providers or sewage carriers), as well as upon a railway company.

A most instructive discussion followed upon Dr. Macadam's interesting paper on river pollution, in this department at Manchester, where we had the advantage of hearing Lord Robert Montagu's clear summary of the question, and Mr. Rawlinson's able comments on the practical working of various experiments. The River Commission has to some extent endorsed the principle of the resolution carried on that occasion,

* Ninth Report, M. O. P. C., p. 331.

recommending prohibitory legislation against the pollution of rivers. Should the legislature proceed in the course it has wisely commenced, and determine eventually that no natural stream of water shall be defiled by the refuse of towns, mines, or manufactories, we need not doubt that adequate and remunerative methods will be discovered for safely disposing of them all, and thus maintaining our rivers as distributors of life, health, and pleasure to an increasing and prosperous population. In the discussion just referred to, it was conclusively shown that a prohibition of this kind had fully answered with respect to gas works, and that the principle had been, and might further be, advantageously applied to lead, copper, and tin mines, as also to the principal manufactures.

Now, it has been clearly established, that the particular defilement of water, which is most dangerous to the public health, is that caused by putrescent animal matter, which has either passed through town sewers, or percolated the soil, and in both cases has led to contamination of drinking-water.

Sanitary reformers have, therefore, to consider, in the first place, the case of towns which are committed to the modern sewerage system, of which the metropolis is the grand exemplar, and which, in the aggregate, have spent many millions sterling upon their cyclopean constructions.

The only practical question here, is—what is to be done with the results? It is almost childish to propose to abolish that system, and to commence *de novo*.

From analyses made of the earlier results of filtration, we might conclude that not less than six-sevenths of the really fertilizing elements of town sewage remain in the fluid which has passed through the strainers and tanks of outfall works. So that, besides the injury to health and life caused by allowing this foul water to escape into rivers, the means of augmenting and cheapening the food supply of a teeming and needy population. have been wantonly wasted.

With regard to the sanitary injury, it is true that, given a sufficient time, sufficient length of current, and sufficient aëration of river water, the greater portion—and how much is not exactly known—of the dissolved and suspended poison is consumed by the oxygen naturally existing in the water and constantly renewed from the air. This is another of those beautiful provisions of nature which one cannot pass by without thankful acknowledgment.

The burning power of oxygen, so wonderfully active in the air, is almost as surely, though far less quickly, efficient in running water, provided the quantity of refuse thrown into the stream is not enough to extinguish the combustion. It is

therefore a matter of the utmost importance not to tax the oxygen of water unduly. Oxygen being far more soluble than nitrogen in water, it is well for mankind that the air contained in running water should consist of nearly double the proportion of oxygen which the atmosphere holds. This bountiful provision of oxygen seems as though it were intended to compensate in part for the slower combustion of dead and decomposing organic matter in water.

A remarkable proof of the gradual extinction of the burning, by the corrupting, principle, was furnished in the Thames at the height of its pollution by London sewage. Professor Miller tells us that in 1858, the river water at Kingston showed oxygen in normal proportion; at Hammersmith the ratio had sunk to half; at Somerset House to one-fifth; and at Greenwich and Woolwich the oxygen was almost annihilated. The friendly elemental fire was quenched! Corruption had triumphed! The naturally purifying action of aërated water has thus its limits and its fatal counteractions. Neither can it be trusted when the contamination is of a peculiarly fatal character. It is the quality rather than the quantity of organic matter which determines its danger. We are, as yet, quite ignorant of the degree of tenacity of life possessed by the germs of specific diseases. The proportion of nitrogenous matter, as determined by the chemist, does not even mark clearly the distinction between what is putrescent and what is not at the time decomposing. Still less does it tell of more recondite organic constituents.

"To look for a specific test for miasma in water is absurd;" said Mr. Tichborne, in a remarkable paper read in the Physiological Section of the Medical Association at Dublin (1867) —"there are certain subtle substances of intense power which are physically unrecognizable—substances that, so far as we have gone, no balance can weigh, no microscope can (enable us to) see."

That pretty and popular test, the permanganate of potass, though useful enough for demonstrating the loss of oxygen in water, and indicating roughly, though serviceably, the unwholesomeness of water, has been shewn to be untrustworthy for determining the proportion of the worst forms of organic matter. Nor does the apparent completeness of the burning work of oxygen in water, as shewn by the presence of nitrates or nitrites in the clear, cool, sparkling, yet treacherous, water of certain town wells, prove that the most dangerous ingredients have been destroyed. Well-known facts of disease and mortality among the drinkers have proved that it still exists.

We come then to the only known and reliable method of

dealing with this hideous creation, Town Sewage, which we have formed, as Frankenstein did his Fiend, by dabbling with decomposition,—a monster which, like his, may shorten our miserable days, unless we bury it in the earth:—our fourth element.

Metaphor apart, the distribution of this pernicious yet precious sewer water over the land by irrigation, within safe and accessible distances from our large towns, appears to be plainly indicated as the best cure for the evil; and it has now been proved to be both practicable and remunerative, at least in all those places where irrigation can be accomplished by gravitation.

III. Thus we arrive at EARTH, the matrix and birth place of elementary forms and germs of living beings, where they lie dormant and apparently dead, until roused into action by water or air or both; action which may be either beneficial or pernicious to man, according to the origin of those seminal principles.

The marvellous properties of earth, especially of the aluminous soils, in arresting, fixing, and assimilating, the nitrogenous and ammoniacal constituents of dead animal matter, point out earth as the proper destination of sewage, wherever it can be so used. For this conclusion we are mainly indebted to the researches and experiments of Professor Way, eighteen years ago. Even the poorer soils, consisting chiefly or wholly of gravel, sand, silica, or shale, may be converted from barren wastes into productive farms. This kind of land seems capable of absorbing almost any amount of sewage. The well-known case of the Craigentinny Meadows, near Edinburgh, a sea-beach in pre-historic times, and worthless in a commercial sense until treated with the sewage of the town, has settled that question; although the rough and very disgusting methods, adopted at Edinburgh, have tended to bring sewage irrigation into disfavour. And now, the Maplin sands on the Essex coast, are performing the same duty for the filthy flood of London; and seem likely, *pace* Baron Liebig, to receive the like benefit.

But it would be wrong to rely on the disinfecting properties of sandy and gravelly soils. They have not proved their capability of decomposing nitrogenous organic matter, or of fixing its elements in vegetable growth. They cannot, therefore, be depended on for the completion of that marvellous cycle of life, that adjustment of the balance of organic nature, which Dumas and Boussingault long ago demonstrated as essential to the existence of plants and animals—that "eternal round in which death is quickened and life appears, but in which matter merely changes its place and its form."

I would gladly avoid the details of utilization of sewage, a subject which involves both water and earth, and which has now a voluminous literature of its own. But some further notice of the question seems almost inevitable.

Recent disposals of town sewage by irrigation at Banbury, Warwick, and elsewhere, seem to promise grand success, after the failure of all chemical nostrums; success, both in arresting the reflux of impurity into the river, and in producing rich crops of various kinds.

But I beg to offer a few words of caution with respect to the multitude of schemes, now pretentiously advertised, for treating town sewage with chemicals, with the object of precipitating and solidifying its organic constituents for agricultural use, as dry manure. I am not aware that hitherto any of the projects have succeeded financially. The undissolved matter of town sewage contains, we are assured, only about one-sixth or one-seventh of its fertilizing elements. And all plans of this kind involve this enormous disadvantage, that the more perfect the separation and precipitation of the suspended (or, perhaps, dissolved) matters may be, the less available does the fluid become for any useful purpose, and therefore the greater temptation is there to allow of its escape into water-courses, which ought never to be permitted until we have obtained satisfactory guarantees for its thorough disinfection.

There is, indeed, one tried process—and others may yet be discovered—which are not equally open to these objections.

Dr. Bird's plan of precipitation, submitted to the York meeting of this Association in 1864, and for three years past in partial operation at Stroud, deserves a more extensive and thorough trial. It consists in the application of what he calls Sulphated Ferruginous Clay to both the solid and fluid portions of the sewage. It is said, on good authority, to furnish a compost which does pay the manufacturers and does succeed in procuring a marked increase of agricultural produce. But, to sanitarians, the main recommendation is, that it is based on the scientific truth, already noticed, that water charged with organic matter is chemically purified by filtration through aluminous soil. If, by the advancing perfection of this process (of which a scientific writer* has just informed us), the effluent water should become so nearly pure, as not to be worth the cost of distributing by irrigation on land; yet, if it cannot be proved that this water has been freed from noxious germs so as to be safely used for domestic purposes; the town authorities, or the contractors, or both, may still find themselves in an awkward dilemma.

A less favourable criticism may apply to a more recent scheme, the A B C process, as it is called, which professes to be based on the Chinese principle, of applying an aluminous compound to excreta. It has already been tested, with some promise of success, at Leicester; but even the last and most favourable statements† shew that more than

* *Lancet*, September 26, 1868. † *Times*, August 25.

ten grains of organic matter remain in each gallon of the water after the A B C process, while in the last report of Dr. Bird's aluminous treatment, the volatile and combustible matter seems to have been reduced to less than two grains.

Now, should none of these ambitious processes succeed in absolutely clearing sewer water of deleterious principles, even if proved to be financially profitable;—should the nymph of the sewer, like other chronic invalids who have been dosed with a variety of drugs, find that treatment by quacks and patentees does not restore her to health and purity, she must still carry her foul stream, rich in its nitrogenous, and not wanting in its phosphoric, elements, to the broad acres of the landowner, there to augment the food supply of the people. The problem will then be solved, at least for those places which are irreversibly pledged to the common-sewer system.

From the evidence already in our possession, and on reviewing many conflicting statements, it may, I think, be fairly inferred, that, in the use of fluid sewage for land irrigation, the following sanitary conditions should be observed.

An extent of land surface should be obtained, which shall be sufficient, under engineering direction and proper precautions, to absorb the whole of the fluid in dry weather; sufficient to decompose and fix its organic constituents; sufficient, again, to prevent atmospheric pollution; sufficient, also, to admit of long intervals between the periodical applications of the fluid to each portion of the surface; and, therefore, sufficient to promote a succession of crops, roots and cereals, so that we may hear of something better, on good soils, than Italian rye-grass.

To secure the fulfilment of these conditions, and on physiological grounds generally, though perhaps not in accordance with eminent engineering authority, I suggest that not less than an acre of clay or loam be secured for every thirty or forty of town population.

If sand, gravel, or silica constitute the bulk of the soil—these admitting of a far larger proportion of sewage on the same area—the effluent water should not be allowed to enter any stream which may be needed for domestic use, until it had been disinfected by scientific and approved methods.

Before dismissing the question of removing town-refuse, by means of water, I would say that the system so well planned and ably described by Mr. Menzies, deserves a complete and careful trial. It seems to be the first reasonable and practicable proposal for carrying into effect the famous alliterative dogma of Mr. F. O. Ward—"The Rainfall to the River, the Sewage to the Soil." It accordingly promotes economy in

the use of water. It also embodies the principle of upward filtration, first suggested by the wise and good Prince Consort. By substituting Dr. Bird's aluminous compound for the disinfectants suggested by Mr. Menzies, his plan of filtration would probably be much improved. I believe that in a large proportion of the yet unsewered towns, a skilful combination of the measures proposed by Dr. Bird and Mr. Menzies, might be very advantageously adopted.*

At all events, in those towns and villages which are not yet hopelessly involved in the difficulties of the water-carriage arrangement, the local authorities would be fully justified in pausing until repeated scientific experiments (which I agree with Dr. Child, of Oxford, ought to be aided by Government) shall have determined, as far as possible, the comparative merits of the several rival systems.

But, if threatening dangers demand immediate action, these places had better adopt that most ancient method, recently revived, in which earth is brought to the matter to be disinfected, in its primitive condition, instead of carrying that matter, in solution and suspension, to the earth.

The fact that certain soils possess the power, to which I have already referred, not only to deodorize, but also to abstract from decomposing animal matter, those elements which may be assimilated by the roots of plants, leads to the conclusion that the Jewish Legislator of old proclaimed a most philosophical, as well as a very practicable and profitable, expedient. Had the principle of that sanitary regulation been discreetly observed by the inhabitants of Jerusalem, under the monarchy, they might have preserved the Valley of Hinnom from pollution, as the lay-stall and common cesspool of the city, and thus perhaps have prevented that strange use of the perpetual fires of Hinnom, in which, as some learned commentators say, abominations of all sorts were burnt and reduced to ashes. This cinereal method of dealing with animal remains is not likely to find favour in England, unless, which God forbid, another cattle-plague should break out.

It is, then, an ascertained fact, that by covering the matters

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* Another very clever invention by a gentleman of this town, Mr. Edwin Chesshire, claims our notice. Its principle is to make, by means of intercepting house tanks, such separation of the fluid and solid matter to be removed, as would greatly diminish the subsequent difficulties of disposal and utilization. It appears also to be a sure preventive of the sanitary failures in house drainage, so carefully investigated by Dr. Carpenter, of Croydon. The same principle, though by a different method, has been advocated by Mr. Bannehr, C.E., of Exeter.

in question with dried clay, marl, or peaty loam, their volatile and nitrogenous constituents are at once fixed, and with their phosphates are slowly assimilated by the earth. The deodorization is perfect, because it is the result of complete chemical change. The compound resulting from this mixture becomes in a few weeks a uniform inodorous earth, again capable of performing the same digestive function; and this process may be repeated several times by the same mass of earth. The success of the experiment appears to depend on the dryness and separateness of the particles of soil, allowing the air with its oxygen to penetrate them freely.

The disinfecting quality of ordinary *humus*, is, I need hardly say, quite distinct from the power possessed by sand and gravel of promoting the oxidation of nitrogenous matters in solution. The latter is, indeed, a good instance of mechanical agency. But the former is a more remarkable proof of the provision made by nature for the chemical arrest of putrefaction, and so for our safety and preservation, if we did but reasonably follow her indications, as the dog and the fox do, when they bury their dead prey for future food. The slowness of the *eremacausis* in this case as compared with the rapidity of the change in watery solutions (sewer-water for instance) depends, probably, on the more speedy and perfect contact of the decomposing matter with its disinfectant in the latter case. But the certainty of the change is as great in the mixture of the solids, and the permanent benefit seems to be greater. The earth-method has another advantage, viz., that the compound may be safely dry-stored and transported without inconvenience to any part of the country.

We, therefore, revert to our common mother—Earth—in adopting the Rev. Mr. Moule's invention; and, notwithstanding certain practical difficulties attending on its domestic use, difficulties which may be insurmountable in crowded populations, sanitary reformers are surely right in advising the extension of this method as widely as possible. Its successful use in India, in military encampments, in the Buckinghamshire villages of Baron Rothschild, and in schools and various public institutions, has already established its practicability and value. That the general adoption of the earth system in scattered populations would tend directly to economize and protect their water supplies, is no mean argument in its favour.

Whether, while preventing contamination of (surface and running) waters and vitiation of air—the use of this dry compound in agriculture might possibly in any way injure the soil—for instance, by introducing undestroyed germs of disease, which, in the varying level of subsoil water, described

by Pettenkofer, might be developed into active and dangerous energy, is a point deserving of some consideration. I am not, however, disposed to attribute exclusively to earth, the propagation of germs of cholera or other zymotic disease.

On Pettenkofer's own theory, if I understand him rightly, water must, in the first place, have been the means of conveying any such specific *contagium* through the soil to the level of the subsoil water when at an unusual height; and then, on its subsidence, when the soil in drying becomes permeable by air, the morbific germ could be conveyed to man only by means of evaporation. The water, therefore, would be the first carrier, the air the second, while the earth would be merely the intermediate resting-place.

The practical lesson to be learnt from the researches of that celebrated Professor consists mainly, I think, in the importance, (1) of securing, as far as possible, dryness of soil; (2) of preventing contamination of earth in the immediate neighbourhood of dwellinghouses; and (3) of providing, in the particular process under consideration, a supply of really dry earth. It is with much satisfaction that I can now refer to the full recognition of this method by the Legislature, in the amended Sanitary Act of last session.

I am also glad to call attention to an excellent address, just printed by Dr. Newman of Stamford, in which he has had the courage and good sense, while urging the immediate abolition of the abominable cesspools in that town, to warn its inhabitants against the fashionable water method, and to recommend them at once to adopt the dry-earth system.

One caution given by the River Commission* appears to be of extreme importance, viz., that the general use of Mr. Moule's contrivances should be placed by the local authorities under vigilant inspection; and this of course implies a much more efficient staff of nuisance inspectors than at present, and more frequent domiciliary visits in poor and crowded localities.

IV. In the preceeding observations on air, water, and earth —as modified by the all-pervading principle of oxygen, representing the old elemental fire—in their various relations to public health and to some recent measures for its improvement, I am well aware that I have already exceeded the ordinary limits of a departmental address.

Continual reference to well-known facts in physiology and natural science may have appeared tedious and unnecessary to one portion of my audience, while certain disagreeable details

* Second Report, p. xiv.

may have been as distasteful to others. Yet while confessing to have dwelt perhaps too long upon principles which seem to me to lie at the root of all sound sanitary legislation, I cannot satisfy my sense of what is due to you on this occasion, without making, in conclusion, some reference to the practical question of administrative machinery.

From a remote period of English history, there have been laws and constituted authorities which took cognizance of matters injurious to the health of communities.

Actionable nuisances were condemned in courts of law, and certain public, as well as individual, wrongs were vigorously redressed. On such points the old common law of England was very explicit and not a little severe, recognizing the right of every man to "fresh and pure air," and to the removal of whatever was deemed unwholesome or even offensive. The common law has often, to the present day, provided a more certain sanitary remedy, in some such cases, than proceedings under modern Acts.

But there were also ancient statutes concerning health. So long ago as the reign of Richard II. a curious law for the prevention and removal of nuisances in "divers cities, boroughs, and towns of the realm and the suburbs of them," declared the condition of ditches, rivers, and other waters to be so bad, "that the air is greatly corrupt and infect, and many maladies and other intolerable diseases do daily happen." This Act is said to be only declaratory of yet older common law.* The mayors and bailiffs were authorized to administer the Act and to enforce penalties on those who transgressed it.

In the times of the Plantagenets, if not earlier, there were Crown Commissioners of Sewers (*Sa-weirs* in Saxon, sea-weirs or sea-fences), which were then merely wide and deep trenches, with embankments to protect the land against inundations, whether from the sea or from navigable rivers. Statutes followed under the Tudors and Stuarts respecting the drainage of land. All this shews the care bestowed by government upon matters affecting the safety of the people in the middle ages.

Then there were Courts Leet, relics of Saxon local government, modified by feudal tenure and service, at which any common nuisance might be presented. But these have fallen into disuse, and are now practically obsolete. Local boards of health are their modern representatives. Justices of the peace in counties, and the chief officers of cities and boroughs,

* Toulmin Smith, P. H. Laws, p. 22, 1848.

were occupied, centuries ago, during periods of pestilence, in what we should now deem unskilful efforts to protect the the health of the people; and those officials have succeeded in maintaining and even strengthening their position as modern sanitary authorities.

Together with the reform and the growth of municipalities, a distinct order of local administrative bodies in sanitary matters, is now established.

I need only mention that the Privy Council has long been authorized to interpose on behalf of the public health in emergencies of extreme danger.

But it was not until the old Poor Laws were amended, and parishes were grouped into unions, nor yet until these union districts were made the chief areas for a general system of registration, in which the main facts of mortality and reproduction, and (to a considerable extent) the causes of deaths, were recorded for the whole country,—that the relations of pauperism and destitution with the sickness and mortality of the suffering masses, were fully brought to light. Not until the new administrative bodies, with their medical and registration staffs, were in full action in these districts, was it clearly shewn, by Mr. Chadwick (in his famous "Report on the Sanitary Condition of the Labouring Population") that the causes of disease and premature death, and the social miseries thereon dependent, might be removed or remedied by a systematic application of sanitary measures. For that full exposition of the principles of an economical and efficient sanitary organization, based on the poor-law and registration divisions, the country is greatly indebted to Mr. Chadwick. It is, in my humble opinion, much to be regretted that the frame-work of local administration then recommended, was not employed for almost all purposes of preventive medicine, as a similar organization in Ireland has since been utilized.

Whatever might have been the original defects of the areas of registration, when viewed in their relations to physical science, or to vital statistics, or to ancient usages and divisions, they are unquestionably, of all existing districts, the best fitted for sanitary administration; and their boundaries are capable of rectification—a process which, in fact, is always at work. The municipal governments, however, have proved to be too strong a power to admit of a rival organization of that kind. The towns claimed independent action, and after a few years' struggle between the boroughs and the State, the Local Government Act was passed, which threw overboard the principle of governmental or national supervision.

No one can doubt that the Act of 1858 has been of great

benefit to many towns and populous places, but I fear that it has sometimes helped to strengthen the obstructives, and it has certainly raised up a host of present difficulties and perplexities in sanitary administration.

Again, during the last thirty years, our sanitary enactments of various kinds have multiplied until they form a library, not very easy of reference, and requiring both abridgement and codification.

Notwithstanding the greater degree of precision and effectiveness which marks the Sanitary Act of 1866 and its supplements,—the continuance, in the same districts, of conflicting jurisdictions, regulations and customs, and the existence of many remaining defects and obscurities in the laws themselves, have given a fresh impulse to the sanitary movement, the result of which, I am happy to say, is that a Royal Commission is about to issue, for full inquiry into these matters.

Under circumstances so propitious, it might be premature to enter into a number of particulars which I doubt not will be thoroughly and impartially investigated by that commission. Something, however, I have to say. The chiefs of several departments to which various matters affecting the health and safety of the community and of the working classes are now referred, are undoubtedly alive to the importance of some greater simplicity and unity in central action. And I believe there is a hearty desire on the part of Government to consider favourably the now general demand for the establishment of a single Department of Public Health.

We may hope that in any reconstruction of existing machinery—supposing such to be sanctioned by Parliament—the future central department may include and empower all those distinguished men who have for years rendered invaluable services to the public, under the present fragmentary and inharmonious system.

Of authorized local administration I wish to speak with all due respect. And I would preface a few remarks on the district question, by explaining that they are not intended to apply to the districts either of the Metropolis or of the largest cities and towns of the kingdom, such as this, the Metropolis of the Midland Counties.

In these vast centres of population, probably, the more pressing necessities of the case might be met by increased facilities of administrative co-operation between the urban and the suburban, and the surrounding rural districts.

It is very satisfactory to perceive that, of late years, local governing bodies throughout the country have become more

zealous and more efficient, and have creditably accomplished some really great undertakings. But it is impossible to shut one's eyes to certain serious defects of local organization—defects which hamper and obstruct the most willing efforts.

The main difficulty which almost everywhere meets the sanitary reformer is the existence of so many different kinds of local authority, in all manner of districts, for the execution of a variety of measures, which, if distinct from each other, are nevertheless cognate and often strictly correlative.

The Sanitary Act of 1866 itself recognizes two orders of local authorities, each containing several genera and species—one order dignified by the name of "Sewer Authorities", the other by that of "Nuisance Authorities."

And here I would observe that from this distinction we are by no means to infer that a *sewer* authority may not prove a grievous *nuisance*. As sewers, in the modern acceptation of the term, are deservedly losing favour; and as it is undesirable to extend the formation of such sewers to districts hitherto without them, one may reasonably regret that it has been thought necessary to stamp their name upon respectable local authorities. So far as sewers may be concerned with what engineers call the "arterial" drainage of land, they would come under the management of authorities of wider jurisdiction.

Now, there are some singularities, I may say oddities, about these sewer and nuisance authorities, which deserve notice.

The Act of 1866, in agreement with former enactments, empowers as Sewer Authorities, the old city and borough councils, other local boards of health, boards of town-trustees and commissioners, parish vestries and vestries of new districts to be cut out of old parishes and called "special drainage districts"—while the Nuisance Authorities are not only the said councils or local boards, but also justices in petty session, and boards of guardians instead of parish vestries.

Great must be the confusion, if not conflict, arising out of efforts to carry out sanitary measures, at all systematically, by bodies having jurisdictions differing in kind and extent;—the larger generally including several of the smaller, although the smaller may be empowered to execute more important functions than the larger. The diminutiveness of a sphere of action obviously tends to impair its efficiency.

No general method of co-operation between the various authorities contained in areas of wide extent (as, for instance, in divisions of counties) now exists.

It is true that some remedies for this admitted defect have been attempted by very recent amendments of the Sanitary Act. The Act of 1867 enables sewer authorities to purchase

or rent land for the purpose of sewage utilization; and while the creation of "special drainage districts" is encouraged, power is given to promote the combination of those districts, and thus to extend areas of drainage,—a principle of the utmost importance as regards the physical topography and geology of a district. But all this is permissive—all depends on the view taken by any local board or vestry of the propriety of such extension.

Again, by the Act of the last session, the sewer authority is to supersede the nuisance authority, where they are different bodies, in certain matters of disease-prevention. In fact, it is manifest that sewer authorities are getting the upper hand, and are likely to have the best of it. On the Darwinian theory, the weaker, though wider, race of nuisance authorities is in process of extinction, unless in good time, we may shew cause for their preservation.

To any sewer authority, out of London, may now be committed, with the sanction of the Privy Council, the power of providing for a temporary supply of medical aid for the poor, as in 1866 the same boards were empowered to supply hospital accommodation for the sick. Yet the public provision of medical relief to the poor throughout England has long been committed to Boards of Guardians, which are now held, by the Sanitary Acts, to be only nuisance authorities. In this matter then, as in others, two kinds of authority, within the same area, are empowered to execute the same description of measures!

A large party of sanitary reformers are calling for compulsory measures. They desire local bodies to be compelled to perform certain acts, without reference to their fitness or qualification for such duties. Now, will not the imposition of stringent obligations of this kind upon incompetent bodies, lead, as it has led, to continual central interference and to frequent appeals to courts of law?

Let me ask you to consider whether it might not be a wiser course to amend the constitution and composition of local bodies, so as to secure a more willing execution and a superior direction of preventive and remedial measures, and thus really to strengthen the great national principle of local government.

Again, as a general rule, I would suggest that prohibition is a safer principle than compulsion. "Shall not" is generally a better legislative formula than "shall." For example, it would be safer to say that local boards shall not empty their sewers into rivers, than to enact that they shall sewer their towns;—better to enact that they shall not permit the

erection of dwellings in already over-crowded localities or on unhealthy sites, than to compel them to evict a badly-lodged population;—better at once absolutely to prohibit (after a stated period) the slaughtering of animals for human food, and the keeping of cows for milk-supply, within the boundaries of towns containing more than (say) ten thousand inhabitants, than to enforce by inspection a variety of minute and vexatious regulations for the mere palliation of evils, which slaughter-houses and cattle-pens and cow-cellars in populous places must more or less perpetuate;—wiser, I repeat, to decide that the local authorities shall not appoint official engineers or surveyors or medical officers of health, without ample guarantees for their superior qualification, freedom of opinion, and devotion of their whole time to their public duties, than to compel local boards to make such appointments without the necessary conditions.

Local authorities—I beg their pardon—Sewer authorities, as we are to call them, are now really in a pitiable plight. They are, of course, expected to do all that sanitary laws empower them to do; they are threatened by advanced sanitarians with compulsory enactments in case of torpor or recusancy; they are officially informed of their liability to ruinous actions for damages, if they poison their own people with a supply of bad water; they are warned that coroners' inquests will be held upon those who die from preventable causes, which they ought to have abolished; yet they incur the greatest risk of Chancery Injunctions, on behalf of land-owners and adjacent districts, if they contaminate the water-courses by obeying the law.

Now, under these embarrassing circumstances, might it not be advisable for these local bodies, in smaller districts especially, to seek, and for the legislature to grant, an improved constitution of the administrative machinery, adapted to the necessities of the public health?

Very desirable does it appear that town and country and union authorities should be enabled to unite in the execution of certain comprehensive measures, and especially in the appointment of superior officers. The administrative economy of large areas has been conclusively proved. And a still more extensive combination of existing sanitary authorities seems to be required for the constitution of River conservancies.

But, before resorting empirically to any schemes, however promising, it would surely be right to consider what might, in the abstract, be the most desirable extent of area and population for local sanitary jurisdictions — for those, I mean, in which the more common hygienic functions are

to be advised and executed; what, again, should be their relations to larger areas, as counties and river conservancies, in which more extensive measures are to be directed,—as well as to smaller areas, namely, parishes, townships, and portions of such, for which only special and limited works are required. Then would reasonably follow the more practical question—how best to reconcile the ideal with the actual, how to rectify, with proper regard to existing interests, the present areas and limits of administration.

The natural features and boundaries of any region, as influencing soil, water, and climate, are very important guides to the formation of districts for local management. And this principle may be advantageously borne in mind, in any future correction of existing boundaries.

The statistical divisions of the kingdom, should, I repeat, be the principal factors in the process. They are the true bases of public sanitary action.

A rational reform of local divisions and a wise extension of administrative areas, are quite compatible with respectful consideration for the ancient limits of parishes, towns, and counties. By judicious improvements and reinforcements of County authority especially, a very noble and excellent characteristic of English society may be preserved in the advance of civilization.

If I have not dwelt with all the enthusiasm of a reformer on the progress and attainments of the last quarter-century, it is not, I hope, that I undervalue great results; but that I consider certain defects and sources of failure to be matters more deserving our immediate attention.

It is well, moreover, to speak with modesty and caution of what has hitherto been accomplished. And, before concluding, I venture to protest against the inconsiderate use—I might almost say the audacious misuse—of local rates of mortality, in support of some favourite sanitary measure, or in opposition to some dreaded reform, by those who may not yet have proved the fallacies of sanitary statistics; or who do not perceive how small may be the bearing of any particular act or neglect upon the variations of a general death-rate; or, again, who forget that the same figures in different places, and in populations differing as to age, class, and occupation, may represent totally different standards of health, vigour, and longevity.

Dr Parkes -
With the Author's kind regards -

A STUDY

OF THE

INFLUENCE OF WEATHER AND SEASON

UPON PUBLIC HEALTH;

MADE UPON ABOVE 217,000 CASES OF SICKNESS NEWLY OCCURRING AT VARIOUS INSTITUTIONS FOR THE RELIEF OF THE SICK POOR IN ISLINGTON, DURING THE NINE YEARS

1857—1865.

INFLUENCE OF ATMOSPHERIC TEMPERATURE.

BY

EDWARD BALLARD, M.D. Lond., M.R.C.P.,

MEDICAL OFFICER OF HEALTH FOR ISLINGTON.

[*From Volume L of the 'Medico-Chirurgical Transactions,' published by the Royal Medical and Chirurgical Society of London.*]

LONDON:

PRINTED BY

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1867.

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Received March 8th, 1866.—Read May 14th, 1867.

With the exception of a paper by Dr. Guy, published in vol. vi of the 'Statistical Journal,' I am not aware of any extensive numerical observations having been made with a view to determine the effect of weather upon public health, except as the latter is measured by the amount of mortality. The indications derivable from the mortality are fallacious, inasmuch as conditions of weather that may bring about a fatal termination of diseases already affecting a population, are not necessarily such as to occasion or favour attacks of illness in persons already in average health. I have frequently been struck, in the preparation of reports upon sickness and mortality, with the great discrepancy in this respect between the tables of sickness and the mortality tables for the same period of time. The inquiry I am about to enter upon, no

doubt, would have been prosecuted long ago, had any national registration of sickness been existent. Several years ago (in 1858) the medical officers of health in the metropolis, feeling how desirable a thing it was that they should be in possession of information as to variations in the amount and character of public sickness, undertook the collection of statistics of sickness, and, returns being made to them from most of the metropolitan districts, the results were published weekly. The aid which they received from the government, however, being withdrawn, this valuable publication ceased. As the medical officer of health in one of its largest parishes, I was a regular contributor to it while it lasted; and when it came to an end, from lack of funds to carry it on, I still continued to collect as before, extending rather than contracting the sources from which I derived information. By the close of 1865 I found myself in possession of a record of over 217,000 cases of sickness, certain acute and readily determined diseases being specially enumerated. In respect of all, I am in possession of a record of the month in which they occurred, and, as respects the greater number, of the week. They were all newly occurring cases of sickness seeking aid either at the hands of parochial surgeons, or at one or other of the dispensaries in Islington; and I have been permitted to include, by the kindness of the surgeon of the establishment, Mr. Bradley, the new cases of sickness happening in the Pentonville convict prison.

The materials at hand are such as to enable me to discuss, with some prospect of success, a considerable number of very important questions; but the first in importance has appeared to me to be the relation which existed between the amount of sickness prevalent at any time and the weather with which it was associated. In doing this I have availed myself of the meteorological tables published by Mr. Glaisher, in the returns of the Registrar General. Their public character, the readiness with which they may be consulted, and their great accuracy, far beyond that of any local tables I could have access to, led me to prefer their use.

Two methods of prosecuting the inquiry were open to me.

One of these was to compare the actual amount of sickness week by week, month by month, quarter by quarter, or year by year, with the meteorological conditions of each of these periods of time; the other, to note the fluctuations only of the sickness observed, and to compare them with the variations which occurred from time to time in atmospherical conditions. Both methods give valuable results and one may be used as confirmatory of the results of the other. But, of the two, the former is open to more fallacy than the latter, inasmuch as the absolute amount of sickness is dependent very much upon long antecedent conditions; so that very different amounts of sickness come to be recorded in seasons which in themselves differ very little in the character of their weather. The latter method is, to some extent it is true, liable to the same objection; but the influence of antecedent seasons is lost sight of where an extensive subdivision of time is had recourse to, and where such short periods with merely their fluctuations of sickness, as taken from very different years and seasons, are mixed together in the same table; note being taken, not of the actual numerical amount of the several meteorological conditions (such as the actual temperature, actual degree of humidity, &c.), but merely of their fluctuations from one short period of time to another. This latter method, then, I propose first of all to adopt, reserving to myself the use of the former where it appears likely to afford valuable information.

Of all the meteorological conditions ordinarily observed, none is more influential than atmospheric temperature; none more constant in its operation, nor more consistent in its mode of operation. I propose then to commence with this element of weather, and first of all to show how it operated in the course of 389 weeks, comparing the variation of mean temperature, week by week, with the fluctuations in general sickness which were associated with it. The materials for this comparison will be furnished by the records of sickness as supplied to me, week by week, in the years 1858 to 1865 from the following sources: viz. the Islington workhouse and infant poor house; the case-books of eight district parochial

surgeons; the books of the Central Holloway Dispensary and of the Islington Dispensary. During these eight years 158,721 new cases of sickness of all kinds came under observation. For a reason to be presently assigned, a few weeks at the close of each year have been excluded from the inquiry, as fallacious in their indications.

Table I represents the fluctuation in general sickness which took place in the course of 196 weeks of rise of mean temperature during the eight years 1858–1865.

Certain weeks immediately about Christmas in each year are excluded from the summary, inasmuch as the account of sickness in my record for those weeks is not to be relied upon as a fair representation of what actually occurred. At and about Christmas I have invariably found that the applications for medical relief at the institutions which supply the basis of my record were greatly and apparently capriciously reduced.

The normal tendency of rises of mean temperature is to occasion increase of sickness in the weeks in which they occur.

In the course of the 196 weeks during which rises of mean temperature of various extent took place, increases of sickness occurred to the total amount of 4246 cases, and decreases to the total amount of 2000 cases.

Thus, for every 1000 cases of increase of sickness there occurred only 471 cases of decrease.

For the purposes of the analyses I have found it convenient arbitrarily to divide both rises and falls of temperature into those which are "slight," or under 2 degrees in extent; "moderate," or to the extent of 2 and less than 5 degrees; and "considerable," to the extent of 5 degrees and upwards.

That this difference as to increase and decrease of sickness was not accidental, but more or less directly the result of the rises of temperature, appears from observing that the increases were greater in proportion to the decreases of sickness according as the extent of the associated rises was greater. Thus—

Tables showing the relation between fluctuations of mean weekly temperature and weekly fluctuations of general sickness.

TABLE I.—*Rises.*

	Number of weeks.	Increase of sickness.					Decrease of sickness.					Neither increase nor decrease of sickness.				
		Sum of rises.	Mean weekly rise.	Number of weeks.	Sum of rises.	Mean weekly rise.	Frequency of cases, of weeks.	Amount of increased sickness.		Number of weeks.	Sum of rises.	Mean weekly rise.	Frequency of cases, of weeks.
								Sum.	Mean.				
Rises generally.....	196	733·5°	3·74°	121	467·5°	4·11°	61·73	4246	35·69	74	232·5°	3·14°	37·75	2000	27·0	1	3·5°	3·5°	0·52
Slight rises (under 2°)	70	70·7°	1·01°	40	39·0°	0·97°	57·14	1166	29·1	30	31·7°	1·05°	42·86	984	32·8				
Moderate rises (2° and under 5°).....	73	245·0°	3·35°	40	137·8°	3·44°	54·79	1295	32·3	32	109·7°	3·24°	43·84	701	23·7	1	3·5°	3·5°	1·3
Considerable rises (5° and upwards).....	53	417·8°	7·88°	41	330·7°	7·82°	77·36	1785	43·5	12	97·1°	8·09°	22·64	251	21·2				

TABLE II.—*Falls.*

	Increase of sickness.					Decrease of sickness.					Neither increase nor decrease of sickness.			
	Number of weeks.	Sum of falls.	Mean weekly fall.	Frequency of increase per cent. of weeks.	Amount of increased sickness.	Number of weeks.	Sum of falls.	Mean weekly fall.	Frequency of decrease per cent. of weeks.	Amount of decreased sickness.	Number of weeks.	Sum of falls.	Mean weekly fall.	Frequency per cent. of weeks.
					Sum. Mean.					Sum. Mean.				
Falls generally	193	700·1°	3·62°	76	2253 29·6	113	436·3°	3·86°	58·55	4538 40·2	4	3·1°	0·7°	2·07
Slight falls (under 2°)	58	69·1°	1·03°	26	1028 39·5	29	31·1°	1·07°	50·00	966 33·1	3	1·1°	0·3°	5·17
Moderate falls (2° and under 5°).....	87	290·0°	3·33°	34	855 25·1	52	170·4°	3·27°	59·77	1852 35·1	1	2·0°	2·0°	1·15
Considerable falls (5° and upwards)	48	350·0°	7·29°	16	370 23·1	32	234·8°	7·33°	66·66	1758 54·8				

In the course of the 70 weeks of slight rise of temperature, for every 1000 cases of increase of sickness there happened 843 cases of decrease.

In the course of the 73 weeks of moderate rise of temperature, for every 1000 cases of increase of sickness there happened 587 cases of decrease.

In the course of the 53 weeks of considerable rise of temperature, for every 1000 cases of increase of sickness there happened 142 cases of decrease.

Table II represents the fluctuation in general sickness which took place in the course of 193 weeks of fall of mean temperature during the same eight years.

The normal tendency of falls of mean weekly temperature is to occasion decrease of sickness in the weeks in which they occur.

In the course of the 193 weeks during which falls of mean temperature of various extent took place, decreases of sickness occurred to the total amount of 4538 cases, and increases to the total amount of 2253 cases.

Thus for every 1000 cases of decrease of sickness there occurred only 496 cases of increase.

That this difference again was not accidental, but more or less directly the result of the falls of temperature, appears from observing that the decreases were greater in proportion to the increases of sickness according as the extent of the associated falls was greater. Thus,—

In the course of the 58 weeks of slight fall of temperature, for every 1000 cases of decrease of sickness there happened 1070 cases of increase.

In the course of the 87 weeks of moderate fall of temperature, for every 1000 cases of decrease of sickness there happened 469 cases of increase.

In the course of the 48 weeks of considerable fall of temperature, for every 1000 cases of decrease of sickness there happened 210 cases of increase.

It is remarkable, and a point which will be again referred to, that the decreases of sickness in the weeks of slight fall

were altogether less than the increases which took place in these weeks.

Assuming that normally rises and falls of temperature to a similar extent act with a like force in producing fluctuations of sickness, although in opposite directions, we may estimate their normal force, under average conditions in regard to supplementary meteorological states of the atmosphere, so far as our tables are concerned, as follows:

We have upon our tables altogether 389 weeks in which rises of mean temperature took place to the total extent of 733·5 degrees, and in which falls took place to the total extent of 700·1 degrees, making together fluctuations, either by way of rise or fall of 1433·6 degrees.

During the 169 weeks of rise of temperature increases of sickness occurred to the amount of 4246 cases and decreases to the amount of 2000 cases, giving thus a clear gain by way of increase of sickness amounting to 2246 cases.

Again, during the 193 weeks of fall of temperature decreases of sickness occurred to the amount of 4538 cases, and increases to the amount of 2253 cases, giving thus a clear gain by way of decrease of sickness, amounting to 2285 cases.

Adding these normal gains together, we obtain as the total result of the 389 fluctuations of mean temperature corresponding fluctuations of sickness, the clear gain from which by way of increase or decrease amounts to 4531 cases. This is the final result of 1433 degrees of fluctuation of temperature, so that the mean result, under average conditions, of a change of temperature either by way of rise or fall, to the extent of one degree, may be taken to be an increase or a decrease of sickness to the amount of 3·16 cases; all above or below which must be attributed to the operation of supplementary meteorological conditions co-operating with or antagonising the rises or falls of temperature. Such conditions may, as we shall see, be concurrent with or antecedent to the changes of temperature referred to.

We may now apply this standard of force to the results of the rises and falls as stated upon the tables. Thus,—

There were 196 rises, the sum of which was 733·5 degrees. The clear gain by way of increase of sickness which might have been anticipated under average supplementary conditions is therefore 2317 cases. But, deducting the decreases from the increases of sickness, we obtain the number 2246 cases of increase only, so that the gain of increase of sickness does not reach the estimated amount by 71 cases. I infer from this that in the course of these 196 weeks of rise of temperature in which various supplementary conditions, promotive some of increase and others of decrease of sickness, were operative, an excess of force was exercised by the antagonistic conditions (those promotive of decrease) which may be represented by saying that it was equal to what would, under average conditions, be exerted by 22·47 degrees of fall of mean temperature or by a mean weekly reduction of temperature to the extent of 0·11 degrees.

Applying the same standard to the results of slight, moderate, and considerable rises severally, we find—

1st. *As to slight rises.*—There were 70 such rises, the sum of which was 70·7 degrees, the clear gain by way of increase from which would, under average conditions, be 223 cases. But, deducting the decreases which occurred from the cases of increase, we obtain as the actual clear gain only 182 cases, so that the gain does not reach the estimated amount by 41 cases. Thus, as respects these 70 weeks of slight rise, we find that in their course an excess of force was exercised on the part of the supplementary antagonistic conditions, which may be represented by saying that it was equal to what, under average conditions, would be exerted by 12·97 degrees of fall of mean temperature, or by a mean weekly reduction of temperature to the extent of 0·18 degrees.

2nd. *As to moderate rises.*—There were 73 such rises, the sum of which was 245·0 degrees, the clear gain by way of increase of sickness from which would, under average conditions, be 774 cases. But, deducting the decreases which occurred from the cases of increase, we obtain as the actual clear gain only 534 cases, so that the gain does not reach the

estimated amount by 240 cases. Hence it is to be inferred as respects these 73 weeks of moderate rise that in their course an excess of force was exercised on the part of the supplementary antagonistic conditions equal to what under average conditions would be exerted by 75·95 degrees of fall of mean temperature, or a mean weekly reduction of temperature to the extent of 1·04 degrees.

3rd. *As to considerable rises.*—There were 53 such rises, the sum of which was 417·8 degrees, the clear gain by way of increase of sickness from which would, under average circumstances, be 1320 cases. But, deducting the cases of decrease of sickness from those of increase, we obtain as actual clear gain 1530 cases, so that the gain exceeds the estimated amount by 210 cases. Hence it may be inferred, as respects these 53 weeks of considerable rise, that in their course an excess of force was exercised on the part of the supplementary co-operative conditions (promotive of increase of sickness) equal to what, under average conditions, would be exerted by 66·46 degrees of rise of mean temperature, or by a further mean weekly rise of 1·25 degrees.

Again. There were 193 falls, the sum of which was 700·1 degrees, the clear gain by way of decrease of sickness from which would, under average circumstances, be 2212 cases. But, now deducting the cases of increase of sickness on the table from those of decrease, we obtain an actual clear gain of 2285 cases, so that the gain exceeds the estimated amount by 73 cases. Hence it may be inferred that in the course of these 193 weeks of fall of temperature, an excess of force was exercised on the part of the supplementary co-operative conditions (promotive of decrease of sickness) equal to what under average circumstances would be exerted by 23 degrees of fall of mean temperature, or by a further mean weekly fall to the extent of 0·12 degrees. Then—

1st. *As to slight falls.*—There were 58 such falls, the sum of which was 60·1 degrees, the clear gain by way of decrease of sickness from which would, under average circumstances, be 190 cases. But we observe on consulting Table 2 that so far from there being any such gain the cases of decrease of

sickness were less numerous than those of increase by 68 cases. Hence we must infer that in the course of these 58 weeks of slight fall an excess of force was exercised on the part of the supplementary antagonistic conditions (promotive of increase of sickness) sufficient not only to neutralize the normal decrease of 190 cases, *but to produce* 68 *cases of increase also*—a force thus capable of increasing sickness virtually by 258 cases, and therefore equal to what under average circumstances would be exerted by 81·65 degrees of rise of mean temperature, or by a mean weekly rise to the extent of 1·40 degrees.

2nd. *As to moderate falls.*—There were 87 such falls, the sum of which was 290 degrees, the clear gain by way of decrease of sickness from which would, under average circumstances, be 916 cases. But, deducting the cases of increase from those of decrease we obtain as actual clear gain a decrease of 968 cases, so that the gain exceeds the estimated amount by 52 cases. Hence it may be inferred, as respects these 87 weeks of moderate fall of temperature, that, in their course, an excess of force was exercised by the supplementary co-operative conditions (promotive of decrease) equal to what under average circumstances would be exerted by 16·45 degrees of fall of mean temperature, or by a further mean weekly fall to the extent of 0·18 degrees.

3rd. *As to considerable falls.*—There were 48 such falls, the sum of which was 350 degrees, the clear gain by way of decrease of sickness from which would, under average circumstances, be 1106 cases. But, deducting the cases of increase of sickness from those of decrease, we obtain as actual clear gain a decrease of 1385 cases, so that the gain exceeds the estimated amount by 279 cases. Hence it may be inferred as respects these 48 weeks of considerable fall that, in their course, an excess of force was exercised by the supplementary co-operative conditions equal to what, under average circumstances, would be exerted by 88·29 degrees of fall of mean temperature, or by a further mean weekly fall to the extent of 1·84 degrees.

A deduction, which there will be occasion to use presently, may here be drawn, viz., that in the weeks of rise generally, and in the weeks of fall generally, the supplementary causes of increase and decrease of sickness are balanced in the same manner. In both the supplementary causes of decrease of sickness operate in excess of those promotive of increase of sickness, and as nearly as possible with the same force.

Relation of Rises and Falls of mean weekly Temperature to the frequency of occurrence of Increase and Decrease of Sickness.

1. *Rises.*

1st. Rises of mean weekly temperature were associated with increase of sickness much more frequently than with decrease of sickness.

Increase of sickness occurred in 61·73 per cent. of the weeks in which a rise of temperature took place; decrease in 37·75 per cent.

2nd. That the rises themselves were influential in producing the greater frequency with which increase of sickness took place is shown by the observation that the frequency with which increase of sickness occurred was greater when the extent of the rises was great than when it was comparatively small.

The frequency of increase of sickness in the 53 weeks of considerable rise of mean temperature (mean 7·88 degrees) was 77·36 per cent.; in the 143 weeks of slight and moderate rise of mean temperature (mean 2·2 degrees), 55·92 per cent. There was one week in which neither increase nor decrease of sickness occurred.

2. *Falls.*

1st. Falls of mean weekly temperature were associated with decrease of sickness much more frequently than with increase of sickness.

Decrease of sickness occurred in 58·54 per cent. of the

weeks in which a fall of temperature took place; increase of sickness in 39·37 per cent.

2nd. That the falls themselves were influential in producing the greater frequency with which decrease of sickness took place is shown by the observation that the frequency with which decrease of sickness occurred was greater when the extent of the falls was great than when it was comparatively small.

The frequency of decrease of sickness in the 48 weeks of considerable fall of mean temperature (mean 7·29 degrees) was 66·66 per cent.; in the 87 weeks of moderate fall of mean temperature (mean 3·33 degrees), 59·77 per cent.; in the 58 weeks of slight fall of mean temperature (mean 1·03 degrees), 50 per cent.

One striking fact at least shows that something else besides the change of temperature influenced the occurrence of increase or decrease of sickness in the weeks under examination, viz., that in the weeks of moderate rise, the frequency with which increase of sickness occurred was less than in the weeks of slight rise. If it were otherwise increase of sickness would always be associated with rises of temperature, and decrease with falls. That decrease of sickness ever occurs with a rise of temperature shows that sometimes supplementary causes are in operation capable of overpowering the influence of the rises; and that increase of sickness ever occurs with falls of temperature shows that supplementary causes are sometimes in operation capable of overpowering the influence of the falls. In any selected week, beside the rise or fall of temperature, supplementary causes both of increase and of decrease of sickness must be believed to be existent, and according as those promotive of increase or those promotive of decrease are in excess or predominant, there will be a tendency either to increase of sickness or to decrease. In the one case the supplementary causes in excess will tend to co-operate with rises and assist them in increasing sickness, or else tend to antagonise the falls and prevent them from decreasing sickness; and in the other case the supplementary causes in

excess will tend to co-operate with falls and assist them in decreasing sickness, or else tend to antagonise rises and prevent them from increasing sickness. Whether in any week sickness will be increased or decreased then will depend upon the manner in which all these influences are balanced as regards their force. The factors are the extent of the rise or fall of temperature (their force); the predominance of supplementary conditions tending to increase or decrease sickness; and the degree (force) of their excess or predominance.

We will now, therefore, endeavour to discover as respects the weeks of rise or fall of mean temperature how far the occurrence of increase of sickness with rises, and of decrease of sickness with falls, as recorded upon our tables, was dependent upon the rises or falls themselves, and how far upon the predominance, in each set of weeks, of supplementary causes of increase or decrease of sickness; and again how far these latter causes operated in producing decrease of sickness with rises of temperature, and increase with falls.

Certain assumptions will have to be made, the probability of which will govern the trust to be placed in the results of the inquiry.

The first is that, just as rises and falls of temperature are about equal in frequency in the course of 389 weeks, and as the distribution of force of the various supplementary causes of increase and decrease is altogether similar in the 196 weeks of rise and the 193 weeks of fall, so also may the frequency with which the supplementary causes of increase and decrease are severally in excess in the weeks of rise or fall of temperature be regarded as similar.

The second is that this assumption may be accepted as applying to rises and falls of all degrees of extent; that is to say, whatever may be determined upon as the frequency with which supplementary causes of increase and decrease of sickness are in excess in weeks of rise and fall of temperature generally, that shall be regarded as the frequency with which either predominates in the weeks of slight, moderate, or considerable rise or fall of temperature respectively.

Let us endeavour, then, to ascertain with what relative frequency the supplementary causes of increase and decrease of sickness predominated in the 389 weeks.

First, looking at Table 1, we see that there were 38·27 per cent. of weeks of rise, in which the supplementary causes of decrease of sickness predominated over all causes of increase of sickness, including rises of temperature.

Secondly, looking at Table 2, we see that there were 41·45 per cent. of weeks of fall, in which the supplementary causes of increase of sickness predominated over all causes of decrease of sickness, including falls of temperature.

There remain 20·28 per cent. of weeks in which it is probable that a similar predominance of one class of causes over the other existed, although not sufficient to neutralize the obvious operation of the rises and falls of temperature. Distributing the frequency of predominance of supplementary causes similarly in these weeks we have 9·74 per cent. additional of weeks in which causes of decrease predominated, and 10·54 per cent. in which causes of increase of sickness predominated.

Hence we may regard it as probable that in the 389 weeks, whether of rise or fall of temperature, supplementary causes of increase of sickness predominated in operation in 52 per cent., and of decrease in 48 per cent.

But we have seen that both in weeks of rise and fall of temperature, the sum of force of operation of the supplementary causes of decrease of sickness was greater than that of the supplementary causes of increase.

Hence a further deduction that the supplementary causes of increase of sickness operate more frequently but with less force than the supplementary causes of decrease, while the supplementary causes of decrease of sickness act with more force but less frequency than the supplementary causes of increase.

1. *As to rises of mean temperature.*

Had there been no rises of mean temperature in the course

of the 196 weeks we should still, upon our estimate of the frequency of predominance of the supplementary causes of increase of sickness, have met with increase of sickness in 52 per cent. of those weeks.

But the actual frequency of increase was 61·73 per cent., that is, there was an excess of frequency of increase in these weeks of rise to the extent of 9·73 per cent. This excess of frequency may be held to be due therefore to the superior influence of the rises of temperature overcoming all antagonistic influences opposed to them; while in 52 per cent. of the weeks of rise the rises merely co-operated with other predominating causes of increase, the increase of sickness that occurred being the joint result of the rises of temperature and these predominating supplementary influences.

Then we have 38·27 per cent. of weeks in which the causes of decrease predominated in force to such an extent as to neutralize the operation of the rises of temperature. In 37·75 of these weeks the force of these causes was sufficient not only to do this but also to occasion more or less manifest decrease of sickness.

Placing this analysis of force in a tabular form we may state it thus:—

Weeks.	Proportion of predominance of supplementary causes of increase or decrease.	
61·73 per cent. increase of sickness.	In 52·00	In 52·00 per cent. of weeks, increase of sickness occurred from joint operation of rises and other supplementary causes of increase.
	In 9·73	In 9·73 per cent., increase of sickness occurred from operation of rises alone overcoming the obstacle afforded by predominance of supplementary cause of decrease.
38·27 per cent. decrease of sickness, or no increase.	48·00	In 37·75 per cent., decrease of sickness occurred from predominant operation of supplementary causes of decrease overcoming the influence of the rises, and producing manifest decrease.
		In 0·52 per cent., merely no increase of sickness occurred from same cause, but not forcible enough to do more than neutralize the rise.
100·00	100·00	

Applying the same method to weeks of rise of temperature of different degrees of extent we may tabulate the results also as follows:—

Weeks of slight rise.

Weeks.	Proportion of predominance of supplementary causes of increase or decrease.	
57·14 per cent. increase.	In 52·00	In 52·00 per cent., increase of sickness occurred from joint operation of slight rises and other supplementary causes of increase.
	In 5·14	In 5·14 per cent., increase of sickness occurred from operation of slight rises alone overcoming the obstacle afforded by predominance of supplementary causes of decrease.
42·86 per cent. decrease.	48·00	In 42·86 per cent., decrease of sickness occurred from predominant operation of supplementary cause of decrease, overcoming the influence of the rises and producing manifest decrease of sickness.
100·00	100·00	

Weeks of moderate rise.

Weeks.	Proportion of predominance of supplementary causes of increase or decrease.	
54·79 per cent. increase.	In 52·00	In 52·00 per cent., increase of sickness occurred from joint operations of moderate rises and other supplementary causes of increase.
	In 2·79	In 2·79 per cent., increase of sickness occurred from operation of moderate rises alone overcoming the obstacle afforded by predominance of supplementary causes of decrease.
45·21 per cent. decrease or no increase.	48·00	In 43·84 per cent., decrease of sickness occurred from predominant operations of supplementary causes of decrease overcoming the influence of the rises and producing manifest decrease of sickness.
		In 1·37 per cent., merely no increase of sickness occurred from same cause, but not forcible enough to do more than neutralize the rises.
100·00	100·00	

Weeks of considerable rise.

Weeks.	Proportion of predominance of supplementary causes of increase or decrease.	
77·36 per cent. increase.	In 52·00 per cent., increase of sickness occurred from joint operation of considerable rises and other supplementary causes of increase.	
	In 25·36 per cent., increase of sickness occurred from operation of considerable rises alone overcoming the obstacles afforded by predominance of supplementary causes of decrease.	48·00
22·64 per cent. decrease.	In 22·64 per cent., decrease of sickness occurred from predominant operation of supplementary causes of decrease overcoming the influence of the considerable rises, and producing manifest decrease of sickness.	
100·00		100·00

2. *As to falls of mean temperature.*

Had there been no falls of mean temperature in the course of the 193 weeks we should, upon our estimate of the frequency of predominance of the supplementary causes of decrease of sickness, have met with decrease of sickness in 48 per cent. of those weeks.

But the actual frequency of decrease was 58·55 per cent., that is, there was an excess of frequency of decrease in these weeks of fall to the extent of 10·55 per cent. This excess of frequency may be held to be due, therefore, to the superior influence of the falls of temperature, overcoming all antagonistic influences opposed to them; while in 48 per cent. of the weeks of fall, the falls merely co-operated with other predominating causes of decrease, the decrease of sickness that occurred being the joint result of the falls of temperature and these predominating supplementary influences.

Thus we have 41·45 per cent. of weeks in which the causes of increase of sickness predominated in force to such an extent as to neutralize the operation of the falls of temperature. In 39·38 of these weeks the force of these causes was sufficient not only to do this, but also to occasion more or less manifest increase of sickness.

Tabulating this statement we may place it thus:—

Weeks.	Proportion of predominance of supplementary causes of increase or decrease.	
58·55 per cent. decrease of sickness.	In 48·00 per cent. of the weeks of fall, decrease of sickness occurred from the joint operation of falls and other supplementary causes of decrease.	
	In 10·55 per cent., decrease of sickness occurred from operation of falls alone overcoming the obstacles afforded by the predominance of supplementary causes of increase.	52·00
41·45 per cent. increase of sickness or no decrease.	In 39·38 per cent., increase of sickness occurred from predominant operation of supplementary causes of increase overcoming the influence of the falls and producing manifest increase of sickness.	
	In 2·07 per cent., no decrease of sickness merely took place from same cause, but not forcible enough to do more than neutralize the falls.	
100·00		100·00

Applying the same method to weeks of fall of temperature of different degrees of extent we may tabulate the results as follows:

Weeks of slight fall.

Weeks.	Proportion of predominance of supplementary causes of increase or decrease.	
50·00 per cent. decrease of sickness.	In 48·00 per cent., increase of sickness occurred from joint operation of slight falls and other supplementary causes of decrease.	
	In 2·00 per cent., decrease of sickness occurred from operation of slight falls alone overcoming the obstacle afforded by the predominance of supplementary causes of increase of sickness.	52·00
50·00 per cent. increase of sickness or no decrease.	In 44·83 per cent., increase of sickness occurred from predominant operation of supplementary causes of increase overcoming the influence of the falls and producing manifest increase.	
	In 5·17 per cent., no decrease merely took place from same cause, but not forcible enough to do more than neutralize the falls.	
100·00		100·00

Weeks of moderate fall.

Weeks.	Proportion of predominance of supplementary causes of increase or decrease.		
59·77 per cent. decrease of sickness.	In 48·00 per cent., decrease of sickness occurred from joint operation of moderate falls and other supplementary causes of decrease.		
		In 11·77 per cent., decrease of sickness occurred from operation of moderate falls alone overcoming the obstacle afforded by the predominance of supplementary causes of increase of sickness.	
40·23 per cent. increase or no decrease of sickness.	52·00	In 39·08 per cent., increase of sickness occurred from predominant operation of supplementary causes of increase overcoming the influence of the falls and producing manifest increase.	
		In 1·15 per cent., no decrease of sickness merely took place from same cause, but not forcible enough to do more than neutralize the falls.	
100·00	100·00		

Weeks of considerable fall.

Weeks.	Proportion of predominance of supplementary causes of increase or decrease.		
66·67 per cent. decrease of sickness.	In 48·00 per cent., decrease of sickness occurred from joint operation of considerable falls and other supplementary causes of decrease.		
		In 18·67 per cent., decrease of sickness occurred from operation of considerable falls alone overcoming the obstacle afforded by the predominance of supplementary causes of increase of sickness.	
33·33 per cent. increase of sickness.	52·00	In 33·33 per cent., increase of sickness occurred from predominant operation of supplementary causes of increase, overcoming the influence of the falls and producing manifest increase.	
100·00	100·00		

Relation of Rises and Falls of Mean Weekly Temperature to the Amount of Increase and Decrease of Sickness when either took place.

1. *Rises.*

The mean amount of increase of sickness in the weeks of rise of temperature in which increase took place was greater than that of decrease in the weeks in which decrease of sickness took place.

Thus the total amount of increase of sickness in the 121 weeks in which it occurred was 4246 cases—mean, 35·09 cases per week; and the total amount of decrease of sickness in the 74 weeks in which it occurred was 2,000 cases—mean, 27 cases per week.

The influence of the rise of temperature in producing the increase of sickness that was observed, and in checking the operation of the causes of decrease, is shown by the fact that the mean weekly amount of all the weekly increases of sickness that occurred in the course of the 389 weeks was 32·99 cases, and of all the decreases 34·96 cases.

In the case of the slight rises, however, it is observable that the mean amount of weekly decrease of sickness when it occurred was greater than that of increase of sickness when increase took place.

A. *As to the amount of increase of sickness.*

1st. The amount of increase of sickness when it occurred was very much governed by the extent of the rises of mean temperature with which it was associated.

This appears from observing that the mean weekly amount of increase of sickness was greater in those weeks in which the extent of the rise of temperature was great than those in which it was comparatively small. Thus, in the 40 weeks of slight rise in which increase of sickness occurred, the mean amount was 29·1 cases; in the 40 weeks of moderate rise, 32·3 cases; in the 41 weeks of considerable rise, 43·5 cases.

2nd. The amount of increase of sickness, when it occurred, was also to a certain degree dependent upon other supplementary meteorological conditions.

The mean extent of the 121 rises of mean weekly temperature with which increase of sickness was associated was 4·11 degrees—the sum of all the rises together being 497·5 degrees. Now, assuming, as we have previously, that a rise of mean temperature to the extent of one degree is in our table equivalent to an increase of sickness to the amount of

3·16 cases, the amount of increase of sickness which under average conditions would have occurred in these 121 weeks is only 1572 cases. But the actual increase that occurred was 4246 cases. Hence in these 121 weeks an amount of increase of sickness to the extent of 2674 cases took place which the extent of the rises of temperature will not account for, and which must therefore be regarded as due to the operation of those predominant supplementary causes of increase of sickness which we have already referred to as co-operating with the rises in most of these weeks. Of the 35·09 cases of mean weekly increase of sickness then only 12·99 can be held due to the operation of the rises, while the larger proportion of 22·10 cases must be otherwise accounted for. The combined force of operation of the supplementary causes of increase in these weeks was then equal to what, under average circumstances, would be exerted by 846·20 degrees of rise of mean temperature, or by a further mean weekly rise of 6·99 degrees.

As to slight rises.—The mean extent of the 40 slight rises of temperature with which increase of sickness was associated was 0·97 degrees, the sum of all these rises together being 39 degrees. Under average conditions the amount of increase of sickness which would have occurred in these 40 weeks is 123 cases only. But the actual increase was 1166 cases, leaving thus 1043 cases due to the predominant operation of supplementary causes of increase co-operating in the majority of weeks with the rises. Of the 29·1 mean weekly increase in these weeks then only 3·1 cases can be regarded as due to the rises of temperature, while 26 cases must be attributed to the operation of other predominant causes of increase of sickness. The combined force of operation of these supplementary causes was then equal to what, under average circumstances, would be exerted by 330·06 degrees of rise of mean temperature, or by a further mean weekly rise of 8·25 degrees.

As to moderate rises.—The mean extent of the 40 moderate rises of temperature with which increase of sickness was associated was 3·44 degrees, the sum of all these rises together

being 137·8 degrees. Under average conditions, the amount of increase of sickness which would have occurred in these 40 weeks is 435 cases. But the actual increase which occurred was 1,295 cases, leaving thus 860 cases due to the predominant operation of supplementary causes of increase of sickness. Of the 32·3 mean cases of weekly increase in these weeks then only 10·9 cases were due to the rise of temperature, leaving 21·4 cases attributable to the operation of the predominant supplementary causes of increase. The combined force of operation of these supplementary causes was then equal to what, under average circumstances, would be exerted by 272·15 degrees of rise of temperature, or by a further mean weekly rise of 6·80 degrees.

As to considerable rises.—The mean extent of the 41 considerable rises of temperature with which increase of sickness was associated was 7·82 degrees; the sum of all these rises together being 320·7 degrees. Under average conditions, the amount of increase of sickness which would have occurred in these 41 weeks is 1013 cases. But the actual increase which occurred was 1785 cases, leaving thus 772 cases which must be attributed to the predominant operation of supplementary causes of increase of sickness. Of the 43·5 mean cases of weekly increase in these weeks, then, 24·7 only can be regarded as the result of the rises, while the remaining 18·8 cases must be attributed to the operation of supplementary causes. The combined force of operation of these supplementary causes was then equal to what, under average circumstances, would be exerted by 244·30 degrees of rise of temperature, or by a further mean weekly rise of 5·96 degrees.

B. *As to the amount of decrease of sickness.*

1st. The amount of decrease of sickness, when it occurred in association with rises of mean weekly temperature as the result of the predominating operation of antagonistic influences, was controlled by the influence of the rises of temperature.

This appears from observing that the mean amount of weekly decrease of sickness was greater in those weeks in which the rises of temperature were comparatively small than

in those in which they were more extensive. Thus, in the 30 weeks of slight rise in which decrease of sickness occurred the mean amount was 32·8 cases; in the 32 weeks of moderate rise, 23·7 cases; in the 12 weeks of considerable rise, 21·2 cases.

2nd. The amount of the decrease of sickness, when it took place in association with rises of mean weekly temperature, was mainly dependent upon the force exerted by the meteorological conditions antagonistic to the operation of the rises, part of which force was expended in nullifying the influence of the rises of temperature, and part in producing manifest decrease of sickness.

The mean extent of the 74 weekly rises of temperature with which decrease of sickness was associated was 3·14 degrees, the sum of all the rises together being 232·5 degrees. Under ordinary circumstances increase of sickness might have been looked for in the course of these weeks, amounting in the sum to 735 cases, or a mean number of 9·9 cases per week. But no such increase took place; it was nullified by the operation of other predominating antagonistic conditions. A further effect of these antagonistic conditions was to occasion actual manifest decrease of sickness to the amount altogether of 2000 cases, or a mean of 27 cases weekly. The virtual reduction of sickness then that took place in the course of these 74 weeks was 2735 cases, or a mean weekly reduction of 36·9 cases. The entire value of the force of the conditions thus reducing the sickness in these weeks may be expressed by saying that it was equal to what, under average conditions, would be exerted by 865·5 degrees of fall of temperature, or a mean weekly reduction of temperature to the extent of 11·7 degrees. Of this force, a force equal to 633 degrees, or a mean force equal to 8·56 degrees of fall per week, was expended in producing manifest decrease of sickness after the influence of the rises was nullified.

As to slight rises.—The mean extent of the 30 slight rises of temperature with which decrease of sickness was associated was 1·05 degrees, the sum of all the rises together being 31·7 degrees. Hence, under ordinary circumstances, an

increase of sickness, to the total amount of 100 cases, or a mean weekly increase of 3·3 cases, would have occurred. This increase was nullified, and a manifest decrease of sickness produced, to the amount altogether of 984 cases or 32·8 cases weekly. The virtual reduction of sickness, then, that took place in the course of these 30 weeks was 1084 cases, or a mean weekly reduction of 36·1 cases. The entire value of the force of the reducing conditions, was then equal to that of 343·03 degrees of fall of temperature, or of a mean weekly fall to the extent of 11·43 degrees. Of this force, after nullifying the rises, a force equal to 311·33 degrees, or a mean weekly force equal to 10·38 degrees of fall, was expended in producing manifest decrease of sickness.

As to moderate rises.—The mean extent of the 32 moderate rises of mean temperature with which decrease of sickness was associated was 3·24 degrees—the sum of all the rises together being 103·7 degrees. Hence, under average conditions, an increase of sickness to the total amount of 328 cases, or a mean weekly increase of 10·2 cases, would have occurred. This increase was nullified and a manifest decrease of sickness produced, amounting altogether to 761 cases, or 23·7 cases weekly. The virtual reduction of sickness then that took place in the course of these 32 weeks was 1089 cases, or a mean weekly reduction of 33·9 cases. The entire value of the force of the reducing conditions was then equal to that of a fall of 344·62 degrees, or of a mean weekly fall of 10·77 cases. Of this force, after nullifying the rises, a force equal to 240·92 degrees, or a mean weekly force of 7·53 degrees, was expended in producing manifest decrease of sickness.

As to considerable rises.—The mean extent of the 12 considerable rises of temperature with which decrease of sickness was associated was 8·09 degrees, the sum of all the rises together being 97·1 degrees. Hence, under average conditions, an increase of sickness to the total amount of 307 cases, or a mean weekly increase of 25·6 cases, would have occurred. This increase was nullified, and a manifest decrease of sickness produced, amounting altogether to 255 cases, or 21·2 cases weekly. The virtual reduction of sickness then that took

place in the course of these 12 weeks was 562 cases, or a mean weekly decrease of 46·8 cases. The entire value of the force of the reducing conditions was then equal to that of a fall of 177·85 degrees, or of a mean weekly fall of 14·82 degrees. Of this force, after nullifying the rises, a force equal to 80·74 degrees, or a mean weekly force equal to 6·73 degrees of fall of temperature, was expended in producing manifest decrease of sickness.

There is upon the table one week in which neither increase nor decrease of sickness occurred. The mean rise of temperature in this week was 3·5 degrees, corresponding, under average circumstances, to an increase of 11 cases of sickness. The increase was simply nullified by the operation of predominating causes of decrease of sickness of similar force to the rise of temperature.

2. *Falls.*

The mean amount of decrease of sickness in the weeks of fall of mean temperature in which decrease took place was greater than that of increase of sickness in the weeks in which increase took place.

Thus the total amount of decrease of sickness in the 113 weeks in which it occurred was 4538 cases—mean, 40·2 cases; and the total amount of increase of sickness in the 76 weeks in which it occurred was 2253 cases—mean, 29·6 cases.

The influence of the falls of temperature in producing the decrease of sickness that was observed, and in checking the operation of the causes of increase was shown by the fact that the mean weekly amount of all the weekly decreases which occurred in the course of the 389 weeks was 34·96 cases; and of all the increases 32·99.

A. *As to the amount of decrease of sickness.*

1st. The amount of decrease of sickness when it occurred was very much governed by the extent of the falls of mean temperature with which it was associated.

This appears from observing that the mean weekly amount of decrease of sickness was greater in those weeks in which the extent of the falls of temperature was great than those in which it was comparatively small. Thus:

In the 29 weeks of slight fall in which decrease of sickness occurred the mean amount of the decrease was 33·1 cases; in the 52 weeks of moderate fall, 35·1 cases; in the 32 weeks of considerable fall, 54·8 cases.

2nd. The amount of decrease of sickness also was to a certain degree dependent upon other supplementary meteorological conditions.

The mean extent of the 113 falls of mean weekly temperature with which decrease of sickness was associated was 3·86 degrees, the sum of all the falls together being 436·3 degrees. Under average circumstances the amount of decrease of sickness that might have been anticipated from falls to this extent is 1379 cases. But the amount of decrease of sickness that actually occurred in these 113 weeks was 4538 cases, leaving thus 3159 cases of decrease to be accounted for by the predominant operation in these weeks of supplementary causes of decreased sickness. Of the 40·2 mean weekly cases of decrease then, only 12·2 cases can be regarded as due to the falls of temperature, the remainder, 28 cases, being attributable to supplementary conditions. The combined force of these supplementary conditions was then equal to what, under average circumstances, would be exerted by 999·68 degrees of fall of temperature, or by a further mean weekly fall of 8·85 degrees.

As to slight falls.—The mean extent of the 29 slight falls of mean weekly temperature with which decrease of sickness was associated was 1·07 degrees, the sum of all the falls together being 31·1 degrees. Such an extent of falls would correspond, under average circumstances, to a decrease of sickness amounting altogether to 98 cases. But the actual decrease that occurred in the course of these 29 weeks was 960 cases, leaving thus 862 cases to be accounted for by the predominant operation of supplementary causes of decrease. Of the 33·1 mean weekly cases of decrease then only 3·4

cases can be regarded as due to the slight falls of temperature, while the remainder, 29·7 cases, must be referred to the operation of supplementary conditions. The combined force of these supplementary conditions was then equal to what, under average circumstances, would be exerted by 272·78 degrees of fall of temperature, or by a further mean weekly fall of 9·40 degrees.

As to moderate falls.—The mean extent of the 52 moderate falls of temperature with which decrease of sickness was associated was 3·27 degrees—the sum of all the falls together being 170·4 degrees. Under average circumstances falls to this extent would correspond to a decrease of sickness to the total amount of 538 cases. But the actual sum of the decreases was 1823 cases, leaving thus 1285 cases to be accounted for by the predominant operation of supplementary causes of decrease of sickness. Of the 35·1 mean weekly cases of decrease then only 10·3 cases can be regarded as due to the moderate falls of temperature, while the remainder 24·8 cases must be referred to the operation of supplementary conditions. The combined force of these supplementary conditions then was equal to what, under average circumstances, would be exerted by 406·65 degrees of fall of temperature, or by a further mean weekly fall to the extent of 7·82 degrees.

As to considerable falls.—The mean extent of the 32 considerable falls with which decrease of sickness was associated was 7·33 degrees—the sum of all the falls together being 234·8 degrees. Under average circumstances falls to this extent would correspond to a decrease of sickness to the total amount of 742 cases. But the actual sum of the decreases was 1755 cases, leaving thus 1013 cases to be accounted for by the predominant operation of supplementary causes of decrease of sickness. Of the 54·8 mean weekly cases of decrease then only 23·2 cases can be regarded as due to the considerable falls of temperature, while the remaining 31·6 cases must be referred to the operation of supplementary conditions. The combined force of these supplementary conditions then was equal to what, under average circumstances, would be exerted

by 320·57 degrees of fall of temperature, or by a further mean weekly fall to the extent of 10·01 degrees.

B. *As to the amount of increase of sickness.*

1st. The amount of increase of sickness, when it occurred in association with falls of mean weekly temperature as the result of the predominant operation of antagonistic influences, was controlled by the influence of the falls of temperature.

This appears from observing that the mean amount of weekly increase of sickness was greater in those weeks in which the falls of temperature were comparatively small than in those in which they were more extensive. Thus:

In the 26 weeks of slight fall in which increase of sickness occurred the mean amount was 39·5 cases; in the 34 weeks of moderate fall, 25·1; in the 16 weeks of considerable fall, 23·1.

2nd. The amount of the increase of sickness, when it took place in association with falls of mean weekly temperature, was mainly dependent upon the force exerted by the meteorological conditions antagonistic to the operation of the falls, part of which force was expended in nullifying the influence of the falls of temperature, and part in producing manifest increase of sickness.

The mean extent of the 76 weekly falls of temperature with which increase of sickness was associated was 3·43 degrees—the sum of all the falls together being 260·7 degrees. Under ordinary circumstances decrease of sickness might have been looked for in these weeks to the total amount of 824 cases, or a mean weekly decrease of 10·8 cases. But no such decrease took place; it was nullified by the operation of other predominating antagonistic conditions. A further effect of these antagonistic conditions was to occasion manifest increase of sickness to the amount altogether of 2253 cases, or a mean of 29·6 cases weekly. The virtual increase of sickness then that took place in the course of these 76 weeks was 3077 cases, or a mean weekly increase of 40·5 cases. The entire value of the force of the conditions thus increasing the sickness in these weeks may be expressed by saying that it was equal to what, under average conditions, would be exerted by 973·73 degrees of rise of temperature, or a mean weekly rise

to the extent of 12·81 degrees. Of this force, after nullifying the falls, a force equal to 713·03 degrees of rise of temperature, or a mean weekly force equal to 9·38 degrees of rise was expended in producing manifest increase of sickness.

As to slight falls.—The mean extent of the 26 slight falls of temperature with which increase of sickness was associated was 1·07 degrees—the sum of all the falls together being 27·9 degrees. Hence, under ordinary circumstances, we might have looked for decrease of sickness in these weeks to the amount of 88 cases, or a mean weekly decrease of 3·4 cases. This decrease was nullified, and a manifest increase of sickness occasioned the sum of which was 1028 cases, or a weekly mean of 39·5 cases. The virtual increase of sickness then which took place in the course of these 26 weeks was 1116 cases, or a mean weekly increase of 42·9 cases. The entire value of the force of the conditions thus increasing sickness was therefore equal to what, under average circumstances, would be exerted by 353·16 degrees of rise of mean temperature, or a mean weekly rise of 13·58 degrees. Of this force, after nullifying the falls, a force equal to 325·26 degrees of rise of temperature, or a mean weekly force equal to 12·51 degrees, was expended in producing manifest increase of sickness.

As to moderate falls.—The mean extent of the 34 moderate falls of temperature with which increase of sickness was associated was 3·45 degrees—the sum of all the falls together being 117·6 degrees. Hence, under ordinary circumstances, we should have looked for decrease of sickness in these weeks to the amount of 372 cases, or a mean weekly decrease of 10·9 cases. The decrease was nullified, and a manifest increase of sickness occasioned, the sum of which was 855 cases, or a weekly mean of 25·1 cases. The virtual increase of sickness then which took place in the course of these 34 weeks was 1227 cases, or a mean weekly increase of 36 cases. The entire value of the force of the conditions thus increasing sickness was then equal to what, under average circumstances, would be exerted by 394·62 degrees of rise of mean temperature, or a mean weekly rise of 11·60 degrees. Of this force, after nullifying the falls, a force equal to 277·02

degrees of rise of temperature, or a mean weekly force equal to 8·15 degrees, was expended in producing manifest increase of sickness.

As to considerable falls.—The mean extent of the 16 considerable falls of temperature with which increase of sickness was associated was 7·20 degrees—the sum of all the falls together being 115·2 degrees. Hence, under ordinary circumstances, we should have looked for decrease of sickness in these weeks to the amount of 364 cases, or a mean weekly decrease of 22·7 cases. This decrease was nullified and a manifest increase of sickness occasioned, the sum of which was 370 cases, or a weekly mean of 23·1 cases. The virtual increase of sickness then which took place in the course of these 16 weeks was 734 cases, or a mean weekly increase of 45·9 cases. The entire force of the conditions thus increasing sickness was equal to what, under average circumstances, would be exerted by 232·28 degrees of rise of mean temperature, or a mean weekly rise of 14·54 degrees. Of this force, after nullifying the falls, a force equal to 117·08 degrees of rise of temperature, or a mean weekly force equal to 7·34 degrees, was expended in producing manifest increase of sickness.

There are upon Table 2 four weeks in which neither decrease nor increase of sickness occurred. The mean extent of the falls in these four weeks was 0·7 degrees—the sum of all together being 3·1 degrees. In these weeks the decrease of sickness was simply nullified by the predominant influence of supplementary antagonistic conditions. Had this not been the case decrease of sickness to the amount of 9 cases might have been looked for, or a mean weekly decrease of sickness of 2·4 cases.

Three of these were weeks of slight fall in which the mean extent of the falls was 0·3 degrees—the sum of all together being 1·1 degrees. The decrease was nullified by antagonistic conditions of equal force: otherwise decrease of sickness to the amount of 3 cases, or a weekly decrease of 1·1 cases, might have been looked for.

The remaining week was one of moderate fall to the extent of 2 degrees, the amount of decrease nullified in this week being therefore 6 cases.

The results of the foregoing discussion will be rendered more distinct by placing them in a tabular form, thus :—

Average result of a change of 1 degree mean weekly temperature = a fluctuation of sickness to the amount of 3·16 degrees.

Rises.

General results of the 196 *rises.*

	Number of rises.	Total extent in degrees.	Estimated clear gain by way of increase of sickness.	Actual clear increase of sickness.	Number of cases of increase above or below estimate.	Number of degrees of temperature represented by the difference of estimated and actual increase.
			Cases.	Cases.	Cases.	Weekly mean. Sum.
Generally	196	733·5°	2317	2246	— 71	— 22·47° — 0·11°
Slight rises	70	70·7°	223	182	— 41	— 12·97° — 0·18°
Moderate rises ...	73	245·0°	774	534	— 240	— 75·95° — 1·04°
Considerable rises	53	417·8°	1320	1530	+ 210	+ 66·46° + 1·25°

Assumed frequency with which increase and decrease of sickness occurred as the result of the operation of rises and of supplementary conditions.

	Weeks of increase of sickness, 61·73 per cent.				Weeks of decrease or no increase of sickness, 38·27 per cent.			
	Increase due to joint operation of rises and supplementary causes of increase.		Increase due to rises alone overcoming antagonistic supplementary causes.		Decrease due to antagonistic supplementary causes.		Increase nullified by antagonistic supplementary causes.	
	Number of weeks	Per cent. of weeks of rise.	Number of weeks	Per cent. of weeks of rise.	Number of weeks	Per cent. of weeks of rise.	Number of weeks	Per cent. of weeks of rise.
Rises generally...	102	52·00	19	9·73	74	37·75	1	0·52
Slight rises	36	52·00	4	5·14	30	42·86		
Moderate rises ...	38	52·00	2	2·79	32	43·84	1	1·37
Considerable rises	28	52·00	13	25·36	12	22·64		

Amount of Increase of Sickness when Increase occurred.

Rises.	Number of weeks of increased sickness.	Extent of rises. Sum.	Extent of rises. Mean.	Value in degrees of rise of temperature of supplementary causes of increase in preceding week of operation. Sum.	Value in degrees of rise of temperature of supplementary causes of increase in preceding week of operation. Mean.	Value in degrees of rise of temperature which caused increase of sickness. Sum.	Value in degrees of rise of temperature which caused increase of sickness. Mean.	Estimated increase of sickness. Cases. Sum.	Estimated increase of sickness. Cases. Mean.	Amount of increase due to supplementary causes. Cases. Sum.	Amount of increase due to supplementary causes. Cases. Mean.	Joint results of rises of temperature and supplementary causes of increase. Cases. Sum.	Joint results of rises of temperature and supplementary causes of increase. Cases. Mean.
Generally	121	497·5°	4·11°	846·25°	6·99°	1343·70°	11·10°	1572	12·99	2874	22·10	4246	35·09
Slight	40	30·0°	0·07°	339·05°	8·25°	369·05°	9·22°	123	3·1	1043	26·0	1166	29·1
Moderate	40	137·8°	3·44°	272·15°	6·80°	409·95°	10·24°	435	10·9	860	21·4	1295	32·3
Considerable ...	41	330·7°	7·82°	244·30°	5·96°	565·00°	13·78°	1013	24·7	772	18·8	1785	43·5

Amount of Decrease of Sickness when Decrease occurred.

Rises.	Number of weeks of decreased sickness.	Extent of rises.		Value in degrees of fall of temperature of supplementary causes of decrease, in Proportion dominant operation producing decrease of sickness.		Value in degrees of fall of temperature of supplementary causes of decrease, modifying, raise and producing similar decrease of sickness.		Estimated normal increase of sickness in similar weeks. — Cases.		Manifest decrease of sickness produced. — Cases.		Virtual decrease of sickness. — Cases.	
		Sum.	Mean.	Sum.	Mean.	Sum.	Mean.	Sum.	Mean.	Sum.	Mean.	Sum.	Mean.
Generally	74	232·5°	3·14°	633·0°	8·56°	865·50°	11·70°	735	9·9	2000	27·0	2735	36·9
Slight	30	31·7°	1·05°	311·33°	10·38°	343·03°	11·43°	100	3·3	984	32·8	1084	36·1
Moderate	32	103·7°	3·24°	240·92°	7·53°	344·62°	10·77°	328	10·2	761	23·7	1089	33·9
Considerable...	12	97·1°	8·09°	80·75°	6·73°	177·85°	14·82°	307	25·6	255	21·2	562	46·8

Summary.—1. In the majority of the 196 weeks in which a rise of mean temperature above that of the previous week occurred, the rise of temperature was associated with an increase of general sickness. The general result of the inquiry is that increase of sickness is the normal effect of a rise of temperature.

2. In the remaining weeks (with one exception) decrease of sickness took place. In the exceptional week no alteration in the amount of sickness was noted. Decrease of sickness or the non-occurrence of increase of sickness in association with a rise of temperature must be regarded as due to the predominant operation of antagonistic meteorological conditions either antecedent to or concurrent with the rises; their force of operation may be expressed in a number of degrees of fall of mean temperature to which they are equivalent in operation.

3. Increase of sickness was, on the whole, observed to occur more frequently in the weeks in which the extent of the rise of temperature was great than when it was comparatively small.

4. The occurrence of increase or decrease of sickness in any individual week of rise of mean temperature depends partly upon the efficient force of the rise (its extent) overcoming or being overcome by antagonistic influences, and partly upon the predominance of operation and force of operation of other influences (supplementary causes of increase or decrease of sickness) co-operating with the rises or antagonising them.

5. Notwithstanding the probable co-operation of other causes of increased sickness in 102 out of the 196 weeks of rise of temperature, the clear gain by way of increase of sickness, in the course of these 196 weeks, did not quite reach the amount which might have been anticipated from a comparison of the extent of change of temperature generally in the 389 weeks tabulated, and the amount of clear gain by way of increase or decrease of sickness which those weeks furnished.

6. Dividing the weeks according as the rise of temperature was slight, moderate, or considerable, it was found that the

deficiency of increase of sickness referred to was only observed in the weeks in which the rises were slight or moderate, and that in the latter especially the clear increase of sickness was most deficient in amount. In the weeks of considerable rise, on the contrary, the clear gain by way of increase of sickness was in excess of what might have been anticipated.

7. The excess or deficiency of the final gain by way of increase of sickness in the weeks of rises of temperature must be held to be dependent upon the force of operation of those supplementary meteorological conditions which assist or antagonise the operations of rises of temperature. Hence it may be inferred that, in the weeks of rise of temperature taken altogether, the force of the antagonistic conditions was such as to reduce the increase of sickness below what would have resulted had not these antagonistic influences predominated in the course of the 196 weeks: that in the 70 weeks of slight rise of temperature the antagonistic conditions predominated sufficiently to reduce the final gain of increased sickness to what it might have been expected to be if the mean extent of the rises had been 0·18 degrees less than the actual extent: that in the 73 weeks of moderate rise the predominance of the antagonistic influences referred to was much more marked, the result being a lessened gain by way of increase such as would have been looked for had the mean weekly extent of the rise been 1·04 degrees less than the actual extent: that on the contrary in the 53 weeks of considerable rise the co-operating influences predominated in force in such a manner as to augment the increase beyond what might have been anticipated, and making the clear gain of increase of sickness equal to that which might have been looked for had the mean extent of the rises been 1·25 degrees greater than the actual extent.

8. The mean amount of increase of sickness in those weeks in which increase of sickness took place was greater than that of decrease of sickness in the weeks in which decrease took place.

9. The mean amount of increase of sickness in the weeks in which it occurred was greater the greater the extent of the

rises of temperature with which it was associated. Thus, it was greater in the weeks of moderate than of slight rise of temperature, and greater in the weeks of considerable than of moderate rise.

10. In those weeks in which increase of sickness took place in association with rise of temperature of all degrees of extent, the greater part of the increase (2674 out of 4246 cases) was due to the influence exerted by other predominating supplementary causes assisting the operation of the rises.

11. In those weeks of slight rise of temperature in which increase of sickness took place, this operation of supplementary causes of increase of sickness was most marked. Out of 1166 cases by which sickness was increased, 1043 cases resulted from the predominating influence of these supplementary conditions.

12. In those weeks of moderate rise of temperature in which increase of sickness took place, the amount of increase attributable to the supplementary conditions promotive of increase of sickness was still disproportionately large. Out of 1295 cases by which sickness was increased in these weeks, 860 cases resulted from the predominant operation of these conditions.

13. In those weeks of considerable rise of temperature in which increase of sickness took place, although the operation of the supplementary causes of increase was still marked, yet it was not in excess of the operation of the rises themselves. Out of 1785 cases by which sickness was increased in these weeks, 772 resulted from the predominant operation of these conditions, while 1013 were due to the influence of the rises.

14. Thus, according as the extent of the rises with which increase of sickness was associated was greater, so the share taken by the rises in producing the increase was also greater, and the share taken by the other supplementary conditions promotive of increase was less.

15. The mean amount of decrease of sickness when it occurred in association with rises of temperature was less in the weeks in which the rises of temperature were more extensive, and greater in those weeks in which they were less

extensive. Thus, it was greatest in weeks when it was associated with slight rises, less when associated with moderate rises, and least when associated with considerable rises.

16. In estimating the force of the conditions producing decrease of sickness in spite of the tendency to increase imparted by a rise of temperature, it is necessary to take into account not only the manifest decrease produced, but the neutralisation of the influence of the associated rises also.

17. In the 74 weeks in which decrease of sickness occurred with rises of temperature of various degrees of extent, the amount of free and predominant antagonistic force expended in producing manifest decrease of sickness was much greater than that expended in neutralising the rises, the proportion of the former to the latter being as 633° to 232°·5.

18. In the 30 weeks in which decrease of sickness occurred with slight rises of temperature, the disproportion referred to was most marked, the amount of antagonistic force expended in producing manifest decrease being to that expended in neutralising the rises as 311°·33 to 31°·7.

19. In the 32 weeks in which decrease of sickness occurred with moderate rises of temperature, the amount of antagonistic force expended in producing manifest decrease of sickness was to that expended in neutralising the rises as 240°·92 to 103°·7.

20. In the 12 weeks in which decrease of sickness occurred with considerable rises of temperature, the amount of antagonistic force expended in neutralising the rises was on the contrary rather greater than that expended in producing manifest decrease of sickness, the latter being to the former as 80°·75 to 97°·1.

21. Thus, the greater the extent of the rises with which decrease of sickness was associated, the greater was the proportion of the antagonistic force expended in neutralising the rises, and the less that expended in producing manifest decrease of sickness.

22. On the whole, the mean weekly amount of antagonistic force expended in neutralising the rises and producing manifest decrease of sickness was greater in the weeks of considerable rise in which decrease occurred than in those of slight or moderate rise, and rather greater in the weeks of slight than in those of moderate rise.

23. Comparing now the weeks of rise of temperature in which sickness was increased with those in which it was decreased we find that the mean weekly value of the forces of decrease neutralising the rises and producing manifest decrease in the latter set of weeks was very slightly greater (by ·6 degrees) than that of all the forces of increase combined and operating in the former set of weeks. A similar observation applies to the weeks of slight, moderate, and considerable rise respectively, in which increase and decrease of sickness took place, the difference being most marked in the weeks of slight rise.

24. Comparing the force of the predominating supplementary conditions promoting increase of sickness in the 121 weeks in which sickness was increased with the force of the predominating supplementary conditions neutralising the rises and producing decrease of sickness in the 74 weeks of decreased sickness, we find that the sum of the forces of the supplementary conditions of promoting decrease of sickness was rather greater than that of the supplementary conditions promoting increase of sickness (viz., as 865°·5 to 846°·2), and that the mean weekly force of the former was to that of the latter as 11°·7 to 6°·99. In the 30 weeks of slight rise in which sickness was decreased the sum of the force of the supplementary causes of decrease was to that of the supplementary causes of increase in the 40 weeks in which sickness was increased as 343°·03 to 330°·06, the difference in the two sums not being great; the mean weekly force of the former was, however, to that of the latter as 11°·43 to 8°·25. In the 32 weeks of moderate rise in which sickness was decreased the sum of the forces of the supplementary causes of decrease was much greater than that of the supplementary causes of increase in the 40 weeks of moderate rise on which sickness was increased (viz., as 344°·62 to 272°·15) the mean weekly force of the former being also to that of the latter as 10°·77 to 6°·8. In the 12 weeks of considerable rise, however, in which sickness was decreased, the sum of the force of the supplementary causes of decrease in operation was much

less than that of the supplementary causes of increase of sickness in the 41 weeks of considerable rise in which sickness was increased (viz., as 177°·85 to 244°·3); but taking the number of weeks into account, the mean weekly force of the former was to that of the latter as 14°·82 to 5°·96.

Falls.

General results of the 193 falls.

	Number of falls.	Total extent in degrees.	Estimated clear gain by way of decrease of sickness.	Actual clear decrease of sickness.	Number of cases of decrease above or below estimate.	Number of degrees of temperature represented by the difference of estimated and actual decrease.	
			Cases.		Cases.	Sum.	Weekly mean.
Generally	193	700·1°	2212	2285	+ 73	+ 23·00°	+ 0·12°
Slight	58	60·1°	190	—	— 258	— 81·65°	— 1·40°
Moderate	87	290·0°	916	968	52	+ 16·45°	+ 0·18°
Considerable	48	350·0°	1106	1385	+ 279	+ 88·20°	+ 1·84°

Assumed frequency with which decrease and increase of sickness occurred, as the result of the operation of falls and of the supplementary conditions.

	Weeks of decrease of sickness, 58·55 per cent.				Weeks of increase of sickness or no decrease, 41·45 per cent.			
	Decrease due to joint operation of falls and supplementary causes of decrease.		Decrease due to falls alone overcoming antagonistic supplementary causes.		Increase due to antagonistic supplementary causes.		Decrease nullified by antagonistic supplementary causes.	
	Number of weeks.	Per cent. of weeks of fall.	Number of weeks.	Per cent. of weeks of fall.	Number of weeks.	Per cent. of weeks of fall.	Number of weeks.	Per cent. of weeks of fall.
Falls generally ..	93	48·00	20	10·55	76	39·38	4	2·07
Slight falls	28	48·00	1	2·00	26	44·83	3	5·17
Moderate falls ...	42	48·00	10	11·77	34	39·08	1	1·15
Considerable falls	23	48·00	9	18·67	16	33·33		

Amount of decrease of sickness when decrease occurred.

Falls.	Number of weeks of decreased sickness.	Extent of falls.		Value in degrees of fall of temperature of supplementary causes of decrease, as predominant operative.		Value in degrees of fall of temperature of united causes of decrease of sickness.		Estimated decrease of sickness. — Cases.		Amount of decrease due to supplementary causes. — Cases.		Joint result of falls of temperature of supplementary causes of decrease. — Cases.	
		Sum.	Mean.	Sum.	Mean.	Sum.	Mean.	Sum.	Mean.	Sum.	Mean.	Sum.	Mean.
Generally	113	436·3°	3·86°	999·68°	8·85°	1435·98°	12·71°	1379	12·2	3159	28·0	4538	40·2
Slight	29	31·1°	1·07°	272·78°	9·40°	303·88°	10·47°	98	3·4	862	29·7	960	33·1
Moderate	52	170·4°	3·27°	406·62°	7·82°	577·05°	11·09°	538	10·3	1285	24·8	1823	35·1
Considerable ...	32	234·8°	7·33°	320·57°	10·01°	555·37°	17·34°	742	23·2	1013	31·6	1755	54·8

Amount of increase of sickness when increase occurred.

Falls.	Number of weeks of increased sickness.	Extent of falls.		Value in degrees of rise of temperature of supplementary and concurrent increase of sickness.		Value in degrees of rise of temperature of suppressive and concurrent antagonistic falls and persistent operative pressure in diminishing amount of sickness.		Estimated normal decrease of sickness nullified. — Cases.		Manifest increase of sickness produced. — Cases.		Virtual increase of sickness. — Cases.	
		Sum.	Mean.	Sum.	Mean.	Sum.	Mean.	Sum.	Mean.	Sum.	Mean.	Sum.	Mean.
Generally	76	260·7°	3·43°	713·03°	9·38°	973·73°	12·81°	824	10·8	2253	29·6	3077	40·5
Slight	26	27·9°	1·07°	325·26°	12·51°	353·16°	13·58°	88	3·4	1028	39·5	1116	42·9
Moderate	34	117·6°	3·45°	277·02°	8·15°	304·62°	11·60°	372	10·9	855	25·1	1227	36·0
Considerable ...	16	115·2°	7·20°	117·08°	7·34°	232·28°	14·54°	364	22·7	370	23·1	734	45·9

Summary.—1. In the majority of the 193 weeks in which a fall of mean temperature below that of the previous week occurred, the fall was associated with a decrease of general sickness. The general result of the inquiry is, that decrease of sickness is the normal effect of a fall of temperature.

2. In the remaining weeks (with four exceptions) increase of sickness took place. In the exceptional weeks no alteration in the amount of general sickness was noted. Increase of sickness or the non-occurrence of decrease of sickness in association with a fall of temperature must be regarded as due to the predominant operation of antagonistic meteorological conditions either antecedent to or concurrent with the falls; their force of operation may be expressed in a number of degrees of rise of mean temperature to which they are equivalent in operation.

3. Decrease of sickness on the whole was observed to occur more frequently in the weeks in which the extent of the fall of temperature was great than when it was comparatively small.

4. The occurrence of decrease or increase of sickness in any individual week of fall of mean temperature depends partly upon the efficient force of the fall (its extent) overcoming or being overcome by antagonistic influences, and partly upon the predominance of operation and force of operation of other influences (supplementary causes of decrease or increase of sickness) co-operating with the falls or antagonising them.

5. The clear gain by way of decrease of sickness in the course of the 193 weeks of fall exceeded the amount which might have been anticipated from a comparison of the extent of changes of temperature generally in the 389 weeks tabulated, and the amount of clear gain by way of increase or decrease of sickness which those weeks furnished. This excess was nearly to the same amount as the defect in the case of the rises, and it was observed notwithstanding that the co-operation of supplementary causes was probably less frequent than in the case of the rises tabulated.

6. Dividing the weeks according as the fall of temperature was slight, moderate, or considerable, it was found that while there was an excess of decrease of sickness in the weeks of moderate and considerable fall, especially marked in the latter, it was quite otherwise in the weeks of slight fall of temperature. In the weeks of slight fall, taken altogether, it was found that the cases of increase of sickness that took place in the course of them were really more numerous than the cases of decrease of sickness, so that the final result was that in these weeks the balance of fluctuation of sickness was in favour of increase and not of decrease of sickness.

7. The excess or deficiency of the final gain, by way of decrease of sickness in the weeks of fall of temperature, must be held to be dependent upon the force of operation of those supplementary meteorological conditions which assist or antagonise the operation of falls of temperature. Hence it may be inferred that in the weeks of fall of temperature taken altogether, the force of the co-operating conditions was such as to raise the amount of decrease of sickness above what would have resulted, had not these co-operating influences predominated in the course of the 193 weeks: that in the 58 weeks of slight fall of temperature, supplementary antagonistic conditions predominated to such an extent as to produce a final result of increase of sickness similar to what might have been anticipated under average circumstances, had no falls of temperature at all taken place, but in lieu thereof a weekly rise to the mean extent of 0°·12: that in the 87 weeks of moderate fall of temperature co-operating supplementary influences predominated to such an extent as to augment the decrease of sickness in a manner similar to that which would have resulted from a further mean weekly fall of 0°·18: and that in the 48 weeks of considerable fall co-operating supplementary influences predominated to such an extent as to augment the decrease in a manner similar to what might have been anticipated from a further mean weekly fall of 1°·84.

8. The mean amount of decrease of sickness in those weeks in which decrease of sickness took place was greater than

that of increase in the weeks in which increase of sickness took place.

9. The mean amount of decrease of sickness in the weeks in which it occurred was greater the greater the extent of the falls of temperature with which it was associated. Thus it was greater in the weeks of moderate than in those of slight fall of temperature, and greater in the weeks of considerable than in those of moderate fall.

10. In those weeks in which decrease of sickness took place in association with falls of temperature of all degrees of extent, by far the greater part of the decrease (3159 out of 4538 cases) was due to the influence exerted by other predominating supplementary causes assisting the operation of the falls.

11. In those weeks of slight fall of temperature in which decrease of sickness took place, the operation of supplementary causes of decrease was most marked. Out of 960 cases by which sickness was decreased, 862 cases resulted from the predominating influence of these supplementary conditions.

12. In those weeks of moderate fall of temperature in which decrease of sickness took place, the amount of decrease attributable to the supplementary conditions productive of decrease of sickness was still disproportionately large. Out of 1823 cases by which sickness was decreased in these weeks, 1285 resulted from the predominant operation of these conditions.

13. In those weeks of considerable fall of temperature in which decrease of sickness took place, the amount of decrease attributable to the supplementary conditions productive of decrease of sickness was still disproportionately large. Out of 1755 cases by which sickness was decreased in these weeks, 1013 resulted from the predominant operation of these conditions.

14. Thus, according as the extent of the falls with which decrease of sickness associated was greater, so the share taken by the falls in producing the decrease was also greater, and the share taken by the other supplementary conditions promotive of decrease was less.

15. The mean amount of increase of sickness when it occurred in association with falls of temperature was less in the weeks in which the falls of temperature were more extensive and greater in those weeks in which they were less extensive. Thus, it was greatest in the weeks in which it was associated with slight falls, less when associated with moderate falls, and least when associated with considerable falls.

16. In estimating the force of the conditions producing increase of sickness in spite of the tendency to decrease imparted by a fall of temperature, it is necessary to take into account not only the manifest increase produced, but the neutralisation of the influence of the associated falls also.

17. In the 76 weeks in which increase of sickness occurred with falls of temperature of various degrees of extent, the amount of free and predominant antagonistic force expended in producing manifest increase of sickness was much greater than that expended in neutralising the falls—the proportion of the former to the latter being as 713°·03 to 260°·7.

18. In the 26 weeks in which increase of sickness occurred with slight falls of temperature, the disproportion referred to was most marked, the amount of antagonistic force expended in producing manifest increase being to that expended in neutralising the falls as 325°·26 to 27°·9.

19. In the 34 weeks in which increase of sickness occurred with moderate falls of temperature, the amount of antagonistic force expended in producing manifest increase of sickness, was to that expended in neutralising the falls 277°·02 to 117°·6.

20. In the 16 weeks in which the increase of sickness occurred with considerable falls of temperature, the amount of antagonising force expended in producing manifest increase of sickness, was nearly equal to that expended in neutralising the falls, the former being to the latter as 117°·08 to 115°·2

21. Thus, the greater the extent of the falls with which increase of sickness was associated, the greater was the proportion of antagonistic force expended in neutralising the falls, and the less that expended in producing manifest increase of sickness.

22. On the whole, the mean weekly amount of antagonistic force expended in neutralising the falls and producing manifest increase of sickness, was greater in the weeks of considerable fall in which increase occurred, than in those of slight or moderate fall, and greater in the weeks of slight than of moderate fall.

23. Comparing now the weeks of fall of temperature in which sickness was decreased with those in which it was increased, we find that the mean weekly value of the forces of increase neutralising the falls and producing manifest increase in the latter set of weeks was nearly the same as that of all the forces of increase combined, and operating in the former set of weeks: that in the weeks of slight fall the mean weekly force of the causes of increase when it occurred was much greater than that of the causes of decrease when decrease occurred: that in the weeks of moderate fall the force of the causes of increase when it occurred was slightly greater only than that of the causes of decrease when decrease occurred: but, on the contrary, that in the weeks of considerable fall in which decrease occurred the mean weekly force of the causes of decrease combined was much greater than that of the causes of increase when increase occurred.

24. Comparing the force of the predominating supplementary condition promoting decrease of sickness in the 113 weeks in which sickness was decreased with the force of the predominating supplementary conditions neutralising the falls and producing increase of sickness in the 76 weeks of decreased sickness, we find that the sum of the force of the supplementary conditions promoting decrease of sickness was rather greater than that of the supplementary conditions promoting increase of sickness, viz., as 999°·68 to 973°·73; but on the other hand, that the mean weekly force of the latter was to that of the former as 12°·81 to 8°·85. In the 26 weeks of slight fall in which sickness was increased the sum of the forces of the supplementary conditions promoting increase was to that of the supplementary conditions promoting

decrease in the 29 weeks in which sickness was decreased, as 353°·16 to 272°·78; and also the mean weekly force of the former was greater than that of the latter, viz., as 13°·58 to 9°·40. In the 52 weeks of moderate fall in which sickness was decreased the sum of the force of the supplementary conditions promoting decrease was to that of the supplementary conditions promoting increase as 406°·65 to 394°·62; but the mean weekly force of the latter was very much greater than of the former, viz., as 11°·60 to 7°·82. In the 32 weeks of considerable fall in which sickness was decreased the sum of the forces of the supplementary conditions promoting decrease was to that of the supplementary conditions promoting increase as 302°·57 to 232°·28; but again, the mean weekly force of the latter was very much greater than of the former, viz., as 14°·54 to 10°·01.

On the supplementary conditions generally co-operating with, or antagonising the influence of the Rises and Falls of mean weekly temperature.

It may not be out of place here to gather up a few further deductions arising out of the preceding inquiry, respecting the frequency and force of operation of the supplementary meteorological conditions so often mentioned as modifying the results of the rises and falls of mean temperature in the 389 weeks which have been submitted to discussion. I propose to group them all together, leaving to a future time the inquiry into the influence exerted by each severally.

The principal of these conditions are, the temperature of the night, the daily range of temperature, variations in the amount of atmospheric humidity, the frequency and amount of rainfall, the direction and force of the wind, and the antecedent occurrence of increase or decrease of sickness depending either upon changes of temperature or other causes. These that I have enumerated have appeared to me to be the most important conditions affecting public health. I do not absolutely exclude the operation of changes of barometric pressure, but I am disposed to think that their connection

with fluctuations of sickness is less direct and independent, nor yet that of electrical states of the atmosphere, the amount of sunlight, and of atmospheric ozone, but the operation of these is less readily defined, and will therefore form no part of my present inquiry.

We may continue to express the force of operation of these supplementary conditions (as I term them for the present) in the number of degrees of rise and fall of mean temperature with which they correspond.

1. *As respects all the* 389 *weeks of change of temperature upon the tables.*

Supplementary conditions promoting increase and opposing decrease of sickness operated on the whole in the course of these weeks, more frequently than those which tend to promote decrease and oppose increase of sickness. That is to say, putting changes of mean temperature out of the question, the supplementary causes of increase of sickness predominated in force over those of decrease of sickness in a larger proportion of the weeks under analysis than did those of decrease over those of increase of sickness.

The supplementary causes of increase predominated in 52·00 per cent., and decrease 48·00 per cent.

Then as regards the force of their operation when either the one or the other set of causes predominated—

	Sum in deg. of rise.	Weekly mean.
The entire force of operation of the supplementary causes of increase of sickness when co-operating with the 121 rises of temperature	= 846·20°	— 6·99°
When antagonising 80 falls of temperature.....	= 976·83°	— 12·21°
Sum in 201 weeks.....	= 1823·03°	— 9·07°
	Degs. of fall.	
The entire force of operation of the supplementary causes of decrease of sickness when antagonising 75 rises of temperature	= 869·00°	— 11·59°
When co-operating with 113 falls of temperature	= 999·68°	— 8·85°
Sum in 188 weeks.....	= 1868·68°	— 9·94°

Thus, while the supplementary forces of increase predominated more frequently than those of decrease, the *sum of the forces of decrease was greater* than that of the forces of increase, and their *mean weekly force* when they did predominate was *greater also*.

Comparing the *force* of operation of the *supplementary causes* of increase and decrease of sickness as exhibited *in the weeks of rise with that exhibited in the weeks of fall* of temperature, we find—

1st. That the sum of the force of the causes of *increase* of sickness predominant and operating in antagonism of the 80 falls of temperature was decidedly greater than that of the causes of increase predominant and operating in assistance of the 121 rises of mean temperature: and moreover, that the mean weekly force of the causes of increase engaged in antagonising the falls was nearly twice as great as that engaged in co-operating with the rises.

2nd. That the sum of the forces of the causes of *decrease* of sickness predominating in the 113 weeks of fall of temperature, and co-operating with the falls was decidedly greater than that of the causes of decrease predominant in the 75 weeks of rises of temperature and antagonising the rises. But that the mean weekly force of the causes of decrease engaged in antagonising the rises was greater than that engaged in co-operating with the falls.

2. *As respects the* 128 *weeks of slight change of temperature.*

I have assumed that the frequency with which supplementary causes of increase or decrease of sickness predominate is the same in weeks of slight, moderate, and considerable rise and fall of temperature, as in all weeks of change of temperature taken together, so that here and subsequently I have merely the question of force of operation to consider.

	Sum in degs. of rise.	Weekly mean.
The entire force of operation of the supplementary causes of increase of sickness when co-operating with the 40 slight rises of temperature	= 330·06°	— 8·25°
When antagonising, 29 slight falls of temperature.....	= 354·26°	— 12·22°
Sum in 69 weeks.....	= 684·32°	— 9·92°

	Degs. of fall.	
The entire force of operation of the supplementary causes of decrease of sickness when antagonising 30 slight rises of temperature	= 343·03°	— 11·43°
When co-operating with 29 slight falls of temperature	= 272·78°	— 9·40°
Sum in 59 weeks.....	= 615·81°	— 10·44°

Thus, in the weeks of slight change of mean temperature the *sum of the supplementary forces of increase* of sickness was decidedly *greater* than that of the supplementary forces of decrease—but the *mean weekly force of operation of the causes of decrease* when they predominated was rather *greater* than that of the causes of increase.

Comparing the force of operation of the supplementary causes of increase and decrease of sickness as exhibited in the weeks of slight rise with that exhibited in the weeks of slight fall of temperature, we find—

1st. That the sum of the forces of the causes of *increase* of sickness predominating in the 29 weeks of slight fall, and antagonising the falls, was rather greater than that of the causes of increase predominating in the 40 weeks of slight rise and co-operating with the rises; and also that the mean weekly force of the causes of increase engaged in antagonising the falls was greater than that engaged in co-operating with the rises.

2nd. That the sum of the forces of the causes of *decrease* of sickness predominating in the 30 weeks of slight rise and antagonising the rises was decidedly greater than that of the causes of decrease predominating in the 29 weeks of slight fall and co-operating with the falls; and also that the mean weekly force of the causes of decrease engaged in

antagonising the rises was greater than that engaged in co-operating with the falls.

3. *As respects the* 160 *weeks of moderate change of temperature.*

	Sum in degs. of rise.	Weekly mean.
The entire force of operation of the supplementary causes of increase of sickness when co-operating with the 40 moderate rises of temperature	= 272·15°	— 6·80°
When antagonising 35 moderate falls of temperature...	= 396·62°	— 11·33°
Sum in 75 weeks.....	= 668·77°	— 8·92°
	Degs. of fall.	
The entire force of operation of the supplementary causes of decrease of sickness when antagonising the 33 moderate rises of temperature	= 348·12°	— 10·55°
When co-operating with 52 moderate falls of temperature	= 406·65°	— 7·82°
Sum in 85 weeks.....	= 754·77°	— 8·88°

Thus, in the weeks of moderate change of mean temperature the *sum of the supplementary forces of decrease* of sickness was decidedly *greater* than that of the supplementary forces of increase. The *mean weekly force* with which either operated when predominant was, however, *nearly the same.*

Comparing the force of operation of the supplementary causes of increase and decrease of sickness as exhibited in the weeks of moderate rise with that exhibited in the weeks of moderate fall of temperature, we find—

1st. That the sum of the forces of the causes of increase of sickness predominating in the 35 weeks of moderate fall and antagonising the falls was very much greater than that of the causes of increase predominating in the 40 weeks of moderate rise and co-operating with the rises; and moreover, that the mean weekly force of the causes of increase engaged in antagonising the falls was also very much greater than that engaged in co-operating with the rises.

2nd. That the sum of the forces of the causes of decrease of sickness predominating in the 52 weeks of moderate fall of temperature, and co-operating with the falls, was decidedly greater than that of the causes of decrease predominating in the 33 weeks of moderate rise of temperature and antagonising the rises—but that the mean weekly force of the causes of decrease engaged in antagonising the rises was decidedly greater than that engaged in co-operating with the falls.

4. *As respects the* 101 *weeks of considerable change of temperature.*

	Sum in degs. of rise.	Weekly mean.
The entire force of operation of the supplementary causes of increase of sickness when co-operating with 41 considerable rises of temperature	= 244·20°	— 5·96°
When antagonising 16 considerable falls of temperature	= 232·28°	— 14·54°
Sum in 57 weeks.....	= 476·58°	— 8·36°
	Degs. of fall.	
The entire force of operation of the supplementary causes of decrease of sickness when antagonising the 12 considerable rises of temperature	= 177·85°	— 14·82°
When co-operating with 32 considerable falls of temperature	= 320·57°	— 10·01°
Sum in 44 weeks.....	= 498·42°	— 11·33°

Thus, in the weeks of considerable change of temperature, the sum of the supplementary forces of decrease of sickness was somewhat greater than that of the supplementary forces of increase—and moreover, the mean weekly force of the causes of decrease when they predominated was much greater than that of the causes of increase.

Comparing the force of operation of the supplementary causes of increase and decrease of sickness, as exhibited in the weeks of considerable rise, with that exhibited in the weeks of considerable fall of temperature, we find,—

1st. That the sum of the force of the causes of *increase* of sickness predominating in the 41 weeks of considerable

rise, and co-operating with the rises, was a little greater only than that of the causes of increase predominating in the 16 weeks of considerable fall, and antagonising the falls—but that the mean weekly force of the causes of increase engaged in antagonising the falls, was very much greater than that engaged in co-operating with the rises.

2nd. That the sum of the forces of the causes of *decrease* of sickness predominating in the 32 weeks of considerable fall, and co-operating with the falls, was nearly twice as great as that of the causes of decrease predominating in the 12 weeks of considerable rise, and antagonising the rises—but that the mean weekly force of the causes of decrease engaged in antagonising the rises was decidedly greater than that engaged in co-operating with the falls.

Distribution of force of the supplementary causes of increase and decrease of sickness.

We may, in the last place, bring together the numbers which show the manner in which the force of the supplementary causes of increase and decrease of sickness appears to have been distributed.

1. *Supplementary causes of increase.*

A. As regards the sum of these forces = 1823°·03 of rise.

	In degs. of rise.
Engaged in antagonising 16 considerable falls	= 232·28°
co-operating with 41 considerable rises ...	= 244·30°
co-operating with 40 moderate rises	= 272·15°
co-operating with 40 slight rises.....	= 330·06°
antagonising 29 slight falls	= 354·26°
antagonising 35 moderate falls.....	= 396·62°

B. As regards their mean weekly force = 9°·07 of rise.

	In degs. of rise.
When co-operating with considerable rises.....	= 5·96°
moderate rises	= 6·80°
slight rises.....	= 8·25°
antagonising moderate falls	= 11·33°
slight falls.....	= 12·22°
considerable falls	= 14·54°

2. *Supplementary causes of decrease.*

A. As regards the sum of their forces = 1868°·68 of fall.

	In degs. of fall.
Engaged in antagonising 12 considerable rises	= 177·85°
co-operating with 29 slight falls	= 272·78°
co-operating with 32 considerable falls ...	= 320·57°
antagonising 30 slight rises	= 343·03°
antagonising 33 moderate rises	= 348·12°
co-operating with 52 moderate falls	= 406·65°

B. As regards their mean weekly force = 9°·94 of fall.

	Degs. of fall.
When engaged in co-operating with moderate falls.....	= 7·82°
slight falls	= 9·40°
considerable falls ...	= 10·01°
antagonising moderate rises.....	= 10·55°
slight rises	= 11·43°
considerable rises ...	= 14·82°

A few further deductions may be made from these two tables, viz. :

1st. That the mean weekly force of the supplementary causes both of increase and of decrease of sickness when engaged respectively *in antagonising* falls or rises of temperature *was greater* than when engaged respectively in co-operating with rises or falls of temperature.

2nd. That the mean weekly force of the supplementary causes of decrease engaged in *co-operating* with falls was greater than that of the supplementary causes of increase engaged in co-operating with rises of temperature.

This difference is least remarkable when comparing weeks of slight and moderate rise with weeks of slight and moderate fall; but it is very strongly marked indeed when comparing weeks of considerable rise with weeks of considerable fall.

The inference is that the falls, and especially the considerable falls when they produce decrease of sickness act less independently than do the rises of mean temperature when the latter increase sickness.

3rd. That the mean weekly force of the supplementary

causes of increase of sickness engaged in *antagonising* falls was slightly greater than that of the supplementary causes of decrease engaged in antagonising rises of temperature.

This, indeed, was only the case when comparing weeks of slight and moderate falls with weeks of slight and moderate rises, nor was the difference then very great. On the contrary, the mean weekly force of the causes of decrease antagonising considerable rises was slightly greater than that of the causes of increase antagonising considerable falls.

EXPLANATION OF THE DIAGRAMS. Nos. 1 to 7. 1859—65.

The irregular line ~~~~~ represents mean temperature.

The thin line ———— represents mean temperature of corresponding period from 1814—1856. (Glaisher's Tables, 1858.)

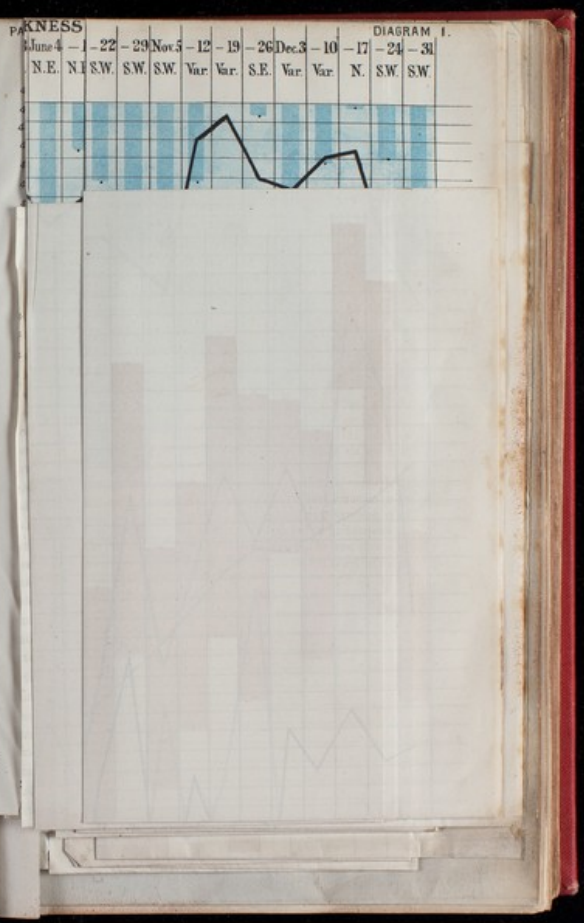
Intermediate black line ———— represents the new cases of sickness.

Thick upper black line ———— represents barometric weight.

Space coloured *pink* represents mean daily range of temperature.

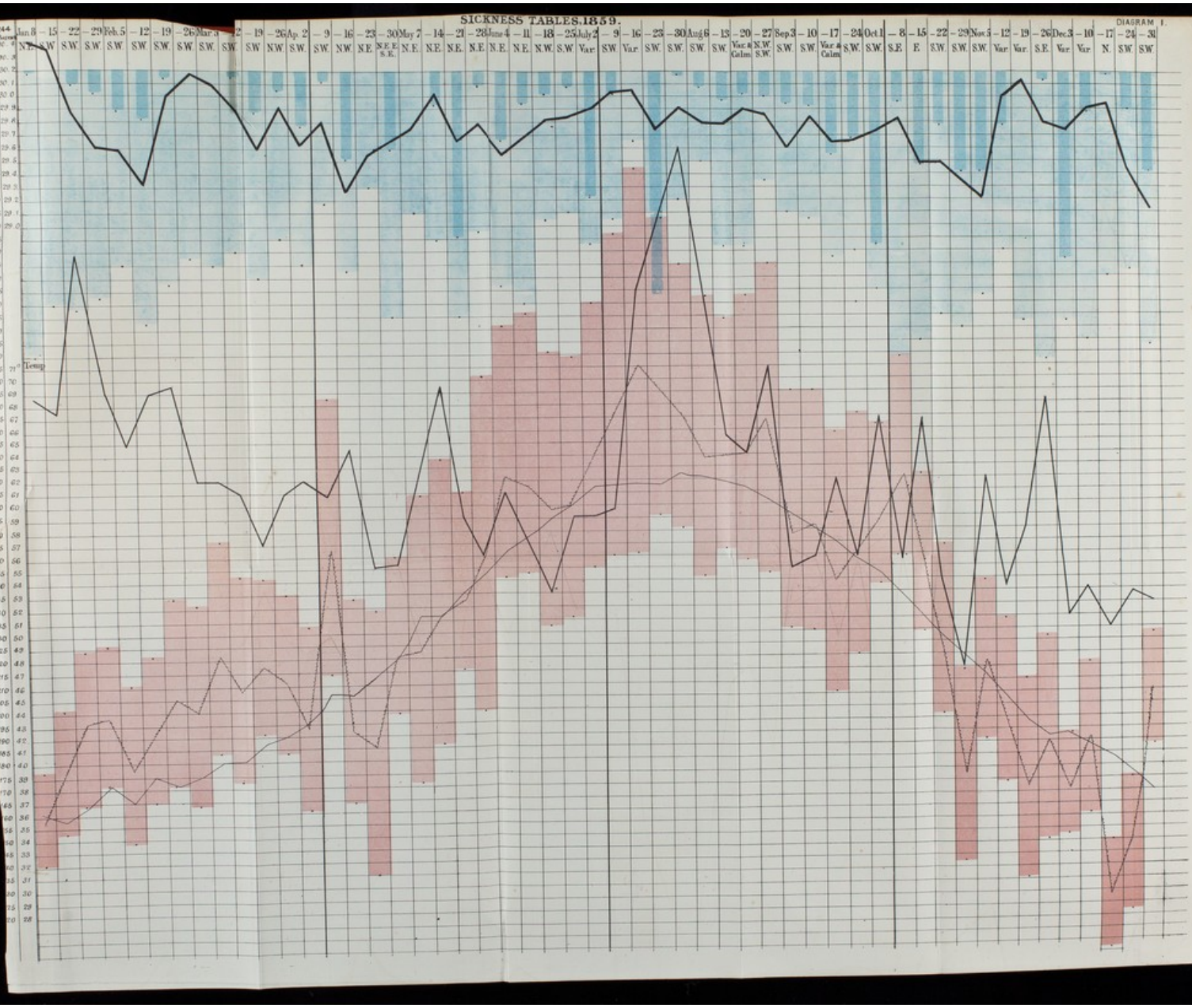
Space coloured *blue* represents humidity of atmosphere, each transverse line corresponding to two degrees of humidity above 50 (saturation = 100).

Space coloured *indigo* represents the weekly amount of rainfall; eight transverse lines corresponding to one inch.



SICKNESS TABLES.1859.

DIAGRAM 1.



PAGE 2

2 — 9	— 27	Nov. 3	— 10	— 17	— 24	Deb. 1	— 8	— 15	— 22	— 29
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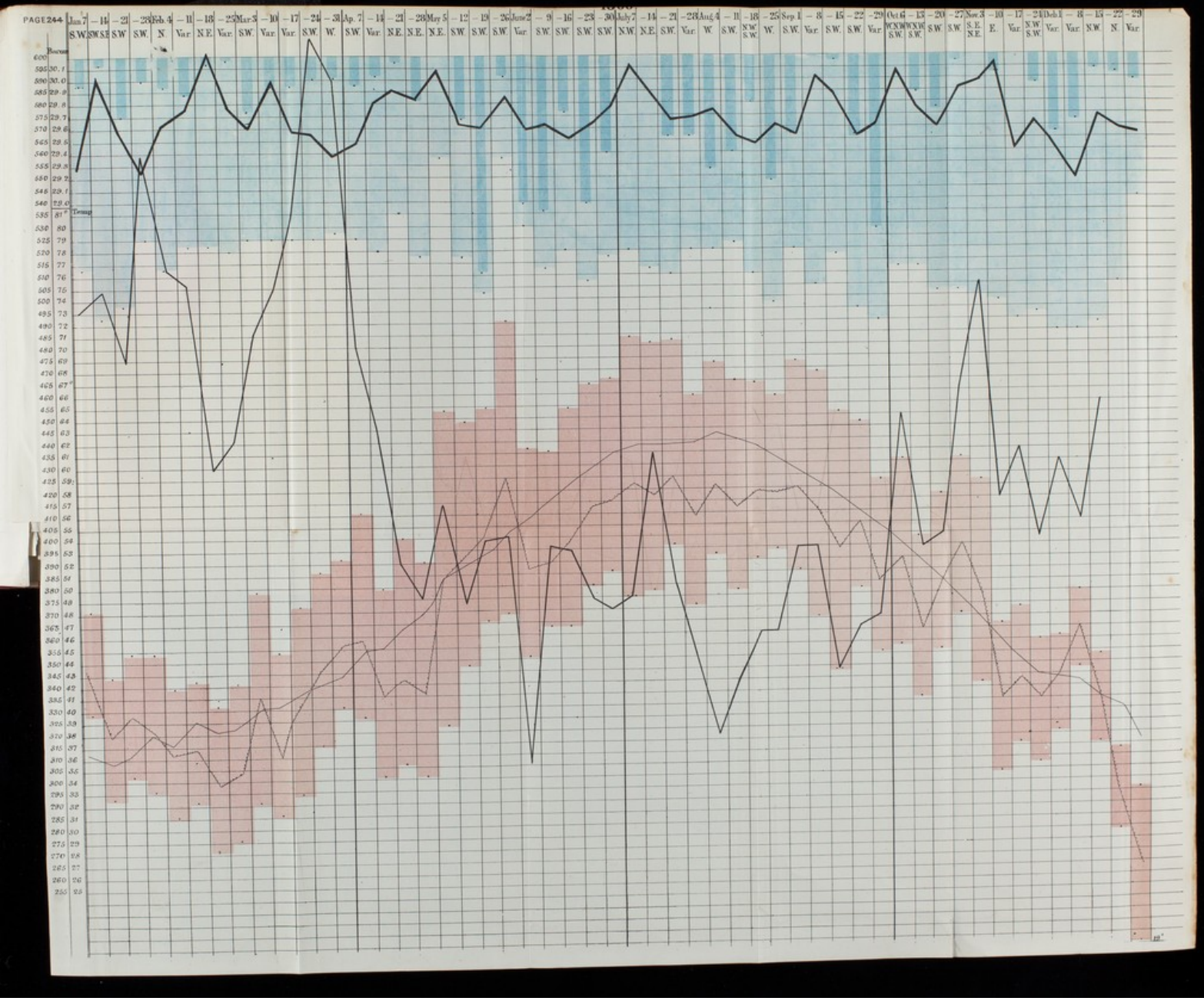
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PAGE	1	8	15	26	Nov. 2	9	16	23	30	Dec. 7	14	21	28
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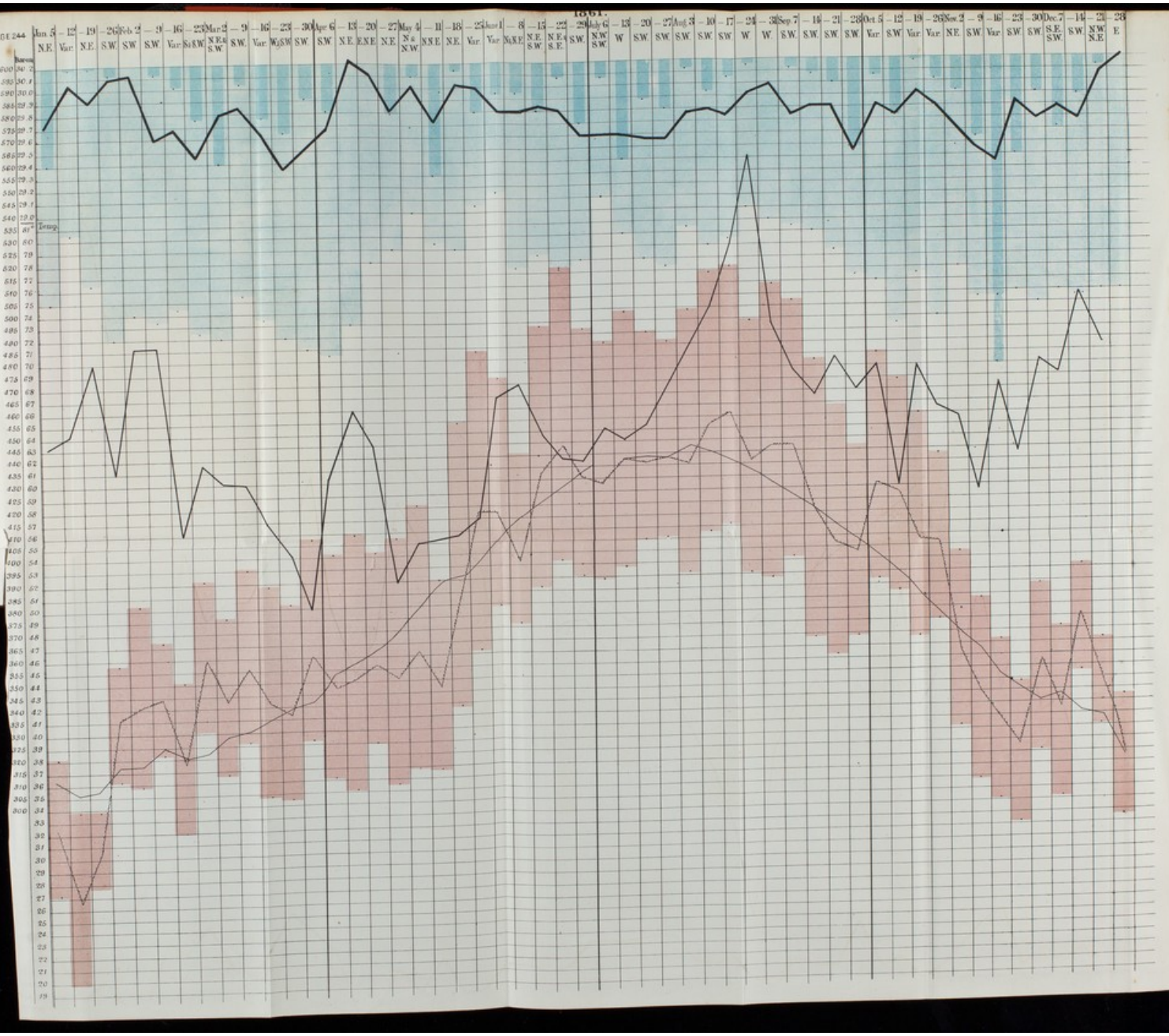
1861.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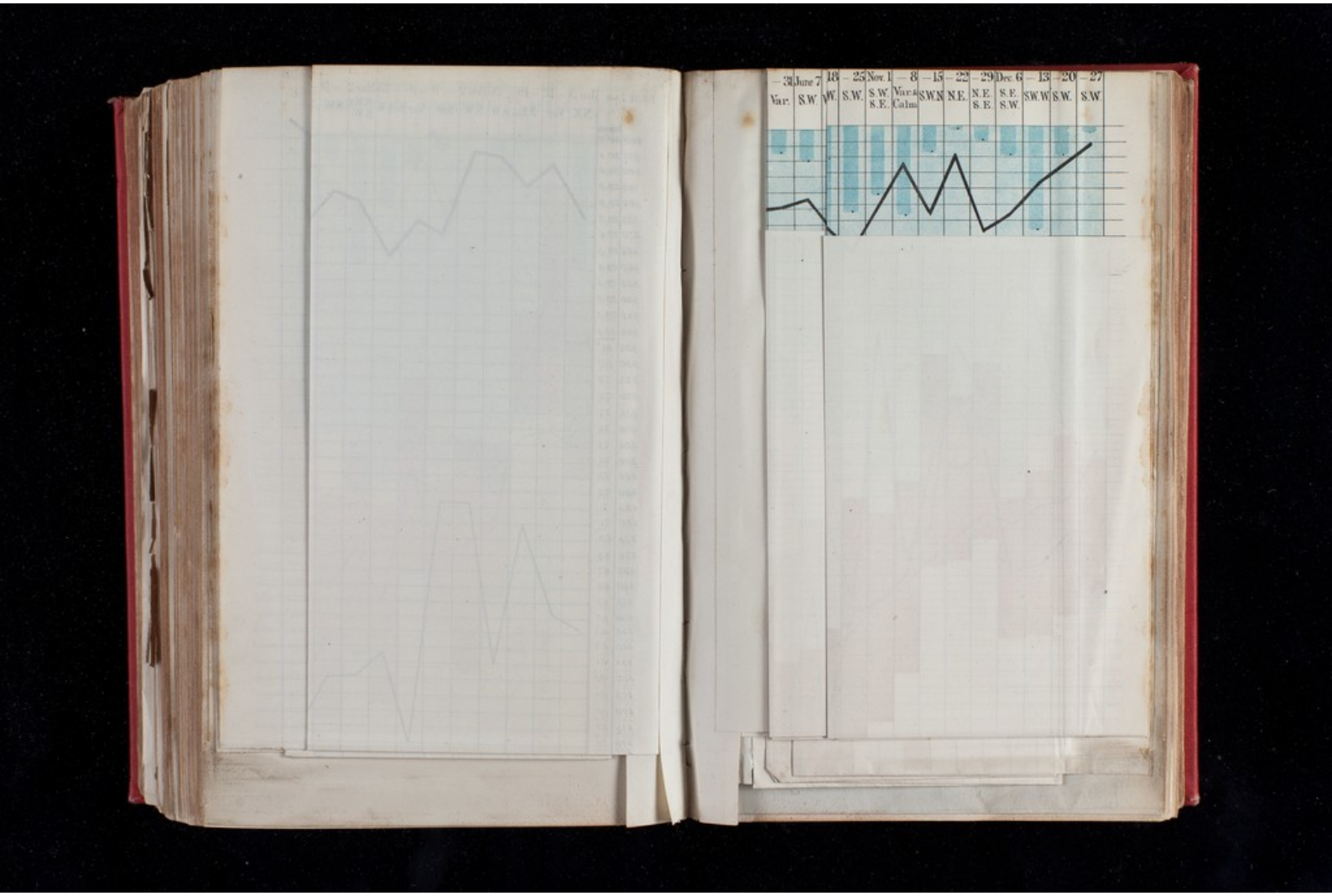
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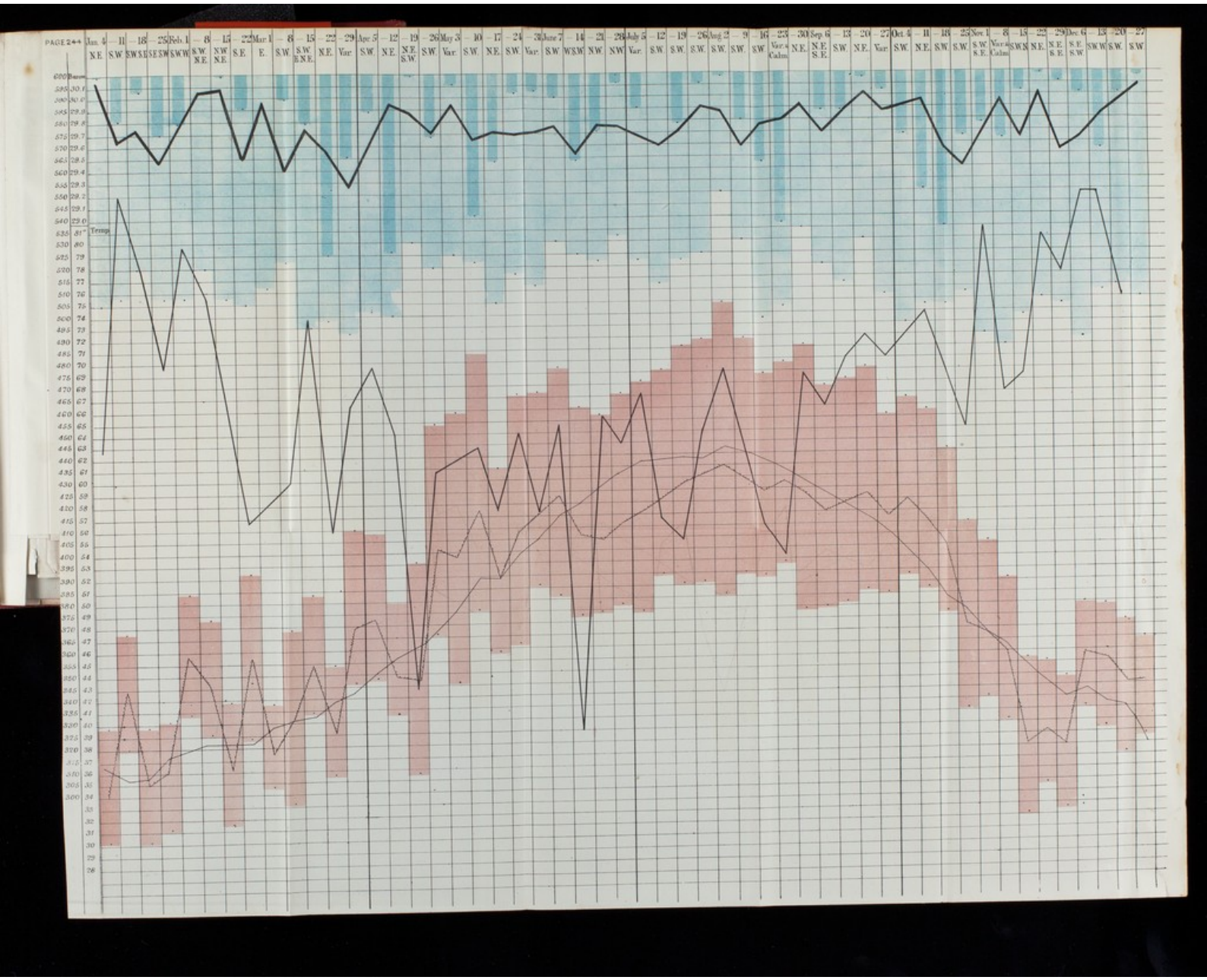
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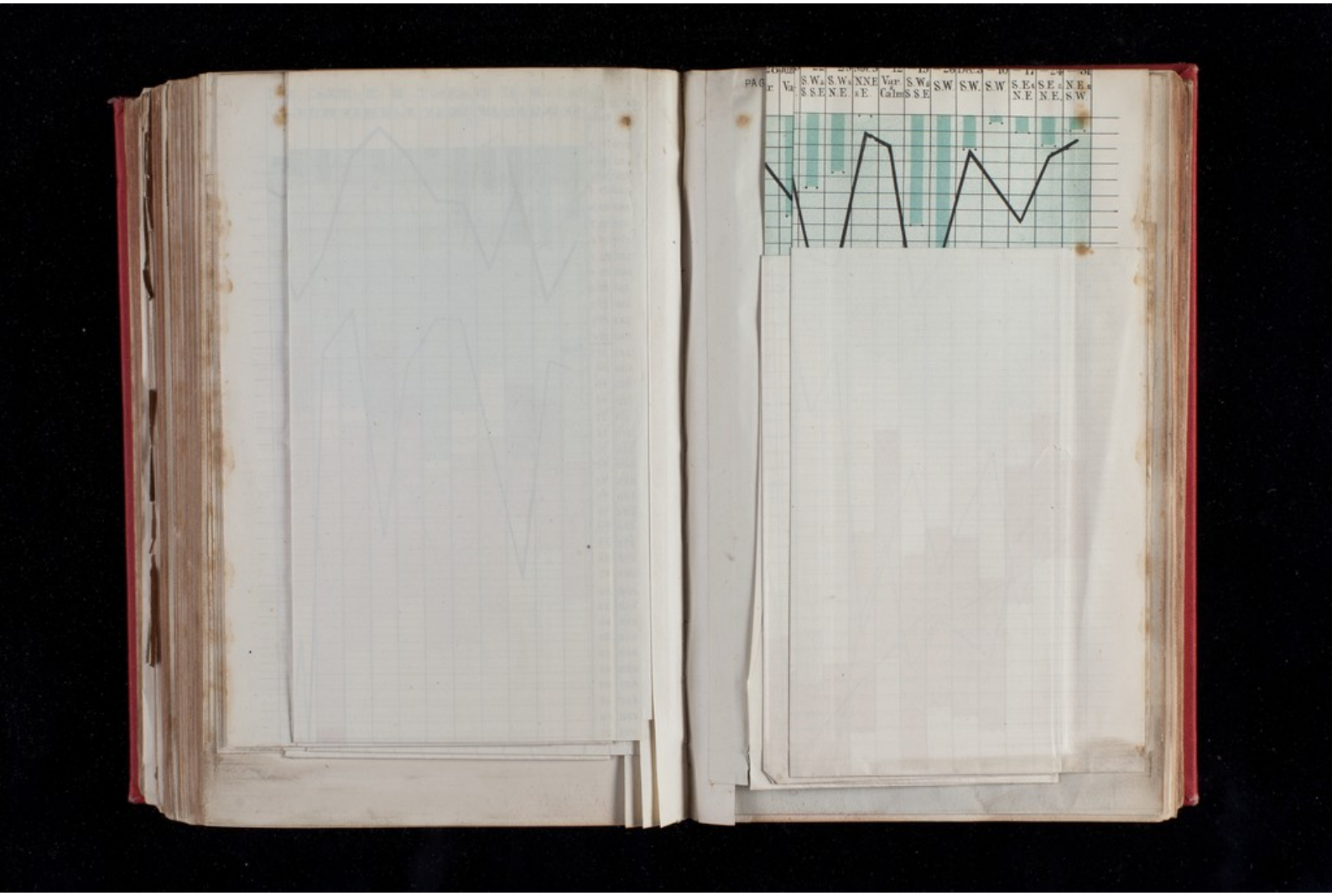
PAG
Var
S.W. & S.E
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1863.

DIAGRAM 5.

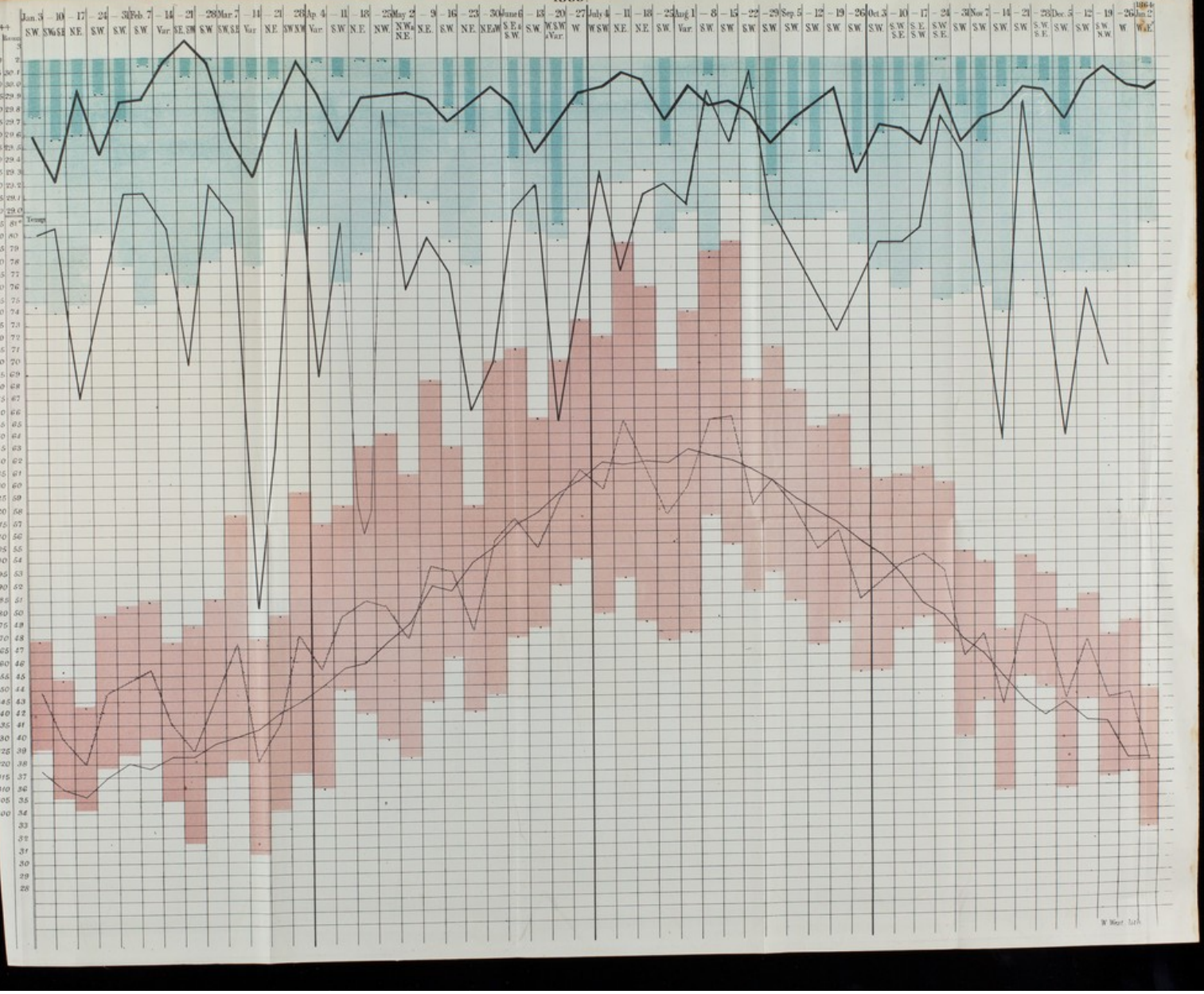

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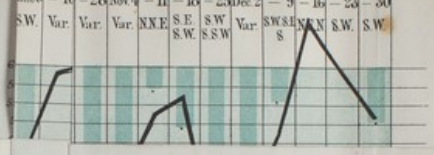
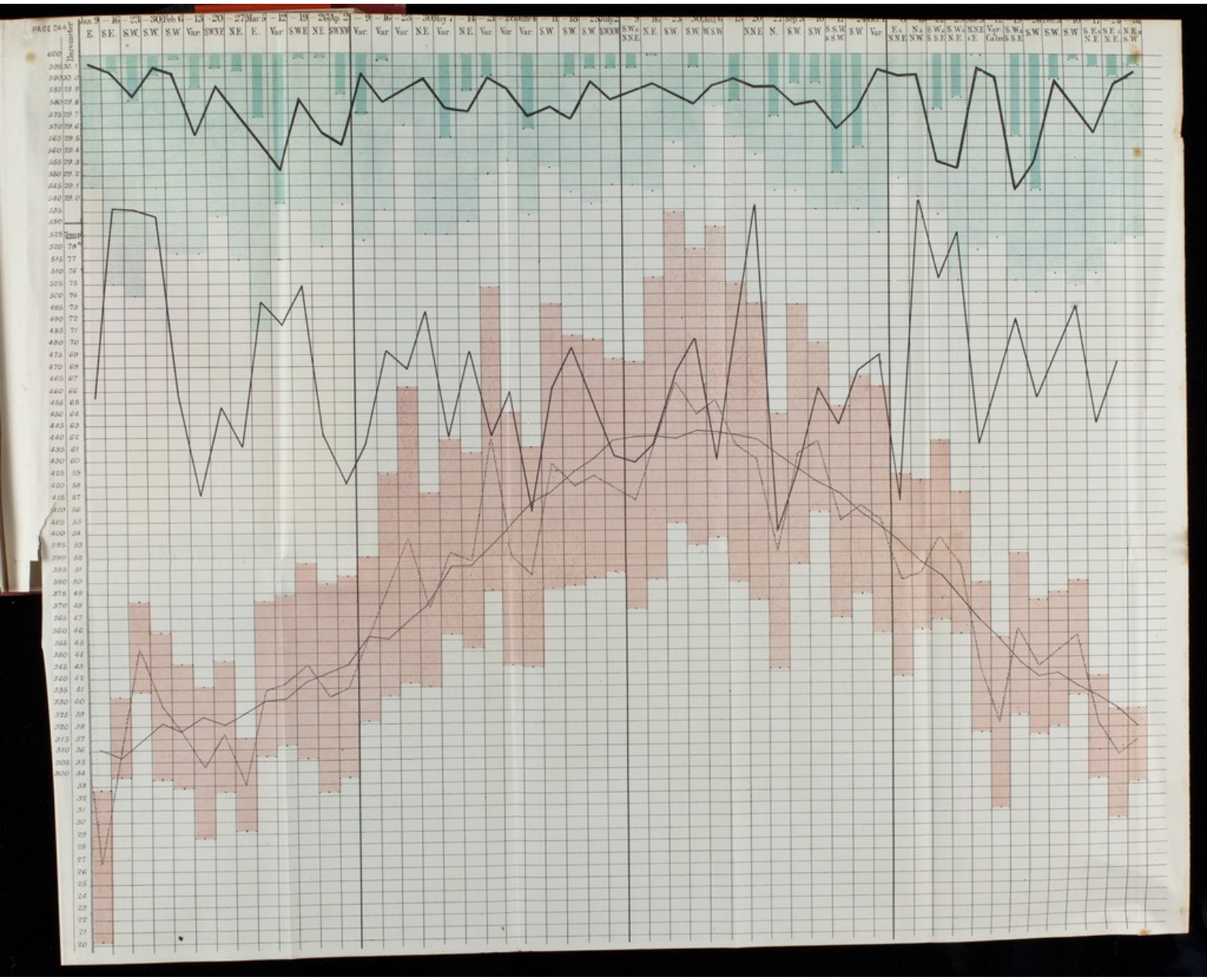
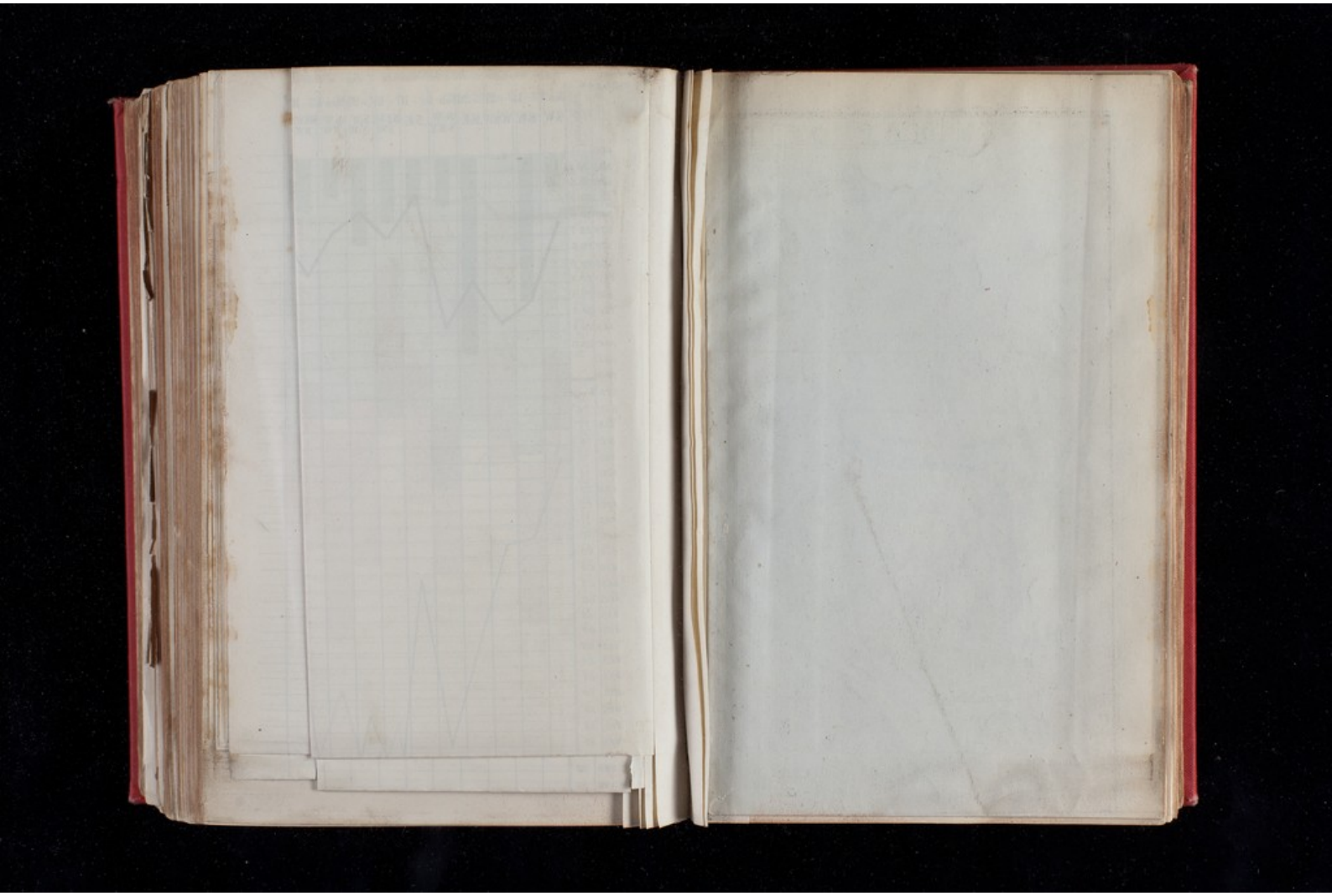
DIAGRAM 7.

June 3	– 10	– 28	Nov. 4	– 11	– 18	– 25	Dec. 2	– 9	– 16	– 23	– 30
S.W.	Var.	Var.	Var.	N.N.E.	S.E. S.W.	S.W. S.S.W.	Var.	S.W. S.E. S.	N. N.	S.W.	S.W.



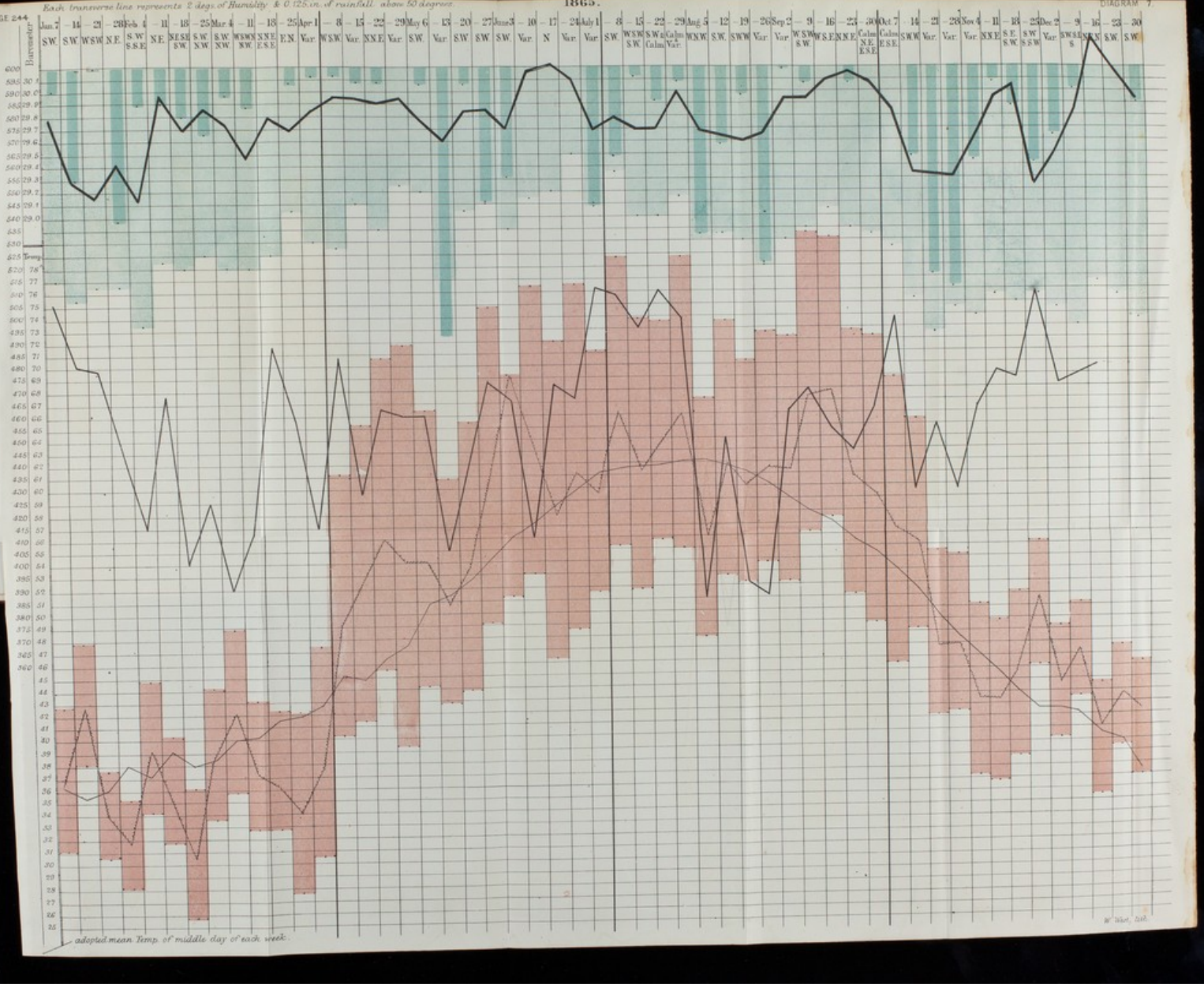


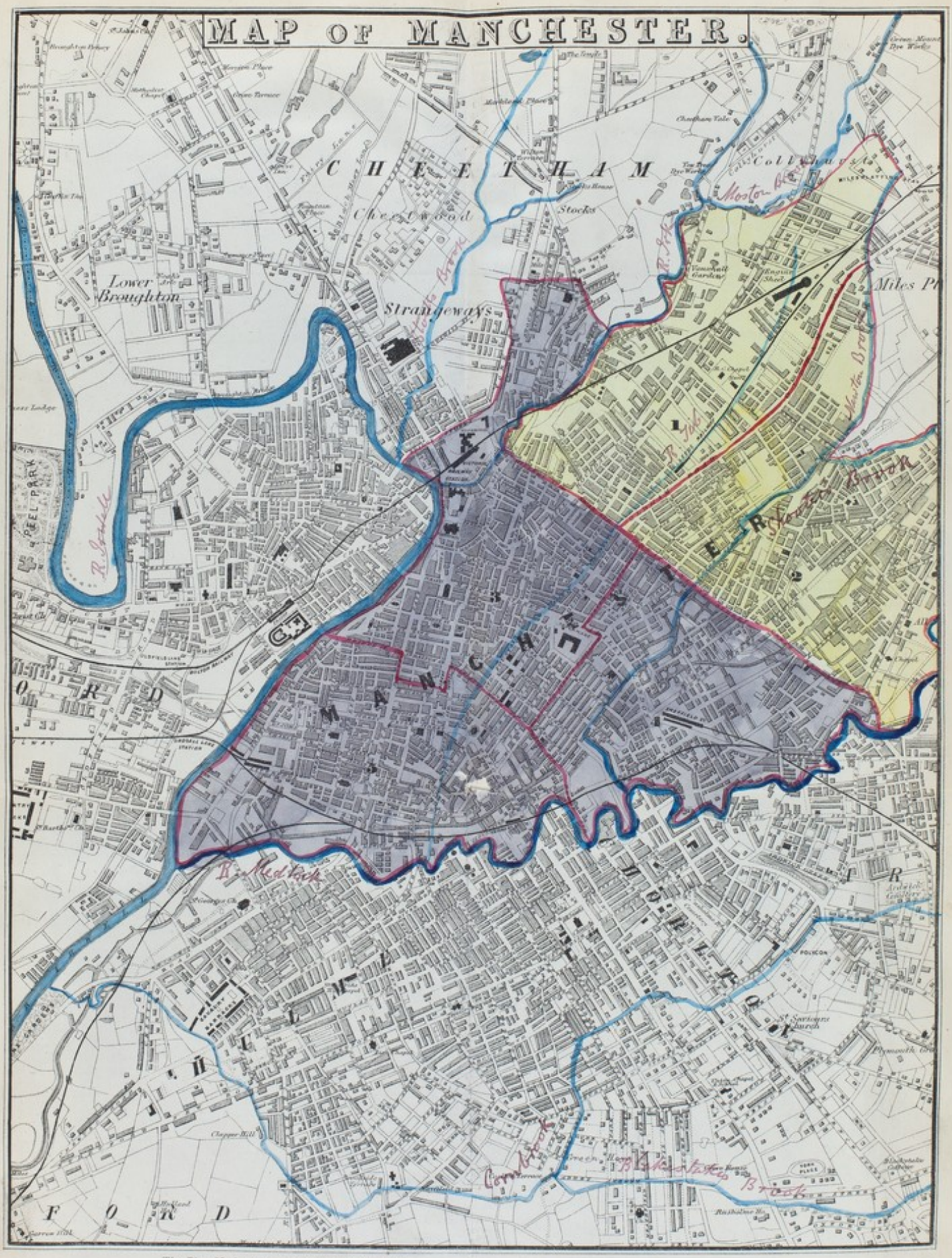


Each transverse line represents 2 degs. of Humidity & 0.125 in. of rainfall above 50 degrees.

1865.

DIAGRAM 7





The Blue Marks indicate the Rivers and Streams.
The Coloured Portions indicate the Districts, thus—1. St. George's. 2. Ancoats. 3. Market Street. 4. London Road. 5. Deansgate.

THE

RATE OF MORTALITY

IN

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PREFACE.

For the purpose of ascertaining the rate of mortality of the several European populations, two methods, each differing more or less from the other in the results, have been employed, namely, by comparing the number of deaths, first, with the number of births; second, with the aggregate population. The first has been preferred by the French and other continental statisticians, the second by the English.

The relative value of these two schemes of computation for determining the sanitary condition of a community would appear to furnish matter for dispute; as English readers, unused to the first, are disposed to doubt its sufficiency for the purpose, preferring to rely rather upon that which has been adopted by the registrar-general of this country.

In the previous editions of this work, the continental method has, from a conviction of its greater accuracy, been used; and I am still of opinion, after carefully reconsidering the various circumstances calculated to affect the results in either case, that this will prove to be the more reliable of the two. As some of my friends, however, whose counsel I esteem, have kindly expressed misgivings on the subject, I have thought it expedient to explain, in a short preface to the present impression, my reasons for confiding in the original plan. Also, in order to exhibit the disparity between the one and the other method, it is purposed on this occasion to place

the issues of both in juxta-position, with an occasional comment by way of explanation when such shall appear to be called for.

In attempting to form an estimate of the relative healthfulness of different localities by means of either process, several agencies liable to vary the results should be taken into account; such, for instance, as the proportion of marriages to population, the ages at which the greatest number of marriages takes place, and the actual fecundity of the producing element, as shown by the average number of births per marriage annually, or for a given term of years; for these have a striking effect upon the death-rate and birth-rate per marriage in different communities compared with one another, although the relative proportions of births and deaths, whether high or low, furnish results equally uniform as to truthfulness in all. But that which has the effect of most disturbing the results as deduced by one of these processes, is the amount of floating population, which is both variable, and in some places large and capable of influencing the death-rate *per population* considerably, while it has but little effect upon the death-rate *per births*.

In any community where the marriage-rate is high as compared with that of any other similarly constituted body, the birth-rate will not only be higher actually in the former than the latter, but will be still higher than the disparity between the sums representing the respective marriage rates would seem to indicate. For, whenever marriages preponderate in a district as compared with the same occurrences in any other, it is found that the excess belongs chiefly to those which take place in early life, when the functional tone is the most robust and healthy—say, before the age of thirty years, and consequently embracing the period of life which is the most prolific of offspring. No two countries afford more

convenient contrasts in this respect than France and England; the disparity between the two being sufficiently striking to serve the purpose of illustration.

In the ten years ended 1860, the sum of marriages in France was 2,877,464 to a population of 37,382,225,* giving an annual percentage of ·769; while in England the total marriages in the ten years ended 1860 amounted to 1,601,731 to a population (in 1861) of 20,066,224, yielding a percentage of ·798—the excess being ·029 in favour of England.

But in France, marriage as a rule is not consummated so early in life as in England. Prudential motives, as alleged, induce men of all classes to delay this important step until, in accordance with the wise Malthusian principle, their means of subsistence shall have accumulated sufficiently to enable them to meet the exigencies of married life. In 1857 (the last year for which the *ages* at the time of marriage are stated), of 232,097 marriages, 69 per cent were contracted before the age of thirty years, and 31 per cent after that age; while in England, in 1860, of 106,285 marriages, the ages of both parties being ascertained, 79 per cent were contracted before, and 21 per cent after the age of thirty years. The respective results particularised are more conspicuously shown as follows:—

	Percentage of Marriages—	
	Before the age of thirty years.	After the age of thirty years.
France	68·669	31·331
England	78·857	21·143

Consequently, about ten per cent more of English than of French marriages extend over the first half of the

* In educing these estimates it seemed desirable, in order to avoid confusion, to employ the sums representing the populations of the last year of the ten, instead of the average of the decennium, as these are unavoidably used in some of the processes which follow. The relations, however, will stand the same for the two peoples respectively.

child-bearing period—say from eighteen to thirty years. And seeing that the first half of married life is decidedly more fertile, in the reproductive sense, than the latter half, it follows that the average number of births per marriage will be considerably greater in one of these communities than in the other. And this is precisely what the results go to illustrate; for the percentage of births to marriages in England for the ten years ended 1860 was 4·254, while that for France in the same ten years was only 3·312, yielding an excess of natural increase of ·942 per cent on the side of England. But even this rate is below what actually takes place, for the death-rate per marriage being somewhat higher in France than in England—viz., 2·705 for the former and 2·657 for the latter; it results that, deducting the difference between the percentage of deaths and births per marriage in France (3·312—2·705) = ·607, from the same in England (4·254—2·675) = 1·579, the actual excess of natural increase in the latter country will be (1·579—·607) = ·972 per cent per decennium.

From the preceding results it is evident that the percentage death-rate as compared with births is widely different in the two countries, being for France ($\frac{2{\cdot}705 \times 100}{3{\cdot}312}$) 81·672, and for England ($\frac{2{\cdot}657 \times 100}{4{\cdot}254}$) 62·459. Hence, according to this mode of computation, the rate of mortality in France is above nineteen per cent higher than that of England, and this accords closely with the natural increase of the two populations respectively, as will be manifest by comparing the relative sums in the following statements, bearing upon the death-rate *per population*.

In France, for the ten years ended 1860, the death-rate per population was 2·323 per cent; in England, for the ten years ended 1860, it was 2·098 per cent; yielding a difference of ·225 per cent per [illegible] in favour of England.

The population of France in 1860 amounted to 37,383,225, having experienced an actual increase in ten years of 1,599,727, being at the rate of 4·47 per cent.

The population of England in 1861 was 20,066,224, having increased in ten years to the amount of 2,138,615, being at the rate of 11·93 per cent.

In the same decennium the number of births in France was 9,535,933, and the number of deaths 8,685,310, giving an amount of natural increase of 850,623.

In England during the decennium the number of births was 6,471,650, and the number of deaths 4,210,715, yielding an amount of natural increase represented by 2,260,935.

Now, as the *actual* increase of population in France in ten years amounted, as above shown, to 1,599,727, while the *natural* increase (*i. e.* by births) was only 850,623, it follows that the remaining 749,104 must consist of an addition from without—that is, of strangers to the soil; and, as in England the *actual* increase of population in ten years was only 2,138,615, while the *natural* increase amounted to 2,260,935, it equally ensues that 122,320 must have left the country during the time specified. So that the percentage of deaths *per population* is a fictitious estimate in both countries.

For, if the 749,104 strangers be deducted from the population of France, the death-rate per population will be 2·379 instead of 2·323; and if the 122,320 absentees be added to the English population, the death-rate will be reduced from 2·098 to 2·085, yielding a percentage excess of deaths for France over England of ·294 instead of ·225.

A still more striking instance of the fallacy of the death-rate estimate *per population* is the following:—The inhabitants of New York amounted in 1840 to 312,710, and in 1850 to 515,547, having, in the space of ten years, experienced an

increase of 202,837, or more than sixty-four per cent. No one will believe that this augmentation was due to natural increase—that is to say, to an excess of births over deaths, for that would necessitate 18·5 births per marriage in ten years, or 1·85 (*i. e.* nearly two) births per marriage per annum. Or, instead of this enormity, the death-rate must have been less than one-half per cent (*i. e.* ·44 per cent per annum), which, it may be safely affirmed, is not true of any population in the world.

All newly colonised countries are subject to the same kind of irregularity, varying in extent according to the amount of floating population introduced. After the English mode of computation, therefore, the rate of mortality of a new colony, whose increase of population is so largely influenced by the influx of healthy adults, chiefly males, will always appear lower than it really is, or than a comparison of its deaths with births would represent it to be; while that of the countries which have furnished the emigrants will appear greater, although it may be lower in reality.

There is no reason to doubt that similar fluctuations are to a certain extent constantly taking place in the several component communities of every civilised nation of the present day, and that they are witnessed among the towns and districts of Great Britain not less extensively than elsewhere.

In any population consisting of a preponderance of young families, the death-rate *per population* will always appear high in comparison with that of any other population where the opposite conditions prevail. But it does not hence follow that the causes of disease or of death are more potent in the first than in the second. The results may be mainly influenced by displacements, and by the ages and circumstances of those

engaged in the interchange. The most notable instances of local translation of families observable in this kingdom, are presented by the manufacturing as compared with the non-manufacturing districts. It is notorious that many of the families of manufacturing towns, at or about the middle period of life, are yearly retiring from business and from the vicinity of the field of their successes, to spend the rest of their lives in tranquillity in localities beyond the precincts of their early activity. It is also known that the rising generation of both sexes in these and similarly constituted communities are systematically removed for educational purposes to seminaries elsewhere. The displacement thus effected is a process of lessening on the one hand and of accumulation on the other, without any equivalent interchange. There is no compensation by a similar movement hitherward. And the individuals engaged in this loss on one side, and gain on the other, consist of the most healthy elements of the population—hale people of middle life in affluent circumstances, and of young people of both sexes who have surmounted the vicissitudes of childhood, amongst both of whom the death-rate is at the lowest. The immediate consequence is, that the census estimate of many of the small agricultural and cathedral towns, containing these migrants, will be represented by sums compared with which the rate of mortality per population, which in all places is influenced most largely by events which occur among the young producing families, commonly permanent residents, will appear to be very low, while that of the districts whence the said floating element has issued is just in the opposite condition.

It is true the manufacturing towns and districts are not without their immigrants; but these consist chiefly of young, often recently married couples, seeking a means of subsistence

for themselves and offspring; and their presence goes mainly to magnify the mortuary results *per population*, though not so *per births*.

Thus, the populations of manufacturing districts are made up much more largely of the producing classes than are those of the agricultural districts and county towns; for, besides the greater influx of necessitous families, those who retire on their gains often leave behind them a producing progeny to pursue the path delineated for them by their predecessors; and the industrial element in such communities is always comparatively large, as well as young; so that both the births and also the early deaths are more numerous here than elsewhere.

It seems evident, therefore, that to form a judgment of the sanitary condition of the manufacturing districts by a comparison of deaths to population, can lead only to erroneous results; while the death-rate, formed by comparison with births, representing as it does the events appertaining to the permanent inhabitants, cannot be far wrong. Such kind of estimate will at least have the merit of being uniform for all populations.

For the sake of further illustration, contrast the city and county of Canterbury with the town and union of Howden, in East Yorkshire, as being similarly circumstanced in two essential points, namely, in number of inhabitants and the absence of cotton manufactories, though differing geographically and socially. The population of Canterbury amounted in 1851 to 14,100, and in 1861 to 16,643, having experienced an *actual* increase in the space of ten years of 2,543 persons, equal to eighteen per cent. But its *natural* increase (*i. e.* by births in excess of deaths) was only 463—the total number of births being 3,980, and the total deaths 3,517; so that 2,080 of this augmentation must have consisted of importations—strangers to the place.

The population of Howden, in 1851, amounted to 14,436, and ten years later (1861) to 15,001, having experienced an *actual* increase during ten years of only 565, at the rate of four per cent, while its *natural* increase (*i.e.* by excess of births) was 2,418—the total number of births being 5,740, and the total deaths 3,322. Here, therefore, is observed a kind of movement very different from that which affected Canterbury; for while the population of Canterbury received an accession from without of 2,080 persons, Howden experienced an exodus of its natives, amounting to 1,853. These remarkable results may be better comprehended by a glance at the following arrangement:—

	Population 1851.	1861.	Actual Increase.	Natural Increase.
Canterbury . . .	14,100—	16,643 . .	2,543 . .	463
Howden	14,436—	15,001 . .	565 . .	2,418

Further: In Canterbury the percentage of marriages, per population, in the same decennium was ·930, the percentage of births per marriage 2·571, and the percentage of deaths per marriage 2·272.

In Howden, the percentage of marriages during the same term of years was ·829, that of births per marriage 3·826, and that of deaths per marriage 2·214. These respective issues stand as follows:—

	Percentage of— Marriages to Population.	Births per Marriage.	Deaths per Marriage.
Canterbury .	·930	2·571 . . .	2·272
Howden. . .	·829	3·826 . . .	2·214

Thus, although the marriage-rate at Howden is ·101 per cent lower than at Canterbury, the birth-rate per marriage is 1·255 per cent more, while the death-rate stands at ·058 less.

The population of Howden, therefore, in regard to its sanitary status, is much more favourably circumstanced than that of Canterbury, seeing that out of 5,740 children born in that community in ten years, 2,418 (more than 42 per cent) were safely reared through the casualties and destructive maladies of early life to maturity; while of 3,980 born in Canterbury, only 463 (less than 12 per cent) were saved. Yet the rate of mortality per population, according to the registrar-general's figures, is in favour of Canterbury, as appears below:—

	Death-rate per population.
Canterbury	$\left(\frac{328 \times 100}{16,642}\right) = 2{\cdot}115$ per cent.
Howden.	$\left(\frac{328 \times 100}{15,064}\right) = 2{\cdot}214$ „

But this is a false representation manifestly. For if the 1,853 of the native inhabitants who left Howden during the ten years specified be added to the population of 1861; and if the 2,080 immigrants to Canterbury in the same decennium be deducted from its population of 1861—elevating the one and reducing the other each to its natural growth, their respective death-rates would be reversed, as below:—

	Death-rate per population.
Canterbury	$\left(\frac{328 \times 100}{14,562}\right) =$ 2·415
Howden	$\left(\frac{328 \times 100}{16,564}\right) =$ 1·971

These last given results, which undoubtedly represent the true state of the case on each side, hold about the same relation to each other as do those obtained by a comparison of deaths with births, as follows. The figures employed are the whole numbers for the ten years:—

	Deaths.
Canterbury . .	$\left(\frac{3,657 \times 100}{5,800}\right) = 88{\cdot}367$ to 100 births.
Howden . . .	$\left(\frac{3,395 \times 100}{5,740}\right) = 57{\cdot}875$ „

Moreover, the character and circumstances of the people engaged in these movements will doubtless have an important significance. What class of migrants would, it may be asked, be most likely to select Canterbury as a place of residence? Not, certainly, young, necessitous families in quest of employment. More probably they who resort thither consist chiefly of those retiring from active life, in search of society and repose. On the contrary. The emigrants from Howden and similar towns, as is well known, are principally the grown-up children of native residents, fitted by education for a pursuit, and sent forth to make a position for themselves elsewhere. In the first case the healthy element is augmented, and in the other diminished, by the change.

RATE OF

MORTALITY IN MANCHESTER, &c.

In regard to climatic qualities, Manchester bears an unenviable character. Its gloomy atmosphere, charged with unwholesome vapours, the product of numerous furnaces, and its reputed humidity, owing, as alleged, partly to some peculiarity in its geographical position, but chiefly to the heavy falls of rain which are spoken of as being incessant throughout the year, must of necessity, if true, render such a locality sufficiently disagreeable; while the density of its poor population, which is thought to be destructively great, and the pernicious influence of factory employment in more senses than one, contribute to form a combination of circumstances calculated to lead, by logical inevitability to the conclusion, that this town must also be eminently insalubrious as well as uninviting. Indeed, to hear its many grave demerits discussed by strangers who know it by reputation only, the listener cannot fail of being imbued with the idea that the city of Manchester can only be compared to a gigantic hotbed of pestilential fermentation.

Nor is the imputation altogether discredited by many of its inhabitants, who, unable to refute, are content to accept it as a truth, and to make the most they can out of time and opportunity, with a view to secure their own safety, by placing themselves at a convenient distance from it whenever circumstances shall render such procedure practicable. In cases of sickness, it is by no means uncommon to hear it assumed, as an admitted fact, that perfect restoration must be impossible unaided by removal to another atmosphere. Nevertheless, the great bulk of the inhabitants of Manchester do recover from maladies of severest type within its precincts, unassisted by such auxiliaries; and it does not appear, judging from its rate of mortality, that the public health of this city is much less favourably conditioned than that of many other town communities, even where cotton manufacturing influences are altogether unknown.

It is not here intimated that removal from the climate of Manchester, with all the associated advantages of change, is not serviceable to the convalescent. On the contrary, it often proves of the highest value, and in some cases, here as elsewhere, is quite essential; but this is, perhaps, chiefly so in the simple sense of exchange of the air of the sick room and that of the surrounding locality, with which the system of the patient has, by protracted confinement, become surfeited, for an atmosphere totally different, whether in town or country, and

irrespective of any specific virtue supposed to be possessed by that removed to. Nor need imagination stand responsible for the assertion that the Manchester atmosphere not seldom proves as powerfully and as speedily renovating to the convalescent whose malady has for weeks or months held him prostrate amidst the balmy air of the Cheshire meadows, or on the breezy hill-slopes of Cumberland, as the sea-side influence does to one removed from the midst of the town.

It is here purposed to enquire, with the utmost possible brevity, into a few of the principal agencies which render, or are supposed to render, the Manchester populace and its inhabitants generally, unfavourably circumstanced as to sanitary conditions in comparison of those of other towns differing more or less from it in regard to the distribution of social elements, and the character of their several industries.

Atmospheric Impurity and Humidity.

A smoke-charged atmosphere is undoubtedly objectionable and unpleasant to the senses, and by no means conducive to salubrity; but its influence upon health and the duration of life has probably been erroneously estimated. They who are most exposed to the direct action of coal smoke, such as

engine-stokers, coke burners, kiln-men, smiths, coal-miners, foundry-men, sweeps, and some others, are among the healthiest and strongest of operatives. It can be shown, moreover, that the inhabitants of some manufacturing towns which are notoriously smoky, are, judging from the results of the Registrar-General's tables, more wholesomely conditioned than those of some other first-class towns where the smoke nuisance does not exist. Take for example, the town of Sheffield as compared with York, Wolverhampton with Stafford, and Manchester with Lancaster. Each of these manufacturing towns with smoky atmosphere has a lower death-rate than that of either of its respective county metropolis, which is not so inconvenienced. The average of the collective death-rate *per births* of the Union populations of Sheffield (67·03), Wolverhampton (63·08), and Manchester (72·73), for the ten years ended 1860, is 70·03; while that for York (72·09), Stafford (73·78), and Lancaster (68·53), is 71·32 (to 100 births), yielding a difference in favour of the salubrity of the manufacturing over that of the aggregate of their respective county Unions, represented by 1·29 per cent.* The disparity for the town populations alone, is still much wider. The death-rate *per population* is in favour of the county towns to the amount of ·324 per cent—the rates

* In previous editions of this work the town populations alone were used in making this contrast. On this occasion it was thought desirable to employ the entire Unions of each community.

being, for York, Stafford, and Lancaster collectively, 2·251, and for Sheffield, Wolverhampton, and Manchester, 2·575. But results obtained by this process, as already explained, are liable to be fallacious.

Manchester stands on a soil varying in character in different localities. In the centre and on the north-east side of the town this is a tenacious clay, while on the south it is chiefly sand or gravel. All the townships are well drained, and liberally supplied with excellent water. The humidity of the atmosphere may be inferred from the actual amount of rain which falls in the space of a year, as compared with the same phenomenon in other localities. The following statement, embodying results for three years in succession, as contained in the elaborate and comprehensive tables of Mr. Symons,* shows the actual fall of rain at the several stations indicated, during the years 1860-61-62, with the elevation of some of these localities above the sea level, and the name of the authority by whom the information is furnished. Of those stations for which the results, for the three years in question, are complete, the average is given in the last column of the tables. It will be seen that the quantity of rain which fell during 1860 and 1862, but especially during the first of these, was much greater, while that in 1861 was below, the general average.

* "English Rain Fall." By G. J. Symons, Esq.

RAIN FALL IN GREAT BRITAIN AND IRELAND.

ENGLAND AND WALES:

DIVISION I.—MIDDLESEX.

STATIONS.	AUTHORITIES.	Height above Sea Level.	Depth of Rain.			
			1860	1861	1862	Average for 3 years.
		feet.	inches.	inches.	inches.	inches.
Middlesex—						
Chiswick	*Gardeners' Chronicle.*	...	30·08	19·48	...	...
Staines	W. Menzies, Esq.	...	...	...	22·79	...
Whitehall	British Met. S. Report	...	27·50	...	...	...
Hammersmith	F. J. Burge, Esq.	12†	...	...	26·64	...
Guildhall	W. Haywood, Esq.	51	28·91	20·87	25·24	25·00
"	" " "	123	...	18·78	24·04	...
Bryanstone Square	C. O. F. Cator, Esq.	...	...	...	27·34	...
Chiswell Street	W. Fletcher, Esq.	...	...	22·85	25·74	...
Mile End	F. Charrington, Esq.	...	...	...	25·50	...
Gray's Inn Road	Mr. R. Strachan	55	...	...	25·67	...
St. John's Wood	Mr. Carter	161	34·60	21·43	28·84	28·29
Camden Town	G. J. Symons, Esq.	100	32·24	22·34	27·57	27·38
Hackney	Dr. Tripe	40	33·10	21·02	29·82	27·84
Finchley Road	G. W. Moon, Esq.	270	...	20·63	...	...
" "	" " "	306	...	13·96	...	...
Tottenham	W. D. Howard, Esq.	60	34·37	20·18	26·48	27·01
" (Vicarage)	Rev. J. S. Winter	...	...	21·41	...	...
Colney Hatch Asylum	Mr. R. G. Rose	...	...	...	26·97	...
Enfield Vicarage	Rev. J. M. Heath	140	34·57	20·02	26·41	27·00

DIVISION II.—SOUTH-EASTERN COUNTIES.

Surrey—						
Godalming (Dunsfold)	W. L. Woods, Esq.	...	...	24·04	25·10	...
Red Hill (Ham)	J. G. Marriage, Esq.	...	34·75	24·15	29·84	29·58
Wonersh (Bramley)	W. L. Woods, Esq.	...	38·14	...	...	...
Dorking (Kitlands)	D. D. Heath, Esq.	580	40·07	30·51	32·22	34·27
" (Deepdene)	Mr. J. B. Whiting	...	37·43	27·38	29·95	31·59
" (Denbies)	Mr. J. Drewett	600	...	25·22	...	...
Betchworth (Brockham)	W. Bennett, Esq.	130	33·12	24·78	29·48	29·13
" (The Holmes)	E. T. Bennett, Esq.	300†	...	25·97	32·10	...

DIVISION II.—SOUTH-EASTERN COUNTIES. *(Continued.)*

STATIONS.	AUTHORITIES.	Height above Sea Level.	Depth of Rain.			
			1860	1861	1862	Average for 3 years.
		feet.	inches.	inches.	inches.	inches.
Surrey—*(Cont.)*						
Cobham	Miss Molesworth	110†	31·57	20·77	26·26	26·20
Weybridge Heath	W. F. Harrison, Esq.	120	30·33	21·05	27·29	26·22
Kew Observatory	Balfour Stewart, Esq	18	28·72†	18·86	28·29	25.29
Wandsworth (S. Fields)	R. Coleman, Esq.	...	...	...	28·48	...
" (St. Ann's Hill)	G. Dines, Esq.	58	34·86	...	29·03	...
Clapham	H. Doxat, Esq.	...	...	...	26·32	...
Battersea	Rev. S. Clark	13	28·26	21·96	27·89	26·04
Kent—						
Dover	H. J. Poulter, Esq.	16	36·25	28·41	24·93	29·86
Staplehurst (HuntonCrt.)	Mr. P. Goddard	...	30·38	21·69	26·05	26·04
" (Linton Park)	Mr. J. Robson	...	33·66	24·01	26·03	28·20
Tunbridge	Dr. Fielding	125	31·43	23·11	27·62	27·39
Maidstone	J. H. Baverstock, Esq.	60	33·65	23·91	26·16	27·91
Welling (Bexley Heath)	H. S. H. Wollaston	...	28·72	20·16	26·08	24·99
Greenwich Observatory	J. Glashier, Esq.	155	32·00	20·40	...	...
" "	" "	177	...	16·10	...	...
" "	" "	205	...	12·90	...	...
Seven Oaks (River Hill)	J. Rogers, Esq.	520	...	...	29·31	...
West Wickham	Rev. J. T. Austen	...	...	...	30·41	...
Sussex—						
Bognor (Aldwick)	W. L. Woods, Esq.	...	29·40	21·20	25·48	25·36
Brighton	Dr. Kebbell	50†	...	...	28·80	...
Worthing	Dr. Barker	10	34·32	29·08	...	...
Thorney Island	W. L. Woods, Esq.	...	33·14	24·12	...	...
West Thorney	F. Padwick, Esq.	10	...	...	24·72	...
Chichester Museum	W. Hills, Esq.	20	37·44	25·15	27·47	30·02
" (Funtington)	W. L. Woods, Esq.	...	35·50	22·28	26·76	28·18
" (West Dean)	H. Paxton, Esq.	250	48·94	30·79	36·11	38·61
" (Shopwyke)	Rev. G. H. Woods	72†	37·51	23·78	27·15	29·48
Lewes (Glynde)	C. L. Prince, Esq.	...	40·30	...	...	...
Hastings (Bleak House)	J. Banks, Esq.	80	34·25	...	...	...
" (H. Wickham)	E. Field, Esq.	212	32·66	24·86	22·82	26·78
" (Cemetery)	J. C. Savery, Esq.	450	...	...	30·11	...
" (39 Tower)	" "	...	33·45	...	...	...
St. Leonards (Marina)	" "	10	30·77	29·29	22·96	27·67
Fairlight	J. Rock, Jun., Esq.	498	29·54	29·15	27·18	28·62
Slindon	Rev. M. A. Smelt	190	44·05	28·18	32·07	34·77
Arundel (Dale Park)	W. L. Woods, Esq.	316	45·09	24·11	34·20	34·47
Chilgrove	" " "	284†	43·50	28·67	32·35	34·84
Battle	F. Webster, Esq.	...	...	...	32·47	...
Hurstpierpoint	Rev. J. Gorham	120	...	27·74	28·74	...

DIVISION II.—SOUTH-EASTERN COUNTIES. *(Continued.)*

STATIONS.	AUTHORITIES.	Height above Sea Level.	Depth of Rain. 1860	1861	1862	Average for 3 years.
		feet.	inches.	inches.	inches.	inches.
Sussex—*(Cont.)*						
Uckfield	C. L. Prince, Esq.	200	42·46	28.35	30·01	33·61
Newick (Beechland)	" "	...	...	...	30·31	...
Buxted Park	" "	...	45·55	...	29·84	...
Maresfield (Rectory)	" "	250	40·70	30·25	30·59	33·91
" (Forest Lodge)	" "	300	39·02	27·56	31·05	32·54
Fair Oak (Rogate)	W. L. Woods, Esq.	...	44·58	28·57	34·91	36·02
Petworth	" "	...	...	...	29·31	...
Cuckfield (Balcombe Pl.)	J. A. Hankey, Esq.	340	...	...	34·12	...
Crawley	E. S. Bigg, Esq.	300	47·63	34·25	38·13	40·00
Hampshire—						
Ventnor (Isle of Wight)	Dr. Martin	150	36·18	27·29	...	...
Ryde (Isle of Wight)	B. Barrow, Esq.	110	36·28	...	...	...
Osborne (Isle of Wight)	Mr. J. R. Mann	172	37·24	25·89	30·65	31·26
Bournemouth	Dr. Falls	30	...	...	27·99	...
Fareham	H. Sharland, Esq.	26	42·00	63·00	32·40	35·00
"	R. Porter, Jun., Esq.	8	...	29·16	28·02	...
Lyndhurst	C. L. Prince, Esq.	...	32·86	...	30·28	...
Southampton (Ordnance Survey Office)	Col. Sir H. James, R.E.	75	44·05	29·85	34·01	35·97
" " "	" " "	94	35·71	24·73	26·68	29·04
" (Gas Works)	Mr. J. Sharp	20	29·56	21·49†	...	...
" (Eling House)	W. C. Spooner, Esq.	...	...	...	27·17	...
Petersfield	W. L. Woods, Esq.	...	53·07	34·42	38·13	41·87
"	Rev. M. A. Smelt	200	48·64	33·71	35·77	39·37
New Alresford	B. Fielder, Esq.	...	...	27·01	32·46	...
Itchen Abbas	Rev. W. W. Spicer	...	39·30	25·07	27·70	30·69
Selborne (The Wakes)	T. Bell, Esq.	400?	42·05	30·40	33·12	35·19
Andover (Abbotts-Ann)	Rev. F. H. White	177	30·17	22·50	25·42	26·03
Aldershott	J. Arnold, Esq.	325	33·42	22·54	25·88	27·28
Berkshire—						
Sandhurst	Sergeant Grose	246	29·84	...	25·74	...
Maidenhead (White Waltham)	J. Silver, Esq.	...	28·84	...	...	...
Windsor	Hon. Maj.-Gen. Hood	...	...	...	25·66	...
Wallingford (Moulsford)	Mr. J. B. Spearing	200	...	20·76	27·60	...
Abingdon (L. Wittenham	Rev. J. C. Clutterbuck	170	30·69	22·67	29·79	27·72

DIVISION III.—SOUTH MIDLAND COUNTIES.

STATIONS.	AUTHORITIES.	Height above Sea Level.	Depth of Rain. 1860	1861	1862	Average for 3 years.
		feet.	inches.	inches.	inches.	inches.
Hertford—						
Watford	R. Littleboy, Esq.	250†	35·00	20·19	26·79	27·33
" (Watford House)	R. Clutterbuck, Esq.	...	...	...	27·52	...
" (Eastbury)	D. Carnegie, Esq.	...	...	...	27·30	...
Hoddesdon (Field's Weir)	N. Beardmore, Esq.	82	...	21·98	25·72	...
Gorhambury	Mr. Bogue	...	34·08	22·13	29·16	28·46
Hemelhempstead	J. Dickinson & Co.	350	34·22	21·20	27·44	27·62
Berkhampstead	W. Squire, Esq.	370	36·24	24·10	29·50	29·95
Hitchin	W. Lucas, Esq.	...	...	...	22·52	...
Royston	H. Wortham, Esq.	367	29·56	19·81	23·93	24·43
Bucks—						
Hartwell House	Mr. Horton	250	31·45	19·43	25·29	25·39
Hartwell Rectory	Rev. C. Lowndes	290	28·21	17·11	21·58	22·30
Oxfordshire—						
Oxford (Rose Hill)	Rev. J. Slatter	270	25·39	26·80	...	...
" (Radcliffe Observ.)	Rev. R. Main	208	31·01	23·40	27·42	27·16
" "	" "	230	26·88	20·29	23·39	23·52
Banbury (High Street)	T. Beesley, Esq.	350	31·92	22·34	27·51	27·26
"	J. Jarvis, Esq.	340	31·56	22·09	26·27	26·64
"	W. Johnson, Esq.	...	...	21·34	23·65	...
" (Neithrop)	T. Beesley, Esq.	470†	...	...	28·76	...
Northampton—						
Althorp House	*Northampton Mercury*	...	25·20	20·76	24·21	23·39
Wellingborough	Mr. M. Sharman	...	29·41	23·75	27·00	26·72
Oundle	G. Ellick, Esq.	124	...	20·45	22·43	...
Peterborough (Marholm	Rev. R. S. C. Blacker	...	33·09	25·22	...	...
Huntingdon—						
Tetworth Hall	H. M. Kaye, Esq.	...	...	...	21·89	...
Earith	Mr. J. Brown, Jun.	...	...	...	17·21	...
Bedford—						
Woburn (Aspley)	Rev. G. W. Mahon	460	31·23	23·29	26·52	27·01
Cardington	Mr. J. B. McLaren	...	25·08	19·02	22·02	22·04
"	" "	104	...	...	17·64	...
Bedford	Dr. Barker	631	24·95	18·43	20·95	21·44
Cambridge—						
Linton (Ashdon)	Rev. J. T. Walker	...	29·08	18·54	...	...
Fulbourne	Rev. J. H. Usill	...	...	...	24·10	...
Cambridge	J. Nutter, Esq.	50	...	...	23·86	...
Wisbeach (North Brink)	Mr. A. Peckover	11	30·86	22·19	26·73	27·93
" (Observatory)	" "	8	...	21·26	21·30	...
" (Mid-level S.)	" "	...	...	19·98	23·26	...

DIVISION IV.—EASTERN COUNTIES.

STATIONS.	AUTHORITIES.	Height above Sea Level.	Depth of Rain.			
			1860	1861	1862	Average for 3 years.
		feet.	inches.	inches.	inches.	inches.
Essex—						
Leyton	Mr. Donald	93	...	20·41	...	...
Epping	H. Doubleday, Esq.	360	37·03	20·42	25·86	27·77
Witham(Dorward'sHall)	H. Dixon, Esq.	20	26·08	18·83	21·78	22·23
Colchester (Frating)	Rev. R. Duffield	...	29·70	16·59	...	...
Dunmow	H. E. Cockayne, Esq.	100?	28·93	17·17	22·81	22·79
Braintree (Bocking)	S. Tabor, Esq.	200?	31·42	19·81	24·14	25·12
Suffolk—						
Grundisburgh	P. Harris, Esq.	...	...	17·46	24·61	...
Bury St. Edmunds	F. Skepper, Esq.	...	31·62	19·50	23·48	24·87
„ (Beech Hill)	H. Turner, Esq.	...	...	...	26·35	...
„ (Botanic Gardens)	E. Skepper, Esq.	...	...	...	26·13	...
Westley	Mr. R. Burrell	...	30·36	17·71	24·83	24·30
Barton	E. Skepper, Esq.	...	...	20·70	...	...
Thwaite	Mr. O. Whistlecraft	150	36·60	23·62	28·84	29·69
Thurston Lodge	Rev. W. Steggall	...	29·43	17·46	24·81	23·90
„ (Nether Hall)	W. C. Bassett, Esq.	...	29·15	18·98	24·04	24·16
Barton Hall	Mr. W. Allen	...	...	...	23·87	...
Culford	Mr. P. Grieve	...	...	19·51	23·78	...
Norfolk—						
Diss	Dr. Stewart	115	...	19·75	23·25	...
Thetford	Dr. Bailey	75	...	...	16·78	...
Norwich	W. Brooke, Esq.	30	34·47	24·80	22·26	27·18
Fakenham (Egmere)	R. Overman, Esq.	150?	31·38	24·82	23·92	26·71
Burnham	H. E. Blyth, Esq.	102	34·65	24·78	26·71	28·71
Holkham	S. Shellabear, Esq.	39	34·69	21·80	22·72	26·40
„	„ „	48	31·58	20·78	22·87	25·08

DIVISION V.—SOUTH-WESTERN COUNTIES.

Wilts—						
Salisbury (Alderbury)	W. L. Woods, Esq.	...	34·12	25·14	26·80	28·69
„ (Baverstock)	Archdeacon Honey	...	37·45	26·75	30·30	31·50
Warminster(Longbridge Deverill)	Rev. J. Slatter	...	40·32	25·52	38·69	34·84
Chapmanslade	F. Singer, Esq.	...	40·31	...	...	...
Marlborough	W. C. Merriman, Esq.	...	...	28·20	31·22	...
Calne (Castle House)	Major Ward	321	...	23·81	33·27	...
„ „	„	348	...	22·26	33·33	...
Chippenham(Badmintn.)	Mr. J. Trotter	...	...	...	33·14	...

DIVISION V.—SOUTH-WESTERN COUNTIES. *(Continued.)*

STATIONS.	AUTHORITIES.	Height above Sea Level.	Depth of Rain.			
			1860	1861	1862	Average for 3 years.
		feet.	inches.	inches.	inches.	inches.
Dorset—						
Portland	J. T. Leather, Esq.	52	30·77	22·07	26·22	26·36
Wareham (Encombe)	O. W. Farrer, Esq.	150	42·65	32·49	34·79	36·64
Little Bridy	H. S. Eaton, Esq.	348	49·04	37·23	37·22	41·16
Bridport	A. Stephens, Esq.	95?	36·63	29·67	32·12	32·81
Netherbury	Rev. C. B. Mount	50?	42·37	36·04?	34·80	37·74
Forde Abbey	Captain Miles	...	...	32·21	37·71	...
Devon—						
Kingsbridge	Mrs. L. Harris	143	42·44	34·30	...	...
Plymouth (Ham)	Rev. C. T. Trelawny.	94	55·58	39·23	46·75	47·19
Tideford Parsonage	Rev. T. Hullah	75?	...	...	43·89	...
Saltram Gardens	Mr. J. Snow	96	57·58	41·69	46·92	48·79
Plympton St. Mary (Ridgeway)	Miss B. T. Phillips	116	62·39	42·98	51·95	52·44
Ivybridge (Torrhill)	J. Widdicombe, Esq.	260?	54·31	42·25	50·49	49·02
Plympton St. Mary (Goodamoor)	H. H. Treby, Esq.	580	72·02	53·66	63·14	62·94
Buckland Monachorum (Crapstone)	„ „	500	65·85	...	...	...
Lee Moor	„ „	900?	...	...	74·57	...
Buckfastleigh (Hawson)	R. T. Abraham, Esq.	350	...	...	74·45	...
Torquay	E. Vivian, Esq.	150	36·36	22·74	...	...
Highwick	Dr. Barham	300?	48·02	34·45	40·45	40·97
Dartmoor	Dr. Roome	1380	63·88	...	93·51	...
Teignmouth	Dr. Lake	60	...	22·20	...	...
„ (Westbrook)	Miss K. T. Clark	25	40·35	30·36	34·61	35·11
Tavistock Institution	W. Merrifield, Esq.	298	47·99	34·45	37·85	40·09
MiltonAbbot(Edgecumb)	H. Clark, Esq.	...	48·72	39·49	52·02	46·74
Dawlish	P. J. Margary, Esq.	62	40·88	29·97	32·16	34·34
Bovey Tracey	J. Divett, Esq.	100	49·82	36·73	42·38	42·08
Exmouth	E. Divett, Esq.	200?	38·37	28·04	31·83	32·75
Chagford	R. L. Berry, Esq.	650	...	...	56·65	...
Clisthydon	Rev. J. Huyshe	200?	41·53	25·21	30·93	32·56
Honiton (Overday)	R. T. Abraham, Esq.	700	...	...	46·04	...
Broadhembury	Rev. W. Heberden	...	42·62	28·52	36·77	35·97
„ „	W. Vicary, Esq.	160	...	27·96	31·81	...
„ (St. Leonard's)	„ „	140	...	28·02	...	...
„ „	„ „	140	...	...	31·40	...
„ „	„ „	160	...	...	27·45	...
„ (High Street)	W. H. Ellis, Esq.	170	36·26	27·92	27·75	30·64
„ (Institution)	Mr. Parfitt	155	36·08	25·80	29·58	30·49
„ (St. Thomas)	W. Vicary, Esq.	50	42·17	28·33?	...	...

DIVISION V.—SOUTH-WESTERN COUNTIES. *(Continued.)*

STATIONS.	AUTHORITIES.	Height above Sea Level.	Depth of Rain. 1860	1861	1862	Average for 3 years.
		feet.	inches.	inches.	inches.	inches.
DEVON—*(Cont.)*						
Tiverton	W. H. Gamlen, Esq.	400†	55·41†	33·55	42·72	43·89
S. Molton (Meshaw Rect.)	Rev. W. H. Karslake	472	...	...	45·02	...
Huntsham Court	Miss A. Troyte	584	62·32	39·96	45·66	49·31
S. Molton (Castle Hill)	Mr. A. Saul	160	57·46	41·19	48·86	49·17
Barnstaple	T. Mackrell, Esq.	31	50·14	37·15	43·78	43·69
CORNWALL—						
Helstone	M. P. Moyle, Esq.	110	42·96	37·62	38·43	39·67
Penzance	W. H. Richards, Esq.	94	49·25	40·98	44·64	44·96
Redruth (Tehidy Park)	Mr. H. Beddard	100	48·63	40·56	45·70	44·99
Truro	Dr. Barham	56	50·06	39·98	44·65	44·89
Newquay	Lieut. Liddell, R.N.	90	...	...	38·62	...
Bodmin	" "	300	56·33	44·56	47·36	49·42
" (Warleggan)	Rev. D. Clements	800	67·05	48·96	55·61	57·21
" (Pencarrow)	Mr. H. Jones	230	51·61	45·32	47·81	48·25
Wadebridge (Treharrock House)	F. B. Hambly, Esq	200†	46·14	36·65	41·04	41·28
Padstow (S. Petroc Minor)	H. H. Treby, Esq.	96	47·40	44·69	...	...
Port Isaac (Rosecarrock)	Mark Guy, Esq.	180	44·33	38·63	42·27	41·74
Camelford	Lieut. Liddell, R.N.	...	68·04	...	54·63	...
SOMERSET—						
Taunton	Dr. Gillett	50†	32·62	26·77	27·32	28·90
Long Sutton	R. Palmer, Esq.	170†	31·92	25·81	28·22	28·65
Bridgewater	A. Haviland, Esq.	45	29·53	...	...	...
Glastonbury (Street)	J. Clark, Jun., Esq.	100	...	25·96	32·32	...
" "	W. S. Clark, Esq.	100†	36·15	23·66	30·08	29·96
Frome (North Hill)	Mr. J. Boycott	...	38·90	27·17	35·01	33·69
" (Mells)	Mr. M. Raynes	300	46·57	31·98	48·86	42·47
Axbridge (Sidcot)	H. Dymond, Esq.	250†	43·17	31·13	35·18	36·49
Bath	C. S. Barter, Esq	150	44·67	34·02	48·19	42·29
" (Batheaston)	A. Mitchell, Esq.	226	...	...	29·61	...
" (Swanswick)	Rev. F. Lockey	...	...	...	26·52	...
Bristol (Brislington)	Dr. Fox	181	...	...	35·94	...

DIVISION VI.—WEST MIDLAND COUNTIES.

GLOUCESTER—						
Bristol Institution	The Secretary	98	42·96	29·59	...	...
Clifton	W. C. Burder, Esq.	192	40·80	31·31	32·87	34·99
"	" "	242	35·52	27·39	28·61	30·51
Cirencester	T. C. Brown, Esq.	446	36·94	27·39	32·46	32·26

DIVISION VI.—WEST MIDLAND COUNTIES. *(Continued.)*

STATIONS.	AUTHORITIES.	Height above Sea Level.	Depth of Rain. 1860	1861	1862	Average for 3 years.
		feet.	inches.	inches.	inches.	inches.
GLOUCESTER—*(Cont.)*						
Gloucester (Quedgeley)	J. C. Hayward, Esq.	100†	...	...	29·96	...
" (The Spa)	A. Price, Esq.	50?	27·99	21·30	26·86	25·38
" (Asylum)	Dr. Williams	100	28·01	21·83	28·08	25·97
" (Twigworth)	W. B. Clegram	50†	28·48	20·16	...	...
HEREFORD—						
Rocklands	*Hereford Times*	...	40·77	...	...	...
Leominster (Leysters)	W. L. Woods, Esq.	...	...	26·53	29·09	...
" (West Lodge)	E. P. Southall, Esq.	240†	...	...	29·09	...
SHROPSHIRE—						
Cleobury-Mortimer	Mr. W. Hunter	700	...	26·28	28·83	...
Ludlow (Knowbury)	Rev. J. B. James.	1000	37·87	27·92	30·55	32·11
Shiffnal (Haughton Hall)	Rev. J. Brooke.	450†	31·23	23·80	25·70	26·91
Shrewsbury	Marshall & Co.	192	20·80	16·60	17·10	18·17?
Oswestry (Whittington)	Mrs. Loyd	...	37·90	27·25	...	...
" (Hengoed)	Rev. A. R. Lloyd	...	45·51	30·90	34·68	37·03
STAFFORD—						
W'hampton (Wrottesley)	Mr. J. Hough	532	31·37	24·79	28·14	28·10
" "	"	532	30·49	24·70	26·61	27·27
" "	"	553	25·68	21·29	...	...
Leek	R. Farrow, Esq.	...	46·60	36·40	28·99	37·33
WORCESTER—						
Worcester	S. Marshall, Esq.	...	39·07	23·42	32·30	31·59
" (Lark Hill)	W. Burgess, Esq.	160	...	...	30·44	...
Tenbury (Orleton)	T. H. Davis, Esq.	200	36·89	29·81	34·31	33·67
Northwich Park	Lord Northwick	...	...	...	30·20	...
Malvern	Dr. Williams	450	...	...	23·37	...
WARWICK—						
Leamington	S. U. Jones, Esq.	195	...	...	27·09	...
Stoneleigh Abbey	Mr. T. Bowick	...	31·24	22·64	25·95	26·61
Rugby	F. Fuller, Esq.	...	27·54	20·82	25·19	24·52
Edgbaston	W. Southall, Esq.	...	...	...	32·86	...
Birmingham (Bloomsbry)	D. Smith, Esq.	340	35·16	29·81	31·28	32·08
" (Camp Hill)	T. L. Plant, Esq.	416	35·66	29·31	28·62	31·19

DIVISION VII.—NORTH MIDLAND COUNTIES.

LEICESTER—						
Wigston	T. Burgess, Esq.	...	31·47	23·20	26·13	26·97
Leicester	Mr. J. Payne	...	24·99	...	...	...
"	Mr. H. Billston	...	...	17·62	27·24	...
Thornton Reservoir	J. Bevins, Esq.	...	29·66	25·53	28·14	27·78

DIVISION VII.—NORTH MIDLAND COUNTIES. *(Continued.)*

STATIONS.	AUTHORITIES.	Height above Sea Level.	Depth of Rain.			
			1860	1861	1862	Average for 3 years.
		feet.	inches.	inches.	inches.	inches.
LEICESTER—*(Cont.)*						
Loughborough (Rothley)	Rev. R. Burton	210?	...	22·46	25·58	...
Waltham Rectory	Rev. G. E. Gillett	540†	...	...	23·25	...
Belvoir Castle	W. Ingram, Esq.	337	29·23	22·12	23·35	24·90
RUTLAND—						
Empingham	Mr. W. Fancourt	...	23·52	15·42	...	...
LINCOLN—						
Stamford (Greatford Hall)	Captain Peacock	...	...	...	20·53	...
Wytham-on-the-Hill	General Johnson	...	26·33	19·81	20·62	22·25
Grantham	J. W. Jeans, Esq.	179	29·67	20·51	21·55	23·91
Boston	W. Veall, Esq.	...	30·69	20·38	19·93	23·67
Sleaford (South Kyme)	Rev. H. S. Newcatre	9	31·73	21·65	20·45	24·61
Lincoln (Coleby)	Rev. T. T. Penrose	...	26·38	17·33	...	...
"	M. S. & L. R. Co.	26	27·15	16·97	20·31	21·44
Gate Burton	" "	96	...	21·24	23·53	...
Market Rasen	" "	100	28·79	24·04	21·31	24·71
Gainsborough	" "	76	29·31	19·55	21·36	23·41
" (Spring Gardens)	T. Dyson, Esq.	38	29·75	19·81	20·49	23·35
Stockwith	M. S. & L. R. Co.	21	26·46	18·25	19·71	21·47
Brigg	" "	16	29·27	22·48	23·02	24·92
Grimsby	" "	42	22·29	18·26	17·34	19·29
Barnetby	" "	51	27·04	21·15	22·10	23·43
New Holland	" "	18	28·48	20·73	21·62	23·61
NOTTS—						
Highfield House	E. J. Lowe, Esq.	162	35·88	22·33	23·88	27·36
" "	" "	187	28·71	20·01	21·48	23·40
Beeston Meadow	" "	100	...	...	26·00	...
Southwell (Oxton)	H. Sherbrooke, Esq.	...	...	...	20·45	...
"	Dr. Calvert	200?	...	...	19·56	...
Newark (Stubton)	G. Neville, Esq.	...	...	...	22·97	...
Welbeck	Mr. Tillery	...	30·54	24·16	22·77	25·82
Worksop	M. S. & L. R. Co.	127	30·61	20·41	21·46	24·16
Retford	" "	52	28·13	19·73	22·15	23·34
" (East)	*Doncaster Chronicle*	...	28·13	19·56	22·69	23·46
" (West)	Rev. C. D. Butterfield	50	28·20	19·31	22·62	23·38
DERBY—						
Doveridge	Hon. & Rev. O. Forester	270	...	...	29·00	...
Derby	J. Davis, Esq.	179	32·77	22·01	26·28	27·02
Chatsworth	Mr. A. Stewart	404	...	31·32	30·61	...
Chesterfield	M. S. & L. R. Co.	248	29·54	25·48	26·34	27·12
Norwood	" "	238	27·66	24·15	25·21	25·67
Combs Moss	" "	1669	53·00	38·33	55·81	49·05

DIVISION VII.—NORTH MIDLAND COUNTIES. *(Continued.)*

STATIONS.	AUTHORITIES.	Height above Sea Level.	Depth of Rain.			
			1860	1861	1862	Average for 3 years.
		feet.	inches.	inches.	inches.	inches.
DERBY—*(Cont.)*						
Combs Reservoir	M. S. & L. R. Co.	710	54·17	45·64	53·30	51·04
Chapel-en-le-Frith	" "	965	44·99	37·19	41·91	41·36
Woodhead	" "	939	66·35	49·64	48·51	54·85

DIVISION VIII.—NORTH-WESTERN COUNTIES.

CHESHIRE—						
Bosley Minns	M. S. & L. R. Co.	1210	36·21	28·65	34·19	33·02
" Reservoir	" "	590	34·03	27·76	37·59	33·13
Macclesfield	W. Jeffery, Esq.	500	39·88	32·03	36·97	36·39
"	M. S. & L. R. Co.	539	38·64	30·69	38·82	36·05
Frodsham (Kingsley)	Rev. R. Tyas	208?	...	29·11	37·20	...
Willaston	T. Waring, Esq.	...	...	...	27·04	...
Bollington (Spond's Hill)	M. S. & L. R. Co.	1279	48·61	37·99	43·61	43·40
Waley	" "	602	46·84	37·00	44·08	42·64
Handforth (Quarry Bank)	J. Henshall, Esq.	295	...	...	35·40	...
Northwich (Thelwall)	J. Atkinson, Esq.	96	...	28·93	35·84	...
Marple (Aqueduct)	M. S. & L. R. Co.	391	39·87	33·55	40·41	37·94
" (Top Lock)	" "	543	29·28	31·40	41·22	33·97
Mottram (Hill End)	" "	680	...	34·40	42·33	...
" (Matley's Field)	" "	399	38·93	33·16	40·29	37·46
Newton	" "	296	33·94	31·80	35·51	33·75
LANCASHIRE—						
Liverpool Observatory	J. Hartnup, Esq.	52	24·53	23·15	27·66	25·11
" (The Brook)	W. Lassell, Jun., Esq.	...	...	31·28	39·84	...
" (Sandfield Park)	W. Lassell, Esq.	...	35·40	...	...	...
MANCHESTER—						
" (Old Trafford)	G. V. Vernon, Esq.	106	36·14	29·74	38·60	34·83
" (Sale)	J. Curtis, Esq.	134	36·24	28·58	...	...
" (Market St.)	Mr. Casartelli	...	35·95	29·33	31·78	32·35
" (Piccadilly)	M. S. & L. R. Co.	194	41·40	34·43	43·95	39·93
" (Eccles)	T. Mackereth, Esq.	105	...	...	37·66	...
" (Fairfield)	M. S. & L. R. Co.	312	42·10	35·76	46·33	41·40
Oldham (Waterhouses)	M. S. & L. R. Co.	815	42·43	32·79	39·74	38·32
Radcliffe (Mount Sion)	H. Eaton, Esq.	250	...	...	39·10	...
Bolton-le-Moors (Folds)	H. H. Watson, Esq.	290	57·66	44·91	53·43	52·00
" (Belmont)	H. Baylis, Esq.	800	59·80	55·70	61·90	59·13
" (Heaton)	" "	500	44·90	39·90	47·20	44·00
Wigan (Standish)	J. L. Hunter, Esq.	285	46·04	47·63	49·01	47·56
Bury	W. Wanklyn, Esq.	400?	...	29·67	41·05	...

DIVISION VIII.—NORTH-WESTERN COUNTIES. *(Continued.)*

STATIONS.	AUTHORITIES.	Height above Sea Level.	Depth of Rain.			
			1860	1861	1862	Average for 3 years.
		feet.	inches.	inches.	inches.	inches.
LANCASHIRE—*(Cont.)*						
Ormskirk (Rufford)	J. Porter, Esq.	38	...	...	37·70	...
Preston (Howick)	T. Norris, Esq.	72	39·76	36·59	44·33	40·23
„ (Fishwick)	T. Oddie, Esq.	154	36·04	33·32	38·14	35·83
„ (House of Cor.)	Mr. J. Hesketh	140	37·86	35·90	41·76	38·51
„ „ „	„ „ „	187	33·28	30·75	34·68	32·90
„ (Holme Slack)	J. Newton, Esq.	143	...	38·48	43·87	...
Blackpool (South Shore)	G. Sharples, Esq.	9	31·70	33·70	37·55	34·32
Stonyhurst Observatory	Rev. S. Perry	381	50·60	49·06	54·40	51·35
Garstang (Bleasdale)	Mr. J. Hill	600	...	55·05	51·43	...
Lancaster	W. Roper, Esq.	114	...	...	46·31	...
„ (Caton)	Rev. A. Christopherson	120	46·82	44·54	44·66	45·34
Hest Bank	R. B. Peacock, Esq.	82	...	41·31	43·27	...
Cartmel	S. Marshall, Esq.	...	...	47·23	45·67	...
„ (Holker)	„ „ „	...	47·07	50·11	47·58	48·25
„ (Aynsome)	H. Remington, Esq.	...	...	...	52·90	...
„ (Allithwaite)	Mr. W. R. Nash	88	...	...	44·99	...
Broughton	British Met. S. Report	...	49·70	...	...	...
Coniston	J. G. Marshall, Esq.	150	89·50	102·20	96·40	96·03
Windermere (Wray Casl.)	Dr. Dawson	240	69·45	80·91	74·71	75·02

DIVISION IX.—YORKSHIRE.

WEST RIDING—						
Sheffield Station	M. S. & L. R. Co.	188	27·58	25·55	28·93	27·35
„ (The Edge)	„ „ „	336	...	32·16	30·73	...
„ (Broomhall Park)	D. Doncaster, Jun.	337	37·19	29·68	30·87	32·58
Redmires	„ „	1200	44·28	37·94	40·06	40·76
Tickhill	Dr. Dixon	61	31·33	23·14	18·76	24·41
Wath-upon-Dearne	W. M. Burman, Esq.	186	...	...	20·09	...
Rotherham, West Melton	Rev. J. Boyd	172	...	...	21·99	...
Dunford Bridge	M. S. & L. R. Co.	954	62·79	47·88	52·55	54·41
Penistone	„ „	717	30·11	27·02	29·09	28·74
Carleotes	„ „	1075	...	43·62	51·29	...
Standedge	Mr. Greenwood	1150	56·75	49·75	53·25	53·25
Saddleworth	„ „	640	46·99	32·38	43·02	54·13
Ackworth Villa	W. D. Howard, Esq.	135	33·06	20·89	24·79	29·58
Ackworth	J. Ford, Esq.	...	...	18·26	21·83	...
Huddersfield (Longwood)	Mr. C. Hare	...	34·74	30·42	34·08	33·08
Wakefield	W. R. Milner, Esq.	115	33·48	22·30	26·84	27·54
Huddersfield (Rastrick)	S. Marshall, Esq.	...	33·37	...	32·95	...

DIVISION IX.—YORKSHIRE. *(Continued.)*

STATIONS.	AUTHORITIES.	Height above Sea Level.	Depth of Rain.			
			1860	1861	1862	Average for 3 years.
		feet.	inches.	inches.	inches.	inches.
WEST RIDING—*(Cont.)*						
Halifax (Southowram)	R. Richardson, Esq.	880	...	...	25·01	...
„ (Well Head)	J. Waterhouse, Esq.	540	34·33	30·79	32·22	32·45
„ (Hunter's Hill)	G. W. Stevenson, Esq.	1250	42·30	32·70	...	...
„ (Warley Moor)	„ „	1425	51·20	44·90	49·40	48·20
„ (Midgley „)	„ „	1350	53·10	48·70	51·00	50·93
„ (Ovenden „)	„ „	1375	51·90	43·70	50·00	48·53
Bradford	P. Lund, Esq.	329	...	...	29·33	...
„ (Horton Hall)	Mr. G. Abbey	496	38·47	34·05	36·77	35·79
„ (Chellow Dean)	C. Gott, Esq.	645	...	...	33·30	...
Leeds	H. Denny, Esq.	156	...	...	21·74	...
„ (Holbeck)	E. Filliter, Esq.	95	...	...	21·79	...
„ (Holbeck)	Marshall & Co.	135	28·60	23·30	21·25	24·38
„ (Philosophical Hall)	H. Denny, Esq.	137	28·32	...	...	...
„ (Leventhorpe Hall)	J. T. Leather, Esq.	90	...	...	21·18	...
„ (Eccup)	E. Filliter, Esq.	340	...	...	26·11	...
Red Hall (Whin Moor)	F. Stow, Esq.	455	35·85	24·45	...	...
Otley (Top of Chevin)	Mr. Lawson, Jun.	764	...	26·01	32·76	...
„ (The Valley)	A. H. Thorns, Esq.	206	...	27·29	31·15	...
Ben Rhydding	J. Robberts, Esq.	00	34·39	22·45	...	...
High Harrogate	J. Coupland, Esq.	420	...	28·51	...	...
Harrogate	Dr. Bainbridge	420	...	...	32·58	...
Settle	J. Tatham, Esq.	498	41·78	41·79	42·77	42·11
Ingleborough (Clapham)	Mr. D. Elder	550	41·64	42·03	45·19	42·95
Arncliffe	Rev. W. Boyd	750	54·93	59·94	64·05	59·64
Boston Spa	F. R. Carroll, Esq.	74	...	...	25·63	...
EAST RIDING—						
Patrington	W. B. Pugh, Esq.	32?	28·58	18·62	18·72	21·79
Hull	W. Lawton, Esq.	30	...	...	19·70	...
„ (Beverley Road)	J. Smith, Jun., Esq.	11	...	...	23·70	...
Holme-on-Spalding Moor	G. Dunn, Esq.	32	31·70	22·01	24·17	25·96
Weldrake	Rev. R. B. Cooke	40?	30·30	20·54	24·18	25·01
Beverley (Middleton)	Mr. Lotherington	...	26·78	26·42	26·79	29·99
York	J. Ford, Esq.	50	30·37	20·27	23·11	24·55
Pocklington (Huggate)	Rev. T. Rankin	650	32·13	32·19	...	...
NORTH RIDING—						
Malton	H. Hurtley, Esq.	75?	34·46	24·47	26·29	28·41
Scarborough	R. Champley, Esq.	91	24·00	17·97	19·83	20·60
Redcar	C. C. Oxley, Esq.	20	...	...	19·14	..

DIVISION X.—NORTHERN COUNTIES.

STATIONS.	AUTHORITIES.	Height above Sea Level.	Depth of Rain.			
			1860	1861	1862	Average for 3 years.
		feet.	inches.	inches.	inches.	inches.
DURHAM—						
Darlington	Mr. J. Richardson	140	31·91	32·83	21·25	28·66
Winston (Stubb House)	T. Dodgson, Esq.	460	30·28	24·54	25·84	26·89
Washington	J. Watson, Esq.	120	27·61	...	...	...
Durham Observatory	A. Marth, Esq.	338	30·33	24·28	21·82	25·48
Bishopwearmouth	Dr. Ogden	140	24·71	19·30	20·97	21·66
Sunderland	Rev. G. Iliff	130	29·39	...	21·59	...
,, (Hendon Hill)	J. W. Mounsey, Esq.	150	...	...	24·97	...
Shotley Hall	Mr. G. Routledge	309	35·35	28·80	24·04	29·39
NORTHUMBERLAND—			...	...	...	...
Allenheads	T. J. Bewick, Esq.	1360	59·15	49·35	44·21	50·90
,, (12-in. gauge)	,, ,,	1367	59·91	52·89	50·64	54·48
Newcastle-on-Tyne	Lieut. Sitwell, R.E.	187	27·28	18·78	...	...
,, (Park End)	G. C. Atkinson, Esq.	300?	...	31·07	...	...
Bywell	Mr. J. Dawson	87	38·13	28·44	25·75	30·77
Wylam	G. C. Atkinson, Esq.	96	31·38	23·54	24·68	26·53
North Shields	R. Spence, Esq.	124	32·19	24·74	28·02	28·32
Stamfordham	Rev. J. F. Bigge	380	35·26	26·22	26·00	29·16
Alnwick	Mr. J. Scott	400	36·60	29·97	31·02	32·53
Roddam	W. Roddam, Esq.	...	...	26·27	36·00	...
Lilburn Tower	E. J. Collingwood, Esq.	...	34·21	26·02	30·04	30·09
CUMBERLAND—						
Cleator (The Flosh)	T. Ainsworth, Esq.	240	55·89	54·38	...	...
Seathwaite (Borrowdale)	H. C. Marshall, Esq.	380?	142·20	182·58	170·03	164·94
Keswick	Mr. Crosthwaite	245	54·17	74·42	61·37	63·32
Cockermouth	Dr. Dodgson	157	...	...	50·49	...
,, (Winfell Hall)	S. Marshall, Esq.	...	...	68·94	60·81	...
Bassenthwaite (Mirehous)	F. S. Spedding, Esq.	300	49·79	60·35	55·29	55·14
Silloth	Rev. F. Redford	16	37·81	42·47	44·19	41·49
Carlisle (Ord. Sur. Office)	Capt. E. James, R.E.	105	31·62	34·46	...	...
WESTMORELAND—						
Kirkby Lonsdale	S. Marshall, Esq.	...	41·60	...	...	...
Kendal	,, ,,	149	57·00	60·70	54·41	57·37
Ambleside (Leskoth How)	Dr. J. Davey	110	79·97	98·03	88·26	88·75
Troutbeck (The How)	Admiral Wilson	403	102·58	116·26	94·27	101·04
Grasmere (Lancregg)	Sir J. Richardson	...	104·87	123·22	...	...
Lowther Castle	S. Marshall, Esq.	...	45·53	...	...	...
Brougham Hall	,, ,,	...	36·68	...	33·79	...

DIVISION XI.—MONMOUTHSHIRE, WALES, AND THE ISLES.

STATIONS.	AUTHORITIES.	Height above Sea Level.	Depth of Rain.			
			1860	1861	1862	Average for 3 years.
		feet.	inches.	inches.	inches.	inches.
MONMOUTH—						
Chepstow	J. G. Wood, Esq.	...	...	37·51	39·55	...
GLAMORGAN—						
Swansea (Ystalyfera)	J. P. Budd, Esq.	300	73·21	66·78	67·07	69·02
PEMBROKE—						
Pembroke Dock	E. Chevallier, Esq.	30	...	44·77	...	...
Haverfordwest	E. P. Phillips, Esq.	60	56·99	51·80	38·30?	49·03
CARDIGAN—						
Lampeter	Rev. J. Matthews	425	55·30	43·98	43·22	47·50
BRECON—						
Crickhowel (Buckland)	Mrs. G. Holford	...	...	...	31·29	...
ANGLESEA—						
Llandyfrydog	H. Webster, Esq.	92	...	44·45	40·14	...
CARNARVON—						
Llandudno	Dr. Nicol	20?	30·00	31·00	31·95	30·98
Bangor	Rev. J. Purvis	40	...	...	45·52	...
RADNOR—						
Rhayader (Cefnfnes)	J. Jones, Esq.	900	...	...	47·81	...
FLINT—						
Hawarden	Dr. Moffat	260	27·80	21·82	30·37	26·66
Holywell (Maes-y-dre)	*Chester Courant*	...	...	...	24·09	...
Rhyl	E. Evans, Esq.	...	..	...	19·03	...
GUERNSEY	Dr. Hoskins	200	18·00	31·22	32·50	37·27
JERSEY	P. Langloise, Esq.	30?	...	...	26·84	...
SCILLY—						
St. Mary's	J. G. Moyle, Esq.	30	33·20	...	34·18	...
ISLE OF MAN—						
Ballasalla	J. Burman, Esq.	100	37·17	...	...	...
Calf of Man	Bd. of Northn. Lights	395?	...	...	42·49?	...
Point of Ayr	,, ,,	27?	...	...	31·73?	...

SCOTLAND:

DIVISION XII.—SOUTHERN COUNTIES.

WIGTOWN—						
Stranraer (South Cairn)	Mr. J. Kennedy	210	42·30	48·03	56·00	48·78
Mull of Galloway	Bd. of Northn. Lights	260?	...	...	25·44?	...
Corsewall	,, ,,	22?	...	...	42·39?	...

DIVISION XII.—SOUTHERN COUNTIES. *(Continued.)*

STATIONS.	AUTHORITIES.	Height above Sea Level.	Depth of Rain.			
			1860	1861	1862	Average for 3 years.
		feet.	inches.	inches.	inches.	inches.
KIRKCUDBRIGHT—						
Cargen	P. Dudgeon, Esq.	80	44·27	44·25	47·29	45·27
Little Ross	Bd. of Northn. Lights	130?	...	...	26·87?	...
DUMFRIES—						
Dumfries	T. Hogg, Esq.	63	41·75	46·88	41·43	43·35
„ (Crichton Inst.)	Dr. Gilchrist	300	...	...	45·06	...
Drumlanrig	Scot. Met. Soc. Rep.	186?	...	59·40	57·41	...
Wanlockhead	Mr. J. Reid	1400	72·70	...	...	...
„	Mr. G. Dawson	1330	65·31	81·19	74·10	73·53

DIVISION XIII.—SOUTH-EASTERN COUNTIES.

SELKIRK—						
Bowhill	Mr. J. Mathieson	537	32·54	36·21	39·27	36·01
PEEBLES—						
Stobo Castle	Mr. J. Anderson	600	...	27·90	32·70	...
BERWICK—						
Milne Graden	Scot. Met. Soc. Rep.	100?	31·80	29·40	32·78	31·33
Thirlstane	„ „	558?	...	31·35	34·50	...
Dunse (Mungo's Walls)	Mr. J. Thomson	267	29·87	28·37	28·80	29·01
HADDINGTON—						
Yester	Scot. Met. Soc. Rep.	420?	34·40	33·40	37·84	35·21
Smeaton	Mr. J. Black	100	21·45	23·97	26·93	24·12
East Linton	Mr. J. Storie	90	26·61	27·19	29·28	27·69
Dunbar (Thurston)	Mr. R. Mossman	320	34·10	25·80	30·40	30·00
Millfield	Mr. T. Dods	140	...	...	29·80	...
EDINBURGH—						
Harlaw	A. Ramsay, Esq.	770	38·10	40·30	41·80	40·07
North Esk Reservoir	Mr. J. Garnock	1150	39·06	40·27	43·10	40·81
Glencorse	A. Ramsay, Esq.	680	29·70	38·10	43·10	36·97
Dalkeith Park	Mr. W. Thomson	189	...	...	22·81	...
Fernielaw	J. Leslie, Esq.	...	32·75	...	39·85	...
Musselburgh (Inveresk)	Mr. McAuslane	60	31·07	28·51	32·89	31·12
Edinburgh	Adie and Sons	200	...	24·88	...	...
„ (Ord. Sur. Office)	Mr. J. Horsburgh	363	14·39	18·82	...	...
„ (Charlotte Sq.)	J. Leslie, Esq.	195	...	...	33·92	...
„ „	„ „	275	...	...	24·12	...
„ (March Hall)	Scot. Met. Soc. Rep.	250?	...	...	28·80	...
„ Inchkeith	Bd. of Northn. Lights	182?	...	...	21·87?	...

DIVISION XIV.—SOUTH-WESTERN COUNTIES.

STATIONS.	AUTHORITIES.	Height above Sea Level.	Depth of Rain.			
			1860	1861	1862	Average for 3 years.
		feet.	inches.	inches.	inches.	inches.
LANARK—						
Douglas Castle	J. Johnstone, Esq	780	...	61·09	70·92	...
Auchinraith	R. Ker, Esq.	150	30·58?	34·94	40·40	35·31
Bothwell Castle	Mr. A. Turnbull	250	26·02	25·44	38·96	30·14
Glasgow (Baillieston)	Mr. P. Jarvie	230	33·00	50·04	60·67	47·90
Shotts (Hill-end House)	Mr. D. Thomson	620	30·49	39·95	41·09	37·18
Glasgow (Observatory)	J. Wood, Esq.	200	35·76	51·11	57·40	48·09
„ (Ord. Sur. Office)	Major Bayly, R.E.	160	28·87	33·20	...	...
Ryat Linn	J. Burnet, Esq.	310	41·50	58·70	58·95	53·05
Waulk Glen	„ „	280	39·45	55·30	55·25	50·00
Middleton	„ „	550	44·72	66·08	68·08	59·63
Black Loch	„ „	700	...	69·25	68·70	...
AYR—						
Auchendrane House	E. Catheart, Esq.	94	41·93	49·21	50·17	47·10
Largs (Mansfield)	Dr. Campbell	30?	44·60	55·80	54·70	51·70
Brisbane Glen	J. Miller, Esq.	...	48·45	62·00	59·70	56·72
Eaglesham (Ravoch)	A. Mather, Esq.	700	...	...	72·60	...
RENFREW—						
Mearns (Nither Place)	„ „	350	43·40	46·70	43·00	44·37
Kilbarchan	D. Rubie, Esq.	350	58·37	78·82	75·20	69·89
Paisley (Locherfield)	Mr. A. Hardie	...	...	55·90	...	...
„ (Fergaslie House)	Mr. T. Stewart	85	42·58	65·79	62·03	57·13
Greenock	J. Gardner, Esq.	74	59·25	69·14	74·25	67·88

DIVISION XV.—WEST MIDLAND COUNTIES.

DUMBARTON—						
Balloch Castle	A. L. D. Brown, Esq.	91	...	...	67·68	...
Loch Long (Arddarroch)	J. White, Esq.	80	...	...	85·13	...
STIRLING—						
Stirling	Scot. Met. Soc. Rep.	233?	34·57	...	...	...
„ (PolmaiseGardens)	— Murray, Esq.	8	42·60	46·60	49·30	46·17
Mugdock Reservoir	Glasgow Water Works	320	...	...	60·60	...
BUTE—						
Isle of Cumbrae	J. Miller, Esq.	50	40·70	47·20	48·40	45·43
Rothesay	Sharp, Thompson & Co.	40	48·20	56·40	...	...
Pladda	Bd. of Northn. Lights	55?	...	...	53·69?	...
ARGYLE—						
Castle Toward	Mr. D. Bell	80?	47·18	65·34	62·27	58·26
Duncon (Hafton)	Major Bayly, R.E.	40	61·83	82·14	91·32	78·43
Otter House	Dr. Rankin	130	47·76	63·84	64·46	58·69
Kilmory, Lochgilphead	Sir J. P. Orde, Bart.	100?	53·72	59·29	56·96	56·66

DIVISION XV.—WEST MIDLAND COUNTIES. *(Continued.)*

STATIONS.	AUTHORITIES.	Height above Sea Level.	Depth of Rain.			
			1860	1861	1862	Average for 3 years.
		feet.	inches.	inches.	inches.	inches.
ARGYLE—*(Cont.)*						
Calton Mór	Mr. J. Russell	65	45·85	55·83	56·47	52·72
Kilmartin	" "	64	...	63·50	...	...
Inverary Castle	Mr. J. Cale	30	66·40	78·60	63·90	69·63
Isle of Easdale	Mr. J. Whyte	25	47·90	55·50	57·80	53·73
Oban	Capt. Bedford, R.N.	10	54·60	71·98	72·40	66·33
Isle of Mull (Torosay)	J. Pettigrew, Esq.	18	70·60	101·80	94·00	88·80
Campbeltown (Devaar)	Bd. of Northn. Lights	75?	...	...	52·54?	...
Rhinns of Islay	" "	74?	...	...	34·47?	...
Islay (Mc.Arthurshead)	" "	106?	...	...	68·60?	...
" (Rhu Vaal)	" "	54?	...	...	99·90?	...
Jura Sound (Fladda)	" "	20?	...	...	80·90?	...
Lismore	" "	37?	...	...	48·39?	...
Corran (Loch Eil)	" "	14?	...	...	54·54?	...
Mull of Cantire	" "	279?	...	...	43·22?	...
Sound of Mull	" "	12?	...	...	75·50?	...
Ardnamurchan	" "	82?	...	...	53·04?	...
Sorne	J. Pettigrew, Esq.	250	...	...	54·50	...
Tobermorey (Erray)	" "	260	...	...	76·00	...

DIVISION XVI.—EAST MIDLAND COUNTIES.

CLACKMANNAN—						
Dollar	Mr. J. Westwood	170	...	...	47·74	...
KINROSS—						
Loch Leven	Mr. P. Farnie	...	36·10	37·30	42·20	38·53
FIFE—						
Isle of May	Bd. of Northn. Lights	182?	...	...	25·08?	...
Balfour	Mr. J. Dewar	127	24·36	26·76	34·59	28·57
Nookton (Leven)	W. Mc.G. Miller, Esq.	80	30·65	36·42	34·28	31·78
Pittenweem	Mr. D. Tennant	75	27·36	28·45	25·97	27·26
PERTH—						
Aberfoyle	J. Burnet, Esq.	60	40·40	71·60	77·00	63·00
Ledard	" "	1500	73·50	103·10	102·70	93·10
Dunblane (Kippenross)	J. Stirling, Esq.	100	34·10	41·80	49·90	41·93
Deanston	J. Finlay, Esq.	120?	37·30	45·05	51·55	44·63
Lock Dhu	J. Burnet, Esq.	325	...	93·20	101·10	...
Ben Lomond	" "	1800	83·50	99·90	114·17	99·19
Loch Drunkie	" "	420	...	71·70	78·10	...
" Vennachar	" "	275	...	72·70	69·00	...
Bridge of Turk	" "	270	59·80	74·40	71·90	68·70
Lanrick Castle	A. Glover, Esq.	150?	45·10	53·30	57·75	52·05

DIVISION XVI.—EAST MIDLAND COUNTIES. *(Continued.)*

STATIONS.	AUTHORITIES.	Height above Sea Level.	Depth of Rain.			
			1860	1861	1862	Average for 3 years.
		feet.	inches.	inches.	inches.	inches.
PERTH—*(Cont.)*						
Loch Katrine (Tunnel Hill Top)	J. Burnet, Esq.	330	...	89·20	96·90	...
Leny (Callander)	J. B. Hamilton, Esq.	335	...	72·40	75·00	...
Between Glen Finlas and Ben Ledi	J. Burnet, Esq.	1800	53·80	70·40	66·00	63·40
Glen Gyle	" "	380	94·20	112·50	105·10	103·93
Auchterarder House	Mr. R. Wylie	150	28·70	32·98	38·97	33·55
Stronvar (L. Earn Head)	D. Carnegie, Esq.	460	75·64	88·65	97·84	87·38
Colquhalzie House	J. S. Hepburn, Esq.	60?	37·85	44·34	49·52	43·90
Trinity Gask	Mr. R. Wylie	135	33·55	38·20	39·34	37·03
Perth (Early Bank)	Gen. Lindsay	66	37·88	36·08	45·91	39·96
" (Academy)	Dr. Miller	...	...	...	25·97	...
Scone Palace	A. Buchan, Esq.	...	28·75	31·13	34·46	31·45
Tyndrum Mines	Mr. D. Mc.Laren	792	72·70	133·20	...	...
Stanley	Rev. W. Mather	200	31·11	34·58	34·07	33·25
Meigle (Belmont)	W. Stewart, Esq.	300	32·50	32·10	...	...
Taymouth	Scot. Met. Soc. Rep.	372?	...	40·70	...	...
FORFAR—						
Dundee	Mr. Adamson	60	34·71	28·71	33·26	32·23
" (Somerville Place)	J. Kerr, Esq.	230	...	...	33·09	...
Barry	Mr. J. Proctor	35	28·85	27·87	32·54	29·97
Craigton	Mr. Adamson	440	37·57	34·93	38·24	36·91
Kettins	Mr. J. Gibb	318	36·39	32·29	34·49	34·39
Hill Head	Mr. Adamson	500	37·43	35·55	37·33	36·77
Seichen	" "	550	38·80	36·88	38·46	38·05
Arbroath	A. Brown, Esq.	65	30·48	29·66	31·33	30·47
Montrose	Mr. W. Leighton	21	...	25·83	30·27	...
" (Museum)	Mr. J. Campbell	8	26·32	24·03	27·60	25·98
" (Usan)	G. Wyness, Esq.	150	...	...	29·00	...

DIVISION XVII.—NORTH-EASTERN COUNTIES.

KINCARDINE—						
Brechin (The Burn)	Col. Mc.Inroy	210	41·50?	40·80	36·20	39·50
Fettercairn (Balnakettle)	D. Scott, Esq.	450	42·81	44·58	37·73	41·71
" (Bogmuir)	R. Vallentine, Esq.	200	37·40	35·60	32·40	35·13
Strachan by Banchory	Mr. Mc.Connachie	200	38·16	31·43	33·39	34·33
Banchory by Aberdeen	A. Thomson, Esq.	95	33·90	29·80	26·50	30·17
ABERDEEN—						
Braemar	Dr. Cameron	1110	33·36	34·80	33·84	34·00
Aberdeen	A. Cruickshank, Esq.	100	34·70	30·97	30·77	32·15

DIVISION XVII.—NORTH-EASTERN COUNTIES. *(Continued.)*

STATIONS.	AUTHORITIES.	Height above Sea Level.	Depth of Rain.			
			1860	1861	1862	Average for 3 years.
		feet.	inches.	inches.	inches.	inches.
ABERDEEN—*(Cont.)*						
Aberdeen (Girdleness)...	Bd. of Northn. Lights	85 †	...	...	25·54 †	...
Castle Newe.....	Mr. A. Walker	915	40·49	39·06	29·41	36·32
Ellon (Tillydesk)	Mr. W. Hay	360 ?	...	...	28·26	...
Peterhead (Buchanness)	Bd. of Northn. Lights	35 †	...	...	22·44 ?	...
Kinnairdhead	" "	64 †	...	...	25·02 †	...
ELGIN—						
Forres	D. Bonthrone, Esq....	53	...	...	30·48	...
Elgin	Scot. Met. Soc. Rep.	...	25·71	...	...	...
" (Ashgrove)	W. Topp, Esq.	33	...	...	29·63	...

DIVISION XVIII.—NORTH-WESTERN COUNTIES.

ROSS—						
Isle of Lewis (Stornoway)	Sir J. Matheson, Bart	70	42·80	58·07	37·23 †	46·03
" (Bernera) ...	" "	15	32·37	60·91	104·95	66·08
Tarbetness	Bd. of Northn. Lights	61 †	...	...	47·59 †	...
Loch Alsh (Kyleakin)...	" "	3 †	...	...	68·04 †	...
INVERNESS—						
Beaufort Castle	Mr. J. Moir.....	40	27·44	34·91	30·70	31·02
Culloden House	A. Forbes, Esq.	104	21·51	31·41	24·63	25·88
Isle of Skye (Portree) ...	J. Grant, Esq.....	60	87·99	139·04	111·19	112·74
" (Raasay House)	Mr. T. Bunning	80	57·60	86·40	79·20	77·73
" (Oronsay)	Bd. of Northn. Lights	15 †	...	...	67·50 †	...
North Uist (Loch Maddy)	Sir. J. P. Orde, Bart.	20 †	42·65	60·40	69·45 ?	57·50
Barrahead	Bd. of Northn. Lights	640 †	...	...	34·65 †	...
South Uist (Usheneish)...	" "	157 †	...	...	51·93 †	...
Harris (Island Glass) ...	" "	50 †	...	...	25·14 †	...
Cromarty	" "	28 †	...	...	20·36 †	...

DIVISION XIX.—NORTHERN COUNTIES.

CAITHNESS—						
Noss head	Bd. of Northn. Lights	127 †	...	...	21·04 †	...
Dunnethead	" "	300 †	...	...	25·11 †	...
Pentland Skerries	" "	72 †	...	...	29·23 †	...
SUTHERLAND—						
Dunrobin Castle	Mr. J. Mitchell	6	29·40	27·45	23·65	26·83
Scourie	J. Simpson, Esq.....	20	38·30	50·85	...	...
Tongue House	J. Crawford, Esq. ...	30 †	42·10	...	37·50	...
Cape Wrath.....	Bd. of Northn. Lights	355 †	...	...	40·26 †	...

DIVISION XIX.—NORTHERN COUNTIES. *(Continued.)*

STATIONS.	AUTHORITIES.	Height above Sea Level.	Depth of Rain.			
			1860	1861	1862	Average for 3 years
		feet.	inches.	inches.	inches.	inches.
ORKNEY—						
Balfour (Kirkwall)	D. Balfour, Esq.....	50	28·18	33·10	25·60	28·95
Sandwick (Lawn).....	Rev. C. Coulston.....	78	37·96	41·18	34·38	37·84
" (North Park)	" "	94	...	...	33·68	...
Cantickhead.....	Bd. of Northn. Lights	63 †	...	...	44·30 †	...
Hoy Sound (East)	" "	27 †	...	...	33·43 †	...
" (West)	" "	37 †	...	...	33·85 †	...
Sanda (Start Point).....	" "	29 ?	...	...	25·54 †	...
North Ronaldsay.....	" "	21 †	...	...	34·27 †	...
SHETLAND—						
Bressay.....	Rev. Z. M. Hamilton.	20	36·80	41·15	45·95	41·30
"	Bd. of Northn. Lights	72 †	...	...	36·97 †	...
Sumburghead	" "	265 †	...	...	27·62 †	...

IRELAND:

DIVISION XX.

CORK—						
Cork Royal Institution	J. Humphreys, Esq.	80	31·91	38·28	38·09	36·09
Queen's College	Professor England ...	50	...	...	47·27	...
KERRY—						
Valentia	The Knight of Kerry	50	...	72·40	62·19	...
WATERFORD—						
Waterford	R. J. Greer, Esq.....	60	40·86	43·83	45·23	43·31
Portlaw.....	A. Free, Esq.	50 †	...	49·31	50·10	...
Rathculliheen	" "	135	37·56	38·79	41·21	39·19
LIMERICK—						
Limerick	Rev. C. Mayne.....	...	...	44·32	...	...
CLARE—						
Killaloe	" "	128	48·76	51·84	49·85	50·15
"	" "	123	...	53·74	47·37	...
KING'S COUNTY						
Birr Castle	Earl Rosse	202 †	...	...	36·28	...
QUEEN'S COUNTY—						
Portarlington	M. Hanlon, Esq.....	245	34·84	36·70	45·16	38·90
WICKLOW—						
Bray (Fassaroe)	E. Barrington, Esq....	250 †	57·52	51·00	45·80	51·44
GALWAY—						
Galway (Queen's College)	Professor Curtis	25	...	58·62	51·61	...

DIVISION XX.—*(Continued.)*

STATIONS.	AUTHORITIES.	Height above Sea Level.	Depth of Rain.			
			1860	1861	1862	Average for 3 years.
		feet.	inches.	inches.	inches.	inches.
DUBLIN—						
Black Rock	T. Bewley, Esq.	96	26·70	24·67	24·98	25·45
Dublin (Ord. Surv. Office)	Capt. Wilkinson, R.E.	166	...	27·49	30·18	...
„ (Glasnevin)	D. Moore, Esq.	65	31·08	30·16	28·04	29·79
„ (Vicar's Lodge)...	S. Yates, Esq.....	89	...	...	24·63	...
Monkstown	W. H. Pim, Jun., Esq.	90	33·26	31·89	31·25	32·13
„	„ „	190	...	21·01	20·75	...
MAYO—						
Lough Corrib (Cong.) ...	G. H. D'Arcy, Esq....	60 †	43·44	...	...	...
SLIGO—						
Markree Observatory ...	E. J. Cooper, Esq. ...	145	43·74	47·16	39·91	43·60
FERMANAGH—						
Florence Court.....	Earl of Enniskillen...	300	...	...	49·56	...
ARMAGH—						
Armagh Observatory ...	Rev. Dr. Robinson ...	247	...	43·20	42·05	...
DOWN—						
Belfast (Queen's College)	J. Bell, Esq.	58	38·23	34·02	39·18	37·14
„ (Linen Hall).....	J. Stewart, Esq.	12	39·84	37·41	41·18	39·48
Strabane (Leckpatrick)...	Rev. C. Maxwell.....	260	...	...	42·45	...

The average fall of rain at Manchester (Old Trafford)* for the years 1860-61-62, is 34·49 inches. This does not widely differ from that furnished by Sir John Herschell for a series of years, viz., 36·2, in an article from which a quotation will be found elsewhere. There are two other registration stations at Manchester, both in the middle of the town, and not more than half a mile distant from each other, but whose results present a remarkable disparity. One of these (conducted by Mr. Casartelli) is in Market-street, the elevation above sea level not stated, but probably about 140 feet. The average

* On the authority of G. V. Vernon, Esq.

fall here for the three years named is given at 32·35 inches. The other station is on the premises of the Manchester, Sheffield, and Lincolnshire Railway Company—whose attention to this subject, be it remarked, is exemplary and worthy of imitation,—rain gauges having been placed at many of the stations throughout the ramifications of their lines. The elevation of their instrument at Manchester is stated at 194 feet above sea level, and the average rain fall for the past three years 39·93 inches.

The average rain fall at Manchester for these three stations in 1860-61-62 stands at 35·70 inches.

The greatest depth of rain which fell at any place in England in 1860-61-62, according to these records, occurred at Seathwaite, Cumberland, being 164·94 inches; the lowest was at Shrewsbury, 18·17 inches. But Mr. Symons expresses a doubt as to the correctness of the figures for this place. The next lowest was 19·29 inches, at Grimsby, Lincolnshire.

Mr. Vernon, in a paper communicated to the Literary and Philosophical Society of Manchester, February 24, 1863, has exhibited tables representing the amount of rain fall in the vicinity of Manchester for the past 69 years, from 1794 to 1862. From these results it appears that the average amount of rain which fell annually during this period is 35·427 inches. The number of rainy days in Manchester in 1862, which was unusually

wet everywhere in these islands, was 218. But as the rain fall at Manchester in 1862, was 3·171 inches above the average, it is presumable also that the number of rainy days as here given is proportionately in excess; so that the average number of days on which rain fell for the 69 years ended 1862 would be, according to this estimate, less than 200 and not 218.

Mr. Vernon has kindly informed me that from results obtained by observation during the past few years, he has reason to think that 180 will be about the average of rainy days per year for Manchester.

Mr. Symons remarks, in reference to the number of rainy days in different localities, that at about one hundred stations have results on this subject been furnished by observers; but as it is still evident that no uniform system has thus far been adopted, it is thought undesirable that results, on what appear to be insufficient data, should at present be published. "The *best* plan would undoubtedly be to record, however approximately, the number of *hours* during which rain falls; but failing this, it would probably accord best with the usage of the majority of observers to consider a 'rainy day,' each day on which a measurable amount of rain falls. No measurment of less than 0·01 inches to be taken account of." *

This suggestion is so reasonable that it is

* British Rain Fall for 1862, p. 6. By G. J. Symons, Esq.

impossible to take objection to it. For it often happens in Manchester, and doubtless also in other large towns, that moisture is present in the atmosphere during a high reading of the barometer and with a still air, even in the absence of rain clouds. Such occurrence, however, should be considered as a fog moisture only, and not as a rainy day.

The following tables represent the average results for three years of the several divisions of England, Scotland, and Ireland:—

ENGLAND.

Divisions.	No. of Stations.	Average rain fall for three years.		
I. Middlesex	6	27·09	inches	per annum.
II. South-Eastern	41	30·90	,,	,,
III. South-Midland	17	25·68	,,	,,
IV. Eastern	15	26·21	,,	,,
V. South-Western	44	40·32	,,	,,
VI. West-Midland	18	29·76	,,	,,
VII. North-Midland	30	27·55	,,	,,
VIII. North-Western	30	42·67	,,	,,
IX. York	27	35·81	,,	,,
X. Northern	20	49·33	,,	,,
XI. Welsh	6	43·41	,,	,,
Total	254	Mean 34·60	,,	,,

SCOTLAND.

Divisions.	No. of Stations.	Average rain fall for three years.
XII. Southern Counties	4	52·74 inches per annum.
XIII. South-Eastern ,,	11	32·94 ,, ,,
XIV. South-Western ,,	15	50·41 ,, ,,
XV. West-Midland ,,	11	61·35 ,, ,,
XVI. East-Midland ,,	28	47·40 ,, ,,
XVII. North-Eastern ,,	8	35·41 ,, ,,
XVIII. North-Western ,,	7	59·57 ,, ,,
XIX. Northern ,,	4	33·97 ,, ,,
Total	88	Mean 47·35 ,, ,,

IRELAND.

Divisions.	No. of Stations.	Average rain fall for three years.
XX. Cork County	1	36·09 inches per annum.
XXI. Waterford ,,	2	41·25 ,, ,,
XXII. Clare ,,	1	50·15 ,, ,,
XXIII. Queen's ,,	1	38·90 ,, ,,
XXIV. Wicklow ,,	1	51·44 ,, ,,
XXV. Dublin ,,	3	29·11 ,, ,,
XXVI. Sligo ,,	1	43·60 ,, ,,
XXVII. Down ,,	2	38·31 ,, ,,
Total	12	Mean 38·88 ,, ,,

Thus it appears that the average rain fall in England is 12¾ inches less than that of Scotland, and 4¼ less than that of Ireland:—

England, 254 Stations	. .	34·60 inches per annum.	
Scotland, 88 ,,	. .	47·35 ,,	,,
Ireland, 12 ,,	. .	38·88 ,,	,,
Total . 354	Mean . .	40·28 ,,	,,

The statement below, representing the annual amount of rain fall in places beyond the British Isles, rests upon the authority of Sir John Herschell.*

	Inches.		Inches.
Stockholm	20·4	St. Helena	45·2
Petersburg	17·3	Grenada	112·0
Strasburg	27·3	Sierra Leone	86·2
Cambridge, U.S. . . .	38·9	Bergen	88·6
Philadelphia, U.S. . .	37·2	Rome	31·0
Washington, U.S. . .	41·2	Florence	41·3
Lisbon	27·1	Genoa	47·3
Williamsburg, U.S. . .	47·0	Padua	36·9
Madeira	27·7	Verona	36·9
Charleston	54·0	Vicenza	43·8
Havannah	91·2	Milan	37·8
Rio Janeiro	59·2	Lausanne	40·2
Calcutta	76·4	Berne	46·1
Bombay	75·2	Augsburg	39·1
St. Domingo	107·6	Paris	22·2
Madras	44·6	Prague	14·1

It appears from these and the preceding results, that altitude above the sea level has a marked influence in increasing the rain fall. This, which I understand is a rule (with exceptions), holds good to the height of 2,000 feet, above which the humidity gradually lessens with the increasing elevation.

* Encyclop. Brit., Art. Meteorology.

Density of Population.

Respecting the actual density and existing distribution of the population of Manchester, and the relative salubrity of its different districts, some notion may be gathered from the following statements derived from the Registrar-General's tables, representing the average results for the ten years ended 1860.

Manchester (with the Chorlton Union), including the borough of Salford, with their suburbs, contained, in 1861, a population of 518,902 persons, occupying an area of 29,007 acres, being at the rate of 17·88 persons to the acre. It has a death-rate per births of 72·71—that is to say: for every 100 births, there occurred, in the ten years ended 1860, an average of 72·71 deaths; and per population 2·593 per cent. The average death-rate per birth for the whole of England during the same ten years was 65·06, and per population 2·098, showing for Manchester an excess of 7·65 per cent by the first process, and of ·495 by the second, above the general average; but the density of population for the whole of England is only ·54, being somewhat more than one person to every two acres. So that, were each individual—man, woman, and child—to be placed in the centre of his apportioned space of 1·86 acres, they would

probably be barely within hearing distance of each other when shouting, provided the atmosphere were still.

The three component Unions of Manchester, however, exhibit results very different from each other as regards their rates of mortality, and presumably also as to their relative salubriousness, as represented below:—

	Area in Statute Acres.	Population in 1861.	Persons to the Acre.	Deaths to 100 Births.	Deaths to 100 of Population.
Manchester .	12,628	243,988	19·32	81·53*	3·047
Chorlton . .	11,549	169,579	14·68	61·92†	2·071
Salford . .	4,830	105,335	21·81	67·82	2·380
Total .	29,007	518,902	17·88	mean 72·71	2 593

But the preceding figures afford only a very inadequate notion of the actual condition of the crowded parts of the town, as the sparseness of the population occupying the outlying townships, and herewith incorporated, tend to modify the general results, and consequently to conceal the real state of the centre. In order, therefore, to expose these relations more clearly, it may be convenient to render the results for the outside townships and those for the town proper, separately.

The out-townships of Manchester are Newton, Cheetham, Failsworth, Blackley, and Prestwich; those of Chorlton—Didsbury and Gorton; and

* This includes the fatalities in the Workhouses, Hospitals, and Asylums, one of the latter being a County Asylum.

† This item includes the Workhouse fatalities for the five years ended 1855.

those of Salford—Pendleton and Broughton. The items representing their respective populations, densities, and death rates, stand as follows:—

	Districts.	Area in Statute Acres.	Population in 1861.	Persons to the Acre.	Deaths to 100 Births.	Deaths to 100 of Population.
Manchester.	Newton . .	1,924	19,311	10·04	59·19	1·993
	Cheetham . .	1,652	21,731	13·15	54·25	1·437
	Failsworth .	2,335	6,312	2·71	55·83	1·864
	Blackley . .	1,056	4,939	2·52	57·14	1·741
	Prestwich, W.A.	3,281	6,285	1·91	58·27*	1·930†
Chorlton.	Didsbury W .	5,948	5,904	1·00	74·66‡	2·920 §
	Gorton . . .	3,531‖	7,000‖	1·98	55·67	1·546
Salford.	Pendleton . .	2,650	24,448	9·22	59·91	1·804
	Broughton .	960	9,885	10·30	52·25	1·195
	Total . .	23,337	105,815	mean 4·36	57·83	1·731

W. signifies Workhouse; A. Asylum.

From this table it may be seen that the suburbs are very differently circumstanced in some essential points as compared with the entire mass; the density

* The average death-rate affecting the permanent inhabitants of these five out-townships is 56·94; but including the Workhouse fatalities (furnished by Mr Parker, Clerk to the Guardians), amounting in ten years to 178, it is 57·83. The deaths in the County Asylum, situate in the Prestwich township, cannot with fairness be included.

† Including the Workhouse deaths for all the five townships.

‡ This rate for Didsbury, the average for the five years ended 1855, before the Union Workhouse was removed to this district, is undoubtedly high, especially considering the sparseness of its population, which is less than one to the acre. The whole township is flat, tolerably well wooded with hedge-row timber and plantations, and the soil remarkably productive. The high rate of mortality of this suburb it may be difficult to account for; but it is certain that in some parts the drainage is extremely defective.

§ Including the Workhouse deaths for half the decennium.

‖ These are estimated numbers. The actual figures may be a little higher or lower, but probably not widely different from those assumed.

being at the rate of 4·36 persons to the acre, the average death-rate being, to 100 births, only 57·83, and to 100 of population, 1·731.

Deducting the sum of 105,815, which represents the aggregate suburban population, from 518,902, there remain 413,087 inhabitants for the town proper, including the two boroughs. These are confined to a space of 4,770 acres, or 86·60 persons to the acre, and have an average death-rate per births of 76·50, and per population of 2·814 per cent.

The respective results for the three townships composing this central mass are thus stated:—

	Area in Statute Acres.	Population in 1861.	Persons to the Acre.	Deaths to 100 Births.	Deaths to 100 of Population.
Manchester Township	1,480	185,410	125·28	86·25	3·431
Chorlton ,,	2,070	156,675	106·10	62·46	2·123
Salford ,,	1,220	71,002	58·20	71·24	2·744
Total	4,770	413,087	86·60 mean	76·50	2·814

Of these three groups the Manchester township appears to be the most densely peopled, and at the same time the most insalubrious; a coincidence which would naturally lead to the conclusion that overcrowding may have an important share of influence in the production of a high death-rate. Such inference would appear to be further supported by a comparison of the above figures for Manchester with the items of the third line for Salford, which presents a death-rate of 15 per cent per births lower than that of Manchester, and an acreage population lower by more than one-half. But, looking at the second line, which represents the corresponding conditions for

Chorlton, and comparing them with those of Salford, it will be seen that the death-rate for Chorlton—a much larger community—is, per births, 8·78 per cent, and per population ·621 per cent below that of Salford, while its density is 47·90 per acre greater. Over-crowding therefore, cannot, in this instance at least, be regarded in the light of a destructive evil, and it probably becomes so under certain degrees of aggravation only; especially when conjoined with other maleficent influences. This notion appears to be sustained by the results of a further analysis of the preceding groups.

The township of Manchester, consisting of five registration districts, may be conveniently divided into two portions,* namely: the *upper*, including the districts of St. George and Ancoats; and the *lower*, comprising London Road, Deansgate, and Market-street. Of the 1,480 acres which constitute the area of the entire township, the several districts occupy portions varying in extent, but by no means equally proportioned to the number of their occupants. The exact amount of space for each is not stated in the Registrar-General's tables; but their boundaries being marked on the local map, may possibly afford a means of estimating their several areas approximately.

The *upper* division, in 1861, contained 104,038 inhabitants, occupying an estimated area of 700

* In the previous editions, the results for each of the five districts were rendered separately; the present plan is adopted for the purpose of simplification.

acres, being at the rate of 148·62 persons to the acre. Its annual death-rate, per births, was 72·57 per cent, and per average population, 3·019.

The *lower* division, in 1861, contained 81,372 inhabitants, occupying an estimated space of 780 acres, representing a density of 104·27 persons to the acre. Its annual death-rate, per births, was 90·22 per cent, and per average population, 3·232 per cent, exclusive of the populations and events within the large Workhouse and the General Hospital.

The analogous conditions of the sub-districts of Salford (which borough needs not to be further particularised on this occasion) and Chorlton, will be sufficiently exposed in the following table, showing the population, acreage density, and death-rate of the respective districts. The results represent the average for the ten years ended 1860:—

	Districts.	Area in Statute Acres.	Population in 1861.	Persons to the Acre.	Deaths to 100 Births.	Deaths to 100 of Population.
Manchester. Upper District.	St. George Ancoats	700	104,038	148·62	72·57	3·019
Manchester. Lower District.	Market-street London Road Deansgate	780	81,372	104·27	90·22	3·232
Salford.	Ardwick . .	500	40,752	81·50	58·11	2·155
	Hulme . .	870	71,128	81·75	61·75	2·631*
Chorlton	Chorlton-on-M.	700	44,795	63·99	62·47	2·125
	Greengate Regent Road	1,220	{37,534} {33,469}	58·20	{68·82 {74·24	2·871 2·931†
		4,770	413,087	86·60	76·50	

* Including the deaths in the Union Workhouse for the first half of the decennium. † Including the Workhouse population.

Here also the circumstance of agglomeration, as an agent of insalubrity, would appear to hold a place very different in importance from that which is usually assigned to it. In fact, the most healthy—the *upper* district of the Manchester *township*—is at the same time by far the most densely crowded; for whilst it contains a population of more than 44 per acre greater than that of the *lower*, its death-rate is considerably below that of the latter. And viewing the results for the other townships from first to last in succession, the density will be observed to decrease in a certain ratio as the rate of mortality increases.

Certain conditions of distribution—occasioned by the occupation of large spaces of ground by manufactories, warehouses, and other establishments not tenanted as dwellings, and therefore not included in the census results—will necessarily tend to concentrate the inhabitants and to augment the density. The *upper* district is perhaps less occupied in this way than the lower. It contains, however, many manufactories and machine works; and in addition to these, the spaces occupied by the extensive storehouses and locomotive engine works of the railway companies, and those covered by the chief gas establishment of the town, may be safely reckoned at one-sixth of the entire district; thus raising the actual population density to at least 178 to the acre.

The *lower* district is yet more peculiarly

influenced in this way. Probably not much less than one-third of its entire space of 780 acres,—but to be within the mark, say one-fourth at least, is occupied by warehouses and closed shops, railway premises, hospitals, wharves, &c., untenanted during the night—(except the Hospitals and Workhouse, which are not included in this estimate). So that its population density, instead of being 104 as given, must be more than 139 persons to the acre.

Still is the circumstance of overcrowding insufficient to account for the high death-rate in the *lower* district; for it must be again instanced, that the *upper* district possesses a density of population of at least 39 per acre above that of the other, even as compared with the latter elevated estimate, and yet has a lower rate of mortality per births of 17 per cent, and per population of ·213 per cent.

Further. In regard to the relation which agglomeration holds to the co-existence of a high death-rate, it may be remarked that the *upper* division of the Manchester township (St. George and Ancoats), has *increased* in population from 94,810 in 1851, to 104,038 in 1861, augmenting its density by 13 persons to the acre; yet has its death-rate experienced an amelioration during the same time by 2 per cent, namely: from 74, the average for the first half of the decennium, to 72, that for the second half. The decrease *per average population* bears a nearly corresponding ratio, *i.e.*, 3·177 per cent for the first, and 2·907 for the second half.

A different kind of change is found to have taken place in the *lower* division of the township (comprising London Road, Deansgate, and Market-street), this having experienced a *decrease* of population in ten years amounting to 10,804, that is, from 92,176 in 1851, to 81,372 in 1861, diminishing its density by 14 persons to the acre. Yet, notwithstanding this sanitary gain in respect of agglomeration, its death-rate *per births* has decreased only ·66 per cent, although, when estimated *per average population*, the change in its favour is greater. The latter result, however, as already intimated, does not always, and especially here, exhibit a faithful representation of the facts.

Sanitary Condition of the Operatives.

It is popularly believed, especially by those residing at a distance and engaged in other pursuits, that the various employments in cotton manufactories exercise a peculiarly pernicious influence upon the health and bodily growth of those engaged in them; and that the manufacturers who encourage, and increase their wealth by such means must in justice be held accountable for some imaginary but incalculable amount of misery and fatality which their system is the medium of inflicting. There cannot be a fairer opportunity of testing the truthfulness or fallacy of these assertions than is afforded by the results furnished in the tables of the

Registrar-General, bearing on the rate of mortality of the upper and south districts of the town, which contain the dwellings of, at a rough computation, not less than four-fifths of all the factory operatives of the *borough* of Manchester.

This mass of population, amounting to 260,713 persons, is naturally divided by the river Medlock into two groups, one occupying the north-east or right bank, the other the south or left bank of this stream. The two divisions are somewhat differently circumstanced in several respects; but especially in regard to the nature of the soil upon which they are respectively situated, their relative density of population, and the social condition of the inhabitants who occupy them.

The north-east portion of these is the *upper* division of the township already noticed. Its soil is everywhere a dense clay, formerly much used for brickmaking; but the whole district, now crowdedly covered by buildings, is considerably elevated above the river level, and well drained throughout. At least nine-tenths of the houses are small cottage tenements, occupied by operatives. Many of these dwellings, especially such as have been erected within the past few years, are comparatively commodious and healthy, being provided with both front and back doors, by which means a thorough ventilation is secured. Each dwelling is abundantly supplied with excellent water and in some, though by no means in all instances the

household drainage is effectual. Most of them are certainly void of cellarage, the flags or tiles of one or both rooms lying on the soil; but as it is usual to interpose a layer of ashes between the flags and the original soil, it is only now and then that any appearance of dampness is observable. The cellarage occupancy is comparatively limited, care having been taken to rectify this evil, formerly much more prevalent than in the present day.

In this district, the dwellings retain of necessity the old-fashioned appendage which has fallen somewhat into disuse in large towns, namely, the outside ashpit or cesspool, which serves to receive all the ordure and refuse of the household. This "sink of infection," as it has been denominated, is thought by some to be a means of engendering fevers and other pestilential diseases. No greater error could have been committed, or assumption more gratuitous hazarded, implying a misconception of the nature and reactionary processes of the materials they contain. Animal ordure in a healthy state, however exposed, undergoes no change calculated to render it noxious to the health of those subjected to its effluvia. Night-soil men, since they have been persuaded to be temperate, are amongst the healthiest of workmen. It is true, vegetable and animal refuse, the articles chiefly susceptible of noxious transmutation, are thrown into the same receptacle, but these are daily covered by coal ashes from the house fires—one of the most potent as well as the

most plentiful of disinfectants which we possess. In the centre of the town this material is otherwise disposed of, being collected in the early morning at the doors of dwellings and warehouses by the cart of the scavenger, most of the fermentible material, small in individual instances, but cumulatively large, having been already consigned elsewhere.

One circumstance connected with this *upper* division should not be passed over unnoticed. It is this: Although, besides the streets, it contains no open space, either covered or uncovered, for physical recreation; no garden allotments—scarcely a patch of garden ground, and barely a green herb or shrub in its whole extent except those occasionally seen in the cottage windows; no hospital or dispensary, either special or general, whereat appeal for succour might be made in case of accident or other personal exigency; and a population unprecedentedly crowded considering its multitude (104,038), and at the same time so isolated as a class; yet is its death-rate considerably lower, and inferentially its sanitary condition more favourable than that of several of the chief cathedral towns of England, whilst its actual density of population is more than one hundred persons to the acre greater than that of any of them.

The other portion of the quarter containing the dwellings of the factory operatives, comprising the Chorlton townships, occupies the south or left bank of the river Medlock, and partly that of the Irwell, and consists of Hulme, Chorlton-upon-

Medlock, and Ardwick. This quarter contained in 1861, a population of 156,765 persons,* occupying an area of 2,070 acres, which yields a density of 75·70 persons to the acre,—to say nothing of the increased agglomeration caused by the presence of manufactories, which however are fewer in this than in the other districts,—and exhibits a death-rate, per births, of 60·61,†—lower by 4·45 per cent than the general average for England, and lower, estimated per population (2·124), than that of any of the forty county and cathedral towns, except seven of them—Nos. 1, 2, 6, 10, 13, 15, and 30; whilst its acreage occupancy is immensely greater than that of any. The whole of this quarter is flat, but possesses a sufficient fall towards the rivers for effectual drainage. Its soil is light and porous in at least five-sixths of its extent, being chiefly sandy in the Ardwick township, and gravelly elsewhere, with patches of clay towards its southern confines. The tenements, generally more modern than those of the St. George-Ancoats district, are in the main commodious and comfortable, their supply of water and household drainage good, and the streets wider; and there exist also several large open spaces which serve doubtless to improve the salubrity of the atmosphere. This district contains, moreover, a considerable number of detached establishments, the residences of private

* Gorton (estimated at 7,000 inhabitants) and Didsbury being excluded.

† This number includes the fatalities in the Union Workhouse for the five years ended 1855.

families, as well also as a still greater number of less pretentious but excellent houses, sufficiently commodious as dwellings for families of ample means. The proximity of this wealthier class has here, as similar comminglings of social elements have elsewhere, the effect of visibly improving the moral tone of the populace, and of augmenting their material comforts.

It is but an act of justice towards an important class of the community to notice in passing, that although usually residing at considerable distances from their manufacturing establishments, the principals of these concerns are far from being unmindful of the means necessary to the moral and intellectual culture of their workpeople. In many instances, educational institutions, founded and supported by the owners of these establishments, are attached to the large manufactories, and not seldom enjoy the supervision, either of the principal himself, or of members of his family or firm. In one part of the district under consideration, and formerly perhaps the worst locality within its precincts, several considerable streets of poor insalubrious tenements have been entirely removed to afford space for the erection of an extensive and elegant place of worship (episcopal), with commodious schools, reading-rooms, &c., and provided with a well-disciplined staff of teachers. Another similarly endowed establishment, equally commodious and complete, has been planted in a

quarter a little distant from the first-named; and a third is in process of erection,—all within the same township, and done at the expense of one firm, the principals of which are members of one and the same family. The amount of outlay necessitated by these highly praiseworthy undertakings must be very considerable. In efforts to further the objects of these institutions, one of the principals has for years past spent, and does continue to devote the whole of his leisure time, always to the abridgement of his own personal comforts, though probably not always without prejudice to health.

The tenements of the operatives in the south (the Chorlton), like those of the north-east or *upper* (the St. George-Ancoats) quarter, already spoken of, are provided with the outside ashpit or cesspool, the inside water-closet being found in the larger dwellings only.

These two quarters numbered in 1861, as before stated, a population of 260,713 persons, four-fifths at least of whom are families who earn their livelihood in the cotton manufactories, warehouses, machine-works, iron and glass foundries, and other collateral and associated branches of industry. A considerable number of the town shopkeepers also, whose places of business, like the warehouses, are deserted at night, have residences in the Chorlton quarter.

The whole space occupied by this mass of 260,713 inhabitants amounts to 2,770 acres, giving a density

of 94·12 persons to the acre; and the average death-rate per births for the ten years ended 1860 was 65·83. This rate of mortality is ·77 per cent above the national average; but when compared with that of other populations of towns usually deemed healthy, the disparity, though variable, is mostly in its favour. For instance, it is lower *per births* than that of any of the forty county and cathedral towns mentioned, with the exception of five only, namely, Oakham, Derby, Huntingdon, Bedford, and Appleby. Estimated *per population*, its death-rate—2·401 per cent—is lower than that of twenty-two of the county and cathedral towns, though higher by ·198 per cent than the average of the remaining eighteen.

But some allowance may, not unreasonably, be claimed for this combined operative district on the score of dimensions and density; for, while its population is more than 230,000 in excess of the average for each of the said eighteen towns, its rate of occupancy is ninety persons to the acre greater.*

As already stated, the death-rate for the *lower*—the central district of Manchester—was, per births 90·22, and per population 3·232 per cent per annum;

* The towns alluded to are Nos. 1, 2, 3, 4, 5, 6, 9, 10, 13, 15, 16, 17, 19, 27, 29, 30, 32, and 36 in the table. Their aggregate population is 550,713, yielding an average of 30,595 for each town; and the space which they collectively occupy is 163,234 acres, being at the rate of 3·37 persons to the acre. The correlative items for the combined operative district are given in the text.

being 17·65 by the first process, and ·212 by the second, higher than that of the *upper* district. It may be enquired: To what agency or combination of conditions is this excessive mortality owing? It cannot be due to the presence of factory operatives, even were it not already proved that factory employment has not the pernicious tendency commonly assigned to it; for this quarter contains not above one-fifth of them. The greatest number of this supposed one-fifth are found within the precincts of London Road, that of Deansgate having a still smaller proportion. The Market-street district contains but a very minute proportion of this class. Its multitudes of shops (besides warehouses) and its extensive markets, employ the great bulk of its resident poor; but it has also a large strolling, migratory, and vagrant population.

In the production of this higher death-rate many agencies are doubtless concerned, amongst which agglomeration has a share, though perhaps not the principal one; for it has been shown that the districts which are the most densely crowded are more favourably conditioned than those which are less crowded. Neither can it in any great measure be due to the existence of outside cesspools; for in the same, the higher and more healthy quarters, every house is provided with one of these appendages; while in the lower parts, the warehouses, shops, hotels, and respectable private dwellings are furnished with the inside

watercloset; the cesspool receiving chiefly the kitchen refuse, which is daily covered and rendered innocuous by coal ashes.

The greatest amount of disease of almost every kind, and the cases which prove the most intractable under treatment, are ever associated with personal uncleanliness, indolent and unthrifty management, household squalor, organic putrescency, crowded sleeping rooms, the obstinate exclusion of fresh air, cramped, ill-ventilated, badly-regulated workshops, or intemperate habits. These, and a few kindred moral depravities to be met with in every household, doubtless stand foremost among the agents of insalubrity everywhere. Under certain degrees of aggravation and continued operation, they inflict their maleficence as effectively within the isolated mansion, the tenements of the scattered hamlet, the ship at sea, as in the crowded city.

Sewage fermentation plays also its part, and doubtless an important one. In districts having a high situation above the river level, the influence of this agent is less felt; but in situations where the drains become large, and wherever the current is sluggish, the more solid materials are liable to lodge, especially in dry seasons, sufficiently long to putrefy and emit gaseous products, which are extremely noxious as well as offensive. These poisonous effluvia regurgitate along the drains and escape upwards through the first imperfectly-valved grids arrived at, mixing with the surface

stratum of the ozoneless air, already charged with mephitic exhalations from other sources, and unavoidably producing effects more or less prejudicial to the health of those respiring the vitiated compound.

The quarter of the town under consideration, namely, the lower and more central part of Manchester, occupies a gently sloping tract of land, bounded, on three sides, by the rivers Irwell, Irk, and Medlock, with two smaller streams—the river Tib and Shooter's brook—running in nearly parallel course along the slope between the Irk and Medlock, both terminating in the last-named. But the large sewers empty their loads of refuse into the three principal currents, which are further tainted by waste matters poured into them from dye-houses, chemical manufactories, chandleries, &c.; and it is to these agents more especially that a weighty measure of evil is commonly attributed.

Now, it is seriously questionable if these contaminating admixtures have any real share in rendering either the streams or surrounding atmosphere less salubrious than they would be without them. With the drain refuse disposed of as it is, I am inclined to think otherwise. So far as I have been able to learn during a quarter century's experience in the centre of these localities, typhus and other forms of disease commonly attributable to mephitism, are not more prevalent near the banks of the large streams than they are found to be

elsewhere: even the greater prevalence of typhus in towns generally, with streams thus tainted, than in those with limpid currents, is highly problematical.* Unquestionably, both the appearance and the exhalations emitted from the rivers and some of the canals are sufficiently objectionable; but any deleterious effect which these are likely to produce upon physical health is more justly referrible to that portion of the drain matters furnished from sinks and waterclosets, and not to those which impart to the water its dark colour and sometimes peculiar odour.† Such inference would seem to be countenanced at least by this evidence: The liquid refuse issuing from dyehouses and other such places of industry consists largely, if not chiefly, of the products of coal-tar, tan, neutral salts—such as chlorides of lime, alum, iron, and of other basic bodies—articles which chemists especially recommend, under sanction of Government patent, as valuable disinfectants. They cannot, therefore, according to accepted theories, be deleterious to health. Indeed, should an efficient system of drainage be effected, such as that now contemplated for Salford, it might not be unwise to make arrangements for a diversion of these chemical waste waters into the main drain current, both as a means of assisting the flushing process and of deodorisation.

* See note on Deaths from Typhus at the end.

† The word *peculiar* is here used in contradistinction to putrescent or noisome.

Moreover: The operatives employed in dye-houses, chemical manufactories, tanneries, &c., bargemen and their families who live on the tainted streams, and others residing and labouring on their banks, are not known to be less healthy, less vigorous, or more prone to specific ailments than labouring men generally; and their offspring are as numerous and as well developed as those met with in quarters remotely situated.

It remains to be noticed, that no inconsiderable amount of atmospheric impurity of dwellings is due to the very defective state of household drainage. In all or the great majority of houses in towns, the drains leading from the sinks and waterclosets to the main sewers, traverse the whole extent of the basement premises, from extreme back to front. In every instance these conduits are badly constructed, being leaky at numerous points of their transit, from which circumstance the subsoil, especially if of porous quality, becomes saturated with pestiferous moisture to a considerable distance below and on each side of the drain, rendering the air of the lower apartments musty and disagreeable, as well as positively baneful to health. Another essential fault of these basement drains is, that their course is horizontal, or with so little fall that any amount of drenching with water is insufficient to cleanse them, so that they are always more or less choked with stagnant, putrefying

refuse. There is probably no subject which demands the attention of the sanitary reformer more urgently than this.

The tenanted part of the Market-street district has a higher situation above the river level than that of the other two districts of this *lower* quarter, and a steeper descent for its terminal drainage, hence, perhaps its lower death-rate as compared with that of Deansgate and London Road. If it were not so favoured, its rate of mortality might probably be much higher, seeing that its *actual* density is twenty or thirty persons per acre greater than either of the other two. The position of the two last-named districts being much nearer to the river level, the drain current in them is more sluggish, and more liable to be arrested in its course.

Analogous instances are met with in London, and probably also in other large towns. Take for example the parish of Westminster, comprising the districts of St. John and St. Margaret, the former chiefly inland and on elevated ground, the latter low and on the left bank of the Thames. Deducting the fatalities which occur in its three military Hospitals—namely, those of the Grenadier Guards, Coldstream Guards, and Scots Fusileer Guards, and in the Millbank Penitentiary from those of the parish of St. John; and the deaths which occur in the Workhouse, Westminster Hospital, and House

of Correction from those of St. Margaret's,—the population, acreage-density, and death-rate affecting the permanent inhabitants of the two districts respectively, will stand as follows :—

Westminster.

	Area in Statute Acres.	Population in 1861.	Persons to the Acre.	Deaths to 100 Births.	Deaths to 100 Popiatn.
St. John	260	37,483	144·16	63·85	2·239
St. Margaret ...	657	30,730	46·77	77·74	3·037

The Houses of Parliament are situated in the district of St. Margaret, and it was probably the regurgitating air of the large sewers in its concentrated essence that so frequently offended the noses of "honourable members" on recent occasions, and not the effluvia from the river.

Again. The parish of Marylebone situate inland, and that of Chelsea on the river, may be contrasted with similar results. Marylebone, now centrally located and crowded, having a density of 107 to the acre, has a death-rate per births of 77·41; while Chelsea, with an acreage population 34 lower in density, and comparatively suburban, has a death-rate both per births and per population a little higher. The difference is certainly not great, but the less crowded state of Chelsea and its external position, ought to render it much more healthy comparatively. Their items by the two processes stand as below :—

	Area in Statute Acres.	Population in 1861.	Persons to the Acre.	Deaths to 100 Births.	Deaths to 100 Popiatn.
Marylebone	1,509	161,680	107·13	77·41	2·342
Chelsea	865	63,439	73·34	77·56	2·343

Another still more remarkable instance is furnished by the two districts comprised in the parish of St. Martin-in-the-Fields—Long Acre, situate inland, and Charing Cross, bordering the river, and consequently on the tract of the terminal drains. Long Acre is notoriously crowded, having a density of population more than six times greater than that of Charing Cross, yet has a death-rate per births of 2½, and per population ·874 per cent lower—the fatalities occurring in the Workhouse and Hospital of the latter district having been deducted. The respective items stand as follows :—

St. Martin's.

	Area in Statute Acres.	Population in 1861.	Persons to the Acre.	Deaths to 100 Births.	Deaths to 100 Popiatn.
Long Acre	42	11,618	276·62	69·04	2·225
Charing Cross...	263	11,071	42·09	71·80	3·109

One example more shall suffice to finish this category. The parish of St. George, in the borough of Southwark, situate inland, and the combined parishes of St. Saviour and St. Olave in the same borough, bordering the Thames on its right bank—one above, the other below London Bridge, adjoin each other. The fatalities which occurred during ten years in the Workhouse, Queen's Prison, House of Occupation, and the Bethlehem Asylum being deducted from the sum of deaths in the St. George's parish; and those of the two Workhouses, and Guy's and St. Thomas's Hospitals, from the general results of St. Saviour and St. Olave, the population, acreage-density,

and death-rate affecting the permanent inhabitants of these two groups respectively, stand as follows:—

		Area in Statute Acres.	Population in 1861.	Persons to the Acre.	Deaths to 100 Births.	Deaths to 100 Popiatn.
Southwark.	St. George	282	55,510	196·84	65·64	2·250
	St. Saviour..... } St. Olave..... }	419	55,226	131·80	70·81	2·431

In a report published a few years ago (which I am unable at present to find, nor do I, to my regret, remember the author's name) on the relative healthfulness of occupations in London, it was stated that the Thames watermen enjoyed a very favourable measure of health and duration of life. It is not probable, therefore, that dampness, supposed to be charged with noxious effluvia, emitted from a stream which is perpetually renewed by rapid movement, can be a cause of insalubrity in these and similarly situated districts. It is much more likely that, in such instances at least as the preceding, the products of putrefactive fermentation in the large and terminal drains are doubtless the more mischievous agencies.

Rate of Mortality of Manufacturing and Non-Manufacturing Towns Compared.

In regard to rates of mortality affecting other large manufacturing towns in Lancashire, Cheshire, and the West Riding of Yorkshire, the results will be found to differ but slightly from those given for Manchester, although none of them will bear comparison with it in respect of density of population. The following list may serve to illustrate, approximately, the state of salubrity, as denoted by their respective death-rates, of 22 of the chief of these, ranged in the order of their occurrence in the Registrar-General's tables.

In compiling for these several items, it seemed probable that an additional means towards estimating the relative healthfulness of manufacturing and agricultural districts, as influenced by employment, might be afforded by placing, in juxta-position with the results for each town, those also of the entire Unions, of which the respective towns form the centre. For, the suburban populations of growing manufacturing towns are, in most instances, largely engaged in the same branches of pursuits as the more central masses which they surround; while the populace situated immediately beyond the precincts of county towns (with three or four exceptions*) are as largely so in agricultural and the collateral industries.

* Norwich and Newcastle for instance, and in a less degree, Nottingham and Derby.

Table exhibiting the population, acreage-density, and average death-rate for the ten years ended 1860, of twenty-two manufacturing towns and of their respective Unions—including the fatalities in Workhouses, Hospitals, and Asylums in each instance :—

Towns.		Area in Statute Acres.	Population in 1861.	Persons to the Acre.	Deaths to 100 Births	Deaths to 100 Popltn.
1. Stockport	Town ...	7,017	41,084	5·85	76·57	2·685
	Union...	30,709	94,360	3·07	73·23	2·505
2. Macclesfield	Town ...	2,410	27,475	11·40	76·86	2·963
	Union...	81,581	61,543	·75	73·37	2·318
3. Wigan	Town ...	2,161	37,558	17·42	69·53	2·852
	Union...	47,539	94,561	2·00	63·55	2·439
4. Warrington	Town ...	2,507	24,050	9·49	59·89	2·496
	Union...	29,981	43,875	1·47	58·48	2·183
5. Leigh	Town ...	3,331	9,449	2·84	64·15	2·486
	Union...	23,610	37,700	1·59	65·90	2·348
6. Bolton	Town ...	820	43,431	53·00	71·16	2·917
	Union...	43,896	130,269	2·96	64·29	2·527
7. Bury	Town ...	2,370	31,101	13·12	65·06	2·182
	Union...	32,990	101,135	3·06	64·05	2·173
8. Manchester	Town ...	4,770	413,037	86·60	76·50	2·785
	Union...	29,007	518,902	17·88	72·71	2·593
9. Ashton-under-Lyne	Town ...	9,300	41,229	4·43	81·12	2·833
	Union...	38,657	134,753	3·49	72·57	2·512
10. Oldham	Town ...	4,617	72,333	15·66	68·12	2·258
	Union...	16,872	111,276	6·59	65·88	2·358
11. Rochdale	Town ...	?	38,164	?	69·52	2·194
	Union...	40,340	91,754	2·27	66·60	2·121
12. Haslingden	Town ...	4,780	10,320	2·16	62·74	2·124
	Union...	26,681	69,781	2·61	61·20	1·933
13. Burnley	Town ...	21,448	42,702	2·00	66·84	2·164
	Union...	54,126	75,595	1·40	64·31	2·180
14. Blackburn	Town ...	3,610	63,126	17·48	69·80	2·512
	Union...	43,569	119,942	2·75	65·12	2·314

Towns.		Area in Statute Acres.	Population in 1861.	Persons to the Acre.	Deaths to 100 Births.	Deaths to 100 Popltn.
15. Chorley	Town ...	10,859	18,027	1·70	61·94	2·251
	Union...	52,213	41,678	·80	59·78	2·057
16. Preston	Town ...	2,753	82,985	30·12	72·88	2·737
	Union...	68,035	110,526	1·62	71·80	2·545
17. Huddersfield	Town ...	3,950	34,877	8·83	66·61	2·295
	Union...	66,560	131,336	1·97	58·95	2·133
18. Halifax	Town ...	2,330	36,437	13·63	74·41	2·461
	Union...	51,758	128,673	2·48	64·87	2·285
19. Bradford	Town ...	1,680	91,724	54·59	69·83	2·625
	Union...	40,334	196,475	4·87	66·28	2·474
20. Leeds	Town ...	2,100	117,556	56·00	73·28	2·581
	Union...	42,021	227,514	5·41	67·24	2·383
21. Dewsbury	Town ...	1,392	18,148	13·04	64·17	2·490
	Union...	24,456	92,883	3·80	59·57	2·180
22. Sheffield	Town ...	3,120	68,981	22·11	73·15	3·097
	Union...	10,590	128,951	12·14	67·02	2·566

The results presented in the next table, exhibiting corresponding conditions for forty county and cathedral towns, stand in contrast with those of the preceding table, as not containing (with a few exceptions) any large manufacturing industries, and are therefore not incommoded by dense masses of poor people, or the atmospheric impurities arising from manufacturing processes. Fourteen of them, marked with asterisks (*), have no extensive suburban unions, each, or most of them, being complete within its own little county privileges of antique date. In each of these groups, as in those of the preceding table, the births and deaths within Workhouses, Hospitals, and Asylums are included.

Towns.		Area in Statute Acres.	Population in 1861.	Persons to the Acre.	Deaths to 100 Births.	Deaths to 100 Popula.
1. Guildford	Town ...	5,329	2,443	1·80	72·17	2·105
	Union...	65,592	29,330	·45	63·14	1·773
2. Canterbury	*	3,121	16,643	5·36	88·35	2·113
3. Maidstone	Town ...	4,042	23,016	5·70	77·23	2·276
	Union...	38,082	38·670	1·02	72·05	2·189
4. Chichester	Town ...	1,830	8,884	4·85	93·09	2·276
	Union...	21,054	14,775	·70	89·10	2·161
5. Winchester	Town ...	3,861	14,930	3·86	96·11	2 286
	Union...	78,676	26,607	·34	77·32	1·994
6. Hertford	Town ...	18,277	11,163	·61	67·51	1·899
	Union...	34,410	15,301	·44	63·11	1·836
7. Abingdon	Town ...	12,983	8,672	·66	68·56	2·466
	Union...	56,445	20,861	·37	70·76	2·357
8. Buckingham	Town ...	14,983	5,987	·40	78·14	2·458
	Union...	52,419	13,756	·26	69·49	2·268
9. Northampton	Town ...	11,358	37,710	3·32	68·22	2·271
	Union...	20·903	41,160	1·97	67·00	2·243
10. Oxford	*	2,930	20,037	6·84	66·34	2·077
11. Huntingdon	Town ...	20,607	9,368	·45	62·56	3·136
	Union...	77,180	20,518	·27	57·67	1·986
12. Bedford	Town ...	36,727	23,655	·64	64·07	3·037
	Union...	97,320	38,072	·39	61·32	1·943
13. Cambridge	*	3,470	26,361	7·59	71·39	2·088
14. Chelmsford	Town ...	3,533	8,664	2·45	80·62	2·912
	Union...	83,906	32,765	·39	64·20	1·913
15. Ipswich	*	8,395	37,881	4·51	66·02	2·076
16. Norwich	*	4,325	74,440	17·21	75·57	3·388
17. Salisbury	*	480	9,039	18·83	74·21	2·353
18. Dorchester	Town ...	2,830	7,709	·78	75·51	3·178
	Union..	115,339	24,773	·21	66·34	2·113
19. Exeter	*	1,800	33,774	18·68	90·37	2·350
20. Bodmin	Town ...	16,347	6,524	·40	75·64	3·134
	Union...	88,981	19,691	·22	63·04	2·044

Towns.		Area in Statute Acres.	Population in 1861.	Persons to the Acre.	Deaths to 100 Births.	Deaths to 100 Popula.
21. Ely	Town ...	35,884	11,944	·33	65·92	3·350
	Union...	79,894	21,910	·28	60·38	2·179
22. Taunton	Town ...	3,926	10,283	2·62	73·67	2·855
	Union...	70,452	35,601	·56	66·84	1·949
23. Gloucester	Town ...	680	15,214	22·37	70·20	3·461
	Union...	32,222	34,950	1·09	66·31	2·132
24. Hereford	Town ...	2,417	14,065	5·82	87·62	2·625
	Union..	144,991	39,287	·27	76·20	1·988
25. Shrewsbury	*	18,032	25,784	1·43	87·53	2·387
26. Stafford	Town ...	17,581	14,739	·84	83·39	3·003
	Union...	52,022	24,474	·47	73·78	2·150
27. Worcester	*	6,699	30,969	4·62	77·84	2·189
28. Warwick	Town ...	5,410	10,589	2·00	76·94	3·272
	Union...	66,639	44,047	·66	72·20	2·014
29. Leicester	*	3,960	68,190	17·22	68·20	2·400
30. Oakham	*	55,030	11,112	·22	61·54	1·909
31. Lincoln	Town ...	29,614	24,907	·84	66·46	3·190
	Union..	158,920	47,063	·29	60·72	1·935
32. Nottingham	*	1,870	75,765	40·52	75·80	2·413
33. Derby	*	2,970	51,049	17.20	64·32	2·234
34. Chester (Cathedral)	Town ...	25,222	19,762	·78	81·88	2·948
	Union..	107,555	58,501	·54	73·57	2·115
35. Lancaster	Town ...	13,280	18,347	1·38	81·00	2·697
	Union..	138,746	35,297	·25	68,53	2·259
36. York	Town ...	26,456	50,906	1·92	74·00	2·364
	Union...	83,430	59,968	·72	70·71	2·288
37. Durham	Town ...	27,720	18,714	·67	69·32	3·017
	Union...	98,368	70,274	·71	55·68	2·027
38. Newcastle	*	7,102	110,968	15·62	76·75	2·468
39. Carlisle	Town ...	11,782	31,775	2·70	69·41	3·454
	Union...	70,810	44,820	·63	68·03	2·228
40. Appleby	Town ...	55,873	5,529	·10	58·28	2·711
	Union..	177,910	15,411	·09	62·62	1·714

In the first of these two tables, it will be seen that the death-rate per births and that per population bear relations very similar to each other throughout; that is to say, when the death-rate by one process is high, it is so also by the other, and *vice versâ*. This, however, is not the case with those of the second table. The highest death-rate per population among the manufacturing towns is that for No. 22 (Sheffield), namely, 3·077; while, for the other group, there are eight county towns for which it stands higher, namely: Nos. 11, 18, 20, 21, 23, 28, 31, 39, and for some of them considerably so. On the other hand, there are none so low among the manufacturing as among the cathedral and county unions. The lowest among the former is No. 12 (Haslinden Union), which stands at 1·933, while of the latter, five unions have a lower estimate: Nos. 1, 6, 14, 30, 40.

Contrasting the average death-rate per population of the 22 towns comprised in the first table with that of the 40 towns in the second, the result is in favour of the former, as below:—

	Average death-rate per population.	
22 Manufacturing towns	2·549	per cent.
40 County and cathedral towns	2·595	„

The death-rates per births show a still wider disparity, and this I deem to be the more faithful representation, namely:—

	Average death-rate per births.	
22 Manufacturing towns	69·64	per cent.
40 County and cathedral towns	75·54	„

But the sum of inhabitants of the 22 manufacturing towns is 1,320,716, and their density 18·88 persons to the acre; against 998,439 inhabitants, occupying the 40 county and cathedral towns, with a density of only 5·97 persons to the acre. These circumstances taken into consideration, the sanitary condition of the one and the other must be looked upon as still more decidedly in favour of the manufacturing towns.

The entire Unions of the two groups respectively present, as might be expected, results which have a tendency in the contrary direction, as represented per population at least—the death-rate for the second group being ·134 per cent lower than that of the first. Thus:—

	Average death-rate per population.	
22 Manufacturing unions	2·393	per cent.
40 County and cathedral unions	2·199	„

The death-rate per births, however, which, for reasons already stated, is probably more correct, is as follows:—

	Average death-rate per births.	
22 Manufacturing unions	65·76	per cent.
40 County and cathedral towns	67·48	„

The number of inhabitants comprised in the 22 manufacturing unions is 2,743,482, and the density 3·74 persons to the acre; while the aggregate population of the 40 county and cathedral unions, is little more than one-half, *i. e.*, 1,459,834, and the occupancy only ·65 to the acre. So that it is questionable if the manufacturing unions even,

should be considered less favourably circumstanced by either process in comparison with those of the county and cathedral unions in a sanitary point of view, seeing that their density is nearly six times greater, and their reputed higher death-rate (per population) so fractionally small, while per births it is 1·72 per cent more favourable.

Respecting certain anomalies which appear among the results of the second table, such for instance as the want of correspondence noticeable between the death-rate per births and that per population, a few remarks, by way of explanation, may not be out of place, although the question has already been discussed in the preface. A notable example, however, may be adduced of the uncertainty and inconstancy of the death-rate estimate per population, by contrasting the results of two cathedral towns, both similarly circumstanced as regards the absence of cotton manufactories.

The population of Exeter amounted, in 1851, to 32,823, and in 1861 to 33,742, having experienced an *increase* in 10 years of 919.

The population of Ely in 1851 was 22,896, and ten years later 21,910, having experienced a *decrease* in 10 years of 986.

The number of births in Exeter amounted, in the decennium, to 8,776, and the number of deaths to 7,931, showing that only 845, equal to 9·628 per cent of those born had been reared; while in Ely the number of births was 7,907, and of deaths only

4,775, showing that 3,134, being 39·618 per cent of those born, had been brought to maturity. Yet the death-rate per population for Ely, notwithstanding this large disparity is, according to the Registrar-General's figures, only a trifle, *i. e.*, ·171 per cent, lower than that for Exeter, a result altogether disproportionate and fallacious.

For, if the sum of natural increase, with the addition of those who must have left the town in the ten years (*i. e.*, 3134+986), be added to the *average* population of Ely; and if the difference between the actual and natural increase (*i. e.* 74) be deducted from the *average* population of Exeter, elevating the first and reducing the second, each to its normal value, the disparity will be much wider in the contrary direction, and doubtless nearer the truth. Thus:—

	Death-rate per population.	
Ely	1·629	per cent.
Exeter	2·388	,,

These proportions correspond very nearly with those afforded by the process per births:

	Deaths per births.	
Ely	60·33	per cent.
Exeter	90·37	,,

Note on Deaths from Typhus.

The total number of deaths from Typhus registered in England during the ten years ended 1860, amounted to 167,762, being at the rate of 1 to 1,132

inhabitants, and 1 to every 38 births, per annum. These were distributed over the eleven divisions in the following order:—

Divisions.	Average Population, 1851-61.	Deaths from Typhus. Total in 10 years.	Proportion to Population, per year.	Proportion to Births, per year.
I. London	2,583,112	21,444	1 to 1,264	1 to 40
II. South-Eastern...	1,738,039	14,996	1 „ 1,159	1 „ 36
III. South-Midland..	1,264,960	12,810	1 „ 987	1 „ 32
IV. Eastern	1,128,231	10,845	1 „ 1,041	1 „ 33
V. South-Western..	1,819,488	14,968	1 „ 1,209	1 „ 38
VI. West-Midland...	2,286,569	19,726	1 „ 1,159	1 „ 41
VII. North-Midland..	1,252,215	10,465	1 „ 1,196	1 „ 41
VIII. North-Western.	2,711,989	25,664	1 „ 1,057	1 „ 39
IX. York	1,902,294	16,042	1 „ 1,186	1 „ 43
X. Northern	1,060,249	8,167	1 „ 1,298	1 „ 47
XI. Welsh.....	1,249,965	12,447	1 „ 1,004	1 „ 33
	18,997,111	167,762	1 to 1,132	1 to 38

Of these eleven Divisions, the highest death-rate from Typhus in the ten years ended 1860 occurred in the South Midland, being, as compared with births, 1 to 32; the lowest was in the Northern Division, namely: 1 to 47. In the North-Western Division (Cheshire and Lancashire) it stood at 1 to 39, and in comparison with this there are five in which it was higher, and five in which it was lower. The average for the five Divisions (four of which are almost purely agricultural) having a higher death-rate from Typhus than Cheshire and Lancashire, is 1 in 34, and the average of the five with a lower estimate, is 1 in 42.

When compared with population, it appears that in three of the Divisions was the death-rate from

Typhus higher than in the North-Western (Cheshire and Lancashire), and in seven lower. For the three in which the rate was higher (two of which were the South Midland and Eastern, comprising eleven agricultural counties), the average was 1 to 1,011; and for the seven in which it was lower, the average was 1 to 1,202—that for the North-Western being 1 to 1,059.

The same fatalities are further subdivided among the forty-four constituent counties and parts of counties comprised in the preceding Divisions as below: Division I. (London) being already disposed of.

II.—SOUTH-EASTERN.

	Average Population, 1851-61.	Deaths from Typhus. Total in 10 years.	Proportion to Population, per year.	Proportion to Births, per year.
1. Surrey (extra-metrop.)	237,892	1,751	1 to 1,301	1 to 37
2. Kent (extra-metrop.)..	515,146	4,464	1 „ 1,154	1 „ 37
3. Sussex.....	353,220	2,906	1 „ 1,216	1 „ 37
4. Hampshire	429,350	4,172	1 „ 1,029	1 „ 32
5. Berkshire	202,429	1,633	1 „ 1,240	1 „ 37

III.—SOUTH MIDLAND.

6. Middlesex (ext.-met.)	168,965	1,096	1 „ 1,544	1 „ 45
7. Hertfordshire	175,707	1,511	1 „ 1,156	1 „ 37
8. Buckinghamshire ...	145,431	1,428	1 „ 1,018	1 „ 33
9. Oxfordshire.....	170,740	1,780	1 „ 948	1 „ 31
10. Northamptonshire ...	222,456	2,615	1 „ 851	1 „ 29
11. Huntingdonshire ...	57,772	680	1 „ 878	1 „ 29
12. Bedfordshire	135,142	1,624	1 „ 832	1 „ 29
13. Cambridgeshire	186,789	1,986	1 „ 941	1 „ 31

IV.—EASTERN.

	Average Population, 1851-61.	Deaths from Typhus. Total in 10 years.	Proportion to Population, per year.	Proportion to Births, per year.
14. Essex	361,916	3,769	1 to 960	1 to 31
15. Suffolk.....	335,771	2,897	1 „ 1,159	1 „ 37
16. Norfolk	430,541	4,168	1 „ 1,033	1 „ 33

V.—SOUTH-WESTERN.

17. Wiltshire.....	238,481	2,214	1 „ 1,077	1 „ 34
18. Dorsetshire.....	179,644	1,426	1 „ 1,261	1 „ 39
19. Devonshire	579,348	4,863	1 „ 1,192	1 „ 35
20. Cornwall	359,242	2,626	1 „ 1,369	1 „ 46
21. Somersetshire.....	462,771	3,832	1 „ 1,207	1 „ 36

VI.—WEST-MIDLAND.

22. Gloucestershire	431,549	3,228	1 „ 1,337	1 „ 41
23. Herefordshire	102,958	640	1 „ 1,604	1 „ 46
24. Shropshire	254,956	1,668	1 „ 1,531	1 „ 45
25. Staffordshire	700,043	7,288	1 „ 966	1 „ 39
26. Worcestershire	276,843	2,036	1 „ 1,361	1 „ 45
27. Warwickshire.....	520,245	4,814	1 „ 1,081	1 „ 39

VII.—NORTH MIDLAND.

28. Leicestershire	239,784	2,289	1 „ 1,047	1 „ 39
29. Rutlandshire	23,875	146	1 „ 1,662	1 „ 50
30. Lincolnshire	402,187	3,236	1 „ 1,243	1 „ 46
31. Nottinghamshire ...	309,084	2,793	1 „ 1,107	1 „ 39
32. Derbyshire	277,283	2,209	1 „ 1,259	1 „ 43

VIII.—NORTH-WESTERN.

33. Cheshire	445,655	3,526	1 „ 1,264	1 „ 42
34. Lancashire	2,266,333	22,147	1 „ 1,023	1 „ 38

IX.—YORK.

35. West Riding.....	1,417,015	12,519	1 „ 1,132	1 „ 43
36. East Riding.....	263,022	2,326	1 „ 1,131	1 „ 38
37. North Riding	202,257	1,287	1 „ 1,576	1 „ 51

X.—NORTHERN.

	Average Population, 1851-61.	Deaths from Typhus. Total in 10 years.	Proportion to Population, per year.	Proportion to Births, per year.
38. Durham	476,902	4,082	1 to 1,168	1 to 47
39. Northumberland ...	323,296	2,489	1 „ 1,300	1 „ 44
40. Cumberland.....	200,384	1,101	1 „ 1,821	1 „ 59
41. Westmoreland	59,666	296	1 „ 2,016	1 „ 60

XI.—WELSH.

42. Monmouthshire ...	187,053	2,240	1 „ 835	1 „ 34
43. South Wales	653,589	7,151	1 „ 914	1 „ 31
44. North Wales	409,123	3,198	1 „ 1,280	1 „ 37

For these forty-four counties, the average death-rate from Typhus, *per births*, was 1 to 39. That from the same cause in Lancashire was 1 to 38. In twenty-two counties the estimate was higher than that of Lancashire—the average being 1 to 34; and in twenty-one counties it was lower, yielding an average of 1 to 45.

The average death-rate from Typhus *per population* for the forty-four counties was 1 to 1,206. That for Lancashire was 1 to 1,023. There are ten counties in which it was higher by this process than in Lancashire—the average for these being 1 to 914, and thirty-three in which it was lower, the average for them being 1 to 1,299.

The rate of mortality in Manchester from Typhus (which disease, as popularly believed, makes fearful ravages annually amongst the poor of this and towns of similar character), and that of other towns differing from it in regard to the nature of

industries, agglomeration, proportion of the toiling element, and their social condition, is represented in the following tables. The comparison between the twenty-two of the principal manufacturing Unions and the forty county and cathedral Unions is, for the sake of uniformity, still maintained. The averages are only for the five years ended with 1860, because, previous to 1856, the towns and unions were not particularised as to their respective fatalities from Typhus.

Table representing the rate of mortality from Typhus in twenty-two of the principal manufacturing Unions of Lancashire, Cheshire, and West Yorkshire. The population with which the comparison is made in this instance is not the average, but that given in the census of 1861, in each case.

	Population in 1861.	Deaths from Typhus. Total in 5 years.	Proportion to Population, per yr.	Proportion to Births, per yr.
1. Stockport	94,360	414	1 to 1,139	1 to 40
2. Macclesfield	61,543	251	1 „ 1,226	1 „ 42
3. Wigan	94,561	575	1 „ 822	1 „ 31
4. Warrington	43,875	109	1 „ 2,012	1 „ 75
5. Leigh	37,700	134	1 „ 1,407	1 „ 50
6. Bolton	130,269	539	1 „ 1,208	1 „ 45
7. Bury	101,135	395	1 „ 1,280	1 „ 43
8. Manchester	518,902	2,346	1 „ 1,106	1 „ 39
9. Ashton-under-Lyne.	134,753	481	1 „ 1,400	1 „ 48
10. Oldham	111,276	451	1 „ 1,234	1 „ 42
11. Rochdale	91,754	341	1 „ 1,345	1 „ 43
12. Haslingden	69,781	282	1 „ 1,237	1 „ 39
13. Burnley	75,595	293	1 „ 1,290	1 „ 44
14. Blackburn	119,942	639	1 „ 938	1 „ 33
15. Chorley	41,678	159	1 „ 1,311	1 „ 45
16. Preston	110,526	586	1 „ 943	1 „ 43

	Population in 1861.	Deaths from Typhus. Total in 5 years.	Proportion to Population, per yr.	Proportion to Births, per yr.
17. Huddersfield	131,336	575	1 to 1,136	1 to 41
18. Halifax	128,673	427	1 „ 1,506	1 „ 53
19. Bradford	196,475	900	1 „ 1,091	1 „ 41
20. Leeds	227,514	1,043	1 „ 1,091	1 „ 38
21. Dewsbury	92,883	293	1 „ 1,585	1 „ 58
22. Sheffield	128,951	711	1 „ 907	1 „ 35

The next table exhibits corresponding items for forty county and cathedral Unions.

	Population in 1861.	Deaths from Typhus. Total in 5 years.	Proportion to Population, per yr.	Proportion to Births, per yr
1. Guildford	29,330	104	1 to 1,410	1 to 40
2. Canterbury	16,643	87	1 „ 956	1 „ 18
3. Maidstone	38,670	131	1 „ 1,478	1 „ 44
4. Chichester	14,775	69	1 „ 1,070	1 „ 28
5. Winchester	26,607	103	1 „ 1,291	1 „ 33
6. Hertford	15,301	46	1 „ 1,663	1 „ 45
7. Abingdon	20,861	126	1 „ 828	1 „ 28
8. Buckingham	13,756	96	1 „ 716	1 „ 23
9. Northampton	41,160	219	1 „ 928	1 „ 31
10. Oxford	20,037	75	1 „ 1,336	1 „ 41
11. Huntingdon	20,518	127	1 „ 808	1 „ 28
12. Bedford	38,072	194	1 „ 981	1 „ 31
13. Cambridge	26,861	82	1 „ 1,638	1 „ 47
14. Chelmsford	32,765	228	1 „ 718	1 „ 21
15. Ipswich	37,881	156	1 „ 1,214	1 „ 38
16. Norwich	74,440	381	1 „ 977	1 „ 31
17. Salisbury	9,039	13	1 „ 3,476	1 „ 110
18. Dorchester	24,773	82	1 „ 1,510	1 „ 48
19. Exeter	33,724	144	1 „ 1,171	1 „ 30
20. Bodmin	19,691	38	1 „ 2,459	1 „ 84
21. Ely	21,910	145	1 „ 755	1 „ 27
22. Taunton	35,601	123	1 „ 1,447	1 „ 42
23. Gloucester	34,950	129	1 „ 1,354	1 „ 44
24. Hereford	39,287	112	1 „ 1,753	1 „ 45
25. Shrewsbury	25,784	96	1 „ 1,343	1 „ 36

	Population in 1861.	Deaths from Typhus. Total in 5 years.	Proportion to Population, per yr.	Proportion to Births, per yr.
26. Stafford	24,474	76	1 to 1,610	1 to 47
27. Worcester	30,969	109	1 „ 1,420	1 „ 40
28. Warwick.....	44,047	124	1 „ 1,776	1 „ 49
29. Leicester	68,190	372	1 „ 916	1 „ 32
30. Oakham	11,112	36	1 „ 1,543	1 „ 48
31. Lincoln	47,063	258	1 „ 912	1 „ 29
32. Nottingham ...	75,765	357	1 „ 1,061	1 „ 33
33. Derby	51,049	216	1 „ 1,182	1 „ 41
34. Chester	58,501	277	1 „ 1,056	1 „ 30
35. Lancaster	35,297	140	1 „ 1,260	1 „ 42
36. York	59,968	210	1 „ 1,428	1 „ 45
37. Durham	70,274	399	1 „ 881	1 „ 32
38. Newcastle	110,968	545	1 „ 1,018	1 „ 32
39. Carlisle	44,820	145	1 „ 1,890	1 „ 51
40. Appleby	15,411	32	1 „ 2,408	1 „ 63

With reference to the information furnished by the preceding tables respectively, it is noteworthy that the aggregate results are very nearly alike, but the general issue is in favour of the manufacturing group—notwithstanding the telling effect which the numbers for Salisbury, Bodmin, and Appleby, each with a small and sparse population, exercise in favour of the second group as regards the death-rate per population. But the death-rate per births is still more largely in favour of the manufacturing Unions. Thus:

	Population in 1861.	Deaths from Typhus. Total in 5 years.	Proportion to Population, per yr.	Proportion to Births, per yr.
22 Manufacturing Unions	2,743,482	11,947	1 to 1,148	1 to 44
40 County and Cathedral do...	1,459,834	6,402	1 „ 1,140	1 „ 38

A. IRELAND AND CO., PRINTERS, FALL MALL COURT, MANCHESTER.

Ueber die

Kanalisation von Berlin.

Gutachten

der

Königl. wissenschaftlichen Deputation für das Medicinalwesen

nebst einem Nachtrage.

Mit zusätzlichen Bemerkungen

von

Rud. Virchow.

Berlin, 1868.

Verlag von August Hirschwald.

Unter den Linden No. 68.

Separat-Abdruck aus der Vierteljahresschrift für gerichtliche Medicin. N. F. IX. 1.

Gutachten

der Königl. Wissenschaftlichen Deputation für das Medicinalwesen,

betreffend

die Frage nach der angemessensten Art, die Stadt Berlin von den Auswurfsstoffen zu reinigen.

(Erster Referent: **Virchow.**)

Der Herr Minister für Handel, Gewerbe und Bauwesen hat unter dem 1. Juli 1865 ein Gutachten der Wissenschaftlichen Deputation für das Medicinalwesen erbeten über die in der Abhandlung des Geheimen Oberbauraths *Wiebe* untersuchte Frage nach der angemessensten Art, die Stadt Berlin von den Auswurfsstoffen zu reinigen, und zwar wünscht er dieses Gutachten in Rücksicht auf die Interessen der Medicinal-Polizei. Er hat zugleich eine Berücksichtigung des von den Commissarien des Herrn Ministers für die landwirthschaftlichen Angelegenheiten über dieselbe Frage erstatteten Berichtes gewünscht und zu diesem Zweck unter dem 1. August 1865 ein Gutachten des Geheimen Oberbauraths *Wiebe* über diesen Bericht eingesandt.

Weiterhin hat derselbe Herr Minister unter dem 1. August 1866 das hiesige Polizei-Präsidium und die Ministerial-Bau-Commission angewiesen, das Verhalten der für die Ableitung von Water-Closets in die offenen Strassenrinnsteine

angeordneten Sammelgruben durch Sachverständige untersuchen zu lassen, und er übersendet mittelst Schreibens vom 9. Mai d. J. die eingegangenen Berichte nebst einem von dem Polizei-Präsidium vorgelegten Entwurf zu einer Polizei-Verordnung, sowie nebst einem Gutachten des Geheimen Oberbauraths *Wiebe* über den letzteren, um auch über diesen Gegenstand ein die sanitätspolizeiliche Seite beleuchtendes Gutachten der Wissenschaftlichen Deputation zu erhalten.

Indem wir nachstehend über sämmtliche Fragen, wie uns freigestellt war, ein gemeinschaftliches Gutachten erstatten, bemerken wir zum Voraus, dass die Sammlung des nothwendigen literarischen Materials nur langsam und unvollständig hat bewerkstelligt werden können, und dass die von uns gewünschten Erhebungen über die örtlichen Verhältnisse, namentlich über das Grundwasser und die Brunnen der Stadt, zum Theil gar nicht, zum Theil nur in sehr ungenügender Weise zu erlangen waren. Ueberall fehlt es gerade für die sanitätspolizeiliche Erörterung der Fragen an den nöthigen Vorarbeiten, zu deren Gewinnung es sich empfehlen dürfte, nach dem Vorgange Englands eine besondere Untersuchungs-Commission niederzusetzen, welche mit den nöthigen wissenschaftlichen Kräften und ausreichenden Mitteln ausgestattet wäre, um sowohl die Ortsstatistik der Gesundheits- und Sterblichkeits-Verhältnisse, als auch die geologischen und hydrologischen Grundlagen in ausgedehnter und wissenschaftlicher Weise festzustellen. Dann erst, wenn dies geschehen ist, wird es möglich sein, ein entscheidendes Urtheil über die thatsächlichen Nachtheile der gegenwärtigen Zustände und über die in Folge derselben nothwendigen Maassregeln zu gewinnen. Für jetzt sind wir genöthigt, an den meisten Punkten nach allgemeinen wissenschaftlichen Voraussetzungen und nach vielfach zweifelhaften Analogien zu urtheilen.

Gutachten.

Schon seit dem Ende des vorigen Jahrhunderts ist die Frage, inwieweit der Zustand der Rinnsteine und der Cloaken in der Stadt Berlin, sowie die Verunreinigung der Spree durch menschliche und andere Auswurfsstoffe für die Gesundheit der Einwohner nachtheilig sei, von ärztlichen Sachverständigen erörtert worden. Niemals jedoch hat diese Erörterung zur Feststellung bestimmter Thatsachen geführt, durch welche ein solcher Einfluss sicher nachgewiesen werden konnte, und noch die bekannten Untersuchungen von *Albert Magnus* 1841 blieben bei dem Ergebniss stehen, dass höchstens der Zustand der „Cloaken“ (d. h. der Abzugskanäle) gewisse Bedenken errege und einer besonderen Ueberwachung unterstellt werden müsse. Auch die kurz vorher in Paris, namentlich durch *Parent-Duchatelet* in sehr umfassender Weise ausgeführten Nachforschungen hatten eher dahin geführt, die Besorgnisse zu mindern, als ihre Voraussetzungen thatsächlich festzustellen. Die Folge davon war, dass man sowohl bei uns als in Frankreich nur in geringem Umfange und sehr allmählich besondere Vorkehrungen zur Abwehr der vermuthlichen Schädlichkeiten traf.

Einen anderen Gang nahmen die ärztlichen Untersuchungen in England. Nicht nur der Zusammenhang gewisser kleinerer und grösserer Epidemien, namentlich der Gruppenerkrankungen beim Typhus (*typhoid fever*) und bei der Cholera, wurden durch eine Reihe genauerer Localuntersuchungen zu einem hohen Grade von Wahrscheinlichkeit gebracht, sondern fast noch mehr fesselte das verhältnissmässig hohe Sterblichkeitsverhältniss in den Städten, zumal in den grossen, die öffentliche Aufmerksamkeit. Noch in der Zeit von 1850—1859 betrug die Sterblichkeit in den Städten 26,7, auf dem Lande dagegen nur 18,4 *pro mille*

der Bevölkerung; ja in einzelnen Städten, z. B. in Liverpool und Manchester, erreichte diese Ziffer die beträchtliche Höhe von 35,37 und von 35,70 *p. m.* Man schloss daher und gewiss mit Recht, dass in den Städten eine verhältnissmässig grosse Zahl ungünstiger Lebensbedingungen vorhanden sei, deren Beseitigung eine grosse Zahl von Menschenleben retten könne, und man ging sehr bald energisch an das Werk, die aufgefundenen Uebelstände soweit als möglich zu beseitigen. Das im Jahre 1848 erlassene Gesetz zur Verbesserung des öffentlichen Gesundheitszustandes nimmt als Maassstab die durchschnittliche Sterblichkeit des ganzen Landes und gestattet das zwangsweise Vorgehen der Gesundheits-Behörde überall da, wo die Sterblichkeits-Ziffer von 23 *p. m.* überstiegen würde.

Seit dieser Zeit ist eine immer mehr zunehmende Zahl von Städten in England mit ausgedehnten und systematisch angelegten Abzugskanälen versehen worden, deren Wirkung durch die schon seit längerer Zeit eingeführten und daher sehr zahlreichen Water-Closets begünstigt wurde. Der Gesundheitszustand und namentlich das Sterblichkeitsverhältniss hat sich seitdem in mehreren Städten erheblich gebessert; insbesondere ist immer Liverpool hervorgehoben worden, wo die Sterblichkeits-Ziffer von 36 *p. m.* auf 29 und 26, ja 1860 sogar auf 24,2 *p. m.* zurückgegangen ist. Es muss jedoch schon hier bemerkt werden, dass dies erfreuliche Ergebniss keineswegs der Kanalisation allein zugeschrieben werden darf. Die Stadt Liverpool hat im Laufe jener Jahre die Summe von 3 Millionen Pfd. aufgewendet, um in den verschiedensten Richtungen, namentlich auch in Beziehung auf die Wohnungen, bessere Lebensbedingungen herzustellen.

Die englischen Vorbilder sind entscheidend geworden für die nächsten Schritte, welche bei uns geschahen. Aber

es ist wohl zu erwägen, dass bei uns keineswegs wie in England das Sanitätsinteresse entscheidend und leitend war, sondern dass ganz andere Bedürfnisse im Vordergrund standen. Vor Allem war es die Schwierigkeit, bei den geringen Höhedifferenzen des Bodens in Berlin einen genügenden Abfluss für die Rinnsteine herzustellen, welche zur Abhülfe aufforderte. Die in den Rinnsteinen stagnirenden Flüssigkeiten zersetzten sich und verpesteten die Luft an vielen Orten, und zur Zeit grosser Regenfälle waren hinwiederum die Rinnsteine nicht ausreichend, den sich anhäufenden Wassermassen genügenden Ablauf zu sichern. Mit dem Wachsen der Stadt kam dazu die Beeinträchtigung des Verkehrs, ja die Gefahr, welche die tief einschneidenden Rinnsteine nothwendig im Gefolge hatten. Die grosse Zahl von Projecten, welche seit 1816 die Aufmerksamkeit der Behörden und der Bürger beschäftigt haben, war überwiegend auf Zufuhr grösserer Wassermassen zu den Rinnsteinen gerichtet gewesen, obwohl auch schon unter ihnen einzelne eine geregelte Abfuhr in besonderen Gefässen in's Auge fassten. Keines von ihnen fand ungetheilten Beifall, und als auch die seit 1852 in's Leben getretene Wasserleitung sich als nicht genügend auswies, die Reinlichkeit der Rinnsteine in genügender Weise herbeizuführen, so entschloss sich der Herr Handelsminister, den Geheimen Oberbaurath *Wiebe* zu einer speciellen Prüfung der an anderen Orten bestehenden Einrichtungen zu entsenden. Die Ergebnisse dieser Reise liegen in dem 1861 veröffentlichten Werke „Ueber die Reinigung und Entwässerung der Stadt Berlin“ vor.

Das von *Wiebe* ausgearbeitete Project, welches sich eng den neueren Mustern der englischen Städte anschliesst, hat den Standpunkt der Beurtheilung solcher Anlagen gegen früher wesentlich erweitert. Indem es ein ausgedehntes und von der Spree, soweit sie die Stadt berührt, fast unabhän-

giges Kanalsystem aufstellt, löst es nicht nur die Aufgabe, ein genügendes Gefälle für die Rinnsteine zu schaffen, die öffentlichen Flussläufe innerhalb der Stadt rein zu erhalten und den Raum der Rinnsteine der Strassenbreite zuzufügen, sondern es nimmt zugleich die ungleich schwierigere Aufgabe auf, alle menschlichen Auswurfsstoffe und flüssigen Abfälle so schnell als möglich aus den Wohnungen und aus der Stadt zu entfernen. Es umfasst also, so zu sagen, zugleich die bis dahin im Vordergrunde stehende Aufgabe der Strassenbau-Polizei und die neu hinzugetretene der Sanitäts-Polizei. Denn es kann nicht bezweifelt werden, dass gerade die Frage nach der schnellsten Entfernung der menschlichen, thierischen und pflanzlichen Abfälle ein wichtiges Gebiet der Sanitäts-Polizei trifft.

Es liegt auf der Hand, dass die zwei Seiten der Aufgabe, welche das *Wiebe*'sche Project gemeinschaftlich zu lösen versucht, nicht nothwendig in dieser Vereinigung gefasst werden müssen. Und so hat sich die Opposition, namentlich gestützt auf das durch *Liebig* in den Vordergrund geschobene Interesse der Landwirthschaft, gerade dahin concentrirt, die Frage nach der Ableitung des Regen- und Hauswassers von der Frage nach der Entfernung der Auswurfs- und Abfallsstoffe zu trennen. Auch die von dem Herrn Minister für die landwirthschaftlichen Angelegenheiten abgesendete Commission erklärt sich in ihrem 1865 veröffentlichten Berichte für eine Trennung der beiden Aufgaben; sie will einerseits die Anlage von Sielen zur Abführung des Haus- und Regenwassers, andererseits die Organisation eines alle Abgänge umfassenden Abfuhrsystems, und zwar in letzterer Beziehung bei allen Neu- und möglichst auch bei Reparaturbauten Einführung eines bestimmt vorgeschriebenen Tonnensystems für die Abtrittsstoffe.

Es kann nicht unsere Aufgabe sein, die beiderseitigen Projecte in Beziehung auf ihre Bedeutung für die Landwirthschaft und, was damit zum Theil zusammenhängt, in finanzieller Beziehung zu prüfen. Denn wir sind der Meinung, dass die Rücksicht auf die öffentliche Gesundheitspflege, wie in England allgemein anerkannt ist, absolut entscheiden muss, und dass es dabei auf ein Mehr oder Weniger an Ausgaben um so weniger ankommt, als die Ersparung von Menschenleben für Staat und Gemeinde zugleich die beste Finanzmaassregel ist. In England hat man den Werth der verminderten Sterblichkeit und Krankheit nach vollkommen zulässigen Sätzen in Geld berechnet und für die Stadt Liverpool einen jährlichen Gewinn von 617,500 Pfd. festgestellt. Es dürfte schwer sein, einer solchen Rechnung eine ähnlich günstige vom landwirthschaftlichen Standpunkt entgegenzustellen. Die Stadt Manchester, welche das am meisten durchgeführte Abfuhrsystem besitzt, hat dafür eine jährliche Reinausgabe von über 1 Thaler pro Haus zu zahlen, und ihr Gesundheitszustand ist ein durchaus unbefriedigender.

Es muss jedoch anerkannt werden, dass die Verbindung der Frage nach der Wasserableitung mit derjenigen nach der Entfernung der Auswurfsstoffe in dem *Wiebe*'schen Project für die Stadt Berlin keine willkürliche ist. Mit Recht hebt Herr *Wiebe* in dem uns mitgetheilten Gutachten hervor, dass schon jetzt der dritte Theil der Häuser in Berlin bis in die oberen Geschosse mit Wasserleitung versehen ist, und dass es sich durch keine polizeilichen Maassregeln hindern lässt, dass nicht wenigstens der Urin mit dem Küchenwasser hinabgespült wird. Nach den uns vorliegenden amtlichen Berichten betrug am Schlusse des Jahres 1866 die Zahl der mit Water-Closets versehenen Häuser in Berlin 1446. Wenn nun allgemein anerkannt ist, dass gerade der Urin die für die landwirthschaftlichen Zwecke am meisten

werthvollen Stoffe enthält, und wenn die Unmöglichkeit zugestanden werden muss, die Besitzer der mit Wasserleitung und Water-Closets versehenen Häuser zu zwingen, zu einem ganz anderen System zurückzukehren, so ergiebt sich einfach, dass auch bei einer zunächst wesentlich auf Ableitung des Regen- und Küchenwassers abzielenden Sielanlage die Rücksicht auf die Zuleitung anderer, mit Harn und Auswurfsstoffen gemischter Flüssigkeiten sich nicht ausschliessen lässt. Dies lehrt nicht nur das Beispiel von Paris, sondern auch der fruchtlose Kampf der Berliner Polizei gegen die Verunreinigung der Rinnsteine mit derartigen Stoffen. Es könnte sich also nur darum handeln, ob man, wie es in Manchester mit sehr zweifelhaftem Erfolge geschehen ist, sich der ferneren Einrichtung von Water-Closets geradezu widersetzen will.

Gehen wir nun auf die sanitätspolizeiliche Frage näher ein, so müssen wir von vornherein feststellen, dass die Gesundheitsverhältnisse der Stadt Berlin ein so ungünstiges Bild nicht gewähren, wie es die grossen Städte Englands vor der Einführung der Kanalisation darboten. Die Sterblichkeit betrug in der Zeit von 1851—1860 in Berlin im Durchschnitt 26,7 *p. m.* der Bevölkerung; für ganz Preussen dagegen berechnete sich im Jahre 1858 die ungleich höhere Zahl von 29,2 *p. m.* Freilich setzt sich diese letztere Zahl aus sehr ungleichen Ziffern für die Sterblichkeit der einzelnen Provinzen zusammen, denn während diese 1851—1860 in der Provinz Preussen 35,8 *p. m.* betrug, erreichte sie in Westfalen nur 24,7 *p. m.* In der Provinz Brandenburg betrug sie 25,9 und im Regierungsbezirk Potsdam, der doch zunächst in Vergleich zu ziehen ist, 26,1 *p. m.*, so dass also die der Hauptstadt benachbarten, überwiegend ländlichen Bezirke nur um 0,8 und um 0,6 *p. m.* günstiger, als sie selbst, gestellt waren.

Es muss ferner in Betracht gezogen werden, dass die Berliner Sterblichkeitsverhältnisse sich seit einem halben Jahrhundert stetig gebessert haben. Die Sterblichkeit betrug nämlich:

1801—1810: 1 Todter auf 25,18 Einwohner,
1841—1850: 1 „ „ 37,74 „
1855—1860: 1 „ „ 37,33 „

Ja, selbst wenn man sie mit der um ein ganzes Jahrhundert zurückliegenden Zahl für

1761—1770: 1 Todter auf 31,54 Einwohner

vergleicht, so ist sie neuerlich eine sehr viel günstigere. Freilich hat sich auch die Sterblichkeit im ganzen Lande vermindert:

1778: 1 Todter auf 28,00 Einwohner,
1811: 1 „ „ 25,73 „
1843: 1 „ „ 34,80 „
1855: 1 „ „ 31,25 „
1858: 1 „ „ 34,13 „

Man ersieht daraus, dass die Sterblichkeit in der Hauptstadt in viel stärkerer Proportion abgenommen hat, als im ganzen Lande, und es bietet sich daher in keiner Weise ein Maassstab, wie ihn das englische Gesetz angenommen hat.

Es soll damit keineswegs gesagt werden, dass in den Sanitätsverhältnissen der Hauptstadt nichts gebessert werden könne, sondern nur, dass dieselben im Vergleich mit den Verhältnissen des ganzen Landes durchaus günstig sind. Wir glauben freilich auch folgern zu müssen, dass noch jetzt die Befürchtungen, welche man aus dem Zustande unserer Rinnsteine, unserer Abtritte und unserer öffentlichen Stromläufe herleitet, über die Wirklichkeit hinausgreifen, und dass es ganz falsch sein würde, wenn man aus Vergleichen der Berliner Sterblichkeit mit der in anderen grossen Städten des Continents sofort Schlüsse auf den Einfluss der Abtritte

und Cloaken begründen wollte. Wien hatte trotz seiner Lage an einem der grössten und wasserreichsten Ströme 1851—57 im Durchschnitt eine Sterblichkeit von 40,5 *p. m.* Leipzig, welches die Commissarien des landwirthschaftlichen Ministeriums besonders hervorheben, weil daselbst die Anlegung von Water-Closets und der Einlass von Urin und Auswurfsstoffen in die Siele nicht gestattet ist, hatte trotz Abfuhr der Excremente 1858 eine Sterblichkeit von 25,9 und 1861 von 25,7 *p. m.* Dagegen Frankfurt a. M., welches eben im Begriff steht, eine geordnete Kanalisation nach englischem Muster vorzunehmen, hatte 1860—62 nur eine Sterblichkeit von 18,2 *p. m.*

Die Verhältnisse, welche Gesundheit und Sterblichkeit der Bewohner in den grossen Städten bestimmen, sind so zusammengesetzter Art, dass es unzulässig ist, eine einzige Bedingung hervorzuheben als den Grund der Verschlechterung oder der Verbesserung der Sanitätsverhältnisse. Dies gilt sowohl gegen die Freunde der Kanalisation, welche die Einflüsse der letzteren auf die Verbesserung der Gesundheitszustände in England ganz einseitig gepriesen haben, wie gegen die Gegner, welche alle mögliche Schuld, z. B. bei dem Eintreten von Epidemien, den Kanälen anrechnen. Wir erinnern in dieser Beziehung an Croydon, welches die Freunde der Kanalisation als die eigentliche Musterstadt hinstellen, während die Gegner den Ausbruch einer schweren Typhus-Epidemie zu Ende des Herbstes 1852 gerade den Ausströmungen der Kanäle zuschreiben. Von 16000 Einwohnern erkrankten damals 1800 und 60 davon starben.

Derartige Fragen lassen sich nur durch ein eingehendes Studium der einzelnen Erkrankungen ergründen, und wir müssen leider hervorheben, dass es in dieser Beziehung noch fast ganz an den Vorarbeiten für Berlin fehlt. Wir erfahren nur, dass eine erhebliche Verschiedenheit in der

Sterblichkeit auf beiden Spree-Ufern besteht, so dass 1853 bis 1856 auf der rechten Seite der Stadt die Sterblichkeit durchschnittlich 29, auf der linken dagegen nur 22 *p. m.* betrug. In der linken Stadthälfte war demnach das Normalmaass der Sterblichkeit, wie es die *Public Health Act* voraussetzt, noch nicht einmal erreicht, und wir können sagen, dass vom sanitätspolizeilichen Standpunkt aus ein ungleich höheres Bedürfniss nach Verbesserungen auf dem rechten, als auf dem linken Spree-Ufer besteht. Vergleicht man noch kleinere Stadttheile unter einander, so ergeben sich noch grössere Differenzen, welche z. B. für den Zeitraum von 1853—56 die Höhe von 27 *p. m.* (nämlich 18 *p. m.* als Minimum und 45 als Maximum) erreichen.

Auch das Studium der Epidemien hat wenig genauere Anhaltspunkte ergeben. Nur für die Cholera besitzen wir eingehendere Arbeiten, indess sind sie keineswegs entscheidend. Schon *Magnus* machte 1841 darauf aufmerksam, dass einerseits am Schleusenkanal zwischen der Insel- und Gertraudtenbrücke die meisten Kanal-Mündungen sich finden und die zu denselben gehörenden Kanäle aus dem schmutzigsten Theile der Stadt kommen, andererseits hier gewöhnlich die ersten Cholerafälle sich zeigten und später die Krankheit gerade in diesem Theile der Stadt die meisten Opfer forderte. Er war daher geneigt, der Cloakenluft einen bestimmten Einfluss zuzusprechen. Allein die grosse Epidemie des Jahres 1866 hat die Voraussetzungen, welche dieser Auffassung zu Grunde liegen, keineswegs in deutlicher Weise bestätigt. Ebenso bedarf einer weiteren Bestätigung die Angabe, welche sich in dem uns mitvorgelegten Berichte des Polizei-Präsidiums befindet, wonach die mit Water-Closet-Einrichtungen versehenen Häuser von der Cholera-Epidemie des Jahres 1866 im Allgemeinen mehr verschont geblieben schienen, als solche, welche derartige Einrichtungen nicht

enthalten. Wenigstens ergiebt eine Vergleichung der officiellen Choleralisten, dass in den Polizei-Revieren 4, 5, 8—10, 12, wo keine Water-Closets sind, die Zahl der Erkrankungen nur zwischen 9,1 — 16,4 *p. m.* der Einwohner schwankte, während sie in dem Revier 42, wo 118 Häuser mit Water-Closets versehen sind, 18,2 *p. m.* und in dem Revier 1 bei 46 Häusern mit Water-Closets gleichfalls 16,4 *p. m.* betrug. Indess wäre es möglich, dass eine weitere Analyse dieser Zahlen mit Rücksicht auf die einzelnen Häuser die Ansicht des Polizei-Präsidiums bestätigte, was gewiss für die hier zu behandelnde Frage von grosser Wichtigkeit wäre.

Unzweifelhaft ist dagegen die Thatsache aus der letzten Cholera-Epidemie, dass die Bewohner der Kellergeschosse am stärksten heimgesucht worden sind, denn es fand sich hier eine Sterblichkeit von 11,6 *p. m.* der Bewohner, während die allgemeine Sterblichkeit nur 9,2 *p. m.* erreichte. Schwerlich wird man aber behaupten können, dass diese ungewöhnliche Gefährdung des Lebens der Bewohner in einem unmittelbaren Zusammenhange mit der Latrinenfrage steht. Dagegen glauben wir darauf aufmerksam machen zu müssen, dass die Kanalisationsfrage allerdings damit im Zusammenhange steht, und dass sie, auch ganz abgesehen von der Lösung der Latrinenfrage, insofern ein ganz erhebliches sanitätspolizeiliches Interesse darbietet.

Wenn nämlich ein System tief liegender Kanäle angelegt wird, in der Art, dass die Sohle der Kanäle oder gar die Kanäle in ihrer Gesammtheit in das Grundwasser eintauchen, so wird damit eine starke Drainage des Erdbodens herbeigeführt. Denn auch die dichtesten Kanäle scheinen eine gewisse Durchdringlichkeit der Wände zu bewahren, so dass ein Durchsickern der Bodenfeuchtigkeit in die Kanäle stattfindet. Jedenfalls haben die Erfahrungen

in Hamburg und Altona gelehrt, dass mit der Anlage der Kanäle das Grundwasser sinkt, dass die Kellerwohnungen trocken werden, so dass sogar bei Häusern, welche auf Holzrosten erbaut sind, die Unterlagen unsicher werden. Leider besitzen wir bis jetzt keinerlei sichere Beobachtungen über das Grundwasser von Berlin, obwohl dieselben eine der ersten Vorbedingungen für eine weitere wissenschaftliche Beurtheilung sind; alle Versuche, uns thatsächliche Unterlagen in dieser Beziehung zu verschaffen, sind erfolglos geblieben. Aber es kann als notorisch angenommen werden, dass an zahlreichen Punkten Berlins der Stand des Grundwassers bis auf wenige Fuss unter der Bodenfläche heraufreicht, dass die Mauern und Fundamente vieler Gebäude dadurch feucht erhalten werden, und dass namentlich der üble Zustand vieler Kellerwohnungen gerade der Feuchtigkeit des Fussbodens und der Wände zuzuschreiben ist. Zieht man nun in Erwägung, dass nach der Zählung der städtischen Commission vom 3. December 1864 in Berlin 55,942 Menschen in (11,985) Kellerwohnungen leben, dass in einzelnen Stadtbezirken, namentlich auf dem rechten Spree-Ufer, die Kellerwohnungen 9—13 pCt. aller vorhandenen Wohnungen ausmachen, so wird man wohl kaum umhin können, diesen Verhältnissen bei der Beurtheilung der örtlichen Differenzen der Sterblichkeit eine besondere Bedeutung beizulegen, und es darf ebenso wohl mit Zuversicht erwartet werden, dass durch eine tiefgelegte Kanalisation eine erhebliche Besserung eintreten wird. Allein diese wird nicht durch eine Sielanlage im Sinne der landwirthschaftlichen Commission zu erreichen sein, sondern nur durch eine in das Grundwasser-Terrain einschneidende Kanalisation im Sinne des *Wiebe*'schen Projects.

Der Gesichtspunkt, die anzulegenden Kanäle zugleich

als Einrichtungen zur Drainirung des Erdbodens, als eigentliches Entwässerungsmittel zu benutzen, ist in dem Werke des Geheimen Ober-Bauraths *Wiebe* S. 205 nur in einem sehr beschränkten Sinne angedeutet und auch in der Abhandlung desselben über die Reinigung und Entwässerung der Stadt Danzig S. 15, obwohl schon sehr viel freier behandelt, doch noch nicht in vollem Maasse anerkannt. Demselben ist eine ungleich grössere Tragweite bei der Beurtheilung der zu treffenden Anlagen einzuräumen. Denn es sind nicht blos die Keller, welche durch hohes Grundwasser leiden, sondern die Beschaffenheit der Luft überhaupt wird dadurch bestimmt. Aus dem Grundwasser erheben sich namentlich bei gewissen Witterungsverhältnissen Wassermassen in dunstförmiger Gestalt in die darüber stehenden Luftschichten, aus denen sie gelegentlich in Form von Nebeln und feuchten Niederschlägen wieder verdichtet werden. Diese Wasserdünste, welche namentlich in umschlossenen Hof- und Gartenräumen lange Zeit stagniren können, bringen aus dem Boden allerlei organische Stoffe mit, die theils schon im Boden in Zersetzung waren, theils erst nach ihrer Erhebung in die Atmosphäre in Zersetzung eintreten. Schon seit langer Zeit ist man zu der Meinung gelangt, dass solche schlechte Luft (*Malaria*) die Quelle von Wechselfiebern ist, und man hat nicht ohne Grund vermuthet, dass auch andere, seien es acute Krankheiten, wie die Ruhr, seien es chronische Schwächezustände, wie die Skrophulose, dadurch begünstigt werden. Auch für die Cholera und den Typhus sind schon seit Decennien zahlreiche Thatsachen ermittelt, welche auf ähnliche Einflüsse hinweisen, indess hat doch erst seit den Arbeiten von *Pettenkofer* und *Buhl* die allgemeine Aufmerksamkeit sich auf diese Umstände hingelenkt, und man hat sich daran gewöhnt, in vielleicht zu einseitiger Weise das Grund-

wasser als die Quelle für die Entstehung der Krankheit erregenden Agentien anzusehen. Die Staats- und die Stadtverwaltung dürfen sich daher der Erwägung nicht entziehen, dass in den Zuständen des Grundwassers eine der wichtigsten Quellen der Verschlechterung der Luft gegeben ist, und wenn wir es als eine der dringlichsten Aufgaben der Sanitätspolizei bezeichnen müssen, dass recht bald auch in unserer Stadt vergleichende Beobachtungen über die Höhen des Grundwassers und über den Gang der Morbilität und Mortalität der Bevölkerung angestellt werden möchten, so können wir doch, ohne das Ergebniss dieser Untersuchungen im Einzelnen abzuwarten, auf die wohlthätigen Folgen systematischer Drainirung des Erdbodens im Allgemeinen verweisen und schon aus diesem Grunde die Tieflage der Abzugskanäle bei starkem Gefälle derselben als eines der Haupterfordernisse einer jeden Siel- oder Kanalanlage für Berlin bezeichnen. Starkes Gefälle ist, wie der *Wiebe*'sche Bericht mit Recht betont, durchaus nothwendig, weil nur dadurch die Stagnation des Kanalinhaltes und damit die Verderbniss desselben gehindert werden kann.

Berlin hat nach den officiellen Zählungen, welche aus bekannten Gründen nicht unerheblich hinter der Wirklichkeit zurückbleiben, seit 1851 allein durch die Cholera 18,806 Menschen verloren. Wie gross die Sterblichkeit am Typhus ist, lässt sich bei der ungenügenden Einrichtung unserer Mortalitätslisten nicht genau beurtheilen, indess ist es leicht zu constatiren, dass wir jedes Jahr kleinere oder grössere Epidemien davon haben. Die veröffentlichten Listen des statistischen Bureaus weisen für die Zeit von 1843—60 unter den Todesfällen in der Stadt Berlin nach an Typhus (Nervenfieber) 3392
an sporadischem gastrisch-nervösem Fieber . . . 4714
in Summa . 8106

also jährlich im Durchschnitt 450 Fälle. Gerade beim Typhus kommt es aber nicht blos auf die Mortalitätszahlen an, da die Krankheit durch ihre langsame Reconvalescenz und ihre häufigen Nachkrankheiten auch da, wo sie nicht zum Tode führt, schwere Verluste nach sich zieht. Noch weniger können die Mortalitätslisten bei Wechselfieber, Ruhr und allen den chronischen Krankheitszuständen entscheiden, welche für unseren Zweck herangezogen werden könnten; da aber Morbilitätslisten erst seit ganz kurzer Zeit und leider ohne die genügende Unterstützung Seitens der Staatsbehörden von dem städtischen statistischen Amte veröffentlicht werden, so müssen wir uns darauf beschränken zu sagen, dass in manchen Jahren die erwähnten Krankheiten in Berlin in grosser Zahl vorkommen.

Krankheiten dieser Art gehören nach dem englischen Ausdruck zu den vermeidbaren, da sie nur dann eintreten, wenn gewisse, mit dem Aufenthalt, namentlich mit dem Wohnen der Menschen verknüpfte Schädlichkeiten auf den Körper einwirken, und da sie vermieden werden können durch Aenderung des Aufenthalts und durch Beseitigung der Schädlichkeiten. Es muss daher auch als eine Aufgabe der Sanitätspolizei anerkannt werden, auf die Beseitigung dieser Schädlichkeiten hinzuwirken. Mag immerhin der durchschnittliche Satz der Sterblichkeit in Berlin im Verhältniss zu der Sterblichkeit des alten Preussens ein günstiger sein, so ist er dies doch schon nicht mehr, wenn wir die neuen Provinzen hinzurechnen. Die Mortalitätszahlen für Hannover z. B. sind günstiger, als die der günstigst gestellten unserer alten Provinzen, Westfalens (1 : 40,89 gegen 1 : 40,40). Noch mehr fällt in das Gewicht das um so viel günstigere Verhalten der Bevölkerung auf dem linken Spreeufer, welches

einen deutlichen Fingerzeig liefert, wo die bessernde Hand anzulegen ist.

Wenden wir uns nach dieser Betrachtung der allgemeinen sanitätspolizeilichen Gesichtspunkte zu einer speciellen Erörterung der Frage von der Entfernung der Auswurfsstoffe, so glauben wir unseren späteren Auseinandersetzungen am besten vorzuarbeiten, wenn wir in Kürze die Wege und die Formen bezeichnen, in welchen die für die Gesundheit nachtheiligen Stoffe den Bewohnern zugeführt werden können.

Was zunächst die Wege betrifft, so sind es hauptsächlich zwei, der durch das Wasser und der durch die Luft. Unter Wasser ist im Wesentlichen Trinkwasser zu verstehen, da das zum Kochen und Zubereiten der Speisen verwendete Wasser in der Regel seine schädlichen Eigenschaften durch die Einwirkung der höheren Temperatur verliert. Bei dem Trinkwasser können wir für unseren Zweck von dem Wasser der Wasserleitung absehen, insofern dasselbe ausserhalb des Stadtgebietes geschöpft und (bis auf vereinzelt vorgekommene Fälle) durch Filtration gereinigt ist. Es bleibt also für unsere Untersuchung nur das Wasser der öffentlichen und Privatbrunnen. Dieses Wasser ist, wie die Luft, die wir athmen, der Verunreinigung durch Auswurfsstoffe und deren Zersetzungsproducte ausgesetzt, und zwar sind es beide, Luft und Wasser, in doppelter Weise, nämlich direct und indirect.

Direct wird die Luft verunreinigt durch gasförmige Stoffe, welche in Form von Exhalationen aus den verschiedenen Orten, in denen die Excremente, der Harn, die Küchenabfälle u. s. w. sich befinden, emporsteigen. Es kann dies nicht blos aus Abtritten, Senkgruben, Schlammfängen, Rinnsteinen, sondern auch aus Water-Closets und Kanälen (Sielen), aus Flüssen und Gräben geschehen.

Indirect erfolgt die Verunreinigung der Luft, indem die excrementitiellen Stoffe oder ihre Zersetzungsproducte von den zuletzt genannten Orten aus in die Nachbarschaft, namentlich in das umgebende Erdreich eindringen, und erst von hier aus, indem sie an die Oberfläche des Bodens heraufsteigen, in die Luft übergehen. Auf diesem Wege können sie auch in das Grundwasser gelangen und sich mit demselben über grössere Strecken verbreiten. Indess ist es eine Einseitigkeit, anzunehmen, dass das Grundwasser jedesmal durch sie erreicht und verunreinigt werde. In manchen Fällen tränken sie eben nur die Oberfläche des Erdreiches und stellen selbst die Bodenfeuchtigkeit dar.

Auch das Brunnenwasser kann direct von Latrinenstoffen verunreinigt werden, wenn, wie es zuweilen geschieht, kleine Spalten oder Gänge sich von den Abtritten oder Schlammfängen aus zu den Brunnen bilden. Es ist bekannt, dass Ratten solche Gänge eröffnen. Auch kommt es vor, dass sich kleine unterirdische Rinnsale und Wasserläufe von Senkgruben aus bilden. In manchen Fällen geschieht auch ein Ueberlaufen der Abtrittsstoffe, so dass sie von oben her in den Brunnen einfliessen. Immerhin sind dies die seltneren Fälle.

Viel häufiger ist die indirecte Verunreinigung des Brunnenwassers von dem Grundwasser aus oder auch wohl von unterirdischen Quellen her, welche mit Abtrittsgruben u. s. w. in Verbindung treten. Grössere Regengüsse können schädliche Stoffe von der Oberfläche in die Tiefe führen, und obwohl ein grosser Theil jener Stoffe durch das Erdreich abfiltrirt wird, so geschieht es doch bei sehr oberflächlichem Stande des Brunnenwassers, — und grade Berlin hat viele Brunnen solcher Beschaffenheit, — dass die Filtration nicht vollständig wird und dass ein Theil der unreinen Stoffe bis zu dem Brunneninhalt gelangt.

In der Nähe von Flüssen, offenen Kanälen und Gräben können unreine Stoffe, welche in denselben enthalten sind, zumal bei Hochwasser, durch die Erde des Ufers in solche Brunnen gelangen, welche, wie es gleichfalls in Berlin vorkommt, unmittelbar am Ufer angelegt sind.

Das Grundwasser hat demnach eine doppelte Bedeutung. Es vermittelt sowohl den Transport verunreinigender Stoffe zum Brunnenwasser, als auch den Transport zur Atmosphäre. Steigt das Grundwasser, so wird ein vermehrtes Zuströmen zu den Brunnen erfolgen; sinkt dasselbe, so wird aus den trocken werdenden Schichten des Erdbodens eine vermehrte Ausdünstung an die Luft eintreten. Grund genug, seine Zustände mit sorgsamem Auge zu überwachen.

Was nun ferner die Formen angeht, unter welchen die unreinen Stoffe an Luft und Wasser übergehen, so können diese Stoffe sich im gasförmigen, im flüssigen oder im festen Zustande befinden. Denn, wie schon gesagt, auch die Luft nimmt nicht blos gasförmige Stoffe auf, sondern die dunstförmig, d. h. in feinvertheiltem flüssigen Zustande aufsteigenden Wassertheile können selbst feine, im festen Zustande befindliche Körper mit sich fortreissen und der Atmosphäre zuführen. Andererseits absorbirt das Wasser auch gasförmige Stoffe, während es sich von selbst versteht, dass sowohl flüssige, als feste, jedoch feinvertheilte oder an sich sehr kleine Körper ihm ohne Weiteres beigemischt werden können.

Diese unreinen Stoffe sind entweder die natürlichen Auswurfsstoffe oder Abfälle der Haushaltung, oder sie entstehen erst nachträglich aus der Zersetzung derselben, oder sie bilden sich als selbständige Entwickelungen mit und nach der Zersetzung. In letzterer Beziehung ist namentlich an das so überaus häufige Vorkommen kleiner,

infusorieller Bildungen zu erinnern, meist den feinsten Formen der eigentlichen Infusorien, sowie der Pilze und Algen angehörig. Die Keime derselben, obwohl feste Körper, sind doch so fein, dass sie in die Luft emporgetragen und mit ihr fortbewegt werden, ja, dass sie in gewisser Zahl im Wasser vorhanden sein können, ohne dasselbe erkennbar zu trüben. In keiner Weise sind sie jedoch Zersetzungsproducte; häufig stellen sie vielmehr die Zersetzungs-Erreger (Fermente) dar.

Was die natürlichen Auswurfsstoffe und deren eigentliche Zersetzungsproducte angeht, so ist es bekannt, dass sie gleichfalls gasförmig, flüssig oder fest sein können. In ersterer Beziehung heben wir besonders hervor, dass mit den Excrementen sehr gewöhnlich Darmgase abgehen, welche keineswegs einfach den Zersetzungsproducten zugerechnet werden dürfen, obwohl zuweilen Zersetzungsgase einen wesentlichen Antheil an ihrer Zusammensetzung haben.

Ein erheblicher Theil der unreinen Stoffe hat einen üblen Geruch und macht sich leicht bemerkbar. Begreiflicherweise hat sich daher die Aufmerksamkeit gerade diesen Stinkstoffen zugewendet, und ein grosser Theil der Klagen über den Zustand der Rinnsteine und Cloaken, der Spree und ihrer Nebengräben, der Abtritte, Höfe und Thorwege in Berlin begründet sich auf die sehr eindringliche Wahrnehmung ihrer Anwesenheit. Ausgehend von der an sich ganz richtigen Vorstellung, dass stinkende Luft und stinkendes Wasser verunreinigt seien und dass reine Luft und reines Wasser zu den ersten Lebensbedingungen des Menschen gehören, hat man vor allen Dingen die Beseitigung solcher Zustände begehrt. So hat sich zuerst unter den Laien, später auch in wissenschaftlichen Werken die Meinung festgesetzt, dass die Stinkstoffe zugleich die gesundheitsgefährlichen oder kurzweg die schädlichen Stoffe seien, eine Meinung, welche noch gegenwärtig die Frage von der Desinfection so sehr erschwert.

Unter den riechenden Stoffen sind besonders der Schwefelwasserstoff und das Ammoniak, theils einzeln, theils vereinigt, die flüchtigen Fettsäuren, das Trimethylamin zu nennen. Unter diesen hat man schon seit längerer Zeit den zuerst genannten Stoff als die am meisten schädliche Substanz aufgeführt, und es lässt sich nicht leugnen, dass derselbe in einer gewissen Concentration wie ein starkes Gift wirkt. Plötzliche Todesfälle von Grubenarbeitern, welche kurz nach dem Einsteigen in Abtrittsgruben oder Kanäle erfolgen, werden mit Recht in erster Linie der Wirkung des angehäuften Schwefelwasserstoffes zugeschrieben. Geringere, aber fortgesetzte Einwirkungen desselben bringen mancherlei Krankheitszufälle, wenngleich keine besonders gefährlichen hervor. Allein die Quantitäten von Schwefelwasserstoff, welche von den Abtrittsgruben aus sich in die Luft verbreiten oder, an Flüssigkeiten gebunden, die Umgebungen der Gruben tränken, sind gewöhnlich nicht so gross, um ernste Gefahren herbeizuführen.

Unter den uns mitgetheilten Aktenstücken befindet sich ein Bericht des Dr. *Zürek* über den Zustand der Schlammfänge in solchen Häusern, welche Water-Closets besitzen. Er zeigt darin, dass manche Häuser 3 in einander übergehende, durch Röhren verbundene Schlammfänge (Sammelgruben) besitzen, und dass der Reihe nach der Inhalt dieser Schlammfänge an Zersetzungsstoffen abnimmt. In dem ersten Schlammfang fand er einen Gehalt an freiem Schwefelwasserstoff, der zwischen 5,37 und 27,17 Cubikcentimeter per Litre wechselte; als Mittel aus 7 Analysen berechnet sich ein Gehalt von 11,02 Cubikcentimetern. In der zweiten Sammelgrube hatte dieser

Gehalt bedeutend abgenommen; denn im Mittel aus 7 Analysen (derselben Häuser) berechnet sich nur noch die Zahl 8,15; auch sind die Differenzen der einzelnen Gruben unter sich weit geringer, denn die Extreme schwanken nur zwischen 3,11 und 16,87. Eine dritte Sammelgrube, die einzige, deren Inhalt untersucht wurde, ergab 3,93 Cubikcentimeter Schwefelwasserstoff, während in demselben Hause die erste 9,17, die zweite 5,37 gezeigt hatte. Nur in einem einzigen, offenbar sehr ungewöhnlichen Falle fand sich die enorme Zahl von 43,11 Cubikcentimetern (Mittelstrasse 38), wogegen freilich ein andermal auch die niedrige Zahl von 2,13 (Schellingsstrasse 3) steht, beidemal für eine zweite Sammelgrube.

Das Gutachten des Dr. *Zivrek* legt diesen Befunden ein um so grösseres Gewicht bei, als sich die Spuren des Schwefelwasserstoffes in die offenen Strassen-Rinnsteine verfolgen liessen, und als ausser dem freien Schwefelwasserstoff und Schwefelammonium noch beträchtliche Quantitäten von gebundenem Schwefelwasserstoff, in Form von Schwefeleisen, Schwefelcalcium u. s. w. nachgewiesen wurden. Wir unterschätzen gewiss das Gewicht dieser Thatsachen nicht, indess müssen wir dieselben doch in einem weniger ungünstigen Lichte betrachten. Das Schwefelwasserstoff-Gas ist schwerer als atmosphärische Luft, und es bleibt daher um so länger und vollständiger in den Abtrittsgruben, Schlammfängen, Abzugskanälen, je mehr dieselben vor dem Zugange der atmosphärischen Luft geschützt sind. Es wird daher wohl denjenigen, welche sich in die Abtrittsgruben, Schlammfänge und Kanäle selbst begeben, gefährlich, aber selbst dann, wenn grosse Mengen davon sich entwickelt haben, nicht denjenigen, welche sich blos in der Nähe solcher Orte aufhalten oder dieselben für kurze Zeit benutzen. Ein grosser Theil des Schwefelwasserstoffes wird inzwischen durch Metalle und metallische Erden gebunden und bildet unlösliche oder schwerlösliche Niederschläge, welche an sich unschädlich sind und nur dadurch nachtheilig werden können, dass bei späterer Gelegenheit die Verbindung wieder gelöst und der Schwefelwasserstoff wieder frei gemacht wird. Wenn daher nach der von Dr. *Zivrek* gelieferten Tabelle schon in den ersten Schlammfängen mindestens die Hälfte, zuweilen $\frac{3}{5}$ und $\frac{4}{5}$ des gesammten vorhandenen Schwefelwasserstoffes in gebundener Form, also in unschädlicher Verbindung auftritt, so folgt daraus eben der grosse Nutzen der Schlammfänge, namentlich gegenüber den offenen Rinnsteinen, in denen sicherlich ein grosser Theil des Schwefelwasserstoffes sich verflüchtigt haben würde. Aber keineswegs folgt aus der Differenz des Schwefelwasserstoff-Gehaltes der ersten und der zweiten Sammelgruben, dass ein grosser Theil des Schwefelwasserstoffes aus den ersten Sammelgruben an die Luft abgegeben sei. Es ist dies möglich, aber es würde nur durch eine Analyse der Luft aus der Nähe der Sammelgruben dargethan werden können. Wahrscheinlich wird jedoch nur ein kleiner Theil des Schwefelwasserstoffes in dieser Art entfernt, denn erfahrungsgemäss findet sich in der Nähe der Schlammfänge in Häusern mit Water-Closets kein so auffälliger Geruch, dass daraus auf eine sehr reichliche Abgabe von Schwefelwasserstoff an die Luft geschlossen werden kann. Der grösste Theil des Gases wird vielmehr allmählich gebunden. Durch Zusatz sogenannter Desinfectionsmittel, wie namentlich des Eisenvitriols, geschieht dies in einem noch höheren Maasse. Die in dem Entwurf zu einer Polizei-Verordnung §. 5 enthaltene Bestimmung, den Raum der Sammelgruben durch ein Rohr mit der Dachrinne in Verbindung zu setzen, dagegen jede andere Verbindung mit der Luft abzuschneiden, würde da-

gegen begreiflicherweise ganz erfolglos sein, da das schwere Schwefelwasserstoff-Gas jenen Weg zum Dache nicht einschlagen würde.

Aus den in den Akten befindlichen Berichten der DDr. *Pappenheim* und *Zürek* geht ferner hervor, dass zuweilen Schwefelwasserstoff im Brunnenwasser Berlins vorkommt. Der erstgenannte Untersucher giebt an, in dem Wasser eines Privatbrunnens (Eichhornstrasse 3) im Jahre 1857 Schwefelwasserstoff im Betrage von 0,005 Gramm per Litre gefunden zu haben; indess im Jahre 1858 war das Wasser desselben Brunnens frei davon, und es wurde behauptet, dass jener Gehalt von dem grösseren oder geringeren Wasserverbrauch abhänge. Aehnlich scheint es sich auch in den anderen Fällen verhalten zu haben, und man ist daher nicht berechtigt, diese Erscheinung mit den Abtrittsgruben in Verbindung zu setzen. Vielmehr scheint es, dass schwefelsaure Salze, besonders Gyps, unter Umständen durch organische Stoffe, namentlich durch mikroskopische Algen so zersetzt werden, dass Schwefelwasserstoff frei wird.

Glücklicherweise ist der Geruch des Schwefelwasserstoffes noch penetranter, als sein Geschmack. Schon sehr kleine Mengen desselben im Wasser und in der Luft machen sich daher alsbald bemerkbar und mahnen zur Vermeidung, beziehentlich zur Entfernung der stinkenden Stoffe. So erklärt es sich wohl, dass im Allgemeinen der Nachtheil dieser Stoffe auf den Körper lange nicht so gross ist, als es die unangenehmen Eindrücke derselben auf unser Geruchsorgan wahrscheinlich machen mögen. Jedenfalls sind wir ausser Stande, bestimmte Krankheiten aufzuführen, welche in Berlin auf die Stinkstoffe der Abtrittsgruben und Water-Closets bezogen werden könnten; am wenigsten ist man berechtigt, bestimmte Epidemien damit in Verbindung zu bringen. Denn was von dem Schwefelwasserstoffe gilt,

das ist im Grossen und Ganzen auch von den übrigen Riechstoffen auszusagen.

In England ist man daher schon seit längerer Zeit dahin gekommen, die schädlichen Stoffe von den stinkenden zu unterscheiden. Die englischen Berichte enthalten in dieser Beziehung Zeugnisse sehr zuverlässiger Männer, unter denen wir die Ingenieure *Rawlinson* und *Whitehead* hervorheben, wonach bei grossem Gestank der Kanäle und Flüsse der öffentliche Gesundheitszustand günstig war, und umgekehrt selbst bei klarem Wasser epidemische Krankheiten ausbrachen. Leider ist es bis jetzt nicht gelungen, weder auf chemischem, noch auf mikroskopischem Wege Stoffe oder Körper von bestimmt erkennbaren Merkmalen zu isoliren, welche als die Träger der schädlichen Eigenschaften angesehen und bei vorkommender Gelegenheit aufgesucht werden könnten. Nicht einmal das ist festgestellt, ob die schädlichen Eigenschaften an gewissen kleinen Organismen, wie an mikroskopischen Pilzen, haften oder ob sie an gewisse chemische Verbindungen geknüpft sind. Unser Wissen beschränkt sich darauf, dass gewisse Arten von unreiner Luft oder von unreinem Wasser, also Gemische von unbekannter Zusammensetzung, im Stande sind, Krankheiten zu erzeugen.

Die einzige Ausnahme davon machen einige chemische Verbindungen, wie der Salpeter, die Chloralkalien und die schwefelsauren Alkalien, welche zu einem gewissen Theil auf menschliche und thierische Abfälle zurückgeführt werden können. Die ausgezeichneten Untersungen von *Carl Schmidt* und von *Weltzien* über die Trinkbrunnen in Dorpat und Carlsruhe haben diese Thatsache über allen Zweifel festgestellt. Für Berlin ist das Vorkommen von Salpeter und Kalksalpeter im Brunnenwasser schon im vorigen Jahrhundert durch *Rose* nachgewiesen worden; *Pappenheim* und

Ziurek haben es neuerlichst bestätigt, jedoch fehlt es an ausreichenden Untersuchungen. Auf den sehr wechselnden Gehalt an Chlorverbindungen hat besonders *Pappenheim* aufmerksam gemacht; er fand Extreme von 0,056 und von 0,266 Gramme per Litre. Allein er leitete, offenbar ohne zureichenden Grund, diesen Gehalt von dem Erdboden ab, während es viel wahrscheinlicher ist, dass derselbe zu einem grossen Theil auf menschliche Ausscheidungen, namentlich auf durchsickernden Harn zu beziehen ist.

Diese Verunreinigungen des Trinkwassers haben insofern eine nicht zu unterschätzende Bedeutung, als sie eine Neigung zu Diarrhöe hervorrufen und zu schwereren Erkrankungen z. B. in Cholerazeiten beitragen können. Trotzdem sind sie, für sich betrachtet, von weniger entscheidender Bedeutung, und man wird Bedenken tragen müssen, ihnen in Beziehung auf die Erklärung der Mortalität überhaupt oder gewisser Epidemien insbesondere einen bestimmten Werth beizulegen. Indess dienen sie, gleich den Stinkstoffen, als Fingerzeige für gewisse Quellen der Verunreinigung und es wird zugestanden werden müssen, dass ein Gehalt an Salpeter und ein grösserer Gehalt an Chlorverbindungen auf die Möglichkeit hinweist, dass auch andere Stoffe von grösserer Bedeutung, namentlich organische Körper, ihren Weg in das Brunnenwasser finden können.

Nach dem Berichte des Polizei-Präsidiums vom 16. Januar 1866, der uns vorliegt, haben sich die Klagen über die Verschlechterung des Trinkwassers in Berlin seit 40 Jahren, namentlich seit Einführung der Gasbeleuchtung, immer mehr gehäuft. Im Jahre 1864 kannte man unter den öffentlichen Strassenbrunnen, deren Zahl Ende 1865 sich auf 940 Pfosten mit 608 Kesseln belief, 86, welche ungeniessbares Wasser hatten. Davon waren 39 durch Leuchtgas verdorben, 24 durch thierische und 6 durch pflanzliche

Stoffe; 17 hatten einen zu grossen Eisengehalt. Jedoch war nur Ein öffentlicher Brunnen wegen Verunreinigung durch Leuchtgas polizeilich geschlossen. Ueber die etwa 14,400 Privatbrunnen war nichts Genaueres bekannt.

Inzwischen hatte die Sanitäts-Commission für Berlin schon im August 1865 eine bis in's Einzelne gehende Localrecherche über den Zustand der Brunnen und Latrinen und dessen etwaigen Zusammenhang mit der Mortalität in den einzelnen Häusern von 4 Strassen (Garten-, Potsdamer-, Stralauer- und Langestrasse) angeordnet. Der Generalbericht über diese Recherchen ist erst am 18. Juli d. J. vertheilt worden. Es ergiebt sich daraus das bemerkenswerthe Resultat, dass an keiner Stelle eine nachweisbare Verunreinigung der Brunnen durch Latrinenstoffe vorhanden war, obwohl die Beschaffenheit des Brunnenwassers vielfach darauf hinzudeuten schien. Von 171 untersuchten Privatbrunnen hatten 105 gutes, 45 mittelmässiges, 16 schlechtes und 5 sehr schlechtes Wasser. Indess muss bemerkt werden, dass die Untersuchung in einer für den Zweck sehr ungünstigen Zeit, gegen Ende des Jahres 1865 vorgenommen wurde, und dass ausgedehntere chemische Untersuchungen unterblieben. Der erstattete Bericht erklärt, dass auch in Beziehung auf die Gesundheitsverhältnisse der einzelnen Häuser sich nichts ergeben habe. In dieser Beziehung lässt sich jedoch Manches einwenden. Wir beschränken uns darauf hervorzuheben, dass sich in Beziehung auf die Cholera-Epidemie des Jahres 1866 allerdings ein nicht unerhebliches Resultat ergiebt. Die Zahl der Häuser, in welchen Cholera-Erkrankungen vorkamen, war ungleich grösser in der Kategorie der schlechten und sehr schlechten Trinkwasser, als in derjenigen der mittelmässigen und guten, wie folgende Zusammenstellung zeigt:

	Häuser:	darunter Häuser mit Cholera:	
Gutes Trinkwasser	105	44 = 41,9 pCt.	36,6 pCt.
Mittelmässiges -	45	11 = 24,4 -	
Schlechtes -	16	9 = 56,2 -	52,3 pCt.
Sehr schlechtes -	5	2 = 40,0 -	

Zieht man in Betracht, dass jede der 4 Strassen von einer besonderen Commission untersucht worden ist, also nicht überall der gleiche Maassstab für die Classification des Wassers angelegt werden konnte, so ist dies Resultat an sich nicht zu unterschätzen. Beschränkt man sich aber auf die Betrachtung derjenigen beiden Strassen, in welchen die Cholera stärker auftrat, nämlich auf die Stralauer- und Langestrasse, so ist das Ergebniss ungleich auffallender. Hier stellen sich die Zahlen so:

	Häuser:	davon Cholera in:	
Gutes Trinkwasser	63	30 = 47,6 pCt.	45,5 pCt.
Mittelmässiges -	27	11 = 40,7 -	
Schlechtes -	10	6 = 60,0 -	61,5 pCt.
Sehr schlechtes -	3	2 = 66,6 -	

So mager im Ganzen auch diese Thatsachen sind, so genügen sie doch, um darzuthun, dass der Zustand der Privatbrunnen eine aufmerksame Berücksichtigung der Sanitätspolizei verdient. Auch lässt sich nicht verkennen, dass die unzweifelhafte Zunahme in der Verschlechterung des Berliner Brunnenwassers, welches sich sonst eines so ausgezeichneten Rufes erfreute, den Verdacht einer zunehmenden Zufuhr von Stoffen, welche aus Harn, Excrementen und Küchenabfällen herstammen, erregt, wenngleich der unzweifelhafte Nachweis noch nicht geliefert ist.

Darin stimmen jedoch alle Berichte überein, dass die gegenwärtige Einrichtung der Mehrzahl der Abtritts- und Kothgruben in Berlin eine sehr üble ist und einer Abhülfe dringend bedarf. Die beste Desinfection reicht dazu nicht

aus, denn jede Art derselben hat nur für eine gewisse Zeit Einfluss; sie trifft immer nur die zunächst zur Zersetzung geneigten und vorbereiteten Stoffe. Nach einiger Zeit kommen neue Theile zum Zerfall, und wenn dann nicht immer neue Massen desinficirender Stoffe zugeführt werden, so tritt der ungünstige Process doch mit Nothwendigkeit ein. Ueberdies entzieht sich derjenige Antheil der Auswurfsstoffe, welcher sich in das benachbarte Erdreich verbreitet oder gar das Grundwasser erreicht, der späteren Wirkung der Desinfectionsmittel.

Es ist daher unumgänglich nöthig, dass eine häufige Entfernung der Auswurfsstoffe aus den Wohnungen erfolge. Je schneller diese geschehen kann, um so besser. Von diesem Gesichtspunkte aus ist das Tonnensystem dem System der Gruben, das Kanalisationssystem wiederum dem Tonnensystem vorzuziehen. Bei den Gruben ist eine wirksame Controle der Abfuhr an sich unmöglich, ja es ist kaum möglich, eine häufige Entleerung derselben zu fordern, da in diesem Falle die Kosten höher sein würden, als bei dem Tonnensystem.

Die landwirthschaftliche Commission hat sich für ein bestimmtes Tonnensystem nicht entschieden, und wir können uns daher hier enthalten, auf Einzelnes einzugehen. Ihren Vorschlag, sowohl das *Mosselman*'sche als das *Müller-Schür*'sche System genauer zu prüfen, können wir nur empfehlen, und zwar um so mehr, als eine solche Prüfung keine allzu lange Zeit erfordert und als selbst in dem Falle, dass man sich für eine Kanalisation im Grossen entscheidet, immer gewisse Häuser und Gegenden neuer Stadttheile existiren werden, welche nicht sofort dem allgemeinen System angeschlossen werden können. Es wäre daher gewiss sehr zweckmässig, wenn die Verwaltungsbehörden sich

durch eigene Erfahrung ein sicheres Urtheil über den Werth der verschiedenen Methoden bildeten.

Vom sanitätspolizeilichen Standpunkte aus lässt sich an sich gegen ein Tonnensystem nichts sagen. Die Auffangung in Tonnen hindert unzweifelhaft die Verunreinigung des Erdbodens, des Grundwassers und der Brunnen; die schnelle Entfernung und der Wechsel der Tonnen lässt die Zersetzung des in den Tonnen befindlichen Unrathes keine grossen Fortschritte machen; endlich durch Zufügung von Desinfectionsmitteln lässt sich diese Zersetzung, wenn auch nicht absolut hindern, so doch sehr verlangsamen. Auf die Verunreinigung der Abfallröhren können wir ein so grosses Gewicht nicht legen, wie es das *Wiebe*'sche Gutachten thut. Denn auch hier lässt sich durch passende Wahl des Materials und durch geeignete Desinfectionsmittel ohne grosse Kosten der möglichen Gefahr vorbeugen. Der einzige erhebliche Uebelstand besteht in der Schwierigkeit, einen reinlichen Verschluss der Abfallröhren herzustellen, indess lässt sich dieser Uebelstand sehr vermindern, wenn zugleich eine wirksame Ventilation mit den Abfallröhren in Verbindung gebracht wird.

Die Einrichtung von Water-Closets in Verbindung mit einer tiefliegenden Kanalisation leistet jedoch in Beziehung auf die einzelnen Häuser ohne Zweifel das Vollständigste. Die Entfernung der am meisten zur Zersetzung neigenden Stoffe, namentlich des Harns erfolgt sofort, und zwar in einem solchen Zustande der Verdünnung, dass jedes Anhaften grösserer Massen an den Wandungen des Leitungs-Apparates vermieden wird. Die Salubrität der Wohnungen wird auf diese Weise am vollkommensten erreicht, immer natürlich vorausgesetzt, dass genügende Wassermassen zur Verfügung stehen, um die

Verdünnung und Fortführung der Auswurfsstoffe in ausreichendem Maasse sicher zu stellen.

Vom sanitätspolizeilichen Standpunkte aus ergeben sich nur in Beziehung auf einzelne Theile des *Wiebe*'schen Projects und, in gewissem Sinne, der Kanalisationssysteme überhaupt Bedenken:

1) Man hat die Besorgniss ausgesprochen, dass die Wasserverschlüsse, welche das Aufsteigen schädlicher Gase aus den Strassenröhren in die Hausröhren hindern sollen, ihren Zweck nur unvollständig erfüllen werden, dass insbesondere nach einiger Zeit, wenn das in dem Verschlusse befindliche Wasser sich mit den Gasen gesättigt hat, ein Entweichen gegen die Hausröhren hin eintreten werde. Es lässt sich nicht leugnen, dass dieses Bedenken zulässig ist. Indess scheint es uns, dass es erheblich an Gewicht verliert, wenn man erwägt, dass im Innern der Häuser die einzelnen Abschnitte der Röhrenleitung wiederum mit Wasserverschlüssen versehen sind, und dass erfahrungsgemäss die Ableitungsröhren der Küchen u. s. f. bis zum Dache verlängert werden. Jedenfalls wird die heutige Technik Mittel besitzen, um diese Gefahr zu beseitigen. Indess verdient dieser Punkt die ernstlichste Prüfung.

2) Aehnliche Bedenken sind in Beziehung auf die Ventilationsschächte der Haupt- und Sammelkanäle in noch höherem Maasse zu erheben. Die in dem *Wiebe*'schen Plane in Aussicht genommenen Modelle von *Rawlinson*, wo die Luft, bevor sie nach aussen tritt, durch Kohlenkasten steigen muss, scheinen allerdings manche Sicherheit zu bieten, indess wäre doch namentlich zu erwägen, ob nicht bei schnellem Anwachsen des Druckes in den Kanälen, sei es durch ungewöhnlich starken Wasserzufluss bei Regengüssen, sei es durch stärkere Gasentwickelung bei ungewöhnlich hoher Temperatur, alle diese Vorsichtsmaassregeln unzurei-

chend würden. Wir verkennen dabei nicht, dass unter Voraussetzung starken Gefälles und genügender Spülung eine bedeutende Gasentwickelung nicht zu besorgen steht, und dass voraussichtlich kaum so starke Ausströmungen zu erwarten sind, wie sie jetzt an vielen Orten aus den städtischen Kanälen stattfinden und wie sie gewiss auch aus den von der landwirthschaftlichen Commission in Aussicht genommenen Sielen eintreten würden. Andererseits sind doch auch die Erfahrungen über die Wirkung der Kanalisation noch zu neu und die Aussagen der Betheiligten über derartige Ausströmungen unter sich zu widerstreitend, als dass nicht eine besonders sorgfältige Prüfung vorhergehen sollte, bevor man sich entscheidet. Denn man würde sonst möglicherweise auf die Strassen verlegen, was man jetzt auf den Höfen hat.

3) Besonders zahlreich sind die Bedenken, welche in Beziehung auf mögliche Undichtigkeit und Durchdringlichkeit der Kanal- und Röhrenwände geäussert worden sind. Es handelt sich hier nicht sowohl um grosse Brüche und Spalten der Kanäle, welche ja in einem ungleichen, namentlich moorigen Boden vorkommen könnten; diese sind beim Begehen der Kanäle ohne grosse Schwierigkeit zu entdekken. Vielmehr hat man hauptsächlich daran gedacht, dass die menschlichen Auswurfsstoffe, namentlich Harn, bei ihrer Zersetzung einen sehr nachtheiligen Einfluss auf Eisen, Mörtel und selbst Mauersteine ausüben, so dass dieselben unter fortschreitender Oxydation verwittern und auf diese Weise selbst sehr starke und dichte Wandungen nach und nach gelockert, verdünnt und undicht gemacht werden. Man hat sich ferner auf bestimmte Beispiele, namentlich aus England, jedoch auch aus Cöln bezogen, wo derartige Zustände an dem Mauerwerk der Kanäle vorgekommen und die Folge davon das Auftreten schwerer Krankheiten gewesen sei. Glücklicherweise treffen diese Beispiele wenig zu, so wenig, dass

es schwer ist zu begreifen, wie man ihnen einen so grossen Werth hat beilegen können.

Die englischen Beispiele beziehen sich sämmtlich auf ältere Kanalanlagen. Auch *Gairdner* (*Public health in relation to air and water. Edinb.* 1862. *p.* 249—61.), der von *Thorwirth* und seinen Nachfolgern so oft citirt wird, sagt nichts weniger, als das, was scheinbar wörtlich aus ihm citirt wird. Er ist entschiedener Anhänger der Kanalisation, und seine Vorwürfe beziehen sich ausdrücklich auf ältere und schlecht construirte *(ill-constructed)* Kanäle. Herr *Cresy*, der Secretair des *Metropolitan Board of Works* in London, berichtet auf eine besondere Anfrage unter dem 25. April 1866, dass man in alten, schlecht gebauten Kanälen häufig ein Durchschwitzen *(percolation)* finde, zumal in den ursprünglich mit Mörtel gemauerten, wo der Mörtel die Fugen verlasse. Bei der neueren und besseren Construction mit guten Backsteinen *(stock bricks)* und Portland-Cement sei „nie die geringste Spur eines Durchdringens gefunden“. Ja, selbst, wo in alten Kanälen der Mörtel nachgelassen habe, mache in der Regel eine tüchtige Schicht von Portland-Cement den alten Kanal wasserdicht. Aus Hamburg liegt aus der neuesten Zeit ein gleich günstiges Zeugniss vor. Wir meinen daher bei der anerkannten Vortrefflichkeit unseres Materials soweit unbesorgt sein zu können, als überhaupt bauliche Constructionen Dauer versprechen; verwittert selbst hie und da ein Stein, oder löst sich eine Fuge, so kann der Ersatz ohne Schwierigkeit geschehen.

Man könnte aber noch in einer anderen Richtung die Frage von der Durchdringlichkeit der Kanalwände discutiren. Wenn nämlich, wie früher auseinandergesetzt, die Steine für Grundwasser und Bodenfeuchtigkeit soweit durchgängig sind, dass die Kanäle wie Drainröhren wirken und

eine Entwässerung des Bodens bedingen können, so liegt die Betrachtung nahe, dass möglicherweise auch ohne allen Bruch oder Verwitterung durch die Continuität der Steine hindurch ein Ausschwitzen von Kanalflüssigkeiten nach aussen stattfinden, dass, wie bei anderen porösen Scheidewänden, ein gegenseitiger Austausch, gewissermassen eine Exosmose und Endosmose der Stoffe eintreten könne. Käme dies vor, so würde es natürlich ein Gegenstand der ernstesten Besorgniss sein, zumal in einer Stadt, welche einen so feuchten Untergrund und so poröse Bodenschichten besitzt, wie Berlin. Der ganze Untergrund würde sich in einen unterirdischen Sumpf verwandeln; vergiftetes Wasser würde überall zu den Brunnen treten, und der Zustand, den man eintauschte, wäre um Vieles schlimmer, als derjenige, den man aufgeben will. Auch in dieser Beziehung lauten die Nachrichten sowohl aus Hamburg, als aus London durchaus befriedigend. Herr *Cresy* macht dabei die wichtige Bemerkung, das Wasser komme oft mit grossem hydraulischen Drucke hinein, zumal wenn der Kanal tief ist, in welchem Falle der Druck von innen nach aussen in der That sehr gering sei; um das Grundwasser abzuhalten, müsse man ein dickes Bett von Concret (*concrete*) oder Thon (*clay puddle*) anwenden.

Der angeführte Grund ist durchaus plausibel. Bei einem tief liegenden Kanal ist der äussere Druck leicht begreiflich ein sehr hoher, während innen, wo die Flüssigkeiten schnell fortgleiten und zudem ein grosser Theil des Raumes nur mit Luft gefüllt ist, ein sehr geringer Seitendruck ausgeübt wird. Nur bei Hochwasser könnte vorübergehend dieser Seitendruck sehr steigen, indess ist ein solcher Zustand nach unseren meteorologischen Verhältnissen gewöhnlich ein sehr kurz vorübergehender. Auch würde gerade dann das Kanalwasser so verdünnt sein, dass ein

etwaiges Durchschwitzen kaum nachtheilige Folgen haben dürfte.

Immerhin folgt aus dem Mitgetheilten, ein wie grosses Gewicht gerade vom sanitätspolizeilichen Standpunkte aus auf die Vorzüglichkeit des Materials und auf die Genauigkeit der Arbeit gelegt werden muss.

4) Das grösste Bedenken in Beziehung auf die Kanalanlage bezieht sich auf den endlichen Verbleib der aus der Stadt geschafften Stoffe. Das *Wiebe*'sche Project will bekanntlich die flüssigen Stoffe unterhalb Charlottenburg an einer Stelle, welche hinter dem hohen Damm der Hamburger Eisenbahn in einer ganz unbewohnten Gegend liegt, in die Spree laufen lassen, und zwar so, dass sie stets unter der Wasserfläche der Spree aus den Röhren ausströmen. Sand und andere Sinkstoffe sollen vorher in besonderen Sandfängen abgeschieden und später durch eine Art von Baggerung in Flussfahrzeuge gebracht und fortgeschafft werden.

Wir wollen von dem Verbleib dieser Bodensätze nicht sprechen, da auch das Project sich darüber nicht weiter auslässt; es mag genügen, darauf aufmerksam zu machen, dass jedenfalls sehr viele organische Stoffe, insbesondere Küchenrückstände, darunter sein werden und dass auch diesen Absätzen nicht wenig von dem excrementitiellen Charakter des ganzen Kanal-Inhaltes anhaften wird. Aber um so mehr müssen wir die Ueberzeugung betonen, dass es ganz unzulässig erscheint, die gesammte Masse der flüssigen Auswurfsstoffe an einem einzigen Punkte in die Spree zu schütten. Mag auch die Gegend der Einmündung bis jetzt unbewohnt sein, so erreicht die Spree doch bald nachher wieder bewohnte Gegenden, sie berührt Spandau und ergiesst ihr an sich so trübes Wasser in die Havel, welche der Reihe nach eine grössere Zahl bewohnter Ortschaften

berührt. Beide Flüsse haben geringes Gefälle und treten leicht bei Zunahme ihres Wassers über die Ufer, wo sie ihren Schlamm absetzen. Wie stinkend der Spreeschlamm schon gegenwärtig ist, dafür liefern die Wiesen von Moabit jedes Jahr sehr fühlbare Beweise. Wie ganz anders müsste dies auf den Wiesen vor Spandau werden, wenn hier an einem einzigen Punkt der gesammte Schlamm der Metropole, er mag noch so verdünnt sein, ausgeschüttet würde!

In England sind die Klagen über die Verunreinigung der Flüsse so gross und allgemein geworden, dass die ganze Sanitäts-Bewegung dadurch eine andere Richtung genommen hat. Und doch handelt es sich dort meist um grosse Flüsse mit starker Strömung. Selbst in Hamburg hat sich schon jetzt eine solche Verschlechterung des Elb-Bodens in der Nähe der Kanalmündung herausgestellt, dass in dieser Gegend keine Taucherarbeiten mehr vorgenommen werden können.

Bereits in seinem Werke S. 308. hat Geh. Oberbaurath *Wiebe* auf die Möglichkeit hingewiesen, statt des Abflusses in die Spree eine Ueberrieselung einzurichten. In seinem uns vorliegenden Gutachten führt derselbe diesen Gedanken weiter aus, und es lässt sich nicht verkennen, dass auf diese Weise in der That ein Compromiss zwischen den zwei sich entgegenstehenden Richtungen angebahnt werden kann. Wie sich das so modificirte Project vom Standpunkte der Sanitätspolizei stellen würde, können wir zur Zeit nicht beurtheilen. Dies würde erst dann möglich sein, wenn ein bestimmt ausgearbeiteter Plan mit Bezeichnung der zur Ueberrieselung zu wählenden Oertlichkeit uns vorläge.

Wenn wir zum Schlusse auf die uns vorgelegte Frage zurückkommen, ob eine weitere Einleitung der Water-Closets in offene Rinnsteine zu verhindern sei, so können wir

uns in dieser Beziehung nur bejahend aussprechen. Allerdings lässt sich, wie aus unseren früheren Auseinandersetzungen hervorgeht, kein einzelner bestimmter Stoff nachweisen, der von den Rinnsteinen her als Krankheitserreger verbreitet wird. Aber im Wesentlichen gilt für ihren Inhalt, soweit er durch Closet-Zuflüsse gebildet wird, dasselbe, was für Sammel- und Abtrittgruben gilt, höchstens, dass die Menge der festen Stoffe, welche in die Rinnsteine übergehen, etwas geringer und die Zersetzung etwas weiter vorgeschritten ist. Mit Recht ist in einigen Gutachten bemerkt, dass diese unreinen Stoffe sich nicht blos der Luft mittheilen, sondern auch das Erdreich im Umfange der Rinnsteine weit und breit durchdringen, dasselbe feucht erhalten, von da in Brunnen gelangen können u. s. w. Wir theilen daher auch die Meinung, dass eine fernere Einleitung der Closet-Zuflüsse in offene Rinnsteine unzulässig ist.

Dagegen sind wir nicht der Meinung, dass Sammelgruben den üblen Einfluss auf die Rinnsteine nothwendig vermehren. Es kommt hier eben auf die Zeit an, während welcher die Stoffe in der Sammelgrube verweilen. Sehr gewöhnlich, wie aus den Analysen des Dr. *Ziurek* folgt, gehen die Hauptzersetzungen schon in der ersten Sammelgrube vor sich; in der zweiten sind sie geringer, also im Rinnstein offenbar am geringsten. Das für unsere Sinnesorgane Widerwärtige und für die Gesundheit Nachtheilige sind zum grossen Theile nicht die letzten Zersetzungsproducte, sondern vielmehr die in früheren Stadien der Zersetzung sich befindenden Stoffe.

Von den letzten Zersetzungsproducten werden aber viele, wie wir am Schwefelwasserstoff gesehen haben, und wie zum Theil auch vom Ammoniak gilt, durch neue Verbindungen, die sie eingehen, fixirt und aus der weiteren Bewegung ausgeschieden. Geschieht dies schon in den

Sammelgruben, so wird begreiflicher Weise der Zustand der Rinnsteine ein verhältnissmässig günstigerer sein. Geht dagegen bei starkem Nachfluss in die Sammelgrube ein grösserer Theil ihres Inhalts noch unzersetzt oder nur zum Theil zersetzt in den Rinnstein, so werden sich die weiteren Stadien der Zersetzung hier vollziehen, wenn nicht durch kräftige Wasserspülung die Stoffe alsbald weiter befördert werden. Stärkere Spülung der Rinnsteine ist daher dringendes Erforderniss.

Im Uebrigen können wir uns den Ausführungen des *Wiebe*'schen Gutachtens vom 18. April d. J. nur anschliessen. Insbesondere empfehlen wir, den Erlass der projectirten Polizei-Verordnung zu sistiren, bis einzelne der darin gemachten Vorschläge erst im Kleinen praktisch erprobt sind.

Berlin, am 16. October 1867.

Königliche Wissenschaftliche Deputation für das Medicinalwesen.

(Unterschriften.)

Nachtrag

zu dem

Gutachten, betreffend die Reinigung der Stadt Berlin von den Auswurfsstoffen.

Nachträglich ist der Wiss. Deputation eine Verfügung des Herrn Handelsministers vom 10. Sept. d. J. zugegangen, welche Bemerkungen des Geh. Oberbauraths *Wiebe* über den von der Sanitäts-Commission der Stadt Berlin erstatteten Bericht, die vorjährige Cholera-Epidemie betreffend, zu unserer Kenntniss bringt. Da mehrere der darin berührten Gegenstände schon in unserem Gutachten behandelt sind, so können wir uns auf die Besprechung einiger Punkte beschränken.

Der Bericht der Sanitäts-Commission theilt für die einzelnen Reviere, ja zum Theil für die einzelnen Häuser, was in hohem Maasse zu billigen ist, die Aeusserungen der betreffenden Bezirks-Commissionen mit. Allein es ist sehr misslich, ja geradezu unzulässig, diese Aeusserungen als entscheidende anzunehmen. Vergleicht man die Aeusserungen der verschiedenen Commissionen unter einander, so sagen sie öfters das gerade Gegentheil von einander aus. Daher stehen die Ansichten der Königlichen Sanitäts-Commission, welche doch das Gesammtbild der Erfahrungen vor Augen hatte, auch nicht selten in starkem Widerspruche mit den Meinungen einzelner Bezirks-Commissionen. Wir erwähnen in dieser Beziehung namentlich die Erfolge der

Desinfection, über welche sich die *Wiebe*'schen Bemerkungen unserer Ansicht nach in nicht zutreffender Weise höchst ungünstig aussprechen.

Der Bericht enthält eine grosse Zahl von Einzel-Angaben, welche ohne eine ganz in's Einzelne gehende Prüfung nicht angenommen werden dürfen. Selbst die Mittheilung (S. 53) über die Erkrankungen im Cholera-Lazareth der Wallstrasse, welche in Beziehung auf die Wirkung der Cloakengase so sehr entscheidend zu sein den Eindruck machen, erwecken mancherlei Zweifel, welche durch eine Nachfrage bei den Aerzten jener Anstalt bestätigt worden sind. Nach genauester Prüfung des Berichtes können wir leider nicht sagen, dass unser Wissen über die eigentliche Ursache der Cholera durch denselben in irgend einem Punkte wesentlich bereichert worden wäre oder dass der Gang der Epidemie in Beziehung auf ihre Abhängigkeit von der Zersetzung menschlicher Auswurfsstoffe durch denselben eine wissenschaftlich genügende Aufklärung erhalten hätte.

Von grosser Bedeutung ist der Bericht dadurch, dass er die örtlichen Verhältnisse der Epidemie in einer früher nicht erreichten Klarheit darstellt und dadurch für die weitere Vergleichung und Untersuchung bestimmte Anhaltspunkte gewährt. So ist allerdings die ungewöhnlich schwere Erkrankung der neugebauten Stadttheile ein Gegenstand von besonderer Bedeutung, und die von dem Geh. Rath *Wiebe* angeregte Frage, ob in der Nähe Ablagerungsstätten von Cholera-Excrementen gelegen haben, verdient eine weitere Nachforschung.

Was die einzelnen Häuser betrifft, so hat die von Hrn. *Wiebe* angezogene Bemerkung der 24. Commission (S. 58), dass die obersten Stockwerke von der Epidemie besonders getroffen worden seien, nach der auf S. 50 befindlichen Zusammenstellung keine allgemeine Gültigkeit, und es kann

daher auch nicht als bewiesen angenommen werden, dass das Stehenbleiben der Excremente die Schuld davon trage. Dass die Bewohner von Hofgebäuden verhältnissmässig seltener erkrankt seien, als die von Vordergebäuden, ist nur scheinbar richtig. In vielen Häusern bewohnen dieselben Familien Vorder- und Hintergebäude; alle diese werden aber in der Statistik der Sanitäts-Commission den Vordergebäuden zugerechnet. Manche Häuser haben überhaupt keine Hintergebäude. Endlich bemerkt aber der Bericht ausdrücklich, dass bei allen in den Lazarethen Verstorbenen die bezüglichen Angaben fehlten (S. 50), und da dies gerade die ungünstiger gestellte Gruppe ist, so ist es sehr wahrscheinlich, dass bei einer genaueren und umfassenderen Aufstellung ein ganz anderes Resultat hervortreten würde.

Die dritte, von Hrn. *Wiebe* aufgestellte Kategorie, nehmlich die starke Erkrankung in den Erdgeschossen der Hofgebäude, widerstreitet zum Theil direct der ersten, nehmlich der verhältnissmässig starken Erkrankung in den obersten Stockwerken. Gestehen wir sie aber auch als thatsächlich zu, so lässt sich doch nicht verkennen, dass noch manche andere ungünstige Verhältnisse ausser der Exhalation von Cloakengasen hier in Betracht kommen, deren Klärung jedoch das in dem Berichte vorliegende Material nicht gestattet.

In Beziehung auf die Water-Closets enthalten die Tabellen der Sanitäts-Commission bei den einzelnen Häusern leider keine speciellen Angaben; in der Tabelle XX. ist nur das Vorhandensein der Wasserleitung constatirt. Gewiss wäre es sehr wünschenswerth, wenn diese Lücke noch nachträglich ausgefüllt würde. Immerhin ist das Resultat (S. 48) sehr bemerkenswerth, dass von den mit Wasserleitung versehenen Häusern nur 19,9, von den übrigen dagegen 27,8 pCt. Cholerafälle aufwiesen. Nur wird man nicht übersehen dür-

fen, dass die mit Wasserleitung versehenen Häuser meist auch sonst besser eingerichtet und von einer besseren Bevölkerung bewohnt sind, und dass daher ihre grössere Immunität nicht allein der Wasserleitung zuzuschreiben ist. Ausserdem kommt hier der Einfluss des Trinkwassers mindestens ebenso sehr in Betracht, wie der Einfluss der Water-Closets.

Auch die besondere Erwähnung der Charité in Beziehung auf ihre Einrichtung mit Water-Closets entscheidet nichts. Denn schon in der Epidemie von 1848, wo die Water-Closets noch nicht bestanden und wo eine überaus grosse Zahl von Cholerakranken in die Charité aufgenommen wurde, sind nur 5 Fälle von Erkrankung im Krankenhause angezeigt worden. Am wenigsten aber kann der Hinweis auf den nahen, fast stille stehenden Graben, in welchen die Abzugskanäle der Charité münden, als ein Beweis für die günstige Wirkung der Verdünnung gelten. Wäre dies der Fall, so könnte man schliessen, dass es unschädlich sein würde, wenn sämmtliche Excremente der Stadt Berlin in die Spree geleitet würden. Denn der Zustand jenes Grabens, namentlich im Sommer, entspricht den schlimmsten Schilderungen, welche englische Beobachter von der Verunreinigung einzelner Flüsse ihres Vaterlandes als abschreckendes Beispiel entwerfen.

Wenn wir daher in wesentlichen Punkten von den Schlussfolgerungen abweichen, welche Hr. *Wiebe* aus dem Berichte der Sanitäts-Commission gezogen hat, so müssen wir auf der anderen Seite anerkennen, dass seine Bemerkungen fast überall Gegenstände betreffen, welche nach den vorliegenden Thatsachen eingreifende Aenderungen im sanitätspolizeilichen Interesse erheischen. Lässt sich auch nicht so weit, wie er es will, der Einfluss der örtlichen Zustände auf den Gang der Epidemie in klare Verhältnisse auflösen,

so zeigt doch die unverhältnissmässige Ausbreitung und Heftigkeit der Epidemie, sowie ihre auffallende Concentration auf gewisse Gegenden, dass nicht etwa allgemeine Einflüsse des Wetters oder der Genius epidemius die alleinige Ursache einer so grossen Calamität waren, sondern dass örtliche Bedingungen von entscheidender Wichtigkeit vorhanden sein müssen. Auch wir vermuthen nach allgemeinen Erfahrungen, dass der ungeregelte Zustand des Latrinenwesens ein wesentliches Stück dieser örtlichen Bedingungen darstellt; nur können wir es im Einzelnen nicht weiter nachweisen, als es schon in dem allgemeinen Gutachten geschehen ist. Pflicht der Sanitäts-Polizei bleibt es, diese Einzelforschung mit Sorgfalt fortzusetzen und schon jetzt alle Vorsichtsmaassregeln zu ergreifen, um der Wiederkehr einer ähnlichen Calamität vorzubeugen. Die von Hrn. *Wiebe* empfohlene stärkere Wasserversorgung ist in dieser Beziehung gewiss von grösster Bedeutung.

Berlin, am 16. October 1867.

Königliche Wissenschaftliche Deputation für das Medicinalwesen.

(Unterschriften.)

Zusätzliche Bemerkungen

zu den beiden vorstehenden Gutachten

von

Rud. Virchow.

Die allseitige Aufmerksamkeit und die überaus rege Arbeit, welche den in den vorstehenden Gutachten besprochenen Fragen in der letzten Zeit zugewendet worden sind, bedingen in ganz naturgemässer Weise einen häufigen Wechsel der Standpunkte. Jedes concurrirende Interesse, jede selbständige Arbeit bringt einen neuen Standpunkt für die Beurtheilung. Der Steuerzahler hat einen anderen Maassstab, als die Verwaltung; der Hauswirth sieht die Sache anders an, als die Polizei. Aber auch die Landwirthschaft hat andere Interessen, als die öffentliche Gesundheitspflege; die Chemie schiebt andere Seiten der Betrachtung in den Vordergrund, als die Biologie. Erst allmählich, theils im Kampfe, theils im Zusammenwirken, werden die höheren versöhnenden Gesichtspunkte gefunden, welche als der Ausdruck der wissenschaftlichen Ueberzeugung des Zeitalters gelten können.

Nirgend hat sich diess in so schroffer Weise gezeigt, wie in Berlin. Viele Jahre hindurch ist es, genau genommen, nur die Frage nach der zweckmässigsten Art der „Entwässerung", wie man bei uns zu sagen pflegt, gewesen, welche die Veranlassung zu Untersuchungen und Entwürfen wurde. Man wünschte Einrichtungen zu treffen, durch welche

das Wasser der meteorischen Niederschläge, sowie das aus den Häusern den Strassen zugeführte, vielfach verunreinigte Wasser so schnell und vollständig, als möglich, entfernt werden könne. Für massenhafte Regenfälle waren die Rinnsteine und Siele, für gewöhnliche Verhältnisse das Gefälle und das zuströmende Wasser vielfach unzureichend. So kam es, dass die Rinnsteine immer tiefer eingeschnitten werden mussten, dass in Folge davon der für den Verkehr bleibende Theil der Strassen immer mehr beengt und die Gefahr immer mehr gesteigert wurde, und dass trotzdem ein befriedigender Zustand sich nicht herstellen liess. Schon frühzeitig hatte man eingesehen, dass es für eine gute Spülung der Rinnsteine nöthig sei, über grössere Wassermassen verfügen zu können, als sie in gewöhnlichen Zeiten vorhanden waren, aber auch die neue Wasserleitung erwies sich als unzureichend.

Da kam endlich das Project der Kanalisation, welches sowohl Gefälle, als Wasser zur Spülung in genügendem Maasse nachwies. Aber dieses Project, welches eine Ausgabe von vielen Millionen für einen, bis dahin ziemlich gering geachteten Zweck in Aussicht nahm, erregte durch seine finanziellen Ansprüche die höchste Aufregung in der Bürgerschaft; es wurde eine Zeitlang Parteifrage, ob man für oder gegen Kanalisation stimmen wolle.

Die Agitation wurde mächtig gefördert durch die eben so bestimmte, als mit grossem Geschick und geistvoller Zusammenstellung von Thatsachen ausgeführte Darstellung, welche zunächst vom agriculturchemischen, sodann auch vom volkswirthschaftlichen Standpunkte aus gegen die Kanalisation geliefert wurde. Zu den grossen Baukosten geselite sich in der Vorstellung der unwiederbringliche Verlust der für die Landwirthschaft werthvollsten Stoffe, welche mit dem Wasser fortgespült werden, und deren Werth nach der Rechnung der Agriculturchemiker eine sehr beträchtliche Jahresrente darstellte.

So erlangte die „Abfuhr“ in der öffentlichen Meinung eine weit überwiegende Bedeutung. Aber diese Bedeutung war eine rein theoretische. Jeder praktische Versuch, der bei uns gemacht wurde, blieb in den Anfängen stecken. Dem Angebot entsprach die Nachfrage keineswegs, und wenn es eine Zeit lang den Anschein hatte, als werde durch die Abfuhr die Stadt oder der einzelne Hauswirth noch eine Rente gewinnen können, so stellte sich sehr bald die Forderung dahin, dass auch die Abfuhr nur gegen eine Entschädigung ausgeführt werden sollte. Nicht, wie man erwartet hatte, die Landwirthschaft sollte oder wollte die Kosten der Abfuhr übernehmen, sondern die Bürgerschaft sollte auch hier eintreten. Die Finanzfrage complicirte sich dadurch. Wenn sowohl die Kanalisation, als die Abfuhr durch finanzielle Aufwendungen herzustellen sind, wenn jene ein grosses Anlage-Capital, diese eine nicht unbeträchtliche Jahres-Ausgabe nothwendig macht, so fragt sich der Steuerzahler mit Recht, welche von diesen beiden Alternativen auf die Dauer kostspieliger sein wird.

Am allerletzten tritt bei uns die öffentliche Gesundheitspflege in die Discussion ein. Noch gegenwärtig ist der Sinn unserer Bevölkerung so wenig für diese Seite der Frage offen, dass selbst bei Gebildeten zuweilen eine abschreckende Gleichgültigkeit, um nicht zu sagen, Rohheit der Anschauung bemerkbar wird. Unsere Bevölkerung ist in dieser Richtung ihrer grossen Mehrheit nach geradezu fatalistisch. Die Krankheit kommt, ein Glied der Familie oder mehrere werden dahin gerafft, man beweint sie, — und man vergisst, wenn nicht sie, so doch meistens die Ursache ihrer Krankheit. Von Zeit zu Zeit erhält ein Haus die Bezeichnung eines Cholerahauses; eine Zeit lang fehlen die Miether, — endlich füllen sich die Räume wieder, als wäre nichts vorgegangen.

Und doch hat selbst dieser Theil der Betrachtung seine finanzielle Seite. Staat und Stadt erhalten ihren Werth nur durch die Menschen und ihre Arbeit. Aller Reichthum, alle Bedeutung der Stadt, wie des Staates, beruht in letzter Instanz auf der Thätigkeit ihrer Bewohner. Kann es daher einen grösseren Verlust geben, als den Verlust an Menschenleben? Repräsentirt nicht jeder Todesfall eines arbeitsfähigen Menschen einen finanziellen Verlust? Bringt nicht jede Krankheit, die ein arbeitsfähiges Glied der Gesellschaft ausser Thätigkeit setzt, Nachtheile, die in Geldeswerth zu veranschlagen sind? Man braucht sich gar nicht auf den humanen oder auf den christlichen oder überhaupt auf den religiösen Standpunkt zu stellen; rein volkswirthschaftlich betrachtet, sind Krankheit und Tod für die Familie, wie für die Gemeinde und den Staat Unglücksfälle. Sie so weit als möglich fernzuhalten, ist eine der ernstesten Aufgaben, welche nur da verkannt werden kann, wo Menschenleben überhaupt nichts werth ist.

Leider ist diese Art der Betrachtung bei uns noch so neu, dass es mir in der letzten Session des Abgeordnetenhauses begegnete, von einem der bekanntesten Volkswirthschafts-Prediger deswegen verspottet zu werden. Jeder neue Gedanke bedarf einiger Zeit, ehe er sich Geltung verschafft. Auch in der Militair-Verwaltung hat es eine Zeit gegeben, wo man den Verlust eines Pferdes höher veranschlagte, als den eines Menschen, weil man Pferde kaufen musste und Menschen umsonst zu haben waren. Umsonst? Konnte man wirklich vergessen, was die Erziehung eines Menschen kostet, was der Verlust eines Menschen an verlorener Arbeit werth ist? Fast sollte man glauben, die Menschen wären nur dann geldeswerth, wenn sie Leibeigene oder Sklaven, aber nicht, wenn sie freie Bürger oder Unterthanen sind. Sonderbare Verwirrung der Begriffe!

Woher kommt diese Schwerfälligkeit in der geistigen Entwickelung bei uns, sobald es sich um grosse öffentliche Fragen handelt? Meiner Meinung nach daher, dass wir diesen Fragen niemals ernstlich auf den Leib gehen. Uebelstände, wie sie in Berlin bestehen, hätten in England, in Amerika, ja selbst in Frankreich längst zu thätigem Eingreifen, zu praktischen Versuchen geführt. Was lag näher, als wenigstens die Abfuhr, wenn auch mit Unterstützung durch städtische oder staatliche Mittel, einmal in einem gewissen Umfange zu experimentiren? Man konnte ja die verschiedenen Systeme neben oder nach einander anwenden, ihre Ausführbarkeit prüfen, ihre Erträgnisse feststellen, ihre finanzielle Bedeutung vergleichen, und so eine Unterlage für die Rechnung gewinnen. Was hinderte, dass man das Grundwasser und die Bodenverhältnisse der Stadt studiren liess, zu deren Ergründung doch Jahre lange Arbeit gehört, und deren Kenntniss nicht bloss für die Kanalisation, sondern für die Anlegung von Brunnen, für die Feststellung des Baugrundes, für die Erforschung der Krankheiten, insbesondere der epidemischen, von höchster Bedeutung ist? Was erscheint dringlicher, als dass wir genaue tägliche und wöchentliche Listen über die Erkrankungen und Todesfälle haben? Aber wir beobachten wohl das Wetter, aber nicht den Gang der Krankheiten. Nicht einmal aus unseren grossen Krankenhäusern erhalten wir rechtzeitig und regelmässig Nachrichten über die Vorkommnisse. Nirgends ist ein positiver Anfang des Arbeitens zu sehen. Wir schrecken schon vor dem Versuche zurück, und wenn wir uns entscheiden sollen, so blicken wir nach auswärts, um zu sehen, was man dort erfahren hat.

Das Gutachten der Wissenschaftlichen Deputation hat diese Hülflosigkeit leider vielfach constatiren müssen. Ueberall fehlt es für ein wissenschaftliches Urtheil an eigenen,

zuverlässigen, zahlen- und erfahrungsmässigen Unterlagen. Möge das Gutachten wenigstens den Erfolg haben, dass man sich nunmehr ernsthaft daran mache, diese Unterlagen zu schaffen, welche ohne eine kräftige Theilnahme der Behörden nicht zu gewinnen sind. Der Hinweis auf das, was in New-York eine Zahl von Aerzten in freier Thätigkeit geschaffen hat, passt nicht für unsere Verhältnisse. Unsere Aerzte sind nicht so gestellt, dass sie ihre Zeit anhaltend zu derartigen Beschäftigungen hingeben können. Ueberdiess darf man doch auch wohl sagen, dass, wenn überhaupt irgend eine Sache den Behörden zufällt, diese ganz vorwiegend ihrer Fürsorge zuzuweisen ist.

Die öffentliche Gesundheitspflege, oder, wie man bei uns sagt, die Sanitätspolizei hat mit der finanziellen Betrachtung der Frage wenig zu thun. Sie kann nur so ernst und dringend, als möglich, auf den Werth des gesunden Menschenlebens überhaupt hinweisen. Der Staat, welcher die allgemeine Bildung anstrebt, die allgemeine Schulpflicht aufstellt, sollte auch die allgemeine Gesundheit anstreben. Erst Gesundheit, dann Bildung! Kein Geld ist rentabler angelegt, als dasjenige, welches für die Gesundheit aufgewendet wird. Möge man das nie vergessen, wenn es sich darum handelt, mit der Landwirthschaft abzurechnen! Die Rücksicht auf die öffentliche Gesundheitspflege muss stets leitender Gesichtspunkt bleiben, wenn es sich um die Entscheidung zwischen Abfuhr und Kanalisation handelt.

Bevor man sich in Berlin entscheidet, wünsche ich allerdings lebhaft, dass man einen nennenswerthen Versuch mit der Abfuhr mache. Die Ausführung der Kanalisation, selbst wenn sie beschlossen wird, kann nur langsam erfolgen; Jahrzehnte werden darüber vergehen, ehe sie fertig wird. Inzwischen werden neue Stadttheile heranwachsen,

und es ist vielleicht fraglich, ob sie alle zu dem jetzt zu beschliessenden Kanalsystem herangezogen werden können. Jedenfalls wird es noch auf lange Zeit hinaus an städtischen Bezirken nicht fehlen, welche auf die Abfuhr angewiesen sind. Also mache man so bald als möglich Versuche, um das beste und einträglichste Abfuhrsystem zu finden.

Handelt es sich aber um die Rechnung, so übersehe man nicht, dass das jetzige System von Rinnsteinen, Sielen und Kanälen trotz seiner Grösse und Kostbarkeit doch unhaltbar ist, dass also auch neben der Abfuhr ein neues Kanalsystem eingerichtet werden muss. Auch dieses System muss, schon um Gefälle und Raum zu bekommen, tiefgelegt werden; es muss also bis zu einem gewissen Maasse dem *Wiebe*'schen Plane entsprechen. Somit kommt ein neues finanzielles Moment in Beziehung auf die Abfuhr in Betracht.

Der Versuch, Abfuhr und Kanalisation im Grossen neben einander herzustellen und wirken zu lassen, ist in Paris in kolossalem Umfange gemacht worden. Meiner Meinung nach ist er missglückt. Der Kaiser, persönlich den Interessen der Landwirthschaft zugeneigt, hat Alles daran gesetzt, der letzteren zu erhalten, was zu erhalten möglich war. In der That hat die „Stadthauptkasse" dadurch eine Jahresrente von 300,000 Frcs., aber diese zahlt nicht die Landwirthschaft, sondern die Hauswirthe von Paris, welche für die Abfuhr den betreffenden Gesellschaften einen so hohen Betrag entrichten müssen, dass jene 300,000 Frcs. als ein „Ueberschuss" an die Municipalkasse zurückfliessen können. Ursprünglich sollten die Kanäle (*égouts*) von Paris ganz frei von Auswurfsstoffen gehalten werden. Aber man hat eine Concession nach der anderen machen müssen, und schon jetzt geht der für die Landwirthschaft werthvollste Theil der Auswurfsstoffe in die Kanäle und von da in die Seine.

Ich habe im vorigen Herbst sowohl die Egouts, als das Dépotoire von la Villette besucht und genau studiren können. Gegenwärtig gelangen durch die Ausfuhr nach la Villette fast nur die festen Stoffe, während der Harn und die sonstigen Flüssigkeiten den Egouts zugeführt werden. Man ist eben beschäftigt, unter jedem Hause einen sogenannten Diviseur aufzustellen, d. h. einen hohlen Doppelcylinder aus Eisenblech, dessen inneres Rohr durchlöchert ist und die sämmtlichen Auswurfsstoffe des Hauses aufnimmt. Durch dieses Filtrum werden die festen Theile von den flüssigen getrennt, welche letzteren sofort abfliessen und unmittelbar in den Egout fallen. Natürlich ist diess nicht bloss Harn, sondern auch ein grosser Theil der durch den Harn ausgelaugten und in Zersetzung begriffenen Fäcalstoffe. Im Laufe von 18 Monaten waren auf diese Weise schon 2000 Häuser mit Diviseurs versehen worden.

Man ist also in Paris in voller Revolution oder, wenn man lieber will, Reform. Das gemischte System (Abfuhr und Kanalisation) nähert sich dem einfachen Systeme der Kanalisation. Während an einzelnen Theilen der grossen Stadt die Kanäle erst gebaut werden, errichtet man an anderen jene Filtrations-Apparate, um sie vielleicht auch bald ganz aufzugeben. Genau genommen, ist also eigentlich gar kein „System" mehr vorhanden. Ich betone dies besonders denjenigen deutschen Schriftstellern gegenüber, welche sehr gelehrte Abhandlungen über die Pariser Einrichtungen schreiben und die Citate dazu aus den verschiedensten Autoren bis vor *Parent-Duchatelet* entnehmen. Es entsteht dadurch eine Darstellung, welche sich zu der Wirklichkeit verhält, wie eine Fricassée zu einem Kalbsbraten.

Die französische Art des Experimentirens ist wahrscheinlich die kostspieligste, welche erfunden werden kann, und ich warne recht eindringlich davor, sie bei uns zu wieder-

holen. Je länger und je sorgfältiger ich diese Frage studirt habe, um so mehr hat sich bei mir die Ueberzeugung befestigt, dass wir nur bei einer systematischen Kanalisation finanziell und gesundheitlich gut fahren werden. Und darum rathe ich dazu, bei Zeiten die Einzelheiten der Frage von der Kanalisation sorgsam zu prüfen, die nöthigen Ermittelungen (Nivellement, Grundwasserbestimmung, geologische Untersuchung, Wasserzufluss) rechtzeitig zu beginnen, und die in dem Gutachten der wissenschaftlichen Deputation bezeichneten vier Punkte einer besonderen Erwägung, wo möglich unter experimenteller Controle, zu unterstellen.

Was die Exhalationen des Kanalwassers anbetrifft, so habe ich mich sowohl in Hamburg, als in Paris davon überzeugt, dass die Kanalluft im Allgemeinen jene für den Geruch empfindlichen Eigenschaften nicht besitzt, welche ihr so oft zugeschrieben werden. Allerdings gab es in den Pariser Egouts einzelne Abschnitte, in denen ein sehr übler Geruch herrschte, allein dies war immer nur in kleinen Strecken der Fall und hing wahrscheinlich mit der Einrichtung der Diviseurs zusammen. Hier fehlt es eben an dem nöthigen Wasser zur Verdünnung der Auswurfsstoffe. Bedenkt man jedoch, dass die Wassereinflüsse von den Strassen durch weit offene Luftlöcher stattfinden, und dass daher auch umgekehrt eine starke Ausströmung von Luft aus den Kanälen nach den Strassen erfolgen muss, so wird schon derjenige, welcher nur das oberirdische Paris kennt, zugestehen müssen, dass von einem starken Geruche wenig wahrzunehmen ist. Dies Verhältniss lässt sich überdies durch zweckmässigere Anlagen sehr erheblich verbessern.

Die Durchdringlichkeit der Kanalwandungen ist überall zugestanden. Am meisten habe ich mich davon bei einer Begehung der eben im Bau begriffenen Kanäle zu Frankfurt a. M. überzeugen können, welche ich unter Leitung des

berühmten Fachtechnikers Hrn. *Lindley* und anderer Herren bei Gelegenheit der letzten Naturforscher-Versammlung vornahm. Das Grundwasser drang so reichlich durch das Mauerwerk, dass sich auf der Kanalsohle ein kleiner Bach gebildet hatte, auch wo noch gar keine Einleitung auf anderen Wegen erfolgt war. Allerdings drang ein Theil des Wassers, wie es schien, durch die Steine selbst, indess war dies offenbar der geringste. Die Hauptmasse kam durch die Fugen, obgleich dieselben mit „gutem“ Cement verkittet waren. Das Wasser löste einen Theil des Kalkes auf, der sich nachher als weisser, hie und da stalaktitenförmiger Absatz wieder an den Wänden niederschlug. An einzelnen Stellen hatten sich selbst kleine Vertiefungen und Löcher in den Fugen gebildet, doch schienen diese nirgend ganz durchzudringen.

Dieser Umstand hat unzweifelhaft etwas Bedenkliches an sich, insofern die Möglichkeit, dass nachher auch von innen nach aussen eine ähnliche Penetration erfolge, nicht ganz ausgeschlossen werden kann. Freilich sind in diesem Punkte alle Techniker einer und derselben Meinung; sie leugnen aus ähnlichen Gründen, wie der im Gutachten angeführte Hr. *Cresy*, das Eintreten eines solchen Falles. Auch sind die Hamburger Erfahrungen, wo man einzelne Kanäle äusserlich freigelegt hat, um den Zustand der Umgebungen zu prüfen, durchaus beruhigend. Nichtsdestoweniger scheint es mir, dass in einem Boden, wie der unserige, wo die Kanäle unmittelbar in das Grundwasser-Terrain gelegt werden müssen, mehr als anderswo zu fürchten ist, und ich denke, dass gerade in dieser Beziehung die sorgfältigste Prüfung angestellt werden sollte.

Endlich die Ueberrieselung. Der Plan des Hrn. *Wiebe* erscheint fast unmöglich, wenn nicht eine andere Art der schliesslichen Verwendung des Kanalinhaltes gefunden wird, als der einfache Einlass des Adelswassers in die Spree. Nun

bieten sich allerdings zwischen Charlottenburg und Spandau allerlei sandige Flächen dar, welche zur Ueberrieselung verwendet werden können. Es wird sich zunächst fragen, ob sie gross genug sind und ob bei fortschreitender Bebauung nicht auch dort die menschlichen Ansiedelungen sich in kurzer Zeit bis in eine zu grosse Nähe heranschieben werden. Auch ist zu untersuchen, ob der Winter nicht eine zu grosse Unterbrechung und damit eine nicht zu überwindende Schwierigkeit herbeiführen wird. Im Uebrigen lässt sich nicht leugnen, dass die neuesten englischen Ermittelungen überzeugend dargethan haben, dass durch eine geeignete Ueberrieselungsfläche eine ausreichende Filtration des Adelswassers möglich wird. Die finanzielle Frage ist auch hier untergeordnet, wenngleich mit Rücksicht auf die Erträge der überrieselten Flächen an Gras nicht ganz zu vernachlässigen.

Gegenüber der Ueberrieselung ist neuerlich ein sehr wichtiger Vorschlag gemacht worden, dessen Bedeutung vielleicht ganz durchschlagend ist; ich meine die Methode des Hrn. *Süvern*, der durch Zusatz von chemischen Mitteln (Chlormagnesium, Kalk und Steinkohlentheer) die Adelswasser nicht nur geruchlos macht, sondern auch durch Niederschlag der festen Stoffe vollständig klärt und zugleich in den Niederschlägen einen grossen Theil der nutzbaren Stoffe sammelt. Indem an den Einfluss-Oeffnungen der Kanäle ein stetiger Strom dieser Mittel in Lösung eingeleitet wird, erzeugt man einen weichen, flockigen Niederschlag in dem Kanalwasser, der das Fortfliessen der Flüssigkeit nicht hindert, der im Gegentheil mit fortgeführt wird und sich erst in den Sammelbassins am Ausflussende absetzt, hier herausbefördert und dann zu Zwecken der Landwirthschaft verwendet werden kann. Nach praktischen Versuchen, die kürzlich in Leipzig angestellt worden sind, scheint dieses Verfahren auch für grosse Leitungen brauchbar und finanziell

durchführbar zu sein, und ich kann daher nur auf das Lebhafteste den bei unseren städtischen Behörden gemachten Antrag befürworten, dass auch bei uns Versuche im Grossen damit angestellt werden möchten. Vielleicht gelingt es so, über den meiner Meinung nach sehr kitzlichen Punkt der Ueberrieselung hinwegzukommen und doch den doppelten Zweck zu erreichen, unsere Flüsse rein zu erhalten und der Landwirthschaft nutzbare Stoffe zu schaffen.

Es kommt hier noch ein besonderer Umstand mit in Betracht. Gerade im Laufe der letzten Zeit hat sich die Meinung immer mehr verbreitet, dass die Keime der meisten epidemischen Krankheiten und daher auch die der Gesundheit schädlichen Stoffe weniger die eigentlichen Zersetzungsproducte, als vielmehr die Zersetzungs-Erreger (Fermente) seien. Man hat bei immer mehr Krankheiten mikroskopische Pilze nachgewiesen, von welchen man annimmt, dass sie sowohl die Zersetzung der Stoffe, als auch die Erkrankung des menschlichen Körpers bedingen. Die Zersetzung würde nach dieser Auffassung also nur die Bedeutung haben, einen günstigen Boden für die Entwickelung und das Wachsthum jener kleinen Pflänzchen zu schaffen, welche nachher in und an den menschlichen Leib gelangen und hier Krankheit und Todesgefahr bringen.

Meiner Meinung nach sind die bekannten Thatsachen nicht ausreichend, um diese Meinung schon gegenwärtig als unzweifelhaft bezeichnen zu können. Aber es lässt sich nicht leugnen, dass die Erscheinungen der Gährung (Fermentation), wie ich seit langer Zeit behauptet habe, die nächste Analogie mit denen vieler contagiösen Krankheiten darbieten, und jedes Verfahren, welches gährungswidrig und pilztödtend (oder pilzlähmend) wirkt, muss uns daher mehr geeignet erscheinen, die Krankheit zu verhüten, als dasjenige, welches nur verdünnend wirkt. Giebt es Cholera-

pilze, so wird die Verdünnung ihnen weniger schaden, als ein chemisches Mittel, welches sie unmittelbar angreift. Daher erklärt sich die steigende Vorliebe für die Desinfektion und zwar für die Desinfektion durch die stärkeren chemischen Stoffe. Eisenvitriol erscheint von diesem Standpunkte aus schlechter, als übermangansaure Salze. Können wir aber Beides verbinden: die chemische Wirkung und die Verdünnung, so wird damit unzweifelhaft das Höchste erreicht, was wir auf dem gegenwärtigen Standpunkte erstreben können. Denn die Verdünnung wirkt der Zersetzung und damit sowohl der Bildung schädlicher Stoffe, als der Entwickelung neuer pilzlicher Organismen entgegen, und sie ist insofern von grossem Nutzen. Die chemisch differente Substanz aber tödtet oder lähmt den Pilz und bindet die zersetzungsfähigen Stoffe.

Zum Schlusse bemerke ich noch, dass jede Untersuchung unvollständig sein würde, die sich nicht zugleich eingehend mit der Frage des Trinkwassers beschäftigt. Eine tiefgehende Kanalisation, welche stark entwässernd wirkt, wird vielleicht zahlreiche Brunnen unserer Stadt trocken legen, und es ist die Frage, ob dieselben sich durch Tieferlegung ohne zu grosse Kosten wieder füllen lassen werden. Auch aus anderen Gründen ist eine verstärkte Wasserversorgung der Stadt von ausserhalb sofort ins Auge zu fassen. Schon jetzt ist die vorhandene Wasserleitung kaum noch zu weiteren Leistungen fähig, und selbst der Ort, wo sie ihr Wasser schöpft, wird mehr und mehr gefährdet. Sorgen wir daher, dass mit der Kanalisation zugleich eine vermehrte Zufuhr von trinkbarem Wasser der Stadt gesichert werde.

Gedruckt bei Julius Sittenfeld in Berlin.

NOTICE

SUR LES

MESURES DE PRÉSERVATION

PRISES A BATNA (ALGÉRIE)

PENDANT

LE CHOLÉRA DE 1867

ET SUR LEURS RÉSULTATS

PAR

E.-I. DUKERLEY,

MÉDECIN MAJOR DE 1re CLASSE,
CHEVALIER DE LA LÉGION D'HONNEUR,
OFFICIER D'ACADÉMIE,
MEMBRE DE PLUSIEURS SOCIÉTÉS SAVANTES.

AVEC UNE CARTE GRAVÉE INDICATIVE DU TERRITOIRE PRÉSERVÉ.

PARIS
ADRIEN DELAHAYE, LIBRAIRE-ÉDITEUR
PLACE DE L'ÉCOLE-DE-MÉDECINE

1868

A. Parent, imprimeur de la Faculté de Médecine, rue Mᵍ-le-Prince, 31.

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SUR LES

MESURES DE PRÉSERVATION

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LE CHOLÉRA DE 1867

ET SUR LEURS RÉSULTATS

I.

Exposé sommaire du sujet.

La plupart des auteurs qui se sont occupés des mesures préventives à opposer aux épidémies cholériques, s'accordent à regarder les cordons sanitaires et les quarantaines terrestres comme d'un établissement absolument impossible ou extrêmement difficile.

Cette proposition étant d'une incontestable vérité pour tous nos pays d'Europe, il en est résulté que les moyens de cette nature n'ont, pour ainsi dire, jamais été appliqués dans les États civilisés avec la méthode et la rigueur voulues pour faire juger du degré réel de leur utilité.

La question de leur efficacité est donc restée à peu près tout entière, et elle ne pouvait en effet être résolue, ou tout au moins notablement éclairée, que dans un pays où le peu de densité des populations, la rareté de leurs communications réciproques, le peu d'importance des intérêts à ménager, les moyens d'action à la disposition des autorités, etc., etc., permettraient de rendre un tel système d'isolement à la fois aussi efficace que possible

pour la préservation publique, et aussi peu gênant que possible pour les transactions commerciales.

Ces conditions, aussi nécessaires que rares, ayant paru, au début de l'épidémie cholérique de 1867, se rencontrer dans la petite partie du cercle de Batna qui comprend la ville de ce nom et ses annexes, on a été conduit à instituer sur ce territoire tout un ensemble de mesures et de précautions, basées sur l'hypothèse de la transmissibilité (1) du choléra par les relations humaines, et ayant pour triple objet :

1° De restreindre le plus possible les communications du territoire à protéger avec les pays infectés ;

2° De n'y laisser arriver, là où des relations devaient être conservées, que des personnes reconnues dégagées de toute influence épidémique ;

3° De rendre les exceptions et les infractions prévues et inévitables aux mesures précédentes aussi peu dangereuses que possible pour la santé publique.

C'est à l'exposé des circonstances diverses et surtout des résultats de cette expérimentation, sur un territoire d'environ 800 kilomètres carrés et peuplé d'environ 10,000 habitants que nous voulons consacrer cette notice.

Nous nous bornerons le plus souvent à la narration des faits eux-mêmes; nous demandons seulement qu'on veuille bien nous pardonner les détails peut-être minutieux dans lesquels nous entrerons quelquefois. Mais nous avons pensé que pour permettre à toutes les opinions d'apprécier sainement un tel essai touchant une question aussi importante et qui divise encore tant d'esprits également éclairés et de bonne foi, il n'y avait

(1) Il va sans dire que pour nous, et contrairement à l'opinion de quelques écrivains, toute maladie *transmissible, importable,* est aussi et nécessairement une maladie *contagieuse,* soit que la transmission d'un individu à l'autre se fasse par inoculation, par contact ou par voie d'*infection* atmosphérique, etc.

Nous n'avons ici, et au commencement de notre travail, employé de préférence le terme de transmissibilité que comme comportant le sens le moins exposé à des restrictions arbitraires.

guère de données négligeables; et nous avons tenu aussi à faire voir que cet essai avait été fait en parfaite connaissance de toutes ses difficultés, et qu'on s'était en conséquence efforcé de l'entourer de toutes les garanties propres à le faire réussir et à le rendre ainsi suffisamment démonstratif.

II.

Mesures adoptées pour préserver de l'épidémie cholérique la ville et le territoire de Batna.

SITUATION SANITAIRE DE BATNA AU MOMENT DE L'INVASION DE L'ÉPIDÉMIE.

Cette ville, chef-lieu de subdivision et de cercle dans la province de Constantine, forme avec ses annexes de Lambèse, de Fesdis et du *Village nègre*, une commune qui compte 2,133 âmes de population civile européenne, dont 1623 (1318 Français et 305 étrangers) appartiennent à la ville elle-même. La garnison, y compris le détachement de Lambèse, a été, pendant l'épidémie, d'un effectif moyen de 1,653 hommes.

Batna est situé à 120 kilomètres sud-ouest de Constantine par 35°,33' de latitude B. et 3°,5 de longitude E., à 1,100 mètres environ d'altitude (*Comptes-rendus de l'Académie des sciences*, rapport de M. Faye sur l'éclipse de soleil du 18 juillet 1860), sur un plateau bordé de part et d'autre par des montagnes boisées, et dont la largeur varie, dans les diverses parties de sa longueur, de 3 à 12 kilomètres. Sa direction moyenne va du sud-ouest au nord-est. Sa limite sud se rencontre à 10 kilomètres de Batna sur la route de Biskra, au point où se trouve à une altitude d'environ 1,200 mètres la crête de partage des eaux entre le Tell et le Sahara. Sa limite nord peut-être, au point de vue hydrographique, placée aux *deux lacs salés* sur la route de Constantine, à une altitude d'à peu près 725 mètres. Pour

y arriver la plaine suit, à partir de Batna, une pente très-régulière en perdant ainsi 375 mètres de hauteur pour un développement de 28 à 30 kilomètres.

Un petit cours d'eau, l'Oued-Batna, occupe le fond de ce bassin. Il est le produit de toutes les eaux descendues des versants montagneux qui bordent la vallée. Il se perd au delà de Fesdis, vers le 104e kilomètre de la route de Constantine à Batna, et ses dernières traces disparaissent aux deux lacs, à la limite même du cercle et de la subdivision.

Le sol, sur les versants qui bordent le plateau, est en presque totalité constitué par des calcaires appartenant aux terrains crétacés (étages cénomanien et turonien d'Alcide d'Orbigny), et dans le fond de ce bassin par des calcaires d'eau douce, de formation beaucoup plus récente et mélangés de cailloux et d'argiles. Là il est recouvert d'une couche de terre végétale de 3 à 4 mètres de profondeur.

La température moyenne de l'année 1867 a été de 14°,41, celle du premier trimestre étant 8°,65, celle du deuxième 17°,26, celle du troisième 23°,46, celle du quatrième 8°,34. Ces chiffres donnent une idée exacte du climat de Batna, qui est, du reste, celui à peu près de tous les hauts plateaux de l'Algérie. Comme partout aussi en Algérie, l'année a été remarquablement sèche et n'a donné que 275mm d'eau. L'année 1866 n'en avait donné aussi que 331.

Pour ce qui est des mois de choléra en particulier, les températures moyennes ont été aussi très-peu différentes de celles de 1866. Nous allons les produire, ainsi que les maxima et les minima, pour donner une idée des variations diurnes de la température estivale, qui sont peut-être le trait le plus caractéristique du climat des hauts plateaux.

	TEMPÉRATURE MOYENNE.	MAXIMA.	MINIMA.
Juillet 1867	26°,53	Le 28. . . 36°,20	Du 7 au 8. 13°,20
Août —	23°,55	Le 1er. . . 35°,50	Du 30 au 31. 10°,40
Septemb. —	20°,32	Le 3. . . . 30°,50	Du 28 au 29. 5°,90
Octobre —	13°,47	Le 4. . . . 22°,60	Du 29 au 30. 3°,10

Le passage de la température estivale à la température automnale s'est fait brusquement du 25 au 26 septembre par un abaissement de 6°,20, dans la température minima, qui, de 13°,60, est descendue subitement à 7°,40. L'année dernière, ce passage s'était produit d'une manière analogue, quoique un peu moins marquée, mais une quinzaine plus tôt.

L'hygrométrie moyenne, mesurée au psychromètre d'August, a été, en juillet, 45°,45; en août, 47°,32; en septembre, 53°,60; en octobre, 66°,97.—Quantité d'eau tombée en juillet, 2mm,50; en août, 14mm,40; en septembre, 28mm,60; en octobre, 25mm,80.

Les vents ont soufflé, à neuf heures du matin :

En juillet, du N., trois fois; du N.-O., deux fois; de l'O., cinq fois; du S.-O., dix fois; du S., une fois; du S.-E., six fois; de l'E., une fois; du N.-E., trois fois.

En août, du N., deux fois; du N.-O., une fois; de l'O., cinq fois; du S.-O., onze fois; du S., deux fois; du S.-E., quatre fois; de l'E., une fois; du N.-E., cinq fois.

En septembre, du N.-O., deux fois; de l'O., six fois; du S.-O., douze fois; du S.-E., cinq fois; de l'E., deux fois; du N.-E., trois fois.

En octobre, du N., deux fois; de l'O., treize fois; du S.-O., cinq fois; du S.-E., cinq fois; de l'E., trois fois; du N.-E., trois fois.

Il résulte de ces remarques que, pendant toute la période, les vents dominants ont été ceux des aires de l'ouest, et en particulier le sud-ouest (*sirocco*) qui a soufflé avec une intensité au moins moyenne trente-huit fois.

La hauteur moyenne du baromètre, à neuf heures du matin, a été : en juillet, de 670mm,79; en août, de 671,5; en septembre, de 667,26; en octobre, 670,10. — Variation maxima d'un jour au jour suivant : en juillet, du 14, — 672,42, au 15, — 667,28; en août, du 16, — 668,65, au 17, — 671,54; en septembre, du 27,— 666,11, au 28,— 672,90; en octobre, du 6,— 668,64, au 7, — 674,04.

Hauteur minima pendant les quatre mois : le 26 septembre, 664,57; maxima, le 30, 674,32.

La ville occupe une superficie de 54 hectares. Les rues, dont

les principales sont plantées d'arbres, sont larges de 15 à 20 mètres, et les maisons n'ont, en général, qu'un rez-de-chaussée et tout au plus un premier étage. Les conditions d'aération ne laissent donc, comme on le voit, rien à désirer.

Au 15 juillet, le nombre des malades présents à l'hôpital était de 45, savoir : 30 militaires, 13 civils européens et 2 civils indigènes. Les affections de ces malades, dont près de la moitié appartenait au service chirurgical, ne présentaient aucun caractère particulier, et celles des mois précédents n'avaient non plus rien offert de remarquable, sauf une petite épidémie de rougeole qui avait donné, pour les diverses catégories de la population, 27 entrées à l'hôpital.

En ville, la situation sanitaire se présentait sous le même aspect.

Il en résulte qu'au moment où l'épidémie était signalée dans la subdivision rien n'était de nature à faire présumer, à Batna, chez aucune classe d'habitants, la préexistence d'aucun germe ou d'aucune influence épidémique.

Ce n'est que postérieurement à l'établissement des cordons sanitaires et pendant le cours de l'épidémie de la province, que nous verrons se dessiner une constitution médicale sensiblement différente, laquelle, nous pouvons le dire par anticipation, n'a point nui à l'immunité dont la ville a joui par rapport au choléra.

QUARANTAINE D'EL-KSOUR (voir la carte, n° 1).

C'est le 14 juillet qu'arrivèrent à Batna les premières nouvelles annonçant l'existence du choléra dans la subdivision. On apprit qu'une épidémie sévissait depuis plusieurs jours déjà chez les Ouled-Amor, fraction du caïdat du Hodna.

Le 16, M. l'aide-major Dubois partit sur les lieux pour en reconnaître la nature. De son rapport il résulta que cette affection était bien le choléra asiatique, mélangé cependant d'un nombre notable de cas de fièvre pernicieuse. Dans les trois journées des 19, 20 et 21 juillet que M. Dubois passa dans le pays infecté, il constata 85 décès, savoir : 65 cholériques et 20 produits par des accès pernicieux.

Mais, dans l'intervalle, arrivaient de Biskra des informations bien plus inquiétantes encore. Le 15 juillet, on signalait à l'état-major de la subdivision les premiers cas et les premiers décès cholériques qui venaient d'avoir lieu dans cette ville. L'épidémie y prenait rapidement des proportions croissantes, et le 18, outre 2 décès à l'ambulance, il y en avait 13 en ville et 51 dans les villages de l'oasis, mortalité qui allait devenir bien plus forte encore les jours suivants.

En présence d'une telle situation, il y avait lieu de craindre que le brusque afflux à Batna d'une partie plus ou moins importante de la population soit européenne, soit indigène de Biskra ne vînt y apporter des éléments de contamination cholérique. Il était donc urgent de prendre sur-le-champ des dispositions qui, sans interrompre d'une manière absolue les communications avec Biskra, et sans interdire à ses habitants l'émigration vers les lieux encore indemnes, ne leur permissent cependant d'aborder à Batna qu'après s'être purifiés de toute influence épidémique.

Ces mesures étaient alors à la fois opportunes et pas trop gênantes, puisque, d'une part, l'excellent état sanitaire de Batna y éloignait toute supposition de la préexistence d'aucun germe ni même d'aucune prédisposition cholérique, et que, de l'autre, le peu d'importance des relations commerciales, qui, dans cette saison surtout, relient les deux places, n'exposait leur application à léser sensiblement aucun intérêt sérieux.

En conséquence, M. le colonel Arnaudeau, commandant la subdivision, ordonna l'établissement d'une quarantaine de huit jours, reduite vers la fin à six, pour les voyageurs provenant de Biskra et des régions limitrophes, et choisit comme le point le plus convenable pour son installation les terrains avoisinant le caravansérail d'El-Ksour, éloigné de Batna d'environ 28 kilomètres et placé à côté d'un bon cours d'eau.

C'est le 19 juillet qu'elle fut établie, et dès le 20 elle recevait 1 voyageur, 9 le 21, 9 le 22, etc., etc. Les quarantenaires étaient logés sous des tentes largement espacées les unes des autres et pourvues de tous les objets de campement et de cou-

chage nécessaires. Le poste de surveillance se composait de 18 cavaliers (chasseurs et spahis), commandés par un officier, et d'un petit détachement d'hommes du train des équipages. Le service médical était confié à M. Gonin, médecin aide-major au 3e spahis, assisté de deux infirmiers. L'ambulance, éloignée du lazaret proprement dit, était installée complétement le 25.

Nous allons donner un extrait du règlement sanitaire de la quarantaine, dont les dispositions ont servi de modèle à celles qui ont été observées dans les campements qui ont suivi l'évacuation de Biskra :

1° Mettre en rigoureuse surveillance tous les nouveaux arrivés en les isolant par une distance d'au moins 100 mètres des anciens occupants.

2° Désinfecter à mesure, en le trempant pendant une heure dans le chlorure de chaux (chlorure de chaux, 500 grammes, eau, 10 litres), tout le linge sale des nouveaux arrivants.

3° Tous les jours, et à plusieurs reprises, interroger rigoureusement l'état de santé des quarantenaires, surtout au point de vue de la diarrhée.

4° Creuser tous les jours dans chaque campement une nouvelle fosse pour y jeter toutes les déjections, en les désinfectant plusieurs fois dans la journée au sulfate de fer (sulfate de fer, 300 grammes pour 10 litres d'eau), et les recouvrir de terre chaque soir.

5° Isoler dans une ambulance séparée, en évitant surtout de la faire entrer dans le caravansérail, toute personne présentant des symptômes suspects.

6° Désinfecter sur-le-champ, par le chlorure de chaux, le sol qui a reçu les déjections de toute personne malade.

7° S'assurer rigoureusement, à la levée de chaque quarantaine, de l'état de santé des partants, afin de ne laisser venir à Batna que des personnes parfaitement saines, en retenant impitoyablement au lazaret tout ce qui présenterait le moindre symptôme suspect.

Pendant les deux mois qu'elle a été maintenue, la quarantaine a reçu 116 individus, savoir : de Biskra directement ou bien des détachements évacués 48 civils et 44 militaires; d'El-Kantara 23 civils, dont la plupart étaient des émigrants de Biskra; et enfin de Barika 1 militaire.

Sur ce nombre, 1 civil s'est évadé, 6 civils et 1 militaire sont

retournés à Biskra, 3 civils sont retournés à El-Kantara, 2 civils sont partis directement pour Constantine (indigènes réclamés d'urgence par la justice comme témoins), 1 militaire a été retenu à la quarantaine pour y faire le service, 10 militaires ont été évacués sur le 2e camp du 3e bataillon d'Afrique, 54 civils et 32 militaires ont été reçus à Batna, et enfin 5 civils et 1 militaire sont décédés.

Ces décès sont les suivants.

1° Le 24 juillet. — Mme Segnant, partie de Biskra le 19. — Arrivée à El-Ksour le 21. — Déjà malade à son arrivée.

2° Le 25 juillet. — Mlle Mathieu, enfant de 11 mois. — Partie de Biskra et arrivée à El-Ksour ledit jour. — Déjà malade à son arrivée.

3° Le 1er août. — Mme Debats, partie d'El-Kantara le 30 juillet. — Arrivée au Ksour le même jour. — Prise du choléra au Ksour le 30 juillet.

4° Le 2 août. — M. l'abbé Burget, parti de Biskra le 31 juillet. — Arrivé au Ksour le 1er août. — Déjà atteint du choléra à son arrivée.

5° Le 2 août. — Mme Parizel, partie d'El-Kantara le 30 juillet. — Arrivée au Ksour le même jour. — Atteinte du choléra le 1er août.

6° Le 15 août. — Clamer, conducteur du train des équipages, ayant accompagné l'évacuation de Biskra du 3e bataillon d'Afrique. — Tombé malade le 7 août aux Tamarins, d'où il fut évacué le même jour sur la quarantaine.

Il n'y a eu parmi les quarantenaires d'autres cas de choléra que les précédents, tous mortels. Mais il y a eu un autre cas, suivi de mort également, chez l'un des hommes du détachement du train, employé au service de la quarantaine. Le 30 juillet a eu lieu le décès de Barbier, soldat du train, ayant fait le service des transports sur le camp de N'za-ben-Messaï où se trouvait alors l'escadron de chasseurs évacué de Biskra. On ne sait au juste, si malgré les ordres donnés et les dispositions prises en conséquence (dépôt des objets transportés à trois ou quatre cents mètres du camp où les troupes venaient les prendre, etc.) il avait communiqué avec eux. Tombé malade en route à son retour, il était entré à l'ambulance de la quarantaine

le 29. Il est à peine besoin d'ajouter que le détachement dont il faisait partie a été retenu au Ksour jusqu'à la levée de la quarantaine.

En défalquant des 86 quarantenaires entrés à Batna, les 23 fonctionnaires et les convalescents de l'ambulance de Biskra qui avaient quitté cette ville depuis quelque temps déjà et dont la quarantaine au Ksour du 25 au 31 août a été pour ainsi dire superflue, on trouve que les 63 restants ont passé au lazaret 461 journées, ce qui donne pour durée moyenne de leur présence 7,32 jours. La durée de séjour maxima, subie par 8 d'entre eux, a été de 10 jours. Les durées minima et qui n'ont eu lieu que dans la dernière semaine de l'existence de la quarantaine, et dans un ou deux autres cas exceptionnels, ont été pour 7 voyageurs de 4 jours, et pour 3 (les derniers quarantenaires) de 2 jours.

Le nombre le plus grand des quarantenaires présents a été de 34 du 1er au 2 août. A partir du 1er septembre le maximum n'a plus été que de 4, et il y a eu même des jours où il ne se trouvait plus personne au lazaret.

Le 18 septembre, la quarantaine d'El-Ksour fut levée. A cette date, l'épidémie avait complétement cessé à Biskra dans la population européenne et était en forte décroissance parmi les populations indigènes, à l'égard desquelles on conserva, comme nous le verrons tout à l'heure, pendant assez longtemps encore, le deuxième poste de surveillance établi à El-Ksour. C'est le 23 septembre que la diligence de Biskra revint directement à Batna pour la première fois.

LAZARETS INDIGÈNES.

Lazaret des Tamarins (voir la carte, n° 2). — Nous passons maintenant à l'exposé des mesures prises spécialement à l'égard des Arabes, en commençant par le récit des incidents qui en précédèrent et en motivèrent l'institution.

Trois hommes des Ouled-sidi-Yahia-ben-Zekri, deux des Ouled-Zian, et trois des Ouled-Addi, établis les uns aux environs

immédiats de Batna, et par conséquent en territoire civil, les autres sur différents points du caïdat de Batna, s'étaient rendus ensemble à Biskra au moment où l'épidémie venait d'y éclater, pour y exécuter un transport. Leurs affaires faites, ils en repartirent aussitôt. Deux des Ouled-sidi-Yahia furent frappés en route et moururent sous leur tente établie aux environs du Ksour. Le troisième, Ali-ben-Djeraba, dont la tente était établie près de l'endroit nommé *Fontaine de l'hôpital*, c'est-à-dire à environ 3 kilomètres de Batna et près de la route de Constantine, revint aussi chez lui malade, mais se rétablit plus tard.

Un des Ouled-Zian, berger du sus-nommmé Ali-ben-Djeraba, et dont la tente se trouvait à côté de la sienne, fut frappé aussi dès son retour à sa demeure et mourut le lendemain, c'est-à-dire le 23 juillet. — Quant au deuxième individu de cette tribu, nous le retrouverons bientôt dans la suite de ce récit.

Sur les trois hommes des Ouled-Addi, un, le nommé Ali-ben-Ammor, tomba également malade du choléra en arrivant chez lui et mourut le lendemain, c'est-à-dire encore le 23 juillet, dans sa tente établie près du magasin à fourrages, à côté de la route de Lambèse, non loin du *Village nègre* et à moins d'un kilomètre de Batna. — Le deuxième, frère du précédent, Taïeb-ben-Ammor, revint malade aussi, mais se rétablit définitivement un peu plus tard. — Le troisième de cette fraction, Ali-ben-Bacha, dont la tente était établie à Seggana sur la route de Batna à Barika, fut frappé aussi et mourut peu après en rentrant chez lui.

Les décès d'Ali-ben-Ammor et du berger d'Ali-ben-Djeraba, ainsi que la présence de deux autres cholériques dans des campements arabes très-rapprochés de Batna, furent connus des autorités dans cette même journée du 23 juillet. On comprit aussitôt le danger que, dans l'hypothèse de la transmissibilité du choléra par les relations humaines, la répétition d'arrivages du même genre pouvait faire courir à Batna et à ses annexes ; et on reconnut aussi l'insuffisance du poste quarantenaire du Ksour pour empêcher l'abord à Batna, des voyageurs arabes venant des pays infectés. Des mesures plus étendues, et aux-

quelles d'ailleurs on avait déjà pensé, furent donc jugées immédiatement nécessaires et résolues immédiatement aussi.

La première de toutes était, outre l'éloignement de tous les campements indigènes des environs les plus rapprochés de Batna, le transport, dans un lazaret établi en dehors des territoires civils, des douars qui avaient reçu des gens malades ou suspects. — En conséquence, le lendemain 24 au matin, le bureau arabe, après s'être concerté avec M. le commissaire civil, fit enlever les deux douars où étaient morts les deux cholériques.

Celui d'Ali-ben-Djeraba (*Fontaine de l'hôpital*) se composait de trois tentes : la sienne et les deux d'Ouled-Zian, ses bergers, dans l'une desquelles venait de mourir l'un d'eux à son retour de Biskra.

Le douar de Taïeb-ben-Ammor (*magasin à fourrages*) se composait également de trois tentes, la sienne, où se trouvait aussi son frère Mohamed, et celles de ses deux autres frères Belkassem et Abdallah.

Dès que ces tentes eurent été enlevées, on désinfecta avec le sulfate de fer et le chlorure de chaux, les emplacements des deux douars, et les effets des cholériques décédés furent brûlés.

Ces six tentes furent dirigées sur le point choisi pour l'emplacement du lazaret et situé sur la rive droite de l'Oued-El-Ksour, à une bonne distance de la route de Biskra et du caravansérail des Tamarins. Elles étaient conduites par un spahis du bureau arabe de Batna qui devait également continuer à les surveiller pendant tout le temps de l'existence du lazaret.

Comme il importait d'éloigner des environs de la quarantaine tout élément de contamination cholérique, elles ramassèrent à leur passage au Ksour la tente où étaient morts les deux hommes des Ouled-sidi-Yahia à leur retour de Biskra. Plus loin, sur la route, elles furent rejointes par celle du nommé Ali-ben-Bacha de Seggana. Le lazaret comprit donc ainsi dès son début huit tentes.

En arrivant à Téniet-el-Youdhi, entre le Ksour et les Tamarins, un des Ouled-Zian du douar d'Ali-ben-Djeraba et le deuxième de ceux qui étaient allés à Biskra, fut frappé d'une attaque de choléra foudroyante et mourut en peu d'heures.

Les tentes une fois installées au lazaret, il mourut les jours suivants :

1° Dans la tente d'Ali-ben-Djeraba, une femme.

2° Dans les tentes des Ouled-Zian, sur cinq habitants qui les occupaient, une femme, une jeune fille et un enfant. En comptant par conséquent les deux bergers déjà décédés, il est mort dans ces deux tentes cinq personnes sur sept.

Point d'autres décès dans les autres tentes qui composaient primitivement le lazaret.

Au moment où ces tentes étaient évacuées des environs de Batna sur le lazaret des Tamarins, toutes les populations de la contrée intermédiaire étaient encore indemnes. — Mais quelques jours après, aux huit tentes désignées ci-dessus, furent réunies deux autres tentes appartenant à des Ahel-Defar, des Lakhdar-el-Halfaouïa, qui s'étaient rendus dans l'oasis d'El-Kantara, où régnait alors l'épidémie. Ces deux individus moururent peu après leur rentrée chez eux ; c'étaient les premiers cas de choléra signalés parmi les Lakhdar. — Il mourut au lazaret dans ces tentes une femme. Une jeune fille et une autre femme y tombèrent malades, mais se rétablirent en faisant usage de laudanum qui avait été envoyé par le bureau arabe, au spahis surveillant, avec quelques autres médicaments et des désinfectants.

Le nombre des décès au lazaret des Tamarins se borne donc à 5. — Le choléra néanmoins éclata vers cette époque dans le village de Tilatou, situé à 3 ou 4 kilomètres du lazaret et où il mourut 6 personnes sur une population d'une centaine d'habitants. Mais le lazaret, soigneusement surveillé, se garda de toute communication avec les gens de ce village, de sorte qu'il n'en reçut aucune atteinte épidémique. Vers le 15 août même, la santé de tous les occupants s'étant maintenue bonne depuis le commencement du mois, le lazaret fut levé, et les tentes, sous la conduite du spahis surveillant, replacées près de

leurs anciens campements, où, à partir de ce moment jusqu'à la fin de l'épidémie, elles ne présentèrent rien de suspect.

Pour ne rien omettre de ce qui se rapporte à ce lazaret, nous ajouterons en terminant qu'un des convoyeurs qui avaient été employés au transport des tentes évacuées, fut atteint du choléra peu après sa rentrée dans son douar appartenant à la section dite des Mherabaïa de la tribu des Harakta-el-Madher et mourut rapidement. Ce douar, indemne jusque-là, assure le caïd de Batna, fut infecté à partir de ce moment et il en fut de même ensuite des campements voisins.

Lazaret d'El-Guergour (voir la carte, n° 3) *et autres dans le caïdat des Ouled-bou-Aoun.* — Pendant que les mesures précédentes s'exécutaient dans le caïdat de Batna, des dispositions semblables et précédées de circonstances analogues aussi, étaient ordonnées et accomplies dans un autre caïdat limitrophe également du territoire qu'on voulait protéger, le caïdat des Ouled-bou-Aoun.

(1) Au moment où éclatait le choléra à Biskra s'y trouvaient

(1) Pour ne pas allonger cette notice, et surtout pour ne pas mélanger d'autres questions au sujet limité et tout pratique que nous nous étions imposé, nous avons mis de côté les faits, nombreux cependant, d'*importation cholérique* qui nous ont été attestés pendant les recherches auxquelles nous venons de nous livrer sur la dernière épidémie dans le cercle de Batna. Toutefois nous avons dû faire exception pour quelques-uns de ceux qui se rattachent à des mesures de préservation, la création du lazaret d'El-Guergour, par exemple. Nous donnerons donc ici les assertions extraites du rapport détaillé du caïd des Ouled-bou-Aoun sur l'origine de l'épidémie dans son commandement, et plus particulièrement dans les premières fractions cholérisées, les Haouara et les Ouled-sidi-Abderrhaman. Mais, à cause de la difficulté d'un contrôle efficace, nous n'en garantissons pas l'exactitude au même degré que pour les faits rapportés jusqu'ici et pour tous ceux qui concernent directement le territoire protégé, ou bien, dans d'autres localités, se sont passés sous les yeux d'autorités françaises. — Et pour la même raison, nous faisons la même réserve à l'égard des autres attestations du même genre et de sources semblables, bien qu'en général, et dans ce qu'elles ont d'essentiel, nous les tenions pour sincères et plausibles.

cinq hommes des Ouled-bou-Aoun (fraction des Haouara), marchands de moutons, qui y étaient arrivés trois jours avant l'explosion de l'épidémie. C'etaient les nommés Si-Brahim-ben-Mohamed, Messaoud-bel-Haouan, Hamida-ben-Si-Mohamed, Saïd-ben-Sultan et Sliman-bel-Hadj.

Les trois premiers furent atteints et moururent à Biskra et les deux autres en repartirent pour retourner chez eux. — Saïd-ben-Sultan fut pris du choléra en route au caravansérail des Tamarins. — Sliman-bel-Hadj le quitta là, et revenu seul dans sa fraction de tribu, prévint les parents de son compagnon de la position dans laquelle il l'avait laissé. Deux de ces derniers partirent sur-le-champ pour aller chercher le malade qu'ils trouvèrent encore vivant aux Tamarins et qu'ils transportèrent jusqu'au Ksour *où il n'existait point encore de quarantaine*, circonstance très-importante dans ce récit en ce qu'elle précise l'époque des faits en les plaçant à une date antérieure au 20 juillet, premier jour du fonctionnement de la quarantaine.

Là, quittant la route de Batna, ils passèrent par la montagne pour regagner leur douar, mais le malade des Tamarins mourut en route à une petite distance du Ksour, et un de ses conducteurs, le nommé Ammor-ben-Lakhdar, subit le même sort dans la même journée en un lieu nommé Aïn-el-Guemmel. Le deuxième parent, Salah-ben-Ahmed, se détourna alors de sa route pour se rendre dans un douar des Lakhdar qui se trouvait aux environs, mais, déjà atteint par le choléra, il mourut avant d'y arriver.

Revenons maintenant à Sliman-bel-Hadj, de retour de Biskra aux Haouara, et qui tomba malade dans sa tente peu après son arrivée.

A l'époque de cette rentrée, des ordres venaient d'arriver du bureau arabe de Batna, prescrivant de placer dans un lazaret à établir à El-Guergour, toutes les tentes des fractions avoisinantes de la tribu des Ouled-bou-Aoun, qui auraient reçu des gens venant des pays infectés.

En conséquence, cette mesure fut prise le lendemain, à l'égard de la tente de Sliman-bel-Hadj, habitée par lui et sa fa-

mille. Le jour suivant, cette tente fut rejointe au lazaret par trois autres venues des Ouled-sidi-Abderrhaman, autre fraction des Ouled-bou-Aoun, où nous allons faire connaître également les circonstances originaires de l'épidémie.

Trois hommes de cette fraction, les nommés Mohamed-ben-Si-Brahim, Ali-ben-Maklouf et Saadi-el-Hadri étaient dans le commencement de juillet partis de Batna pour Biskra avec leurs mulets pour faire des transports au compte de divers colons. Ils avaient quitté Biskra un peu avant le commencement de l'épidémie dont ils n'apprirent l'invasion qu'à leur arrivée au caravansérail d'El-Ksour. De là ils se rendirent dans leur fraction de tribu. Cinq jours après, les deux premiers tombèrent malades du choléra ; immédiatement ils étaient transportés au Guergour avec leurs tentes et une troisième, voisine de celle de Mohamed-ben-Si-Brahim, et dans laquelle on venait aussi de signaler un malade.

Dans les jours qui suivirent, on envoya au lazaret onze autres tentes de cette même fraction, dont plusieurs habitées par des proches parents de Mohamed-ben-Si-Brahim, plus trois tentes de la fraction voisine, les Halimia, qui, au dire du caïd des Ouled-bou-Aoun, avait été infectée par des communications récentes avec le douar de cet homme.

A partir de ce moment, l'épidémie s'étant généralisée dans ces trois fractions des Ouled-bou-Aoun, et pour ne pas donner trop d'accroissement au lazaret du Guergour, on cessa d'y envoyer de nouvelles tentes.

Quoi qu'il en soit, les diverses tentes étaient groupées au lazaret par fractions de tribu. Une mortalité assez grande se déclara presque aussitôt dans celles des Ouled-sidi-Abderrhaman et des Halimia. Mohamed-ben-Si-Brahim entre autres mourut peu après son arrivée au lazaret ainsi que sa femme et son fils, seuls habitants de sa tente avec lui. Son compagnon de Biskra, Ali-ben-Maklouf mourut aussi ainsi que sa femme. Dans la troisième tente, de celles primitivement envoyées au lazaret, il y eut trois morts sur sept individus, et plusieurs des autres tentes des parents et voisins de Mohamed-ben-Si-Brahim, perdirent également plusieurs de leurs habitants. Trois ou quatre cependant de ces tentes, bien que campant à côté de celles-là, n'ont point été atteintes.

Quant à la tente de l'homme des Haouara, Sliman-bel-Hadj, naturellement isolée de toutes les autres, puisqu'elle était seule de sa fraction, ce n'est que dix ou douze jours après, que sur sept individus qui l'habitaient, il en mourut trois, savoir : la femme et deux des filles de Sliman-bel-Hadj, qui lui-même guérit. Le douar des Haouara, dont cette tente faisait partie et où Sliman-bel-Hadj avait séjourné, avait été mis en quarantaine immédiatement ; l'épidémie s'y déclarait néanmoins quelques jours après et y continuait par la suite, aussi bien qu'aux Ouled-sidi-Abderrhaman.

D'après le rapport détaillé du caïd, produit à la suite d'une enquête qui a compris toutes les fractions de son commandement, il paraît établi qu'à l'époque de la rentrée des convoyeurs de Biskra aux Haouara et aux Ouled-sidi-Abderrhaman, il n'y avait point encore de choléra dans aucune partie du caïdat des Ouled-bou-Aoun. — Des détails donnés aussi sur la marche de l'épidémie dans ce caïdat il semble résulter que celle-ci a eu pour point de départ les deux foyers simultanément établis dans ces deux fractions, d'où par des communications successives et expressément signalées, elle se serait étendue de proche en proche aux autres populations du caïdat.

Nous ignorons le chiffre exact de la mortalité totale qui régna dans les dix-huit tentes du lazaret d'El-Guergour, les décès ayant été comptés au titre des diverses fractions auxquelles appartenaient les cholériques décédés.

Quoi qu'il en soit, vers la fin d'août, époque de diminution très-marquée de l'épidémie chez les Ouled-bou-Aoun, le lazaret n'ayant plus de malades fut levé, et c'est près de là, comme nous le verrons, que vint camper en quarantaine un atelier de condamnés venant des environs de Sétif.

Pendant la durée de son maintien, d'autres lazarets, moins considérables et temporaires également (huit jours en général), furent établis, à mesure des besoins, sur divers points du caïdat,

pour recevoir les *nezla* (réunions de cinq ou six tentes), sur lesquelles était mort un cholérique, et aussi divers douars où avaient été reçus des gens venant des pays cholérisés. Ces lazarets étaient installés sur des points renommés par leur salubrité et à portée de bonnes sources. Le principal d'entre eux fut celui d'El-Hassi, qui reçut des malades de la fraction des Ouled-Mehenna.

DOUBLE CORDON SANITAIRE AUTOUR DE BATNA ET DE SES ANNEXES.

Si l'établissement des lazarets indigènes, en isolant un certain nombre de familles cholérisées ou suspectes des deux caïdats les plus voisins de Batna, diminuait dans une certaine mesure les chances d'infection de ces tribus elles-mêmes, et par suite celles de l'abord à Batna des gens susceptibles d'y apporter la maladie, d'autres mesures plus radicales encore restaient à prendre pour restreindre le plus possible les communications de Batna et de ses annexes avec les pays infectés, et, en prévision du passage prochain des nomades revenant du Tell dans le Sahara, en éloigner tout particulièrement les indigènes voyageant en grandes troupes.

C'est à quoi il fut pourvu, dès le 24 juillet, par la création de dix-sept nouveaux postes de surveillance composés de spahis et de cavaliers indigènes, et disposés autour de Batna en deux lignes courbes fermées, à peu près tangentes l'une à l'autre en un point situé au sud-est de Lambèse.

Voici les emplacements des principaux de ces postes :

1re *ligne* (ligne extérieure, la plus éloignée de Batna).

1° *El-Ksour.* — A côté du poste de la quarantaine, un autre poste destiné plus spécialement à interdire sur le territoire protégé les passages de nomades et ceux des caravanes venant du Sud, et surveillant aussi immédiatement les Lakhdar, etc.

2° *Oued-Chabah.* — 3° *Aïn-Chellala.* — 4° *Djerma.* — Ces trois postes installés dans les défilés conduisant des Ouled-bou-Aoun, dans le territoire de Batna, et ainsi plus spécialement dirigés contre les

provenances de ce caïdat, et en général contre celles de toutes les tribus de l'Ouest (Hodna, Ouled-Sultan, etc.).

5° *Oum-el-Asnam.* — 6° *El-Madher.* — Ces deux derniers de part et d'autre de la route de Constantine, et arrêtant tous les arrivages indigènes, principalement les caravanes de nomades venant des diverses parties du Tell.

7° *Aïn-el-Hassafeur.* — Sur la route de Khenchla, arrêtant les provenances des tribus de l'Est.

8° *N'za-Sdirah* (vulgairement les trois pierres). — Sur la route dite de l'Oued-Taga. —9 ° *Tafrent.* — Sur une crête de l'Aurès aux Ouled-Fedalah. — Ces deux derniers ayant pour objectif principal les provenances des tribus de l'Aurès et protégeant ainsi plus spécialement Lambèse.

Plusieurs de ces postes étaient reliés entre eux par d'autres moins importants que nous ne nommons pas, mais qui sont marqués sur la carte jointe à cette notice.

2e *ligne* (ligne intérieure, la plus rapprochée de Batna).

Cette deuxième ligne avait pour objet d'arrêter et de faire rétrograder tous les voyageurs qui auraient réussi à franchir la première, en passant entre deux postes, genre de service qu'elle a rendu en deux ou trois circonstances.

Elle se composait des cinq postes suivants :

1° *El-Biar.* — Sur la route de Batna à Biskra, doublant les deux postes d'El-Ksour.

2° *Le Ravin bleu.* — Aux Ouled-Chilih, doublant les postes qui observaient les Ouled-bou-Aoun.

3° *Aïn-Fesdis, ferme Moreau.* — Doublant les postes de la route de Constantine.

4° *Aïn-el-Hassafeur.* — Doublant le poste de première ligne de ce nom et surveillant la même direction.

5° *Tizerouïn.* — Doublant les postes surveillant les Aurès.

A N'za-Sdirah les deux cordons sanitaires étaient pour ainsi dire tangents l'un à l'autre, la deuxième ligne n'ayant pu, dans cette direction, être rapprochée davantage de Batna pour ne pas interrompre les communications journalières avec Lambèse, et la première ligne n'ayant pas dû être portée plus loin

à cause de la configuration particulière de ce pays montagneux, tout couvert de forêts et à peu près non habité. Dans cette direction la première ligne était au reste suppléée par les postes établis sur les crêtes par les tribus limitrophes elles-mêmes, savoir : les Beni-Maafa et les Ouled-Fedalah.

Le premier des dix-huit postes qui fut levé fut, comme nous l'avons déjà vu, celui de la quarantaine de Biskra, le 18 septembre. — Le deuxième, — le 25 septembre, — fut celui d'Aïn Chellala pour les Ouled-bou-Aoun. — Les autres le furent successivement à mesure que l'on en reconnut la convenance (1).

Les derniers postes levés furent : vers le milieu d'octobre, ceux du Ksour, d'Oum-el-Asnam, et d'Aïn-el-Hassafeur, maintenus jusque-là pour empêcher d'un côté le passage, près de Batna, des caravanes de nomades retournant du Tell dans le Sahara, et de l'autre celui des caravanes venant des oasis du Sud; et enfin, vers le 20 novembre, le poste de N'za-Sdirah, dont le maintien tardif avait été motivé par la persistance du choléra dans certains villages de l'Aurès, dépendants du caïdat de l'Oued-Abdi.

Cependant, à partir de la fin de septembre, pour ne pas priver plus longtemps les habitants de Batna des raisins et autres produits de l'Aurès, on délivrait, pour venir au marché, des laissez-passer individuels à quelques gens des villages reconnus absolument indemnes.

Le marché arabe avait été suspendu de fait pendant plusieurs semaines, où les provisions maraîchères étaient exclusivement apportées de Constantine. A sa reprise même il s'est tenu en dehors de la ville; il était alors alimenté seulement par les champs et les jardins du territoire compris à l'intérieur des cordons sanitaires.

On voit par là que, pendant près de deux mois, Batna et ses annexes ont été investis de tous côtés par dix-huit postes de

(1) A la fin de septembre, l'épidémie était presque complétement éteinte dans les caïdats les plus rapprochés de Batna, et, du 20 au 30 octobre, elle avait disparu de tout le cercle, à l'exception du caïdat de l'Oued-Abdi.

surveillance interdisant toutes communications avec les contrées infectées. — La seule communication qui, pour des motifs d'intérêt majeur, dut rester constamment et complétement libre, fut celle avec Constantine, par la diligence et le roulage européen; mais nous pouvons assurer personnellement qu'*aucun cholérique n'est arrivé à Batna par cette voie*, ce qui s'explique très-bien quand on sait, d'une part, que les Arabes usent assez peu des voitures publiques, et de l'autre que les Arabes presque seuls alimentaient l'épidémie qui régnait alors à Constantine.

Nous avons à peine besoin d'ajouter que les convois militaires hebdomadaires avaient tout d'abord, et dès le début de l'épidémie, été suspendus entre Constantine et Batna.

Celui qui inaugura leur rétablissement, composé de 148 hommes de toutes armes, arriva à Batna le 19 septembre au moment où toute épidémie avait déjà cessé sur cette route; et pour surcroît de précautions, bien qu'il ne présentât aucun malade suspect, campa pendant huit jours avant d'entrer en caserne. — Pendant quelque temps encore, les convois de ce genre n'eurent lieu que tous les quinze jours.

AUTRES MESURES ORDONNÉES EN PAYS ARABE.

Pendant tout le temps que ce système d'isolement fut en fonction, et même au delà, des mesures analogues furent ordonnées dans les tribus arabes limitrophes du territoire protégé. D'après les résultats annoncés, et dont nous aurons l'occasion de faire connaître quelques-uns, elles paraissent avoir été surtout bien exécutées dans diverses parties des caïdats de Batna, des Ouled-bou-Aoun, de l'Oued-Abdi et des Achêches. De véritables cordons sanitaires constitués par des gardiens installés sur les routes naturelles, dans les défilés et sur les crêtes découvertes, furent établis par certaines tribus elles-mêmes, pour en interdire l'accès aux gens qui venaient des pays infectés.

Les douars avaient reçu en outre, du bureau arabe, l'ordre formel de ne recevoir personne venant de ces contrées. Les in-

digènes devaient aussi s'abstenir de tout voyage, et plus particulièrement éviter les grandes agglomérations. Il résulta de la mise à exécution de ces dispositions que la plupart des marchés furent pendant les premières semaines de l'épidémie supprimés de fait.

A Batna, l'*hakouma* (séance judiciaire) du bureau arabe avait été suspendue jusqu'à nouvel ordre. En en mot, on évitait toutes les occasions qui pouvaient appeler et faire séjourner à Batna les indigènes, même ceux placés à l'intérieur des cordons sanitaires.

D'autres recommandations avaient été aussi faites quant aux mesures de désinfection, et d'après les renseignements en notre possession, elles paraissent surtout avoir été exécutées avec quelque soin dans plusieurs fractions du caïdat des Ouled-bou-Aoun, et plus particulièrement au lazaret d'El-Guergour. Là, quand un individu mourait du choléra, ses effets et souvent même son gourbi (cabane en feuillage) étaient immédiatement brûlés, et on allumait de grands feux sur les places où les déjections avaient été reçues et que dans certaines fractions même, celle des Ouled-Mohamed-ben-Ferroudj par exemple, on avait soin d'enterrer. Le douar décampait immédiatement et l'emplacement qu'il avait occupé, et surtout celui de la tente du décédé, étaient également purifiés par de grands feux promenés sur le sol.

Les inhumations, chose cependant difficile à obtenir des Arabes, se faisaient plus profondément que d'habitude. Si on avait de la chaux, on en jetait sur les cadavres; sinon on les recouvrait d'une forte couche d'argile sur laquelle on jetait un grand amas de terre ordinaire. Les transports des cadavres dans des cimetières éloignés du lieu de décès étaient formellement interdits.

Le médecin en chef de l'hôpital de Batna avait enfin fourni au bureau arabe les matériaux d'une petite instruction qui fut rédigée en arabe, imprimée et répandue dans les tribus et qui était relative aux précautions hygiéniques et aux moyens curatifs les plus à la portée des indigènes et spécialement des caïds, cheikhs, etc.

MESURES PRISES A BATNA.

Ce sont, comme nous l'avons vu, les bonnes conditions de toute nature, dont nous avons signalé l'existence à Batna au commencement de l'épidémie, qui ont encouragé l'autorité supérieure à instituer les diverses mesures d'isolement que nous avons exposées. Mais, comme d'avance on ne pouvait répondre ni de leur parfaite exécution, ni même, dans l'état d'incertitude de la science, de leur suffisante efficacité, il était urgent de se préoccuper de l'éventualité où l'épidémie viendrait à éclater spontanément à Batna, ou bien y serait apportée par les quelques infractions, dont sont inévitablement passibles les mesures d'isolement même les plus sévèrement exécutées.

On réunit donc le 24 juillet, à l'hôtel de la subdivision, la commission hygiénique de la place et de la commune, dans le but d'arrêter toutes les dispositions à prendre pour rendre ces infractions aussi peu nuisibles que possible, et dans tous les cas assurer dans les meilleures conditions de salubrité et de sécurité pour la ville le traitement des cholériques.

C'est à quoi la commission, après avoir ratifié de son suffrage les mesures déjà prises et recommandé les dispositions de détail propres à en faciliter le fonctionnement, pourvut aussitôt en décidant l'établissement, pour les cholériques éventuels, d'une ambulance sous double tente, dont elle désigna aussi elle-même l'emplacement.

(Voir la carte, n° 4.) Cette ambulance qui pouvait comprendre au besoin seize grandes tentes pour les malades militaires et civils européens, fut installée quelques jours après à 7 ou 800 mètres Est de la ville entre les portes de Lambèse et de Constantine, sur un large plateau très-sec et très-découvert. — Elle occupait, en comprenant tous ses aménagements et toutes ses dépendances de diverses natures, une superficie d'environ 4,000 mètres carrés. — Les tentes des malades étaient espacées l'une de l'autre de 4 à 5 mètres.

Une ambulance spéciale pour les indigènes fut établie à 100 mètres plus loin vers le nord.

Une prison arabe encombrée était située à proximité de l'hôpital, et pouvait, en cas d'épidémie, devenir pour celui-ci un dangereux foyer d'infection. Elle fut immédiatement évacuée, et quelques jours après démolie. La plupart même des prisonniers furent renvoyés dans leurs tribus.

Des instructions rédigées par le médecin en chef de l'hôpital furent enfin imprimées et répandues dans le public pour recommander aux habitants toutes les précautions hygiéniques à leur portée. — On y insistait surtout sur le traitement hâtif des cas de diarrhée et sur la nécessité de désinfecter sur-le-champ et avec soin les déjections et linges des malades ainsi que les fosses d'aisances, etc.— Inutile d'ajouter que des recommandations semblables étaient mises à exécution dans les établissements publics soit civils, soit militaires.

III.

Résultats des mesures précédentes.

Centres européens.

Batna. — Toutes ces mesures, en ce qui concerne la garnison et la population civile, soit européenne soit indigène de Batna, ont obtenu un succès complet.

A partir de l'établissement des cordons sanitaires jusqu'à la levée de la quarantaine d'El-Ksour, il n'y a eu aucun cas de choléra parmi les habitants de Batna.

Mais, comme il avait été prévu, quelques gens atteints du choléra parvinrent jusqu'à Batna malgré la surveillance des postes sanitaires et furent, à d'assez longs intervalles, traités à l'ambulance, qui ne compta presque jamais qu'un malade à la fois.

Ces cas de choléra sont les suivants :

1° Le 3 août. — Ahmed-ben-Abdallah, venu à pied de Soukahras, sans domicile à Batna, ramassé place du Marché à dix heures du soir. — Décédé le 4.

2° Le 12 août. — Tourré (Victor), ouvrier cordonnier, venu à pied de Constantine, sans domicile à Batna, ramassé le matin en dehors de la porte de Sétif. — Décédé le même jour.

3° Le 14 août. — Zabrouk-ben-Ali, Sahari, venu à pied de Constantine, sans domicile à Batna, ramassé vers le soir en dehors de la porte de Constantine. — Décédé le 15.

4° Le 30 août. — Belkassem-ben-Ali, venu le 25 de la tribu des Beni-Mâafa, reçu à Batna chez son frère tenant l'établissement des bains maures, pris le 28 de diarrhée et le 29 au soir d'accidents cholériformes. — Visité le 30 par le médecin en chef et envoyé à l'ambulance. — Sorti guéri le 10 septembre.

5° Le 6 septembre. — Abdallah-ben-Mohamed, se disant venu du *Ravin bleu* le 5 septembre et tombé malade le même jour, sans domicile à Batna, ramassé dans les champs le 6 au matin. — Décédé le même jour. — Les recherches faites depuis ont établi que cet homme était complétement inconnu des populations campées aux environs du *Ravin bleu* et même dans toute la tribu des Ouled-Chilih. Aussi le caïd de Batna ne l'a-t-il point porté sur les états de décès de son commandement. Il règne donc une grande incertitude sur la provenance de ce cholérique que nous continuerons cependant, pour fixer les idées et nous tenir dans les données les moins favorables à nos conclusions, à attribuer aux Ouled-Chilih.

6° Le 11 septembre. — Merzoug-ben-Belkassem, des Ouled-Chilih, tribu placée entre le premier et le deuxième cordon sanitaire. — Arrivé à Batna le 7 septembre, reçu dans une maison près la porte de Constantine. — Visité le 11 par le médecin en chef, reconnu atteint d'accidents cholériques arrivés à la fin de la période algide, envoyé à l'ambulance. — Sorti guéri le 21 septembre.

7° Le 21 septembre. — Bouzid-ben-Bel-Kheir, venu de Ghamorra dans les Achèches depuis trois jours, sans domicile à Batna, pris le 21 au matin de symptômes cholériques, ramassé le soir dans les champs aux environs du *Village nègre*. — Décédé le 22.

Il résulte de ce tableau, que pendant toute la période que nous venons de considérer, tous les cas de choléra observés à Batna ont été offerts par des étrangers, la plupart venus (cinq sur sept au moins), de pays situés complétement en dehors du territoire protégé, et dont deux au plus, les n^os^ 5 et 6, venaient de localités situées entre les deux cordons sanitaires.

A la suite de la levée des premiers postes sanitaires et jusqu'à la fin de l'épidémie, la situation s'est maintenue essentiellement

la même à Batna, *dont aucun habitant ne nous a présenté un cas de choléra avéré.*

Le 29 septembre cependant Kolher (Michel), soldat au 36e de ligne, employé à la subdivision, a été pris d'accidents cholériformes. — Entré à l'ambulance le 30, il en est sorti guéri le 5 octobre.

Il a été établi depuis, par les déclarations mêmes de ce militaire, que les accidents dont il a été atteint, et que nous avons dû alors, sur leur apparence et à cause du silence obstiné gardé par lui, attribuer à un cas de choléra, des plus légers à la vérité, ont immédiatement suivi l'ingestion de plusieurs coques de ricin, cueillies dans le jardin même de la subdivision, qu'il avait jugé à propos de s'administrer dans le but, trop surabondamment atteint, de se purger. — Il devient donc évident que ce cas ne peut plus être rattaché à l'épidémie.

Il en est de même probablement de celui présenté, le 10 octobre, par Victoire Laribe, petite fille d'une dizaine d'années, entrée à l'hôpital à la suite de l'empoisonnement accidentel par l'arsenic qu'elle avait subi, avec sa famille, le 13 septembre. L'apparence des premiers symptômes indiquait d'abord aussi un cas de choléra. Mais leur physionomie et leur marche subséquentes, jointes aux effets mêmes du traitement antipériodique et aux antécédents de la malade, nous ont porté, nous et nos collaborateurs, à reconnaître dans ce cas singulier plutôt une fièvre intermittente bilieuse algide, comme il s'en présente quelquefois en Algérie, surtout dans la saison d'automne. Cette affection dont, paraît-il, cette enfant avait déjà éprouvé d'autres atteintes, a pu être modifiée et aggravée par quelques lésions gastriques ou intestinales résultant de l'empoisonnement subi par elle quelques semaines auparavant. — Après quelques jours d'assez sérieux dangers, entrée en convalescence le 20 octobre et sortie de l'hôpital le 8 novembre.

Nous ne connaissons donc pour cette époque de cas pouvant se rattacher d'une manière à peu près certaine à l'épidémie que le suivant :

8e Le 6 octobre. — El-Kalfa-ben-El-Allouach, venu des Ouled-Chilih à la prison de Batna depuis quatre jours, entré le 6 octobre au soir à l'hôpital pour diarrhée et placé à la salle des consignés ; pris dans la nuit de quelques accidents cholériformes. — Cas extrêmement léger, presque insignifiant. — Sorti guéri le 11 octobre.

En raison de diverses considérations, cet homme ne fut point envoyé à l'ambulance, mais traité dans un cabinet bien séparé des salles

de malades, et il en fut de même, en raison de son sexe et de son âge, de Victoire Laribe.

Avant de quitter ce sujet, nous remarquerons que pendant un instant nous avons eu la crainte que le cas de cette dernière n'eût été le produit du voisinage infectant, résultant du séjour de Kalfa, pendant la nuit du 6 octobre, à la salle des consignés, située directement au-dessous de la salle des femmes, où était placée la petite Victoire. Mais cette supposition perdit bientôt presque toute probabilité en présence de l'obscurité même de l'affection de cette jeune fille. Nous n'avons pas besoin d'ajouter, au reste, que pendant le traitement de ces deux malades, on a pris à leur égard les précautions les plus minutieuses d'isolement et de désinfection.

L'ambulance, devenue dès longtemps inutile, fut levée le 23 octobre.

On voit donc, pour nous résumer, que, pendant toute la durée de l'épidémie, il n'y a eu à Batna de cas de choléra avéré que sur huit personnes, toutes étrangères à la localité, et dont cinq au moins venaient de régions situées en dehors du territoire protégé.

A cette époque cependant les flux intestinaux, tels que diarrhées et dysentéries, se sont montrés à Batna avec une fréquence relative sensiblement plus grande qu'à l'ordinaire.

Ces affections qui, dans les mois correspondants de 1866 (juillet, août, septembre et octobre), n'avaient donné lieu pour les militaires qu'à 26 entrées à l'hôpital, — et à 25 dans la même période de 1865, — en ont fourni cette année 38.

Pour la population civile admise à l'hôpital et pour la même période, nous constatons une augmentation analogue : diarrhées et dysentéries, en 1867 : 12 ; en 1866, 9 ; en 1865, 9.

En ville, une situation semblable s'est produite également pendant le même temps, et nous avons eu surtout à remarquer un certain nombre de cas de *diarrhée verte des enfants*, dont deux ou trois ont été suivis de mort.

Cette constitution médicale, annuelle à Batna, et seulement

un peu plus marquée en 1867, mais qui, d'après une expérience déjà ancienne et incontestée, est de nature à servir de cause prédisposante au choléra, n'a point empêché cependant, comme nous venons de le voir, la complète immunité dont les habitants de Batna de toutes races, de toutes classes et de toutes professions ont joui à l'égard de cette maladie, et n'a point suffi par conséquent à la faire naître spontanément sous forme épidémique.

Comme de coutume au surplus, les affections dominantes, quant au nombre, pendant cette période, ont été les fièvres d'accès qui ont donné lieu à 84 entrées pour les militaires et à 26 pour les civils, chiffres très-faibles cependant en regard de ceux des mois correspondants de 1866 (132 pour les militaires, 54 pour les civils) et de 1865 (118 pour les militaires, 28 pour les civils), différence qui fait mieux ressortir encore la tendance plus marquée en 1867 vers les affections purement abdominales.

Nous ferons remarquer enfin, que, pendant les quatre mois d'épidémie, la mortalité à l'hôpital pour les affections internes (15 décès, non compris les 5 décès survenus à l'ambulance) n'est point sortie de ses proportions ordinaires et est restée par conséquent indépendante de toute influence attribuable à l'épidémie. En ville, les diverses catégories de population ont donné, pendant les quatre mois, 25 décès se rattachant aux maladies ordinaires.

Lambèse. — A 10 kilomètres sud-est de Batna, au pied de petits chaînons montagneux détachés de l'Aurès, lesquels dessinent tout autour une espèce de fer à cheval et forment ainsi un petit bassin hydrographique, où on peut placer la source de l'Oued-Batna. L'altitude est d'environ 1,200 mètres. La population civile européenne du village est de 400 habitants, dont 33 étrangers. — Deux compagnies d'infanterie y tiennent garnison pour le service de la maison centrale peuplée de 1060 détenus. — Les conditions hygiéniques sont sensiblement les mêmes qu'à Batna.

Aucun cas de choléra n'a été observé à Lambèse pendant toute la durée de l'épidémie.

Ce résultat a été d'autant plus heureux que la maison centrale pouvait, d'après l'expérience de ce qui a eu lieu dans d'autres épidémies, et si le choléra était venu à y éclater, devenir pour tout le voisinage un redoutable foyer dont les rayonnements auraient pu s'étendre jusqu'à Batna.

Par deux fois même, pendant le cours de l'épidémie, il y a eu lieu de prendre des précautions particulières contre cette éventualité.

Le 15 août, il arriva à la maison centrale 27 hommes, faisant partie d'un atelier qui travaillait sur la route de Constantine à Sétif. Sur les avertissements de M. le Commissaire civil, le Directeur fit placer ces hommes pendant huit jours dans un bâtiment isolé et éloigné de tous les autres en leur interdisant toute communication avec les autres détenus. Une visite sévère leur avait été en outre préalablement passée par M. le médecin de la prison, indépendamment du certificat de M. le médecin de la colonisation de l'Oued Téménia, attestant que le lieu d'où ils venaient n'était point infecté par le choléra.

Le deuxième chantier rentré à la maison centrale pendant l'épidémie venait de Bir-el-Arch, également sur la route de Sétif, où il avait perdu, sur 30 hommes qui le composaient, 7 hommes, sans compter 5 autres entrés à l'hôpital de Sétif, et dont 3 sont morts. Il ne restait donc que 18 condamnés et 1 gardien lorsque ce détachement reçut l'ordre de rentrer à Lambèse. Il dut s'arrêter à El-Guergour où il fit une première quarantaine du 30 août au 12 septembre, aux environs de l'emplacement de l'ancien lazaret indigène qui alors n'existait plus. Arrivé à Lambèse il subit, dans le bâtiment qui avait déjà servi à cet usage, une seconde quarantaine jusqu'au 25, jour de sa rentrée définitive dans l'établissement.

Aucun nouveau cas de choléra au reste ne s'était manifesté, depuis son départ de Bir-el-Arch, dans ce détachement qui s'était maintenu isolé pendant toute sa route.

Une ambulance pour les cholériques éventuels avait été pré-

parée à Lambèse dans une maison isolée et située en dehors du village, mais, comme on le voit, elle n'eut pas lieu de fonctionner.

Fesdis. — Village situé à 13 kilomètres Est de Batna, à quelque distance à droite de la route de Constantine. — Population européenne 110, dont 42 étrangers.

Aucun cas de choléra n'a été constaté à Fesdis pendant toute la durée de l'épidémie.

Populations indigènes du territoire civil.

Elles se composent de 373 israélites, de 1519 arabes et de 199 nègres, répartis dans les diverses localités déjà étudiées, — ou bien habitant le *Village nègre*, — ou bien établis dans des douars dispersés dans la campagne.

Nous n'avons rien à ajouter à l'égard de ceux qui vivent dans les trois centres européens et qui ont joui de la même immunité que les autres catégories d'habitants.

Village nègre. — Situé à 500 mètres sud de Batna et peuplé d'environ 400 habitants, dont la moitié appartient à la race nègre.

Il s'y est présenté trois cas de choléra :

1° Le 26 juillet. — Décès d'Amar-ben-Mohamed, individu étranger à la localité, arrivé la veille des Ouled-bou-Aoun, tribu à laquelle il appartenait, et où régnait déjà l'épidémie.

2° Le 2 août. — Cas suivi d'une prompte guérison du nommé Brahim, nègre habitant de la localité, mais qui était revenu la veille d'Aïn-Mlilah, sur la route de Constantine, pays alors infecté par le choléra

3° Le 21 août. — Décès de M'brouka-bent-Mohamed, négresse habitante du village; cas dont la filiation avec l'extérieur n'a pu être constatée. — Il faut dire cependant que cette femme faisait des absences fréquentes et prolongées. Il est donc permis de présumer qu'elle aura eu quelques communications avec des douars situés en pays infecté et peut-être même avec des caravanes de nomades qui passaient à cette date non loin du territoire protégé.

Ces trois cholériques n'ont pas été transportés à l'ambulance, mais, vu la grande rapidité de la mort ou de la guérison, ont été visités sur place par M. le médecin de la colonisation.

Là, au reste, aussi bien qu'à l'ambulance de Batna, les inhumations se sont faites promptement, les déjections des cholériques ont été enfouies, les effets des morts brûlés et les locaux désinfectés immédiatement par les soins de la police.

A partir de la fin de juillet, les habitants sérieusement avertis et surveillés par l'autorité ont cessé de recevoir des étrangers et suivi très-docilement toutes les précautions hygiéniques édictées par elle. Leur empressement à cet égard était même tel, qu'ils ont, il faut l'avouer, employé les désinfectants sur une échelle qui allait souvent jusqu'à l'abus.

Campements arabes du territoire civil. — *A partir de l'établissement des cordons sanitaires jusqu'à la fin de l'épidémie aucun cas de choléra n'a eu lieu parmi ces populations.*

Populations indigènes du territoire militaire.

Ces populations, dépendantes du caïdat de Batna, se composaient à l'époque de l'épidémie des tribus suivantes : Harakta-Djerma-Guebala, — Ouled-Chilih, — El-M'saïd, — Ouled-Addi, — Ouled-Yahia-ben-Zekri, et Ouled-Deradj.

Harakta Djerma-Guebala (du Sud). Pop. 485 hab. *Cette fraction, placée tout entière à l'intérieur du premier cordon sanitaire, est restée complétement indemne pendant tout le temps de l'épidémie.*

L'autre fraction de la même tribu, les Harakta-Djerma-Dahra (du Nord), établie en dehors des cordons sanitaires, a compté 10 décès.

Ouled-Chilih. — Pop. 1740 hab. — Un seul douar de cette fraction, où il est mort 9 personnes, a été frappé par l'épidémie. Il était alors établi aux Harakta-el-Madher, en dehors par conséquent des cordons sanitaires.

Tous les autres douars, situés sur le territoire protégé, n'ont compté, sur place, ni un seul décès, ni un seul cas de choléra.

Trois hommes seulement, se disant venus de ces campements, et dont un est décédé, ont été reçus, comme nous l'avons vu, à l'ambulance de Batna.

El-Msaid.—Pop. 119. hab.—Cette petite fraction n'a compté que deux décès qui ont eu lieu à la Zaouïa du cheikh Si-Abd-el-Semet (école religieuse arabe, où demeurent des gens de toutes tribus), loin par conséquent du territoire protégé.

Tous les autres campements, situés en dedans des cordons sanitaires, sont restés absolument indemnes.

Ouled-Addi. — Pop. 174 hab., et Ouled-Sidi-Yahia-ben-Zekri. — Pop. 448 hab. — Ces deux fractions n'ont eu de décès que ceux qui sont survenus au lazaret des Tamarins ou qui se rattachent à son établissement. Parmi ces décès nous comptons aussi les bergers d'Ali-ben-Djeraba, bien qu'ils appartinssent à une tribu, les Ouled-Zian, étrangère au territoire protégé et même au caïdat de Batna.

Tous les campements restés sur le territoire protégé ont été absolument préservés.

Ouled-Deradj. — Pop. 186. *Cette fraction, habitant tout entière le territoire protégé, est restée toujours complétement indemne.*

Il résulte de ce qui vient d'être dit, *qu'à partir de l'établissement des cordons sanitaires, 24 juillet, il n'y a eu dans les campements indigènes placés entre ces cordons et Batna aucun cas de choléra.*

Dans les cimetières de ces tribus au reste, il n'a été inhumé pendant toute la durée de l'épidémie qu'un seul décès cholérique dont l'enterrement s'est fait d'ailleurs avec tous les soins recommandés par le bureau arabe. C'était un enfant, fils d'Ahmed-ben-Said, des Ouled-Chilih, qui était mort aux Harakta-el-Madher, à l'extérieur du territoire protégé, et dont

le cadavre, avec la permission de l'autorité, avait été ramené de là pour être inhumé près de sa famille.

Pendant toute la période, au surplus, il n'y a eu, à part même le choléra, aucune espèce de mortalité remarquable parmi ces populations.

Quelques douars des Ouled-Fedalah, fraction du caïdat des Achèches, placés vers la limite des cordons sanitaires de Batna et isolés également par les conditions topographiques de leur habitat et par les cordons sanitaires de l'Aurès, ont été complétement indemnes. Faute de renseignements suffisants et sur leur effectif et sur le lieu exact de leurs campements, on ne les a pas compris dans les populations du territoire préservé tel qu'il est délimité sur la carte jointe à cette notice (1).

Ensemble du territoire protégé.

Si nous considérons maintenant ce territoire dans son ensemble, nous verrons qu'il affecte la figure d'un ovale irrégulier dont le grand axe, sensiblement formé par une section de la route de Constantine à Biskra, est dirigé du nord-est au sud-ouest. Sa longueur, comptée du Ksour à Oum-el-Asnam, est d'environ 44 kilomètres. L'axe qui lui est perpendiculaire, d'Aïn-Chellalah à N'za-Sdirah, est d'environ 20 kilomètres.

C'est donc en tenant compte de la forme et des irrégularités de ce périmètre, une aire totale d'à peu près 800 kilomètres carrés qui était circonscrite par le premier cordon sanitaire.

Cette superficie était au momont de l'épidémie habitée par les populations suivantes :

(1) Cette immunité a, au reste, été partagée, au dire du bureau arabe, par les autres douars de la fraction et par ceux de la fraction voisine, les Beni-Mâafa. Ces populations étaient, en effet, les mieux isolées de tout le cercle de Batna, tant par leurs propres cordons sanitaires que par ceux de Batna et de l'Oued-Abdi, et leur vigilance ne s'est pas démentie pendant toute l'épidémie, favorisée qu'elle était de surcroît par leur habitation sur des crêtes à l'écart de toute route fréquentée.

TERRITOIRE CIVIL

EUROPÉENS

Batna		1,623	TOTAL du territoire civil. 6,937
Lambèse.	village	400	
	maison centrale	1,960	
Fesdis		110	
Garnison de Batna et de Lambèse		1,653	
TOTAL		4,846	

INDIGÈNES

Arabes	1,519	
Nègres	199	
Israélites	373	
TOTAL	2,091	

TERRITOIRE MILITAIRE

TRIBUS INDIGÈNES DÉPENDANTES DU CAÏDAT DE BATNA

Harakta-Djerma-Guebala	485	TOTAL du territoire militaire. 3,152
Ouled-Chilih	1,710	
Ouled-Sidi-Yahia-ben-Zekri	448	
Ouled-Addi	174	
Ouled-Deradj	186	
El-M'Saïd	149	
TOTAL	3,152	

Total général : 10,089, dont 5,243 indigènes.

On voit par ce tableau combien l'application de ce système d'isolement a dû être facilitée par le peu de densité de la population du territoire protégé qui est d'environ 12 1/2 habitants par kilomètre carré, c'est-à-dire, de beaucoup inférieure à celle du département le moins peuplé de France.

En nous résumant, on voit, que sur tout le territoire protégé il n'a été constaté à partir du 24 juillet, jour de l'établissement des cordons sanitaires, jusqu'à la fin de l'épidémie, que 11 *cas de cholera, dont* 4 *au plus seulement* (3 *des Ouled-Chilih,* 1 *au Village nègre*) *n'ont pas été évidemment importés du dehors.*

OBSERVATIONS SUR LES RÉSULTATS PRÉCÉDENTS.

Nous espérons n'avoir pas besoin de nous arrêter à de longues reflexions, pour établir la relation, tout au moins très-probable, qui existe entre les résultats que nous venons de signaler et les diverses mesures que nous avons exposées en premier lieu.

Nous avons d'abord à écarter une objection qui peut être soulevée avant tout autre examen.

On peut se demander, en effet, si l'isolement a été aussi sérieux, aussi réel qu'il semble avoir été efficace.

La réponse à cette objection se trouve, ce nous semble, dans le très-petit nombre même des cholériques qui, venus de pays situés en dehors des cordons sanitaires, ont réussi, dans un intervalle de deux mois, à aborder à Batna et au *Village nègre*, et dans l'absence absolue d'arrivages de cette nature à Lambèse et à Fesdis.

Tous les témoignages que nous avons recueillis s'accordent en outre à affirmer expressément qu'à part les rares infractions déjà connues, commises par des individus isolés, et celle que nous signalerons tout à l'heure, les consignes des postes sanitaires ont été sévèrement exécutées et n'ont laissé passer aucun groupe d'individus venant des pays infectés. Les habitants de Fesdis bien à portée d'en juger *de visu*, puisqu'ils étaient voisins de deux postes, font les mêmes déclarations.

Et une autre preuve encore que les postes sanitaires fonctionnaient avec rigueur, c'est qu'ils interdisaient l'approche de Batna, aussi bien aux Européens qu'aux indigènes eux-mêmes. Pendant tout le temps qu'ils ont été maintenus en effet, il n'est pas arrivé à Batna *un seul des colons et des bûcherons du Bel-lezma*, qui pour entrer dans le territoire protégé avaient à franchir le premier cordon à travers les postes qui surveillaient

les Ouled-bou-Aoun. Les expéditions qu'ils avaient à faire sur Batna avaient lieu, à partir du premier cordon sanitaire, par l'intermédiaire même des cavaliers des postes qui se les passaient de relai en relai jusqu'à destination. Une disposition analogue était adoptée pour celles qu'ils avaient à recevoir, et qui étaient attendues par leurs convoyeurs également au premier cordon sanitaire (1).

Jusqu'à la levée des premiers postes sanitaires, il en a été absolument de même pour les convois arabes venant d'autres lieux, et particulièrement de Constantine. Et même pendant quelque temps encore après cette levée, les convoyeurs n'étaient point admis en ville et devaient, jusqu'à leur départ, camper au dehors à une distance qui leur était assignée.

La correspondance avec les annexes du bureau arabe et les caïdats se faisait également par l'intermédiaire des gardiens des postes auxquels les messagers transmettaient leurs dépêches sans pénétrer dans le territoire protégé et sans communiquer directement avec eux.

Il faut bien se le rappeler, au surplus, les cordons sanitaires étaient plus spécialement établis contre les deux ordres de provenances les plus dangereux pour Batna; — 1° les voyageurs de Biskra; — 2° les caravanes de nomades.

Pour ce qui est des arrivages de Biskra, on ne connaît qu'un seul individu qui se soit évadé de la quarantaine, et la surveillance de l'unique poste qui la gardait alors n'a été éludée, dans les premiers jours qui ont suivi son établissement, que par le groupe de convoyeurs venus de Biskra dont l'abord près de Batna, comme nous l'avons vu, a motivé la création du lazaret des Tamarins et de tous les autres postes sanitaires. — Et quant aux voyageurs qui arrivaient à Batna après quarantaine, ils ont été presque tous visités par le médecin en chef de l'hôpital qui s'assurait de leur état de santé, et dans le cas où ils y devaient séjourner, ils donnaient leurs adresses à la police afin d'être facilement retrouvés au moindre symptôme de maladie.

(1) Voir, à la suite de cette notice, la pièce annexe n° 1.

Pour ce qui concerne les passages de caravanes sur le territoire protégé, c'était bien, on peut l'assurer, chose très-laborieuse que la surveillance nécessaire pour les empêcher; une seule fois cependant, cette surveillance s'est trouvée en défaut. Vers le 20 août, et pendant la nuit, deux petits détachements de nomades ont réussi à franchir les cordons et à traverser le territoire indemne, et le lendemain au matin, on ramassait aux environ d'El-Biar huit cadavres qu'ils avaient laissés derrière eux. Cette infraction a été stérilisée, à notre avis, et par la rapidité avec laquelle a eu lieu le passage sur le territoire prohibé et par l'heure à laquelle il s'est effectué et qui a garanti les habitants de toute communication avec les groupes infectés.

Le 22 août au soir, on a été à Batna sous l'imminence d'une infraction de cette sorte beaucoup plus grave. Deux cents tentes environ des Arab-Gheraba, venant des environs de Guelma et rentrant dans le Sahara, refusaient d'obéir aux injonctions des gardiens des postes et menaçaient de suivre leur route à travers le territoire protégé. Il fallut, pour leur faire entendre raison et les obliger à prendre d'autres itinéraires éloignés de ce territoire, faire sortir au-devant d'elles, par deux routes différentes, l'escadron de cavalerie de la garnison, ainsi que l'escadron de chasseurs alors campé à la *Fontaine de l'hôpital*.

L'isolement, sans être toujours absolu, chose que l'on savait d'avance impossible à obtenir, a donc été très-réel, très-sérieux, surtout en ce qui concerne les provenances les plus dangereuses.

Une autre objection, également très-sérieuse contre l'efficacité supposée des mesures d'isolement, s'est aussi présentée à notre esprit, quand n'étant pas encore exactement informé du degré d'immunité dont avaient joui, dans le territoire protégé, les populations indigènes campées sous la tente, nous avons eu connaissance du très-faible chiffre de mortalité relevé dans le cercle de Batna, pour les civils européens.

Les tableaux hebdomadaires, fournis à l'époque de l'épidémie, ne donnent en effet pour ceux-ci que 8 décès cholériques constatés, savoir : 3 survenus à la quarantaine d'El-Ksour, sur des émigrants de Biskra, — 1 à l'ambulance même de Batna

sur un étranger venu de Constantine, — 1 au caravansérail des Tamarins, et 1 à l'auberge d'Aïn-Yacouts. — 2 autres décès, très-probablement cholériques aussi, ont eu lieu aux environs d'Aïn-Yacouts, dans un chantier de condamnés occupant ce point de la route.

En présence de ce tribut, si insignifiant par comparaison avec les Arabes, payé, en dehors même du territoire protégé, par la population civile européenne du cercle de Batna, et bien que celle-ci soit extrêmement peu nombreuse en dehors de la ville de ce nom et de ses annexes, il y avait lieu de se demander si l'immunité des habitants de Batna, de Lambèse, etc., ne tenait pas à peu près exclusivement à une aptitude moindre chez les Européens à contracter le choléra, résultant d'une meilleure alimentation, d'un régime de vie mieux entendu, etc.

Il est vrai que les populations indigènes habitant ces mêmes localités avaient été également épargnées; mais, comme elles participent nécessairement et dans une mesure assez large aux conditions hygiéniques où vivent les Européens, cette considération ne pouvait affaiblir de beaucoup l'objection dont il s'agit (1).

Pour la faire tomber complétement il a fallu, ce qui a eu lieu en effet, l'immunité tout aussi complète dont ont joui à la même époque les populations indigènes habitant *sous la tente* à l'intérieur du territoire protégé. Elles n'étaient pas, à peine avons-nous besoin de le faire remarquer, mieux partagées sous le rapport du bien-être et des habitudes hygiéniques que les groupes congénères, de même nom quelquefois, qui, placés dans les régions extérieurement attenantes au premier cordon sanitaire, y subissaient les atteintes de l'épidémie cholérique. — Les tribus des Ouled-Chilih, des Ouled-Addi, etc., sont tout au contraire les plus misérables peut-être de tout le cercle de Batna.

(1) Voir cependant, à la suite de la notice, le tableau comparatif des décès cholériques musulmans dans les territoires civils des diverses parties de l'Algérie.

C'est donc la préservation des douars indigènes, et plus particulièrement des tribus appartenant au territoire militaire, qui donne leur véritable caractère et toute leur valeur aux résultats que nous avons énoncés.

Pour mesurer l'importance de cette immunité, nous allons donner les chiffres des décès indigènes dans plusieurs des régions avoisinant le territoire protégé. C'est le seul élément de comparaison dont nous disposions, le nombre des cas de choléra survenus dans ces pays n'ayant pu être exactement établi.

Nous ne connaissons pas non plus, d'une manière bien précise, le chiffre total des décès indigènes du cercle de Batna. Toutefois, d'après les renseignements en notre possession, nous ne croyons pas nous éloigner de la vérité en le fixant *au plus bas mot* à environ 3,000, ce qui pour une population totale de 108,229 habitants donne une mortalité relative de 2,77 pour 100.

Mais nous avons des chiffres exacts (1) pour les cinq caïdats les plus rapprochés de Batna, et avec lesquels la ville entretient en temps ordinaire le plus grand nombre de relations : ceux de Batna enclavant de tous côtés le territoire protégé — des Ouled-bou-Aoun le confinant au nord-ouest — des Achêches à l'est — des Ouled-Daoud — et de l'Oued-Abdi situés au sud.

(1) Il ne peut y avoir aucun doute sur la réalité ni sur le nombre de ces décès, portés sur des états nominatifs, par fractions, fournis par les caïds à la suite d'un recensement opéré après l'épidémie. — Mais, quant à la nature de l'affection à laquelle ils sont rapportés, il est bien évident que, n'ayant pu être soumise à un contrôle médical, elle n'est point d'une certitude à l'abri de toute contestation. Néanmoins, les erreurs à cet égard ne peuvent avoir été, en face de mortalités exceptionnelles, que relativement bien peu nombreuses; car les Arabes, surtout après quelques jours d'épidémie, savaient bien reconnaître à ses symptômes le choléra, qu'ils nomment *louba*. — Et comme d'ailleurs ces erreurs ont dû se commettre partout à peu près dans les mêmes proportions, les chiffres en question conservent une valeur très-suffisante d'exactitude pour l'ordre de comparaisons auquel nous les faisons servir en ce moment.

Le caïdat de Batna, sur une population de 12,877 habitants, a perdu 277 individus, soit 2,15 pour 100.

Celui des Ouled-bon-Aoun, sur une population de 9,994, a perdu 238 personnes, soit 2,38 pour 100.

Celui des Achêches, sur une population de 9,413, a perdu 117, soit 1,24 pour 100.

Celui des Ouled-Daoud, sur une population de 7,148, a eu 57 décès, soit 0,80 pour 100, ce qui est la mortalité la plus basse des neuf caïdats du cercle de Batna.

Les chiffres de l'Oued-Abdi sont bien plus significatifs encore que les précédents; nous les donnerons plus loin.

En prenant deux fractions du caïdat de Batna, très-rapprochées du territoire protégé, nous ferons encore mieux ressortir le contraste entre la mortalité qui régnait dans ces régions et l'immunité qui existait à l'intérieur des cordons sanitaires.

Les Harakta-el-Madher, sur une population de 1,120 habitants, ont eu 60 décès, soit 5,35 p. 100.

Les Ouled-si-Ali-Tahamment, sur 1,381 habitants, en ont perdu 53, soit 3,91 p. 100.

En décomptant de la manière la plus défavorable possible les six décès indigènes survenus dans le territoire protégé (4 à l'ambulance de Batna, 2 au Village nègre), c'est-à-dire en prenant le parti exorbitant de ne tenir aucun compte de la provenance extérieure de la presque totalité des individus qui les ont fournis, et en retranchant en outre du total de la population indigène les 373 israélites, il reste encore évident que la mortalité relative accusée par ces 6 décès sur 4,870 musulmans, soit 0,12 p. 100, est de près de sept fois plus petite que celle du caïdat le moins frappé, celui des Ouled-Daoud, — et de vingt-trois fois plus petite que la mortalité moyenne du cercle. — Elle devient à peine appréciable si, au contraire, on tient un juste compte de toutes les circonstances que nous avons mentionnées.

L'influence des prédispositions issues des différences dans le bien-être et dans les habitudes hygiéniques des diverses catégories de population ainsi écartée comme cause principale de

l'immunité du territoire préservé, faudra-t-il plutôt attribuer celle-ci aux conditions géologiques, topographiques ou atmosphériques propres à cette région particulière?

Nous avons vu que le sol était de nature calcaire. Il ne présente point par conséquent la composition qui a quelquefois été invoquée comme garantie d'immunité pour certaines localités.

Le voisinage de forêts ne peut davantage être mis en ligne de compte, car les pays des Ouled-bou-Aoun, des Ouled-Daoud, de l'Oued-Abdi (Aurès occidental) et des Beni-Oudjana et des Hamamra (Aurès oriental) sont en très-grande partie couverts de forêts, et ont néanmoins été frappés par l'épidémie.

La position de Batna et de ses annexes, dans le grand courant atmosphérique qui va de la région saharienne vers les lacs des hauts plateaux, peut-elle à elle seule rendre mieux compte de cette immunité? Non. Car les Lakhdar, au sud du territoire protégé, les Harakta-el-Madher, et les Ouled-si-Ali-Tahamment, au nord, qui sont placés dans le même courant, n'en ont pas moins souffert de l'épidémie.

Et quant à l'altitude de la contrée, il s'en faut de beaucoup que cette condition, dont la valeur est sans doute bien loin d'être négligeable, ait préservé des atteintes de l'épidémie les populations qui semblaient appelées à bénéficier de son influence favorable. Des villages placés dans des vallées et sur des crêtes de l'Aurès, d'une altitude atteignant jusqu'à 1,800 mètres, ont été fortement éprouvés par le choléra, ainsi que le témoigne la mortalité du caïdat de l'Oued-Abdi, formé par une région très-montagneuse. Ce caïdat, en effet, sur une population de 9,974 individus, a compté 335 décès, soit 3,54 p. 100, proportion très-sensiblement supérieure à la mortalité moyenne du cercle de Batna. Et pour le rappeler en passant, c'est dans ces villages de l'Oued-Abdi que l'épidémie s'est maintenue le plus tardivement, circonstance qui, outre les raisons que nous ferons connaître plus tard, est peut-être bien dépendante aussi de l'agglomération dans des habitations fixes et rapprochées, de populations qui, cependant, sous d'autres rapports hygié-

niques, l'emportent sur les populations moins laborieuses campées sous la tente.

Si nous venons maintenant à faire porter les mêmes comparaisons sur les centres européens, elles nous donneront des résultats plus remarquables encore, et encore plus contraires à l'hypothèse, où l'immunité de Batna, pendant la dernière épidémie, serait sous la dépendance exclusive ou même principale des conditions, soit extérieures, soit intérieures d'habitat. Ces conditions ont d'abord été toujours les mêmes pour Batna, et à plus forte raison aux époques où la ville, ayant déjà son étendue actuelle, était sans doute moins peuplée qu'aujourd'hui. Ce qui n'empêche pas que, du 9 novembre 1849 au 7 janvier 1850, je ne relève sur les registres de l'hôpital 154 décès cholériques (137 militaires, — 17 civils), et en 1854, du 27 juillet au 27 septembre, — 90 décès (69 militaires, — 21 civils) produits par la même maladie. Mais alors on était bien loin de penser à des quarantaines et à des cordons sanitaires. Tout au contraire, on se souvient qu'en 1849, comme MM. Vincent et Collardot viennent encore de le constater dans leur travail si remarquable et si concluant sur les épidémies de l'Algérie, l'apparition du choléra à Batna a immédiatement suivi l'arrivée des troupes se rendant au siége de Zaatcha, et qui venaient de pays infectés, et qu'en 1854, les premiers cas ont également suivi l'arrivée à Batna du 68e de ligne, venant de Bône où régnait déjà l'épidémie.

Pour en revenir à celle de 1867, des localités de la province qui, sous les rapports climatériques et topographiques, et aussi sous celui des dispositions intérieures, ont la plus grande ressemblance avec Batna, Sétif et Aïn-Beidah, — pour nous borner à deux exemples, — viennent de payer un tribut des plus notables au choléra.

Nous ignorons la mortalité d'Aïn-Beidah, petite ville du sud-est de la subdivision de Constantine, située à une altitude supérieure à celle de Batna, jouissant d'un climat relativement tempéré, et où les vents, si propres à disperser les éléments cholérigènes, quelles qu'en soient la nature et l'origine, règnent

en tout temps avec une grande force. Mais nous possédons des renseignements exacts sur Sétif, ville située à environ 1,080 mètres d'altitude, et qui, nous le répétons et pouvons l'attester personnellement, puisque nous l'avons habitée, présente des analogies très-frappantes avec Batna.

A Sétif donc, sur une population de 11,510 individus compris dans l'étendue de la commune, il y a eu, du 23 juillet au 29 septembre 1867, 211 décès qui se répartissent ainsi par catégories d'habitants :

	Population.	Décès.	Moyenne.
CIVILS INDIGÈNES			
Arabes.	6,000	114	1.90 p. 100
Nègres.	152	2	1.31 p. 100
Israélites.	762	14	1.84 p. 100
EUROPÉENS			
Population civile. . . .	2,158	68	3.15 p. 100
Garnison (effectif moyen).	2,458	13 dont 5 Musulmans.	0.53 p. 100
Totaux. . . .	11,510	211	MOYENNE GÉNÉRALE : 1.83 p. 100

On voit qu'ici, chose remarquable, la prédisposition à l'épidémie a été, si on doit en juger par la mortalité relative, plus grande chez les Européens que chez les indigènes.

Nous n'avons pas besoin d'ajouter qu'à Sétif, pas plus qu'à Aïn-Beidah, il n'a pu être pris, tout au moins en temps utile, aucune des mesures d'isolement du genre de celles qui ont été appliquées au territoire de Batna, les Arabes du dehors n'ayant été écartés de la ville qu'alors que l'épidémie y sévissait déjà depuis plusieurs jours.

Nous ne voyons plus contre l'utilité supposée des mesures d'isolement qu'une dernière objection, la stérilité des cas de choléra qui sont venus jusqu'à Batna et au Village nègre. Mais cette stérilité, pour ce qui est d'abord de Batna, nous semble

s'expliquer tout naturellement et d'une manière très-suffisante par les bonnes conditions où se trouvait la ville et davantage encore par les dispositions et précautions diverses destinées à venir en aide aux mesures d'isolement et à rendre leurs transgressions prévues aussi inoffensives que possible.

Ces transgressions étant, en effet, à peu près inévitables, les mesures disolement n'ont de raison d'être que dans la supposition où la contagiosité du choléra, bien que réelle, est cependant assez limitée et conditionnelle pour que toutes les infractions commises à leur égard ne soient pas toujours nécessairement, fatalement, et en dépit de toutes garanties appropriées, suivies de conséquences désastreuses. L'isolement, même imparfait, peut donc alors n'être pas tout à fait sans profit pour les populations auxquelles on l'applique et qui auront d'autant plus de chances de se préserver, qu'elles se seront, d'un autre côté, mieux défendues par les diverses mesures de désinfection, d'assainissement, etc., qui doivent se coordonner avec les mesures d'isolement et en sont même le corollaire indispensable.

Or c'est là précisément ce qui s'est réalisé à Batna, et ce qui ressort des faits que nous allons sommairement rappeler.

Les cholériques venus à Batna ont été de sept dans un intervalle de deux mois ; — sont arrivés un à un, à de longs intervalles de temps en général les uns des autres ; — ont été, pour la plupart, peu après leur arrivée, ramassés sur la voie publique et le plus souvent dans les champs ; — n'ont point pour la plupart, par conséquent, séjourné dans des habitations, — n'ont point, par conséquent aussi, communiqué avec des habitants, — ont été, aussitôt que recueillis, transportés à l'ambulance, — c'est-à-dire dans un lieu distant de la ville de près de 800 mètres, — éloigné de toute habitation, — balayé par les vents de toutes directions, — où chacun d'eux, seul dans un vaste camp, n'avait de rapport qu'avec le médecin et l'unique infirmier qui le soignaient, — où leurs déjections étaient immédiatement désinfectées et enfouies, — leurs effets également désinfectés et le plus souvent brûlés.

Ajoutons que les moyens de désinfection ont été aussi em-

ployés dans les lieux où ils avaient séjourné, et spécialement à l'égard du sol souillé de leurs déjections.

Il nous semble, en vérité, que dans une semblable situation, il n'y a pas beaucoup lieu de s'étonner si les quelques rares cholériques en question n'ont point fait naître le choléra à Batna. Et pour ce qui est du Village nègre, bien que les trois cholériques qu'il a présentés aient été traités sur place, les mêmes raisonnements lui sont à peu près applicables, la localité étant aussi située dans de bonnes conditions d'aération, et les habitations nègres étant, comme on sait, notablement plus propres que celles des Arabes, sans parler des précautions déjà indiquées qui ont été observées là aussi bien qu'à Batna.

Nous sommes loin de nous refuser, par conséquent, à faire une part, même assez large, dans l'immunité de nos localités, à l'ensemble des conditions hygiéniques, etc., où elles se trouvaient placées et qui ont dû concourir efficacement au succès des moyens d'isolement. Car si, en se plaçant dans l'hypothèse de la transmissibilité du choléra, le bon sens indique qu'il ne saurait être indifférent de recevoir dans une localité et dans un temps donné, 5 ou 10, — ou 20, — ou 50 cholériques, il est permis de présumer aussi, qu'à nombre égal et dans le même temps, ces cholériques n'exerceront pas la même action dans un lieu bien ventilé, ou dans un lieu étouffé, — par une température basse ou par une température élevée, — à l'égard d'individus disséminés dans un vaste espace ou à l'égard d'individus encombrés dans un local étroit, — sur des individus demeurant dans des habitations proprement tenues ou sur des individus logeant dans des réduits infects, — sur des populations robustes et bien nourries ou sur des populations déjà détériorées par la misère et les maladies, etc., etc.

Or, tous les ordres à peu près de conditions propres à s'opposer aux dangers de l'importation du choléra se sont trouvés réunis dans les centres européens du territoire protégé, et nous allons les rappeler sommairement pour Batna en particulier.

Ventilation considérable résultant de la situation de la localité sur un large plateau exposé aux vents de toutes les directions,

— rues larges et spacieuses, — maisons non encombrées, — localité peu peuplée relativement à son étendue, — où la surveillance médicale pouvait s'exercer sur chaque individu, soit habitant, soit arrivant, et était facilitée aussi par le fractionnement des arrivages par petits groupes successifs, — police vigilante et attentive à parer à tous les incidents de nature à intéresser la santé publique, — éloignement de tout foyer d'infection préexistant, — absence dans la ville et à sa proximité immédiate de toute agglomération de population misérable et détériorée, — état sanitaire initial de la population et de la garnison excellent, — dispositions morales des diverses catégories d'habitants très-bonnes également, et entretenues telles par la confiance même inspirée par les mesures d'isolement, etc., etc.

Et pour l'ensemble du territoire protégé, d'autres circonstances encore rendent un compte très-suffisant de l'efficacité des mesures adoptées pour le préserver: circulation des voyageurs d'une faible importance et se faisant par des routes peu nombreuses, — moyens suffisants tant en personnel qu'en matériel pour assurer la meilleure installation et le meilleur fonctionnement des quarantaines et des cordons sanitaires, etc., — et par-dessus tout enfin la *hâtiveté* même avec laquelle ces dispositions ont été appliquées. C'est le 15 juillet, comme nous l'avons vu, que le choléra est signalé à Biskra, et dès le 19, la quarantaine d'El-Ksour est établie et le 20 elle fonctionne. Des décès cholériques sont signalés du 20 au 23 juillet chez les indigènes dans le territoire civil de Batna et aux Ouled-bou-Aoun, et dès le 24 sont organisés les lazarets et les cordons sanitaires destinés à éloigner de Batna les gens suspects. On était alors certain, nous ne pouvons trop le répéter, de prendre ces mesures en temps encore utile, car d'une part, les arrivages infectés n'avaient encore eu lieu dans les environs que par petits groupes, et de l'autre, rien dans la constitution médicale de la ville et de ses annexes n'était de nature à y faire craindre l'importation déjà effectuée d'une influence épidémique. En peut-on dire autant de toutes les mesures du même genre qui ont été

prises à d'autres époques dans diverses localités? N'ont-elles pas bien souvent été ordonnées et mises à exécution, après seulement que des arrivages de pays infectés, le plus souvent inaperçus, avaient déjà déposé le germe épidémique parmi les populations qu'il s'agissait de défendre? Et faut-il alors s'étonner de leur plus ou moins complète inefficacité?

Arrivé au terme de cette discussion, il ne ne nous reste donc plus, pour expliquer rationnellement l'immunité du territoire de Batna en contact de tous côtés avec l'épidémie cholérique, que les mesures d'isolement, renforcées par les conditions et par les précautions diverses que nous avons exposées.

DIVERS EXEMPLES DE POPULATIONS INDIGÈNES AFFIRMANT S'ÊTRE PRÉSERVÉES PAR DES MESURES D'ISOLEMENT.

La conclusion que nous venons de formuler est appuyée encore par ce fait que les populations du territoire de Batna ne sont pas les seules dans le cercle qu'un isolement, même imparfait, ait plus ou moins complétement préservées pendant la dernière épidémie. De sorte que là aussi les mêmes résultats semblent avoir été la conséquence des mêmes moyens.

Sans parler en effet des localités ou des groupes qui seront mentionnés dans le chapitre suivant, les recherches que nous avons faites sur la marche du choléra de 1867 parmi les populations indigènes du cercle, nous ont fait connaître, outre les Ouled-Fedalah et les Beni-Maafa déjà mentionnés, nombre de fractions de tribu de divers caïdats qui, grâce, assurent les caïds, à leur docilité persistante aux prescriptions du bureau arabe, et quelquefois aussi à leur isolement naturel, sont restées indemnes pendant tout le cours de l'épidémie.

Le fait même de l'immunité de ces populations est à peu près indéniable. Celui de leur isolement réel par leurs propres soins, plus difficile à admettre au premier abord, n'étonnera cependant beaucoup que les personnes qui ne connaissent pas le régime de vie et les habitudes des Arabes, et par conséquent ne savent pas combien longtemps ils peuvent supporter la

privation de relations extérieures qui leur sont infiniment moins nécessaires qu'aux Européens. Les Arabes de la tente, en effet, n'ont et ne font guère *d'affaires*, et, à l'époque de l'épidémie, la misère n'étant pas chez eux, à beaucoup près, ce qu'elle est devenue depuis, ils trouvaient encore assez facilement sur place la maigre satisfaction de leurs médiocres besoins. Rien aussi de moins impossible pour eux, quand ils le veulent bien, que d'isoler de toutes communications extérieures des douars, composés seulement de quelques tentes, toujours disséminés à de grandes distances les uns des autres, et souvent placés hors de toutes routes fréquentées et sur des points même d'un accès difficile (1).

Aussi ces faits d'isolement allégués par les caïds sont-ils admis comme vrais par le bureau arabe de Batna. Nous allons en produire quelques exemples.

La tribu des Zoui, située tout à fait au nord du caïdat de Batna, se divise en trois fractions.

La première, celle des Ouled-el-Kadi, n'a eu d'atteint par l'epidémie qu'un seul douar composé de vingt tentes et où il est mort seize individus. Le choléra y avait éclaté immédiatement après le retour de Srah, cercle de Constantine, du nommé Messaoud-ben-Bahloul, sa première victime. —Tous les autres douars de cette fraction, s'étant maintenus dans l'isolement, sont restés préservés.

Même chose est arrivée à la deuxième fraction, celle des Ouled-si-Ahmed-ben-Saïd, qui n'eut également qu'un douar de frappé, celui qui avait reçu le cholérique Mohamed-Srir-ben-Si-Brahim à son retour du marché de l'Oued-Dekri, route de Constantine à Sétif. Ce douar, composé d'une dizaine de tentes, a eu dix décès. — Tous les autres douars de la fraction, ayant maintenu jusqu'au bout leur isolement, ont été préservés.

Les faits ne sont pas présentés avec la même netteté pour la troisième fraction, celle des Ouled-si-Ahmed-ben-Bouzid qui a

(1) Ce sont là aussi les conditions qui rendent facile, dans un douar, la constatation de la provenance des premiers cas de choléra qui s'y présentent.

payé à l'épidémie un bien plus fort tribut que les précédentes (35 décès), et dans laquelle il y eut plusieurs douars de frappés. Il paraît cependant que jusqu'à une période assez avancée de l'épidémie plusieurs d'entre eux étaient restés indemnes grâce à un rigoureux isolement. Mais vers la fin de l'épidémie leurs habitants se relâchèrent, dit-on, de leurs précautions et visitèrent des pays infectés. Ils en revinrent malades, et à partir de là, l'épidémie sévit chez eux.

Dans le caïdat des Ouled-bou-Aoun, les faits de ce genre sont plus nombreux et plus complets. Toutes les fractions, en effet, assure le caïd, isolées soit par la nature, soit par les mesures prises par elles-mêmes en conformité des ordres du bureau arabe, ont été absolument préservées. Aucune des fractions que je vais nommer ne figure en effet au tableau des décès cholériques aux Ouled-bou-Aoun, tel qu'il a été fourni par le caïd.

Ce sont : 1° Les Ouled-Menah, petite fraction de 110 âmes, placée entre les Halimia et les Ouled-sidi-Abderrhaman, fractions cholérisées (isolement artificiel).

2° Une petite fraction, dite des Arab-Tadjinent, placée au milieu des Halimia (isolement artificiel).

3° Les Rouagheub, petite fraction placée dans le pays de Taga, aux environs des Ouled-si-El-Hadj-ben-Ameur, infectés pendant quelque temps (isolement artificiel).

4° Les Ouled-sidi-Ali-Haïdoussa, habitant le pays de Merouana, entre les Ouled-sidi-Abderrhaman et les Haouara (isolement artificiel).

5° Les Ouled-Zerafa; population, 958 habitants.

6° Les Ouled-En'Seur; pop., 505 hab.

7° Les Ouled-Yahia-ben-Zeman; pop., 703 hab.

Et 8° Les Beni-Maklouf; pop., 558 hab., isolés, outre les mesures prises par eux, par la constitution orographique du pays, c'est-à-dire séparés par des crêtes de montagnes des contrées infectées qui les avoisinaient, et qui étaient habitées par d'autres fractions du caïdat des Ouled-bou-Aoun, les Lakhdar et les Ouled-Sultan.

Jusqu'à une époque assez avancée de l'épidémie, la fraction

des Ouled-si-El-Hadj-ben-Ameur, composée de 999 habitants, s'était maintenue soigneusement isolée et était restée complétement indemne. Le choléra, qui, du reste, n'y a fait en tout que sept victimes, y a suivi le retour et la mort de deux hommes qui étaient allés voir aux Ouled-Mehenna un malade nommé Belkheir-ben-Djabala.

Mais c'est surtout dans le caïdat de l'Ouled-Abdi que l'on trouve des exemples remarquables et avérés de groupes de populations indigènes qui, étant restés indemnes tant qu'avait duré leur isolement, n'ont souffert de l'épidémie qu'après s'être départis de leurs précautions primitives et ont payé alors plus ou moins cher leur manque de persévérance.

Les villages de Nahra, de Tagoust, de Bouzina et de Teneyet-el-Abed s'étaient d'abord isolés avec beaucoup de soin, et, grâce à ces mesures, étaient parvenus à se préserver jusque environ le milieu d'octobre, époque où le choléra sembla sur le point de s'éteindre dans tout l'Oued-Abdi où il régnait depuis les premiers jours du mois d'août. Mais dans la seconde quinzaine d'octobre ils se relâchèrent de leurs précautions. A ce moment, une recrudescence de l'épidémie venait de se déclarer à Menah, où la maladie avait été réimportée par deux individus de ce village qui venaient de rentrer de Biskra et qui étaient morts à leur arrivée. Le village de Nahra, jusque-là épargné, reçut des gens de Menah et fut infecté à partir de ce moment. Il en fut de même, et pour semblable cause, de celui de Tagoust et un peu après de celui de Bouzina qui reçut des gens de Tagoust même et d'autres villages cholérisés.

Il mourut à Nahra 69 personnes, à Tagoust 25, à Bouzina 41 et 14 à Teneyet-el-Abed, où l'épidémie ne se déclara que vers le 10 novembre, en tout 149 personnes ; et c'est la persistance de l'épidémie dans ces localités, jusque environ le 16 novembre, qui motiva, comme nous l'avons vu, le maintien tardif du poste sanitaire de N'za-Sdirah.

Nous ne connaissons dans l'Oued-Abdi d'exemple d'immunité à peu près complète que le suivant :

Un nommé Ben-Si-Labed, venu avec sa famille de Chettma

(oasis de Biskra) à Oum-el-Kha, y mourut peu de jours après son arrivée ainsi que sa femme. On ne voulut pas les enterrer dans le cimetière de ce village (1) et on les inhuma avec soin dans un lieu particulier et éloigné. Un des individus qui avaient assisté à l'inhumation, mourut aussi un peu après. Ces trois personnes furent les seules victimes du choléra. Car à partir de ce moment, le village d'Oum-el-Kha, ayant repris son isolement, resta indemne.

Il faut en convenir au surplus, malgré la bonne volonté manifestée en plusieurs lieux par les habitants, l'isolement n'était pas facile à maintenir dans ce caïdat, où la population est en grande partie agglomérée dans des villages rapprochés les uns des autres, le long de vallées plus ou moins resserrées.

Bien autres sont les conditions, au point de vue qui nous occupe, du caïdat voisin, les Ouled-Daoud, situé également dans les montagnes de l'Aurès. Là, les villages sont peu nombreux, et les populations, disséminées sur de vastes espaces, habitent presque toutes sous la tente. L'été venu, elles se dispersent même davantage encore, et vont camper par petits douars sur des crêtes et dans des gorges situées à de grandes hauteurs, et peu fréquentées par conséquent par les étrangers. C'est cet isolement naturel, dans un pays des plus accidentés, qui rend compte, en partie au moins, de la très-faible mortalité qui a frappé ce caïdat, et qui contraste si fort avec celle de l'Oued-Abdi habité cependant par des populations de même race (Berbères chaouïa).

Pour en finir avec les faits d'isolement préservateur qui se sont produits en pays arabe, nous rappellerons encore l'immunité complète dont jouit, pendant toute la durée de l'épidémie, un douar des Ouled-si-Sliman du caïdat des Ouled-Sultan, qui n'eut pas un seul cas de choléra, bien qu'il fût voisin d'un autre douar de la même fraction qui fut fortement frappé par l'épi-

(1) Plusieurs faits, relevés dans la dernière épidémie, semblent révéler l'influence nocive des émanations des cimetières où ont été enterrés des cholériques, surtout quand les inhumations, comme il n'arrive que trop chez les Arabes, sont faites trop superficiellement.

démie. Mais il en était séparé par une rivière, et il mit à profit cette circonstance pour interrompre avec lui toutes communications à partir du moment où l'épidémie s'y déclara. Ces douars, étant de tous ceux de la fraction les plus rapprochés l'un de l'autre, le caïd qui nous a exposé ce fait ajoute, que le contraste qu'ils offrirent entre eux frappa vivement l'attention des populations.

En comparant enfin la mortalité générale du cercle de Batna qui est d'environ 3,000 décès, soit pour une population totale de 108,229 habitants—2,77 pour 100,—à celle du cercle de Sétif, il est permis de présumer encore que la dissémination des populations, et peut être aussi les mesures d'isolement prises par elles rendent compte, au moins en partie, de la différence assez marquée qu'on trouve en faveur du cercle de Batna.

Celui de Sétif qui, sur une étendue territoriale beaucoup moindre, possède une population de 146,000 habitants, a eu, d'après les renseignements que nous possédons, au moins 5,300 décès, ce qui lui donne une mortalité moyenne de 3,63 pour 100 à peu près.

IV.

Éloignement temporaire de la garnison de Biskra. — Ses résultats.

Comme appendice aux mesures prises pour préserver Batna, nous avons maintenant à exposer les principales circonstances qui se rattachent à l'éloignement temporaire des troupes françaises de la garnison de Biskra.

Les dispositions adoptées pour effectuer ce mouvement ont dû en effet avoir pour objet, à la fois d'assurer aux troupes évacuées l'immunité la plus prompte possible, et de garantir les populations, dont elles avaient à traverser le territoire, de toute importation épidémique.

Un isolement rigoureux devait donc leur être imposé, au

moins pendant les premières semaines qui suivraient l'évacuation. C'est ce qui a eu lieu en réalité, et comme nous allons le voir, avec un résultat des plus satisfaisants.

Évacuation de l'escadron du 6e chasseurs à cheval. — Cet escadron qui, sur un effectif de 102 hommes, en avait déjà perdu une vingtaine depuis le commencement de l'épidémie, se mit en route dans la nuit du 25 au 26 juillet, en laissant 14 hommes à l'hôpital de Biskra. Il avait deux étapes à faire avant d'atteindre sa destination, et il lui fut sévèrement prescrit d'éviter pendant la route toute communication avec les populations, et plus particulièrement les caravansérails. Il dut en conséquence laisser à quelque distance sur sa droite le défilé d'El-Kantara, en passant par la faille de l'Oued-Chebaba.

A son arrivée à N'za-ben-Messaï, le 27 juillet (voir la carte, n° 5), il avait perdu en route 3 hommes, et il avait 6 cholériques à l'ambulance, laquelle était placée à 130 mètres du campement des troupes.

Jusqu'à la levée du camp, le 4 août, jour du départ pour Aïn-Touta, il y eut 7 décès, savoir : 1 le 28 juillet, — 2 le 29, — 1 le 30, — 1 le 2 août, — 1 le 3 août, — 1 le 4 août.

Voici au reste le mouvement des malades pendant la durée du séjour à N'za-ben-Messaï :

	ATTEINTS	SORTIS par guérison	MORTS	ÉVACUÉS sur l'ambulance de l'Oued-El-Ksour	RESTANT en traitement.	
6e chasseurs..	29	20	6	3 dont 1 mourut à 300 mètres avant d'arriver	»	
Artillerie....	1	1	»		»	
Tr. des équip.	1	1	»		»	
Infirmiers...	2	»	1		1	

Au moment de l'arrivée au campement d'Aïn-Touta, et vu l'évacuation qui venait d'être faite sur l'ambulance de l'Oued-El-Ksour, il ne restait plus avec l'escadron qu'un seul homme suspect, l'infirmier Vasse qui, dans la journée même du départ,

venait d'être atteint de symptômes cholériques, d'une apparence d'abord assez bénigne.

Dans la matinée et avant le départ, son camarade Perruchot, venu avec lui de Batna pour assister le médecin aide-major, avait succombé à une attaque de choléra foudroyante survenue, paraît-il, à la suite d'un excès de boisson.

Quant à Vasse, après avoir paru pendant quelques jours marcher dans la voie d'un complet rétablissement, il fut pris, dans la journée du 10 août, à la suite, dit-on, d'une indigestion également, d'une rechute qui devint mortelle au bout de quelques heures.

Ce fut pendant toute la durée du campement d'Aïn-Touta, le seul décès survenu parmi ces évacués, *qui ne présentèrent là aucun nouveau cas de choléra.*

Ces deux infirmiers ont ainsi fourni les deux dernières entrées à l'ambulance pour cause cholérique, le 4 août, *c'est-à-dire neuf jours après le départ de Biskra.*

Ils étaient partis de Batna le 28 juillet, avaient couché le 28 et le 29 à El-Ksour, et étaient arrivés le 30 au camp de N'za-ben-Messaï; c'étaient donc des nouveaux-venus dans le foyer cholérique, et cette circonstance, jointe à leur contact incessant avec les malades, permet de supposer avec quelque vraisemblance que, malgré l'amélioration déjà constatée dans l'état sanitaire de l'escadron, toute influence infectante pour les étrangers pouvait bien n'y être pas encore tout à fait éteinte. — Supposition corroborée encore par le fait de Barbier, homme du train, atteint du choléra le 29 juillet, à la suite d'un transport fait sur le camp des chasseurs, et mort à la quarantaine d'El-Ksour le 30. — Au surplus, il n'est pas à la rigueur impossible que ces infirmiers aient contracté le choléra à la quarantaine même où ils ont séjourné deux jours.

(Voir la carte, n° 7). A Aïn-Touta, l'escadron était campé sur les terrains vacants à l'est de la grande avenue conduisant au Bordj de la smala de spahis et à quelques centaines de mètres des bâtiments. Cet établissement militaire, dirigé par un officier français, était resté jusque-là, et resta jusqu'à la fin com-

plétement indemne, grâce à l'isolement dans lequel il se maintint pendant tout le temps de l'épidémie, isolement bien facilité, il faut l'avouer, et par le très-petit nombre des habitants du Bordj (les spahis étaient alors presque tous occupés au service des quarantaines et des cordons sanitaires), et par la dissémination des cultivateurs indigènes en dépendants par petits campements espacés, dans un pays alors d'autant moins fréquenté que le marché d'Aïn-Touta avait été suspendu par ordre supérieur. Cependant, à plusieurs kilomètres du Bordj, à l'époque où les chasseurs vinrent y camper, se trouvaient quelques douars des Lakhdar infectés par le choléra; mais toute communication leur était interdite aussi bien avec la smala qu'avec les chasseurs.

Quant à l'isolement entre les chasseurs eux-mêmes et la smala, malgré la vigilance des commandants des deux postes, nous ne voudrions pas garantir qu'il put être, pendant les neuf jours que dura le voisinage, toujours complétement observé, à cause de la faible distance qui les séparait. Heureusement alors les infractions ne pouvaient avoir de sérieux dangers puisque, comme nous l'avons vu, les chasseurs eux-mêmes étaient déjà à peu près purifiés de toute influence épidémique.

Nous n'avons pas besoin d'ajouter que pendant toute la durée du camp de N'za-ben-Messaï, situé beaucoup plus loin de la smala, l'absence de communication avec elle avait été absolue, et qu'à la date où nous sommes arrivés, il en était de même pour le camp voisin de l'Oued-El-Ksour, alors occupé par les compagnies du 3e bataillon d'Afrique évacuées de Biskra.

Au moment de la mort de Vasse, l'état sanitaire était devenu très-bon dans l'escadron, et la constitution médicale s'était même modifiée au point de donner lieu à des bronchites assez nombreuses. — Le 9 août au soir, on reçut plusieurs chasseurs sortis guéris de l'ambulance de l'Oued-El-Ksour. Par surcroît de précaution, ils furent pendant plusieurs jours consignés à l'ambulance sans contact avec leurs camarades.

Le 13 août, levée du camp d'Aïn-Touta, et le 14, après avoir évité le passage à travers la ville, arrivée à la *Fontaine de*

l'hôpital, sur la route de Constantine, à 3 kilomètres nord-est de Batna (voir la carte, n° 9).

Les communications avec la ville restèrent encore interdites aux troupes pendant une quinzaine de jours. — La rentrée à Batna en caserne eut lieu le 25 octobre.

Pendant toute la durée de ce campement, il n'y eut parmi les hommes d'autres maladies qu'un certain nombre de fièvres rémittentes, quelques-unes même à caractère typhoïde, qui furent traitées à l'hôpital de Batna et qui toutes furent suivies de guérison. Elles étaient attribuables, sans doute, à quelques terrains marécageux situés aux environs de la butte sur laquelle le camp était établi.

Évacuation du bataillon d'Afrique (2 compagnies). — A la fin de juillet la garnison de Biskra, composée de 425 hommes, avait perdu par le choléra environ 80 militaires.

Cette situation ne paraissant pas devoir se modifier promptement, Son Excellence M. le maréchal gouverneur de l'Algérie, ordonna l'éloignement temporaire de la plus grande partie des troupes. — Cette opération, déjà heureusement entamée par le départ des chasseurs, se continua comme il suit par le départ des deux compagnies du 3e bataillon d'Afrique, etc.

On commença par l'évacuation des malades transportables de l'hôpital. — Le 31 juillet, à dix heures du soir, ce premier détachement se mit en route. — Il était ainsi composé : 1 officier, — 1 médecin aide-major, — 9 infirmiers, — 32 malades, — 9 convalescents, — 3 soldats du train, — 1 caporal et 11 chasseurs du 3e bataillon d'Afrique, en tout 67 hommes. — On laissait à l'hôpital 18 malades avec M. le médecin aide-major Dubois et une partie du personnel d'administration.

Après avoir bivouaqué le 1er août dans la plaine d'El-Outaïa, le détachement arriva le 2 de très-bonne heure aux environs d'El-Kantara, où il passa la journée et dont il partit à la fin de la nuit pour le campement définitif de l'Oued-El-Ksour, où il arriva le 3 à six heures du matin. — Malgré le sirocco, il

n'avait point eu de malheur à déplorer en route et il arrivait avec 5 ou 6 hommes seulement dangereusement malades.

A cause des difficultés de la marche résultant du transport des malades, on n'avait pu éviter de prendre la route des caravansérails, et en conséquence de passer par la gorge d'El-Kantara, au voisinage par conséquent d'une oasis infectée et devant l'auberge où une vingtaine environ de personnes aisées de Biskra étaient venues se refugier pendant l'épidémie. Mais, sans parler des dispositions que nous ferons connaître un peu plus loin, ce passage ayant eu lieu vers la fin de la nuit, aucune communication ne fut possible entre le détachement et les habitants quelconques de ces localités.

C'est ici le lieu de signaler l'immunité dont, à part les deux femmes qui vinrent mourir à la quarantaine d'El-Ksour, jouit pendant la durée de l'épidémie, malgré le voisinage de l'oasis infectée, le petit groupe européen d'El-Kantara, composé des habitants de l'auberge et d'un petit atelier d'ouvriers des ponts et chaussées, travaillant à la route.

Le premier cas de choléra avait eu lieu dans l'oasis, le 22 juillet, sur un indigène étranger à la localité, et dans les premiers jours d'août, l'épidémie y régnait et enlevait 15 à 20 personnes par jour.

Cette oasis, étant située au sud de la gorge, était séparée des habitants européens, situés au nord, par les gigantesques rochers du Djebel-Gaous et du Djebel-Essor, formant ainsi entre les deux populations une sorte d'écran naturel. Quant à l'isolement artificiel entre les Européens et les habitants de l'oasis, nous ne voudrions pas affirmer que, pendant toute la durée de l'épidémie dans les villages, c'est-à-dire environ un mois, il fut absolument complet. Car nous savons qu'il venait fréquemment des indigènes à l'auberge d'El-Kantara pour leurs achats. Toutefois, ce n'étaient là que des individus isolés, qui ne s'arrêtaient que quelques instants à l'auberge, et dont aucun, au reste, ne présenta de symptôme de maladie. Et, quant aux gens de Biskra réfugiés dans l'auberge, ils auraient été en trop grande contradiction avec le but même de leur présence à El-

Kantara et avec les recommandations d'isolement qui leur avaient été faites aussi bien qu'aux ouvriers travaillant sur la route, — recommandations qui, pour le dire en passant, étaient *à l'ordre du jour* chez tous les Européens dans le cercle de Batna, — s'ils ne s'étaient mis rigoureusement à l'abri de toute communication avec les gens suspects. Ils se tenaient donc presque toujours renfermés dans leurs chambres et plus particulièrement au moment des passages des voitures, des détachements, etc., venant de Biskra. Il va sans dire que bien moins encore ils allaient dans l'oasis, d'autant mieux que, par les soins du cheikh de la localité obéissant aux ordres supérieurs qu'il avait reçus, celle-ci était gardée par une sorte de cordon sanitaire qui empêchait l'abord des étrangers; les voyageurs indigènes étaient même obligés, pour éviter l'oasis, de passer par le défilé de l'Oued-Chebaba. Quant aux voyageurs européens, sans parler des défenses sévères faites par les chefs de détachement, des gardes indigènes étaient placés, pour empêcher les soldats de pénétrer soit dans les villages de l'oasis, soit dans le hameau européen; et tout soldat voyageant isolément était arrêté par eux, aussi bien, au reste, que toute personne voyageant à pied ou en voiture sans permis de l'autorité. Et enfin, sous la surveillance très-assidue et très-dévouée de M. Parizel, conducteur des ponts et chaussées, qui dirigeait l'atelier, les inhumations se faisaient dans les cimetières de l'oasis avec de grands soins, et les tombes furent recouvertes de grandes quantités de chaux.

Voilà bien des raisons qui peuvent rendre compte, selon nous, de l'immunité de la population européenne d'El-Kantara. — Mais revenons au détachement évacué de Biskra.

Il campa sur le bord de l'Oued-El-Ksour, rive gauche, à 2 kilomètres au-dessus du camp des chasseurs. Des dispositions furent prises pour empêcher toute communication avec les divers campements environnants, ainsi qu'avec le Bordj d'Aïn-Touta.

Pendant cette journée et dans la nuit du 3 au 4, on eut à constater six nouveaux cas de choléra : sur un homme du train,

— un caporal et un chasseur du bataillon — et trois infirmiers. — Ces derniers étaient encore des nouveaux-venus, tout récemment envoyés de Constantine et de Batna; l'un d'eux même, Guillon, parti de Batna le 31 juillet, n'avait rejoint l'évacuation que le 2, au nord d'El-Kantara, et était parti avec elle pour aller camper à l'Oued-El-Ksour. — Tous trois moururent dans les journées du 4 et du 5.

On ne peut s'empêcher, à cette occasion, de faire remarquer le lourd tribut payé à l'épidémie de Biskra par le corps des infirmiers. — A l'époque de l'invasion de l'épidémie, 25 composaient l'effectif de l'hôpital, 25 autres ont été successivement envoyés de Constantine et de Batna comme renfort et comme remplacement. Sur les 50, 28 ont été frappés; — parmi les anciens, 12, dont 6 sont morts; — parmi les nouveaux, 16, dont 12 sont morts.

Le 3 août, au soir, eut lieu le départ de Biskra de la 1re compagnie du bataillon. Le 5, elle arriva à El-Kantara et alla camper sur le bord de la rivière, à une grande distance au nord de la gorge, et le 6, au matin, sans avoir eu aucun malade en route, elle rejoignait l'ambulance à l'Oued-El-Ksour.

Vers la fin de la même journée, arriva également, avec la plus grande partie du personnel de l'hôpital, la 2e compagnie du bataillon qui était partie de Biskra à peu près en même temps, emmenant le bureau arabe et les services civils qui furent installés le 7 au caravansérail des Tamarins.

C'est le 4 au soir et le 5 au matin qu'arrivèrent les ravitaillements abondants de Batna, qui furent reçus avec les précautions déjà indiquées pour éviter toute communication avec les soldats convoyeurs.

Les détachements de Biskra étant dès lors réunis, les dispositions furent prises pour le campement définitif. L'ambulance fut laissée isolée sur la rive gauche, et les compagnies allèrent camper sur la rive droite sur un monticule très-aéré et situé à 400 mètres de la rivière et près d'une source très-abondante et très-bonne. (Voir la carte, n° 6.) — Le cimetière fut placé à 1500 mètres du camp dans une gorge abritée de tous les vents.

Faute de combustible et pour ménager les désinfectants, les cadavres étaient enterrés avec leurs effets et leurs couvertures. La même chose se faisait pour les mêmes motifs au camp des chasseurs.

Le 5 août on avait eu deux nouvelles atteintes sur deux infirmiers, qui guérirent tous deux.

Les dernières entrées à l'ambulance eurent lieu le 6 août, fournies par le chef du dernier détachement évacué de Biskra, M. le lieutenant Goirand, et par un chasseur de sa compagnie qui avaient pris le choléra en route. — Tous deux moururent, le chasseur, le 9, et M. Goirand, le 18 août, à l'ambulance alors établie près de la quarantaine d'El-Ksour.

On voit que les derniers détachements évacués de Biskra se purifièrent de toute influence épidémique plus rapidement encore que l'escadron de chasseurs.—A quoi attribuer cette si prompte immunité? A deux causes : d'abord et incontestablement à l'éloignement du foyer épidémique si intense qui existait à Biskra ; puis ensuite à l'isolement qui, *dans un pays lui-même infecté*, empêchait dans les camps l'apport de nouveaux éléments de contamination cholérique, et laissait ainsi aux troupes le bénéfice complet de toutes les conditions favorables où elles étaient venues se placer.

Voici au reste le mouvement de l'ambulance du 31 juillet au 10 août.

CORPS.	RESTANT en traitement.	ENTRÉES.	SORTIES.	MORTS.	RESTANTS.
Civils.	1	»	»	»	1
Militaires. . . .	31	19 y compris les évacués des chass.	13	7	30

Le 15 août, l'état sanitaire étant des plus satisfaisants, le camp de l'Oued-El-Ksour fut levé. — Les compagnies allèrent camper ce jour-là à El-Biar, pour de là se diriger sur l'Oued-Hamla (camp dit des Cèdres), où elles arrivèrent le 16 et où elles furent

rejointes par l'aide-major du bataillon, qui y prit le service médical. (Voir la carte, n° 10.)

Quant à l'ambulance qui comptait alors 21 malades, presque tous convalescents, et 18 infirmiers, dont 6 auxiliaires, elle alla s'installer sur la rive droite de l'Oued-El-Ksour, à 500 mètres environ de ce cours d'eau, et à un bon kilomètre de la quarantaine. (Voir la carte, n° 8.)

Elle y resta jusqu'au 25, où réduite, par des évacuations successives sur l'Oued-Hamla, à deux convalescents, elle évacua ceux-ci sur le lazaret d'El-Ksour, où tout le personnel d'officiers de santé, d'administration et d'infirmiers qui la composaient vint se joindre à eux avant de rentrer à Batna, le 31, après une dernière quarantaine de six jours.

Voici le mouvement de l'ambulance de Biskra, du 10 au 25 août, jour de sa dissolution :

CORPS.	RESTANTS.	ENTRÉES.	SORTIES.	MORTS.	RESTANTS.
Civils.	1	»	1	»	»
Militaires. . .	30	»	29 y compris les évacués.	1	»

La situation n'était pas moins bonne au camp des Cèdres placé dans une excellente position, et sous le rapport de l'aération et sous celui de l'eau. L'isolement fut maintenu dans toute sa sévérité jusqu'au 24 août, où quatre hommes du génie, faisant partie du camp, rentrèrent à Batna après désinfection de leurs effets et visite du médecin, et où les officiers de la garnison de Batna furent autorisés à aller visiter leurs camarades à l'Oued-Hamla.

Pendant toute la durée de leur séjour sur ce point, les compagnies du camp des Cèdres n'eurent pour ainsi dire pas de malades, et elles n'envoyèrent à l'hôpital de Batna que des affections insignifiantes.

Le 21 septembre eut lieu la rentrée, à Batna, du détachement

du train campé à l'Oued-Hamla, et le 11 octobre les compagnies du bataillon elles-mêmes rentrèrent en caserne à Batna.

La nouvelle garnison de Biskra y fut envoyée en plusieurs détachements, du 20 au 26 octobre.

V.

Conclusions.

Les mesures diverses d'isolement et de dissémination exposées dans cette notice n'ont, chacune prise à part, rien de bien nouveau et qui sorte des recommandations déjà formulées dans le but d'arrêter la propagation des épidémies cholériques.

Ce qui leur donne, à notre avis, et leur originalité et leur valeur, c'est l'application qui en a été faite dans des circonstances encore peu expérimentées jusque-là, — c'est surtout l'ensemble homogène et méthodique qu'elles ont formé en se coordonnant entre elles et avec les précautions hygiéniques destinées à les appuyer; — ce sont enfin, aussi, les soins que l'on a pris pour les faire exécuter aussi bien que possible, en regard des moyens dont on diposait, et qui, pour être plus grands qu'en France, n'étaient pas cependant sans limites.

Aussi, malgré les infractions inévitables qu'elles ont dû souffrir, malgré les lacunes, les irrégularités, les fautes qui n'ont pu manquer de se produire dans plusieurs des nombreux et difficiles détails de leur exécution, nous croyons-nous autorisé à tirer des résultats dont elles ont été accompagnées les conclusions suivantes :

I. Les mesures d'isolement, y compris les quarantaines et les lazarets, appliquées contre le choléra là où elles peuvent l'être, et comme elles doivent l'être, ne sont point dangereuses.

De ce qu'en effet elles ont été trop souvent jusqu'ici mises à

exécution avec inintelligence, avec désordre, avec brutalité, il ne s'ensuit nullement qu'il en doive être toujours ainsi à l'avenir. La science et la bonne administration n'ont point encore dit leur dernier mot à leur égard, et rien ne prouve qu'elles ne trouveront pas les moyens d'en écarter, en grande partie au moins, les vices qu'on leur a reprochés. — Les petits lazarets, par exemple, installés sous la tente, dans des lieux très-aérés, là où le climat et la saison le permettent, paraissent répondre aux principales exigences de la question.

II. Il ne semble pas nécessaire que les quarantaines, pourvu qu'elles soient bien faites, soient de longue durée.

Les faits relevés dans le courant de cette notice paraissent établir en effet que, dans les circonstances au moins où ils se sont passés, dix jours au plus de quarantaine suffisent pour dégager de toute action infectante les personnes venant d'un foyer cholérique. — Toutefois, l'expérimentation n'a pas eu lieu sur une échelle assez étendue pour résoudre cette question, dont l'étude devra être continuée dans des conditions variées.

III. Les mesures d'isolement et de dissémination recommandées par les principes contagionnistes doivent se combiner avec toutes les mesures hygiéniques de nature à en assurer l'efficacité, en rendant moins dangereuses les transgressions dont elles sont passibles.

Ces mesures hygiéniques peuvent se résumer en deux mots : *aération*, *propreté;* et il n'y a rien de plus en harmonie avec les hypothèses de la doctrine contagionniste, que les précautions d'où résultent : la propreté, qui a pour but et pour effet d'éloigner et de détruire les matières cholérigènes, et l'aération, qui dissipe les émanations qui s'en dégagent. — Et de leur côté, l'isolement et la dissémination ont pour conséquence, précisément, de rendre la propreté et l'aération plus faciles et en même temps plus efficaces.

La doctrine de la contagion a donc, plus encore que la doctrine opposée, et si elle veut être fidèle à elle-même, besoin de la pratique rigoureuse des prescriptions hygiéniques.

IV. A ces conditions, et pourvu qu'elles restreignent notablement les communications dangereuses, et lors même qu'elles n'arriveraient pas à réaliser un isolement parfait, les mesures du genre de celles qui ont été prises à Batna peuvent acquérir une efficacité, sinon absolue, au moins très-appréciable, et en limitant la propagation des épidémies cholériques, rendre des services signalés aux populations.

V. Malgré les difficultés très-réelles de leur application, elles ne sont donc point, toujours et partout, absolument impraticables, et elles peuvent recevoir, sans cesser d'être utiles, les tempéraments exigés par les circonstances et réglés par la prudence et par l'humanité.

En preuve des précautions de détail qui étaient prises pour assurer la meilleure exécution des mesures sanitaires, nous donnons la lettre suivante :

PIÈCE ANNEXE N° I.

Lettre adressée aux Européens concessionnaires d'usines dans le Bellezma, par M. le commandant supérieur de la subdivision, au sujet des précautions à prendre contre le choléra.

Batna, le 4 août 1867.

« Plusieurs cas de choléra s'étant déjà manifestés dans les fractions des Halimia et des Ouled-sidi-Abderrhaman, de la tribu des Ouled-bou-Aoun, les Européens et les indigènes du Bellezma devront cesser toutes relations, à partir de ce jour et jusqu'à nouvel ordre, avec Batna.

« Des postes indigènes ont été établis sur le plateau du Chellala, au *Ravin bleu* et au débouché de toutes les gorges qui conduisent des Ouled-bou-Aoun dans la plaine de Batna, pour l'exécution de cette mesure.

« Afin d'assurer les approvisionnements de votre établissement, des mulets seront placés en permanence aux postes du Chellala et du Ravin bleu pour relever ceux que vous dirigeriez sur Batna, pour votre ravitaillement ou pour vous apporter toutes les denrées que vous pourriez avoir à demander à cette localité.

« Ces denrées seront apportées par ces mulets jusqu'au poste du plateau du Chellala, où elles devront être enlevées par vos soins.

« Tout Européen qui voudrait quitter le Bellezma pendant l'épidémie pour se fixer à Batna, ou pour y faire un séjour momentané, devra se rendre à Oum-el-Asnam pour y subir une quarantaine de huit jours. Quelques tentes seront établies sur ce point pour les recevoir. Il en sera de même des individus qui conduiraient vos charrettes sur Batna ou Constantine (1).

« Dans les circonstances actuelles, il convient que vous cherchiez à vous isoler le plus possible, dans votre établissement et vos chantiers, des indigènes, afin de soustraire vos ouvriers aux influences de l'épidémie dont ils sont atteints.

(1) Il n'y a pas eu lieu d'exécuter ces dispositions.

« Je donne à cet effet des ordres, afin que les postes de garde qui vous avaient été donnés au mois de mai dernier soient retirés.

« Les raisons qui avaient nécessité un moment l'installation de ces postes n'existent du reste plus aujourd'hui, et ils ont cessé d'être nécessaires pour garantir la sécurité de vos chantiers.

« Je prescris en outre que l'on fasse éloigner de votre établissement les douars qui peuvent en être actuellement trop rapprochés.

« Vous devrez, de votre côté, vous employer à empêcher toutes relations de vos ouvriers Européens ou indigènes) avec les indigènes du dehors, et interdire d'une manière formelle, à ces derniers, l'accès de votre établissement. Demandez à cet effet, si vous le jugez nécessaire, au caïd de la tribu, l'installation de quelques postes formant un cordon sanitaire, à une certaine distance, autour de votre usine.

« Il a des ordres pour se rendre à votre demande (1).

« Quelque pénible que doive être pour vous et pour vos gens l'exécution de ces diverses prescriptions, vous comprendrez qu'elles sont commandées dans les circonstances actuelles par des exigences de salut public, devant lesquelles doivent s'effacer toutes les questions d'intérêt ou de convenance personnelle.

« J'espère aussi qu'appréciant les raisons impérieuses qui me les ont dictées, vous emploierez votre influence sur vos ouvriers pour obtenir qu'elles soient ponctuellement exécutées.

« Je compte à ce sujet d'une manière complète sur votre concours.

« Je vous adresse ci-joint une instruction, établie par M. le médecin en chef de l'hôpital militaire de Batna, sur les précautions hygiéniques à prendre pour prévenir l'invasion du mal.

« Cette instruction renferme, en outre, quelques indications sur la médication à suivre dans les cas de maladie et les prescriptions à observer en cas de mort.

« Je vous prie de m'annoncer réception de la présente dépêche.

« Le caïd des Ouled-bou-Aoun reçoit des ordres pour transmettre à Batna toutes les lettres que vous pourriez avoir à m'adresser pendant le cours de l'épidémie, ainsi que vos lettres particulières. Ces lettres seront remises par les cavaliers du caïd aux postes du cordon sanitaire, qui les feront parvenir à Batna.

« ARNAUDEAU. »

(1) Ces dispositions ont été exécutées en effet.

Pour faire apprécier à toute sa valeur le degré d'immunité dont ont joui les populations musulmanes du territoire civil de Batna, nous produisons le tableau comparatif suivant, dont la plupart des éléments sont empruntés à l'*Annuaire de l'Algérie* et au numéro du 25 janvier 1858 de la *Gazette médicale de l'Algérie*, et se rapportent exclusivement, sauf pour Constantine, aux populations musulmanes des divers territoires civils, où elles participent dans la même mesure qu'à Batna aux conditions où vivent les Européens. — Le chiffre des décès pour Constantine a été pris sur le rapport de M. le docteur Reboulleau.

PIÈCE ANNEXE N° II.

STATISTIQUE

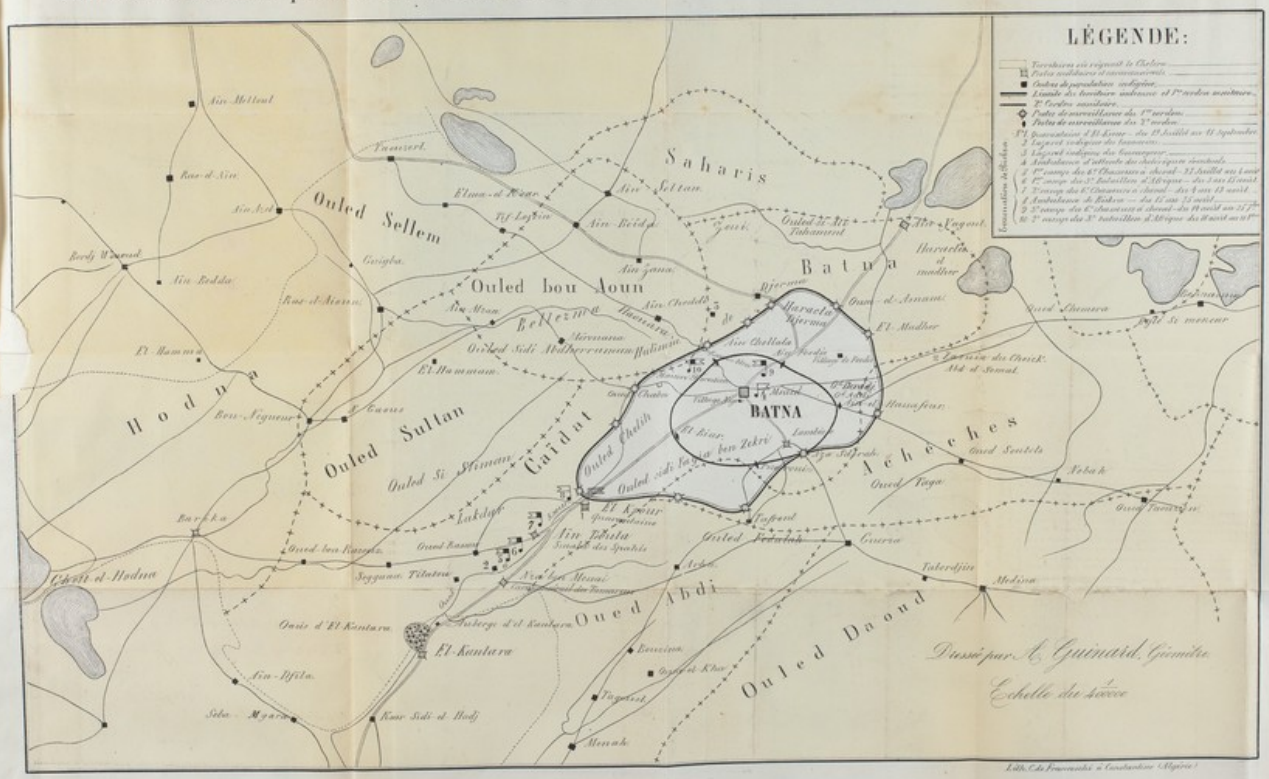
des décès cholériques musulmans dans les territoires civils de l'Algérie (1867).

LOCALITÉS.	POPULATION	DÉCÈS.	PROPORTIONS.	OBSERVATIONS.
Algérie entière. . . .	199.571	6.521	3,26 %	
Prov. d'Alger. . . .	91.844	4.500	4,90 %	
— de Constantine.	55.686	1.563	2,70 %	(1) Il convient de se rappeler que l'épidémie n'a commencé dans cette province que vers le mois de septembre, ce qui explique le chiffre relativement faible des décès.
— d'Oran (1) . . .	52.041	548	1,0 %	
Ville de Constantine.	(2) 25.131	(2) 335	(2) 1,33 %	(2) Israélites compris.
— de Setif.	6.132	116	1,89 %	
Territoire civil (3) de Baina (cord. sanit.).	1.718	6	0,35 %	(3) Pour faciliter la comparaison, on voit qu'ici nous trouvons compté uniquement du lieu où les décès se sont produits, sans avoir égard à la provenance des individus qui ont succombé.

Paris. — A. PARENT, Imprimeur de la Faculté de Médecine, r. Mr-le-Prince, 31.

CARTE

indicative du territoire préservé du CHOLÉRA en 1867 par les cordons sanitaires établis autour de BATNA (*Algérie*)



STATISTICAL EXAMINATION

OF THE

MARGATE DEATH-RATE,

FOR THE

FIVE YEARS, 1863-1867.

BY ORDER OF THE COUNCIL OF THE BOROUGH OF MARGATE.

BY

EDWARD MOTTLEY.

AUTHOR OF "THE VITAL STATISTICS OF THE TOWN OF MARGATE, FOR THE TWELVE YEARS ENDING JUNE, 1849," ALSO "A REPORT ON THE SANITARY CONDITION OF MARGATE, FROM 1837 TO 1862."

MARGATE: PUBLISHED BY THOS. H. KEBLE.

1868.

TO THE

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OF THE

Borough of Margate,

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IS DEDICATED

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Having given my attention since the year 1864 to statistical inquiry, and examined by careful analysis the reports of the Registrar-General from 1838 to 1867, and the registration of Margate for 20 years, I felt confident the question of the Registrar-General could be satisfactorily answered, and the apparent heavy death-rate of Margate fully accounted for and explained. With this view I requested an interview with the chief magistrate, as the public health of the town is one within the immediate jurisdiction of the town council, acting as a board of health. The result was the appointment of a committee for the purpose of obtaining the necessary information, and being entrusted with the inquiry, I caused the records of the mortality of the sub-district Margate to be copied with great exactitude. I have submitted the same to a careful analysis, the results of which I have now the honour to lay before you.

The growth of the vast metropolis, London, the facility of transit, the improvement and increasing reputation of the town, adding annually to the number of visitors, the deaths of invalids and patients in the hospital increase in a similar ratio. In the year 1864, the names of 58 visitors and 44 patients in the hospitals were inscribed in the registrar, increasing the death-rate of 168 to 10,000 residents to 270 mixed population. During the five years, 1863-1867, 88 strangers have died annually on the average at Margate. Within the last half century the deaths from this source have increased threefold. The names of strangers now occupy one-third of the registration list, a fact certainly never before recorded, and one that has no parallel at any place of

* Quarterly Report, p. li. 1864.

popular resort on the continent, and certainly not in any of the 623 districts of England and Wales. Should the increase continue in the same proportion, in a short space of time the deaths of strangers and inhabitants will be equal. Margate in this respect stands quite alone.

The necessity of classifying the registration lists of districts situated similar to Margate has become so prominent that Dr. FARR in his appendix to the 24th report of the Registrar-General says—"In large hospitals and lunatic asylums the mortality is so much higher than the rest of the population, that the mortality of the district deduced from the living and dying, including hospital patients, does not correctly express the mortality of the inhabitants of the place. Local inquirers are alone in a condition to correct effectively local derangements."

The two previous publications of 1850 and 1862, relating to the public health of the town, were based upon a classified population. Continental statistical writers invariably classify the population, and with a greater degree of minuteness than is possible in English statistics.

The mortality of the town and sub-district Margate for the 5 years 1863-1867, stands thus:—

—	Residents.	Visitors.	Hospitals.	Total.
	873	265	177	1,313
Annual Average	174	53	35	262

or, 17 to 1,000 resident. Dr. Farr's standard of normal health.

MORTALITY FROM EPIDEMIC, ENDEMIC-CONTAGIOUS (ZYMOTIC) DISEASES.

—	Residents.	Visitors.	Hospitals.	Total.
	163	48	19	228
Annual Average	32	9	3	47

DEATHS OF INFANTS UNDER ONE YEAR OF AGE.

—	Births.	Residents.	Visitors.	Total.
	1,485	176	43	219
Annual Average	—	35	8	43

Annual infant mortality, 10 per cent.

MORTALITY FROM CONSUMPTION.

—	Residents.	Visitors.	Hospitals.	Total.
	85	21	7	113
Annual Average	17	4	1	—

Annual mortality from consumption, 17 to 10,000 living.

MORTALITY FROM INFLAMMATORY DISEASES OF THE LUNGS.

—	Residents.	Visitors.	Hospitals.	Total.
	88	17	3	108
Annual Average	17	3	—	—

Annual mortality from inflammatory diseases of the lungs, 17 to 10,000 living.

Compared with the general mortality of England and Wales, the numbers range as follows:—

—	England.	Margate.
General Mortality	22	17
Infant Mortality	20	10
Zymotic Diseases	50	32
Consumption	26	17
Respiratory Organs	31	17
Bronchitis	13	7

When it is considered that the previous calculations are founded upon the census of 1861 (presumed incorrect), and no allowance made for the increase of the population, it will be evident how highly favourable the public health has been during a period eminently insalubrious.

The Registrar-General made the following observations in the Quarterly Report, page li.:—"It is doubtful whether the world will continue to resort to places which have often no natural advantages over others, and are selected like some of the insalubrious German watering places by mere accident." I

may here be permitted to remark that Margate seems to have been and to be selected for its health-giving qualities, and for that alone; but medical experience and public observation have alike failed to remark how eminently favourable the locality is for persons liable to pulmonary diseases during the winter months.

It is evident from this, and the preceding publications, that the great number of patients and invalids domiciled amongst the resident inhabitants has not affected the public health of the community. If it be asked what are the objective conditions that produce so favourable a result, the answer must be found in the aphorism of the Great Father of Medicine—"that where the air, the water, and the soil are good, the inhabitants are healthy." The experience and teaching of 3000 years have added nothing to this truth.

At Margate, the north-east portion of the Isle of Thanet, the soil is dry, antiseptic, percolatious and absorbent. No amount of rain lodges more than a few hours on the surface, hence the proverb—

"When England wrings,
The Island sings."

Absorption carries down the minute microscopic particles of decaying offensive matter. Evaporation carries them abroad, and contaminates the atmosphere.

The commission issued a few years back by the Bavarian government to inquire into the condition of certain localities severely visited by the cholera, found the course of that terrible epidemic determined by the character of the soil upon which the towns and villages were built.

Where the soil was spongy, wet, and saturated with moisture, the disease was most severe, and this observation is supposed to be of equal value with that of Dr. Farr, who found that the cholera in London diminished in severity as the streets, lanes, and houses were elevated above the level of the Thames.

The vast substratum of chalk in the Isle of Thanet affords an inexhaustible supply of excellent water.

The whole town is exposed to the influence of the prevailing winds. The sea breeze passing over a great expanse of ocean, arrives at the island in a state of almost chemical purity; owing to this quality, and the cold being modified by great Atlantic waves, it is seldom very low in temperature. These qualities are conspicuous in the eminently favourable column containing the mortality of pulmonary diseases, which are invariably mild where the air is pure, clear, and temperate.

It is to the presence of these great powers of nature that Margate is indebted for its public health, and comparative immunity from the spread of the most dangerous and fatal classes of disease.

The system of registration introduced in the year 1834, has removed the reputation of Margate from the misty region of conjecture, and to use an expressive phrase of the Registrar-General—"Here we stand upon the actual."

"And great truly is the actual; it is the thing that has rescued itself from the bottomless depths of theory and possibility, and stands there, as a definite indisputable fact whereby men do work and live." *

The Register lists were classified into residents and visitors by Mr. Pilcher, the Registrar.

THE PUBLIC HEALTH OF THE FIVE YEARS, 1863-1867, CONSIDERED EACH YEAR SEPARATELY.

Mortality of the Year 1863.

Speaking of this year, Dr. Farr says the deaths were more numerous in this than in any previous year. The increase of mortality is chiefly due to the zymotic class of diseases. In Margate the mortality this year was comparatively extremely favourable, being 171 to 10,000 living. The number of deaths from contagious, epidemic, and endemic diseases (zymotic diseases, class 1, order 1, of Dr. Farr's classification), being 37 to 10,000 residents, a number corresponding with the exceptionably general healthy character of the town.

Compared with the mortality of England the figures stand thus:—

Diseases.			General Mortality.
Zymotic	All England	58	All England and in Margate to 10,000 living.
	In Margate	32	
Bronchitis	All England	15	
	In Margate	9	
Consumption	All England	25	
	In Margate	20	

* Carlyle.

Mortality of the Year 1864.

In the annual report of the Registrar-General for the year 1864, Dr. Farr says—"It has been shown that more people of all ages died this year than in any previous year. The rate of mortality was higher in infancy, higher in middle life, and much higher in old age, than the average."

The death-rate in Margate during this insalubrious year was highly favourable, being 168 to the resident inhabitants, placing Margate on an equality with the exceptionably healthy districts. The number of deaths this year from visitors and patients were 102. The unhealthy character of the year and the heavy mortality of the visitors do not appear to have had the slightest influence on the public health of Margate.

The numbers compared with the general mortality of the country are as follows :—

Diseases.		General Mortality.
Zymotic	All England ... ... 57 In Margate 33	All England. In Margate.
Bronchitis	All England ... ... 18 In Margate 8	
Consumption	All England ... ... 25 In Margate 12	

Mortality of the Year 1865.

The Registrar-General reports of this year—"The mortality was above the average in every quarter of the year, both in town and country." Dr. Farr adds—"The mortality was higher this year than the average, and that males, who at all times die faster than females, suffered this year to an unusual extent."

The death-rate at Margate this year was much below the average standard of public health, being only 15 to 1,000 living. This highly favourable number corresponds with the year 1858.

The comparative mortality was—

Diseases.		General Mortality.
Zymotic	All England ... ... 50 In Margate 30	
Bronchitis	All England ... ... 17 In Margate 11	All England ... 233 In Margate 156
Consumption	All England ... ... 25 In Margate 16	

Mortality of the Year 1866.

The death-rate of this year in Margate rises somewhat above the usual favourable rate of mortality, being 19 per 1,000. But as the number dying of zymotic diseases was only 33 of the entire population, and as this favourable number can hardly be co-existent with the increased general mortality, it is highly probable that the increase of population, occupying the large number of important new houses, accounts for the apparent anomaly—this view is also confirmed by the unusual low rate of mortality from pulmonary diseases.*

At Margate the mortality is as follows :—

Zymotic Diseases	33	to 10,000.
Bronchitis	6	
Consumption	11	

These numbers are among the lowest ever recorded, and Margate appears this year to have assumed its equilibrium—the mortality being 17 per 1,000.

Zymotic	37
Bronchitis	—
Consumption	—

The present examination of the public health of Margate having extended over the whole period of registration, one fact stands out prominently, and that is the exceeding low mortality of lung diseases; this opens a most important field for future inquiries—viz., the value of Margate as a winter residence for persons liable to pulmonary diseases; a comparison of Margate in this special branch of medical geography with some of the most celebrated places of resort in the south of Europe affords a valuable lesson on this most important subject.

* The comparison with the mortality of the country cannot be continued, as at the time of going to press the report of the Registrar-General for 1866-67 was not published.

TABULAR VIEW

OF THE

MORTALITY OF MARGATE,

For the 5 Years, 1863-67.

Year.	Total.	Visitors.	Hospitals.	Inhabitants.
1863	262	54	37	171
1864	270	58	44	168
1865	234	50	28	156
1866	286	55	32	199
1867	261	48	36	179
5)	1,313	265	177	873
Average	262	53	35	174

AVERAGE ANNUAL MORTALITY

For the 5 Years, 1863-67.

Residents	174	}	262
Visitors }	88		
Hospitals }			

Or 17 per 1,000 living of the residents. Dr. Farr's standard of a normal sanatory condition of public health.

INFANT MORTALITY IN MARGATE

Under 1 Year of Age,

For the 5 Years, 1863-67.

Year.	Total.	Visitors.	Residents.	Births.	Average.
1863	30	9	21	261	8
1864	49	10	39	299	13
1865	47	6	41	298	13
1866	46	5	41	314	10
1867	47	13	34	313	10
5)	219	43	176	1,485	54
	43	8	35	297	10

Or 10 per cent. of annual mortality of infants. A highly favourable proportion.

MORTALITY IN MARGATE,

From Zymotic Diseases,

For the 5 Years, 1863-67.

Year.	Residents.	Visitors.	Hospitals.	Total.
1863	37	13	5	55
1864	33	9	6	48
1865	29	9	2	39
1866	36	7	3	46
1867	28	10	3	41
5)	163	48	19	228
Average	32	9	3	47

DEATHS IN MARGATE

From Consumption,

For the 5 Years, 1863-67.

Year.	Males.	Females.	Total.
1863	9	12	21
1864	7	5	12
1865	8	8	16
1866	7	6	13
1867	10	13	23
	41	44	5) 85 Total for 5 Years.
Average	—	—	17

DEATHS IN MARGATE

From Inflammatory Lung Diseases.

Diseases.	1863.	1864.	1865.	1866.	1867.	Total.
Laryngitis ...	1	1	—	—	—	2
Bronchitis ...	9	8	11	6	3	37
Pleurisy	—	—	1	2	-	3
Pneumonia ...	1	1	1	4	5	12
Asthma	—	—	1	—	—	1
Lungs	4	9	3	7	10	33
	15	19	17	19	18	5) 88
Average	—	—	—	—	—	17

DEATHS OF AGED PERSONS

in Margate,

For the 5 Years, 1863-67.

—	1863.		1864.		1865.		1866.		1867.		—
Age.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	Total.
70	4	6	2	5	5	3	8	12	2	4	51
75	5	4	4	5	5	7	1	11	5	2	49
80	4	4	1	5	8	5	8	1	2	3	41
85	2	4	3	6	—	1	3	4	2	5	30
90	—	2	1	2	—	1	4	2	—	1	13
95	1	2	—	—	—	—	—	—	—	2	5
	16	22	11	23	18	17	24	30	11	17	189

INQUESTS HELD IN MARGATE,

For the 5 Years, 1863-67.

Year.	Number.
1863	8
1864	6
1865	5
1866	16
1867	9
	44 Total for the 5 Years.

A REPORT

ON

THE SANITARY CONDITION

OF THE

TOWN OF MARGATE,

FROM THE YEAR 1837 TO 1862,

BY EDWARD MOTTLEY,

MAY BE HAD ON APPLICATION TO MR. KEBLE, BOOKSELLER, MARGATE.

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The necessity of classifying the registration lists of districts situated similar to Margate has become so prominent that Dr. FARR in his appendix to the 24th report of the Registrar-General says—"In large hospitals and lunatic asylums the mortality is so much higher than the rest of the population, that the mortality of the district deduced from the living and dying, including hospital patients, does not correctly express the mortality of the inhabitants of the place. Local inquirers are alone in a condition to correct effectively local derangements."

The two previous publications of 1850 and 1862, relating to the public health of the town, were based upon a classified population. Continental statistical writers invariably classify the population, and with a greater degree of minuteness than is possible in English statistics.

The mortality of the town and sub-district Margate for the 5 years 1863-1867, stands thus:—

—	Residents.	Visitors.	Hospitals.	Total.
	873	265	177	1,313
Annual Average	174	53	35	262

or, 17 to 1,000 resident. Dr. Farr's standard of normal health.

MORTALITY FROM EPIDEMIC, ENDEMIC-CONTAGIOUS (ZYMOTIC) DISEASES.

—	Residents.	Visitors.	Hospitals.	Total.
	163	48	19	228
Annual Average	32	9	3	47

DEATHS OF INFANTS UNDER ONE YEAR OF AGE.

—	Births.	Residents.	Visitors.	Total.
	1,485	176	43	219
Annual Average	—	35	8	43

Annual infant mortality, 10 per cent.

MORTALITY FROM CONSUMPTION.

—	Residents.	Visitors.	Hospitals.	Total.
	85	21	7	113
Annual Average	17	4	1	—

Annual mortality from consumption, 17 to 10,000 living.

MORTALITY FROM INFLAMMATORY DISEASES OF THE LUNGS.

—	Residents.	Visitors.	Hospitals.	Total.
	88	17	3	108
Annual Average	17	3	—	—

Annual mortality from inflammatory diseases of the lungs, 17 to 10,000 living.

Compared with the general mortality of England and Wales, the numbers range as follows:—

—	England.	Margate.
General Mortality	22	17
Infant Mortality	20	10
Zymotic Diseases	50	32
Consumption	26	17
Respiratory Organs	31	17
Bronchitis	13	7

When it is considered that the previous calculations are founded upon the census of 1861 (presumed incorrect), and no allowance made for the increase of the population, it will be evident how highly favourable the public health has been during a period eminently insalubrious.

The Registrar-General made the following observations in the Quarterly Report, page li.:—"It is doubtful whether the world will continue to resort to places which have often no natural advantages over others, and are selected like some of the insalubrious German watering places by mere accident." I

may here be permitted to remark that Margate seems to have been and to be selected for its health-giving qualities, and for that alone; but medical experience and public observation have alike failed to remark how eminently favourable the locality is for persons liable to pulmonary diseases during the winter months.

It is evident from this, and the preceding publications, that the great number of patients and invalids domiciled amongst the resident inhabitants has not affected the public health of the community. If it be asked what are the objective conditions that produce so favourable a result, the answer must be found in the aphorism of the Great Father of Medicine—"that where the air, the water, and the soil are good, the inhabitants are healthy." The experience and teaching of 3000 years have added nothing to this truth.

At Margate, the north-east portion of the Isle of Thanet, the soil is dry, antiseptic, percolatious and absorbent. No amount of rain lodges more than a few hours on the surface, hence the proverb—

"When England wrings,
The Island sings."

Absorption carries down the minute microscopic particles of decaying offensive matter. Evaporation carries them abroad, and contaminates the atmosphere.

The commission issued a few years back by the Bavarian government to inquire into the condition of certain localities severely visited by the cholera, found the course of that terrible epidemic determined by the character of the soil upon which the towns and villages were built.

Where the soil was spongy, wet, and saturated with moisture, the disease was most severe, and this observation is supposed to be of equal value with that of Dr. Farr, who found that the cholera in London diminished in severity as the streets, lanes, and houses were elevated above the level of the Thames.

The vast substratum of chalk in the Isle of Thanet affords an inexhaustible supply of excellent water.

The whole town is exposed to the influence of the prevailing winds. The sea breeze passing over a great expanse of ocean, arrives at the island in a state of almost chemical purity; owing to this quality, and the cold being modified by great Atlantic waves, it is seldom very low in temperature. These qualities are conspicuous in the eminently favourable column containing the mortality of pulmonary diseases, which are invariably mild where the air is pure, clear, and temperate.

It is to the presence of these great powers of nature that Margate is indebted for its public health, and comparative immunity from the spread of the most dangerous and fatal classes of disease.

The system of registration introduced in the year 1834, has removed the reputation of Margate from the misty region of conjecture, and to use an expressive phrase of the Registrar-General—"Here we stand upon the actual."

"And great truly is the actual; it is the thing that has rescued itself from the bottomless depths of theory and possibility, and stands there, as a definite indisputable fact whereby men do work and live." *

The Register lists were classified into residents and visitors by Mr. Pilcher, the Registrar.

THE PUBLIC HEALTH OF THE FIVE YEARS, 1863-1867, CONSIDERED EACH YEAR SEPARATELY.

Mortality of the Year 1863.

Speaking of this year, Dr. Farr says the deaths were more numerous in this than in any previous year. The increase of mortality is chiefly due to the zymotic class of diseases. In Margate the mortality this year was comparatively extremely favourable, being 171 to 10,000 living. The number of deaths from contagious, epidemic, and endemic diseases (zymotic diseases, class 1, order 1, of Dr. Farr's classification), being 37 to 10,000 residents, a number corresponding with the exceptionably general healthy character of the town.

Compared with the mortality of England the figures stand thus:—

Diseases.			General Mortality.
Zymotic	All England	58	All England and in Margate to 10,000 living.
	In Margate	32	
Bronchitis	All England	15	
	In Margate	9	
Consumption	All England	25	
	In Margate	20	

* Carlyle.

Mortality of the Year 1864.

In the annual report of the Registrar-General for the year 1864, Dr. Farr says—"It has been shown that more people of all ages died this year than in any previous year. The rate of mortality was higher in infancy, higher in middle life, and much higher in old age, than the average."

The death-rate in Margate during this insalubrious year was highly favourable, being 168 to the resident inhabitants, placing Margate on an equality with the exceptionably healthy districts. The number of deaths this year from visitors and patients were 102. The unhealthy character of the year and the heavy mortality of the visitors do not appear to have had the slightest influence on the public health of Margate.

The numbers compared with the general mortality of the country are as follows:—

Diseases.			General Mortality.
Zymotic	All England	57	All England.
	In Margate	33	
Bronchitis	All England	18	In Margate.
	In Margate	8	
Consumption	All England	25	
	In Margate	12	

Mortality of the Year 1865.

The Registrar-General reports of this year—"The mortality was above the average in every quarter of the year, both in town and country." Dr. Farr adds—"The mortality was higher this year than the average, and that males, who at all times die faster than females, suffered this year to an unusual extent."

The death-rate at Margate this year was much below the average standard of public health, being only 15 to 1,000 living. This highly favourable number corresponds with the year 1858.

The comparative mortality was—

Diseases.			General Mortality.
Zymotic	All England	50	
	In Margate	30	
Bronchitis	All England	17	All England ... 233
	In Margate	11	
Consumption	All England	25	In Margate 156
	In Margate	16	

Mortality of the Year 1866.

The death-rate of this year in Margate rises somewhat above the usual favourable rate of mortality, being 19 per 1,000. But as the number dying of zymotic diseases was only 33 of the entire population, and as this favourable number can hardly be co-existent with the increased general mortality, it is highly probable that the increase of population, occupying the large number of important new houses, accounts for the apparent anomaly—this view is also confirmed by the unusual low rate of mortality from pulmonary diseases.*

At Margate the mortality is as follows:—

Zymotic Diseases	33	to 10,000.
Bronchitis	6	
Consumption	11	

These numbers are among the lowest ever recorded, and Margate appears this year to have assumed its equilibrium—the mortality being 17 per 1,000.

Zymotic	37
Bronchitis	—
Consumption	—

The present examination of the public health of Margate having extended over the whole period of registration, one fact stands out prominently, and that is the exceeding low mortality of lung diseases; this opens a most important field for future inquiries—viz., the value of Margate as a winter residence for persons liable to pulmonary diseases; a comparison of Margate in this special branch of medical geography with some of the most celebrated places of resort in the south of Europe affords a valuable lesson on this most important subject.

* The comparison with the mortality of the country cannot be continued, as at the time of going to press the report of the Registrar-General for 1866-67 was not published.

TABULAR VIEW

OF THE

MORTALITY OF MARGATE,

For the 5 Years, 1863-67.

Year.	Total.	Visitors.	Hospitals.	Inhabitants.
1863	262	54	37	171
1864	270	58	44	168
1865	234	50	28	156
1866	286	55	32	199
1867	261	48	36	179
5)	1,313	265	177	873
Average	262	53	35	174

AVERAGE ANNUAL MORTALITY

For the 5 Years, 1863-67.

Residents	174	262
Visitors }	88	
Hospitals }		

Or 17 per 1,000 living of the residents. Dr. Farr's standard of a normal sanatory condition of public health.

INFANT MORTALITY IN MARGATE

Under 1 Year of Age,

For the 5 Years, 1863-67.

Year.	Total.	Visitors.	Residents.	Births.	Average.
1863	30	9	21	261	8
1864	49	10	39	299	13
1865	47	6	41	298	13
1866	46	5	41	314	10
1867	47	13	34	313	10
5)	219	43	176	1,485	54
	43	8	35	297	10

Or 10 per cent. of annual mortality of infants. A highly favourable proportion.

MORTALITY IN MARGATE,

From Zymotic Diseases,

For the 5 Years, 1863-67.

Year.	Residents.	Visitors.	Hospitals.	Total.
1863	37	13	5	55
1864	33	9	6	48
1865	29	9	2	39
1866	36	7	3	46
1867	28	10	3	41
5)	163	48	19	228
Average	32	9	3	47

DEATHS IN MARGATE

From Consumption,

For the 5 Years, 1863-67.

Year.	Males.	Females.	Total.
1863	9	12	21
1864	7	5	12
1865	8	8	16
1866	7	6	13
1867	10	13	23
	41	44	5) 85 Total for 5 Years.
Average	—	—	17

DEATHS IN MARGATE

From Inflammatory Lung Diseases.

Diseases.	1863.	1864.	1865.	1866.	1867.	Total.
Laryngitis ...	1	1	—	—	—	2
Bronchitis ...	9	8	11	6	3	37
Pleurisy	—	—	1	2	-	3
Pneumonia ...	1	1	1	4	5	12
Asthma	—	—	1	—	—	1
Lungs	4	9	3	7	10	33
	15	19	17	19	18	5) 88
Average	—	—	—	—	—	17

DEATHS OF AGED PERSONS

in Margate,

For the 5 Years, 1863-67.

—	1863.		1864.		1865.		1866.		1867.		—
Age.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	Total.
70	4	6	2	5	5	3	8	12	2	4	51
75	5	4	4	5	5	7	1	11	5	2	49
80	4	4	1	5	8	5	8	1	2	3	41
85	2	4	3	6	—	1	3	4	2	5	30
90	—	2	1	2	—	1	4	2	—	1	13
95	1	2	—	—	—	—	—	—	—	2	5
	16	22	11	23	18	17	24	30	11	17	189

INQUESTS HELD IN MARGATE,

For the 5 Years, 1863-67.

Year.	Number.
1863	8
1864	6
1865	5
1866	16
1867	9
	44 Total for the 5 Years.

11, *James Street, Buckingham Gate,*
October 29, 1868.

Sir,

With reference to the instructions contained in Home Office letters dated the 29th June and 3rd July, 1868, respectively, upon the subject of the drainage of certain towns situated in the Thames Valley.

I beg to forward herewith, for the consideration of Mr. Secretary Hardy, my Report upon the "Proper Principle of Drainage" which should be adopted in the Towns of Oxford, Eton, Windsor, and Abingdon.

I have the honour to be,

Sir,

Your most obedient

humble servant,

C. B. EWART,

Lieutenant-Colonel, Royal Engineers,

Commanding Royal Engineer,

London District.

REPORT.

Appointment by Home Office.

1. By a letter addressed to me by the Home Department, and dated the 29th June, 1868, I was directed by Mr. Secretary Hardy to inquire into "the plans for the drainage of the several towns situated in the valley of the Thames, with a view to the purification of that river;" and having placed myself in communication with the Local Boards of Health of Oxford, Eton, Windsor, Abingdon, and Kingston, to "report on the principle of drainage to be adopted in these towns."

2. The Local Boards of Health of the towns specified were requested to lay before me all the plans and papers bearing upon the inquiry which might be available, and also to facilitate such examination of the localities, as I might deem necessary.

3. I was directed to address my Report to the Under Secretary of State to the Home Department, by whom (as I was informed) my Report would be forwarded to the authorities concerned.

4. By a subsequent letter from the Home Department, dated 3rd July, 1868, I was instructed that it would be unnecessary for me to visit Kingston.

5. Accordingly, my Report is confined to the proper principle of drainage to be adopted in the towns of Oxford, Eton, Windsor, and Abingdon.

Circumstances which led to appointment.

6. A short account of the circumstances which led to my appointment, and of the nature of the task imposed upon me, will facilitate the understanding of what follows:—

7. In pursuance of the "Thames Navigation Act, 1866" (29 and 30 Vict., cap. 89, s. 64), the Conservators of the River Thames, in or about the month of April 1867, gave notice to the several above-mentioned towns

to remove the whole of their sewage from the River Thames within thirteen months.

8. To understand the full effect of this notice it is only necessary to state that the towns of Oxford, Eton, Windsor, and Abingdon are situate on the banks of the River Thames, and that the system of drainage adopted in each of these towns has consisted, so far as there has been any system at all, in pouring the whole of its foul matter mixed with the rainfall and subsoil water into the Thames.

9. The duty, therefore, thrown upon the authorities by the above notice amounted, in effect, to an obligation to remove elsewhere the whole of the mass of sewage that had hitherto been carried into the Thames; and the task was not made less difficult by the circumstance of the towns in question being so situate as to render it impossible to rely on gravitation for the distribution of the whole of the sewage over land.

10. The local authorities of the above towns, perplexed by the various schemes of drainage in vogue, memorialized the Secretary of State to appoint an Engineer to advise them on the course they should adopt with the view of carrying into effect the provisions of the Thames Navigation Act.

11. The result was the appointment already set forth in the letter dated 29th June, 1868.

Proceedings in appointment.

12. As soon as possible after my appointment I visited the several towns named in my instructions, placed myself in communication with the local authorities, carefully investigated the existing arrangements for the disposal of the sewage, and examined the country in the immediate vicinity to such extent as appeared to be requisite.

13. I received from the local authorities, the authors, or other sources, a number of plans, reports, books, papers, &c., bearing upon the subject under consideration, to which I paid due attention.

14. I subsequently revisited the towns and attended meetings of Consultative Committees named by the Local Boards, with the members of which I fully discussed the circumstances connected with the drainage of the towns represented by them. It was suggested to me that there might be gentlemen interested in the matter who would wish to put their views before me, and I accordingly expressed my readiness to delay my Report for a sufficient

time to enable me to consider any suggestions in writing which might be forwarded to me, and I requested the Chairman of each Consultative Committee to make this known, as well as to forward to me any plans or papers which he might receive.

15. I have fully considered such plans and papers as have been referred to me in consequence of this arrangement.

16. I have consulted Acts of Parliament, Blue Books, and various published Reports bearing upon the subject, and I have also placed myself in communication with the Chairman and Engineer of the Board of Conservators of the Thames, who readily gave me much information and access to such professional Reports as appeared to bear upon the important matter under investigation.

List of places visited.

17. I have visited the following places, where arrangements are in progress for the disposal of sewage, in order to obtain the benefit of the results of the most recent practical trials, viz.:—

Croydon.—Sewage distributed by gravitation at Beddington and Norwood.

Lodge Farm near Barking.—For utilization of the sewage of London, which is pumped for distribution on land.

Aldershot and Hounslow, where the sewage is utilized on land, in the latter case by pumping with steam-power.

Canterbury, where the drainage, after being filtered and treated with chemical deodorizing agents is passed into the river.

Broadmoor, where there is a combination of the systems of earth-closets and of utilizing sewage by irrigation on land.

Bedford, where the system of utilizing sewage on land is extensively carried out. I have deemed this case of so much importance that I have thought it worth while to give a detailed account of my visit to that town, in the Appendix.

18. In pursuing the foregoing investigations most abundant materials for forming a judgment have been laid before me, and no possible system of town drainage has, I believe, escaped my notice.

19. To enumerate in detail the various plans I have investigated would neither be useful nor expedient. The proper course for arriving at a conclusion appears to be

to ascertain a principle to which every good system of town drainage must of necessity conform, and then to measure by that principle the various systems in use for draining towns. These systems, though varying in their details, admit of a division into different classes more readily than would be imagined by a person not thoroughly conversant with the subject.

Object and principle of town drainage.

20. The primary object of every system of town drainage is a sanitary object, and involves the continuous and complete removal of sewage matter from human habitations to a place where it can be disposed of without prejudice to health, and at the same time, if possible, produce, as manure, some income in aid of the expense incurred in its removal.

21. By sewage matter I mean human excreta, slops, and all foul liquid proceeding from human habitations.

22. The mode of removal must be such as neither to poison the air by noxious smells nor to taint the sources of water supply for drinking by the mixture of impure matter.

Cesspit system.

23. The old method of storing sewage matter in cesspits to be emptied periodically and disposed of as manure (the surface water and slops being carried by surface channels or underground drains to the natural watercourses), is diametrically opposed to the foregoing principle.

24. First. It poisons the air by exhaling, in a concentrated form, the dangerous products of the decomposition of sewage filth.

Secondly. It saturates the subsoil, wherever it is at all porous, to such an extent as to render it unhealthy as a site for human habitations, and to pollute with organic matter, wells and other sources of water supply.

25. The least objectionable form of the cesspit system has been adopted at Milan, and partially in Paris, by conducting the sewage matter into receptacles, both air-tight and water-tight, and removing it thence by special carts provided with vacuum reservoirs into which the sewage is drawn up through pipes for conveyance to the neighbouring country.

26. I believe this system to be costly, but I have not examined into the detail of the expense, as, in my judgment, no scheme of town drainage can be recommended which is dependent on mechanical arrangements

of great complexity and in which serious risks to health would be incurred if any fracture or defect were to arise in the machinery used, or any of those failures were to happen which of necessity are incidental in practice to such a scheme.

Closets with moveable tanks.

27. It is scarcely necessary to notice a plan consisting in the use of closets with moveable tanks to be drawn out and emptied frequently into carts. Such a plan is open to every objection that can be urged against the Milan system, and need not, therefore, be further referred to.

28. In the foregoing systems of sewage the human excreta and the house-slops are dealt with together.

Earth closets.

29. The system of earth closets separates these two descriptions of sewage matter.

30. This system, in effect, substitutes for water-closets and ordinary privies a special privy supplied with dry earth or sifted ashes.

31. The excreta are received into a pan and immediately covered with the earth; they can then be removed for manure without causing any offensive odour.

32. A separate provision must be made for the house-slops, which cannot be poured into the privy, as any moisture beyond that of the human excreta destroys the efficacy of the earth as a deodorizer.

33. Earth-closets undoubtedly neutralize, most efficiently, the nuisance arising from human excreta, and make their removal a question of ordinary mechanical transport; and it is impossible to rate too highly the beneficial effect of their adoption in cottages, detached buildings, hot climates, and, in short, any place where a supply of water is deficient or difficult of attainment.

34. On the other hand, the suitableness of earth-closets to towns is a question of a different character.

35. It is difficult, nay, I should say, impracticable, to combine satisfactorily, in the same part of a town, water-closets and earth-closets.

36. A system of water-drainage must be provided for the water-closets, and, when once provided, little is gained by excluding from the foul drains the excreta of a small portion of houses, while much expense is incurred in setting on foot for those houses a special system of scavenging.

37. In short, the *general* use of earth-closets necessitates the *general* abolition of water-closets, and that

general abolition is, in my judgment, inexpedient and impracticable in a town where the better class of house-holders reside and water-closets have been long established.

38. Doubts also may arise how far convenient means can be found for supplying at all seasons and without fail, in the case of a large population, sufficient quantities of dry earth, and of removing the contents of the privies: also, what the relative expense of carrying earth to the excreta instead of carrying the excreta to the earth by water-carriage may be, regard being had to the necessity of removing the house-slops, which cannot practically be done on a large scale except by foul drains.

39. I should add, also, that the drainage of stables, cowsheds, and similar buildings is not readily carried into effect under a general earth-closet system, while under the system I recommend it presents no obstacle whatever.

40. Bearing these considerations in mind, I have come to the conclusion that I cannot recommend the earth-closet system for adoption in the towns to which my Report applies, although I have reason to think that in detached parts of these towns, and possibly in certain other places where the water-supply is difficult to obtain, or some special obstruction arises in using water-drainage, earth-closets may, at all events temporarily, be used with advantage.

Necessity of use of water as carrier of sewage.

41. The question then which I have to decide appears to narrow itself into the enquiry of what is the best mode of using water as a carrier of sewage matter.

42. It is to be recollected that the conditions of the problem are somewhat different from those that have hitherto existed.

43. So long as rivers could be used as the receptacles of sewage, the bulk of the matter poured into them was comparatively of little consequence.

44. True, the stream became foul and unfit for the use of man, and the air was poisoned; but the law was complied with by the transference from the town to the stream, which ran by the town, of all the impurities of its inhabitants.

45. In the case before me, however, the Thames Navigation Act has interposed and necessitated the distribution of the sewage over the land in such a

manner as to purify the liquid before allowing it to enter the stream.

46. In other words, it has become, in my jugement, a necessity for the towns of Oxford, Windsor, Eton, and Abingdon to distribute the whole of their sewage over land.

47. It will be seen at once then what importance attaches to the bulk of the foul matter to be dealt with For the difficulty of irrigating land with sewage, and still more of *profitably* irrigating it with sewage, necessarily varies with its bulk and the uncertainty of the supply.

48. In thus treating distribution over land as the only practical means of satisfactorily disposing of sewage matter, it has not escaped my notice that plans have been adopted in various places; as, for example, at Canterbury, Leicester, and elsewhere of dealing with the sewage by first precipitating the solids, and then leading the liquid residuum after an attempted purification into the natural streams of the country.

49. It is enough to say, with regard to this system, that, apart from the expense of the constant purchase of chemical ingredients, the plan is, in my judgment, wholly inapplicable in the case of the towns to which my decision applies; as no chemical methods hitherto invented purify sewage to such an extent as will render it fit for admission into the Thames under the Thames Navigation Act.

50. Bearing in mind the new state of circumstances which have arisen, I proceed to consider, somewhat in detail, the systems of carriage of sewage by water. These systems may be divided into three classes, and may be called for the sake of distinction, the "joint system," the "mixed system," and the "separate system."*

"Joint system."

51. Under the "joint system" all the rain which falls within the drainage area is carried into the same sewers as the sewage matter, and passes with it in a polluted state to the outfall.

"Separate system."

52. Under the "separate system" (a full explanation of which will be found in "A Treatise on Sanitary Management and Utilization of Sewage in 1865," by William Menzies, Deputy Surveyor of Windsor Forest and Parks,) the sewage matter is carried in separate

* I have adopted these terms from the Memorial presented to the Home Secretary, and mentioned in paragraph 10.

sewers, and the rainfall passes into the river, or is absorbed by the surface on which it falls.

"Mixed system."

53. The "mixed system" is a modification of the first two systems, under which a portion only of the rainfall passes into the sewers, the remainder being carried into the natural channels.

Objections to "joint system."

54. I have devoted very great attention to the "joint system," as it is a system on which London and many other large towns are drained, and has been recommended by some eminent engineers.

55. The general characteristics of the "joint system" are lines of main sewers running down the principal streets, of a size sufficient to admit workmen to clean them out, having openings into the streets by which the rainfall finds its way into the sewer, and communicating with the houses and lesser streets by lateral pipes through which the sewage matter is conducted into the mains.

56. As the sewers in the "joint system," although of the size above mentioned, cannot possibly be constructed of dimensions sufficient to carry off extraordinary rainfalls, they are furnished with openings for overflows, out of which the storm waters may find a vent, in the event of the sewer being overcharged.

57. On the whole, I am of opinion that the joint system does not fulfil the conditions required for the proper drainage of the towns which I am considering.

58. The objections to that system arise from the inconveniences inherent to admitting the rainfall into the sewage drains, and these inconveniences may be shortly stated as follows:—

(1.) The surface waters take with them into the sewers the fine sand or other material from the street. This accumulates inside the sewers (especially where the gradients are low, as is generally the case in the towns in question), and becoming impregnated with fœcal matter forms a clammy mass at the bottom of the sewers, which in summer is of considerable thickness, and from its weight is never completely washed away, even in winter.

(2.) Injurious effluvium proceeding from the putrefaction of this mass finds its way into the streets through the openings made for the passage of the rainfall and for the supply of fresh air to the workmen employed in clearing the sewers. Moreover, such a quantity of foul gas is created in the sewers as to force its way into the dwelling-houses in cases where the traps are ill-made or out of order.

(3.) The overflows are a great source of danger to health. Hitherto they have found their outlet in some way or other into streams, but since that outlet is now closed against them in the Thames Valley, the foul matter must find its way into places where it cannot fail to be a nuisance and productive of injury to health.

59. Passing from the carriage of the sewage to the question of distribution, the "joint system" gives rise to great difficulty. The mixture of the rainfall with the sewage matter makes the quantity of the liquid issuing at the outfall of the sewer greater to a very vast degree, and more uncertain than what it would be if the rainfall were carried by a separate channel.

60. So long as this great flow of polluted matter was allowed to pass into the river comparatively little difficulty arose in getting rid of it, but having regard to the legislation under which the towns in question have to act, the expense of getting rid of sewage matter appears, as already has been observed, to be in proportion to it bulk or volume.

61. Lastly, where the sewage is mixed with the rainfall, the greatest quantity is delivered in winter, when the rainfall is greatest—that is to say, at the time when it is least needed by the land.

Objections to "mixed system."

62. Sewers constructed on the "mixed system" are, to the extent to which the rainfall is admitted, open to the same objections as those constructed on the "joint system."

63. I cannot recommend either of these systems for adoption by the towns in question.

"Separate system."

64. In the "separate system," examples of which will be found at Broadmoor, Aldershot, Hounslow, and to a great extent at Bedford and Canterbury, the sewers are of such size only as is sufficient to carry off the sewage matter, and have no openings into the street, except carefully closed holes for examining the sewers. These sewers therefore are free from the objections urged against the "joint system" in respect to the carriage of sewage, as they are closed throughout their course;

they do not afford any exit to injurious vapours, or involve any overflow or any unsafe accumulation of silt or gas.

65. Under the "separate system" the sewage delivered at the outfall of the sewers is not over-diluted with rain-water, and the bulk is reduced within manageable compass, and is not liable to vary according to the state of the weather.

66. This bulk, it is true, will be somewhat increased in the towns in question by the necessity which exists for periodically flushing the sewers, as the character of the levels will not admit of the sewage matter descending in all cases by gravitation alone.

67. Granting this, and admitting further that in wet weather no such necessity would exist of flushing sewers under the "joint system," I am, nevertheless, of opinion that even at such times it will prove a cheaper operation to provide a small quantity of water to flush small sewers than to pump over the land an enormous quantity of polluted water, which, in the event of a heavy fall, fills the sewers under the joint system.

68. I am aware that the "separate system" involves, in some degree, a double system of drains, the one for the rainfall and the other for the sewage matter; but, having regard to the difference in the size of the sewers, to the difference in the cost of providing the plant for pumping and to the current expense of pumping the sewage matter and to other considerations, I believe that "the separate system," if begun anew, would in the end be, at all events, not more costly than the "joint system;" and in the case of the towns above-mentioned I have less hesitation in recommending the "separate system" on the score of expense, as the existing drains may be made use of with little alteration for the conveyance either of the surface water, or in some cases of the sewage matter, as may be found most convenient.

Report in favour of "separate system."

69. I report to Her Majesty's Under Secretary of State to the Home Department as follows:—

(1.) That the "separate system" of drainage as above described, is the proper principle of drainage to be adopted in the towns of Oxford, Windsor, Eton and Abingdon.

(2.) That a complete system of sewers should be laid out in the above-mentioned towns, to receive all the

sewage matter of the towns; and that such sewers, so far from being of such a size as to enable a man to work in them, should be of such dimensions only as may be sufficient to afford a passage to the sewage matter.

(3.) That the rainfall should not be allowed to enter into the foul sewers, but should either be stored in tanks for domestic use, or be allowed to flow into its natural channels, care being taken in the event of its running into a river, that it is freed from noxious impurities by careful scavenging of the streets, or, if necessary, by passing it into settling beds before allowing it to enter the stream.

(4.) That, as soon as possible, a complete system of water supply should be provided where it does not already exist, and arrangements should be made for enabling such supply to be used for flushing the sewers.

(5.) That the water and sewage works of each town should, if possible, be under the control of the same local authority.

(6.) That all drains communicating with the foul sewers should be trapped where in connection with the houses, and elsewhere when necessary; the traps to be beyond the control of the inhabitants; bell traps to be considered inadmissable.

(7.) That stables or cow-houses should have surface drainage carried through the walls into trapped cesspits, clear of the walls, and thence enter the foul sewers. Examples of which may be found in recently constructed Cavalry and Artillery stables.

(8.) That refuse from gas and other factories, when injurious to vegetation, should be collected into a tank at each establishment previous to the drains from it entering the public sewer, and the noxious constituents be separated by precipitation and filtration; the deposited matters to be frequently removed at the cost of the manufacturer.

(9.) That proper ventilation be provided for all the oul sewers. Ventilating shafts should be carried above the level of the highest windows of the houses, and to such a height as to prevent the noxious gases being blown down the chimnies; the shafts to be connected to the crowns of the sewers by air pipes: and ventilation in no case to be effected by rain water pipes.

(10.) That a sufficient area of land be selected and purchased or leased for the purpose of being laid out for irrigation; and that the sewage be conducted over or

through that land in such manner as not to create a nuisance, and to entirely disinfect the sewage matter. The "carriers" should be covered.*

(11.) That the total quantity of land required will depend upon the nature of the subsoil, but as a maximum, two-thirds of an acre per 100 of the population will suffice, although it would be better to provide one acre per 100, in order to admit of farming the lands subject to the judicious rotation of crops.

In conclusion, I have to state that I am fully alive to the importance of draining the sub-soil water in case of the towns in question, but I am of opinion that drainage of the subsoil water must be conducted on different principles, and in a different manner from the town drainage.

In the low lying districts which form a large proportion of the towns in question, the subsoil when the river rises, forms in effect an underground lake, in which the water stands with slight variations at the same height as the water in the river. No system of drainage dependent on pumping at outlet can possibly under such circumstances free the subsoil as the water would flow from the river into the subsoil as quickly as it was drawn from the subsoil by the pumps.

It is not within my province, to enter into the question of subsoil water, but I make this allusion to it with a view of showing that it has not escaped my observation in recommending the separate system of drainage.

The true method of dealing with the subsoil water in the valley of Thames must depend on an efficient method being devised of bringing the river under control.

(Signed) C. B. EWART,
Lieutenant-Colonel, Royal Engineers,
Commanding Royal Engineer,
London District.

11, *James Street, Buckingham Gate,*
October 29, 1868.

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* Sufficient powers for taking land for this purpose will be found in "The Sewage Utilization Act, 1867" (30 and 31 Vict., c. 113).

APPENDIX (A).

Bedford Sanitary Improvements.

Memoranda made after an Inspection on 10th October, 1868.

Present:

The Rivers Commission—
Lieutenant-Colonel C. B. Ewart, R.E.
The Mayor of Bedford.
The Town Clerk.
Members of Local Board.
John Lawson, Esq., C.E.
&c. &c. &c.

The population of Bedford may be set down at 15,000 inhabitants; but the town is extending and a steady annual increase may be anticipated.

The facilities offered for education by the Foundation Schools, which are supported from the proceeds of an old bequest, are a great inducement to persons with families, and not in affluent circumstances, to take up their residence at Bedford.

The land bequeathed to the town for purposes of education, the support of almshouses, &c., being situated in the metropolis, now produces an income of 14,000*l.* per annum (originally worth 30*l.* a year).

The town of Bedford is situated in the valley of the Ouse, which river is not here subject to tidal influence, nor is it navigable (except by pleasure boats and barges of small tonnage), or used for traffic: the river presents a sluggish appearance, but is subject to the usual interruptions, at flood seasons, arising from the existence of water-mills; and the low-lying parts of the town of Bedford have, it is stated, been flooded at times.

This town is situated upon a bed of gravel varying from 8 to 12 feet in depth, over-lying the Oxford clay, below which oolitic rock is found.

The sanitary improvements which have recently been undertaken have been in progress for about three years, and consist of:—

1. Water supply.
2. Sewage works combined with land irrigation.

The whole of these works have been designed and carried into execution by Mr. Lawson, Civil Engineer.

The cost will all be defrayed by money borrowed from Insurance Offices on the security of the rates, subject to re-payment with interest within thirty years.

The accounts have not, as yet, been made up, nor can they be closed, as some portions of the works still remain to be executed; but it is understood that the maximum cost will not exceed 3*l.* per head on the population, or 45,000*l.* in all, including every contingent expense.

The Town Clerk stated that, to meet the present requirements, two rates of 1*s.* 10*d.* each for "sanitary purposes" had sufficed, and that these would be gradually reduced as the works came into operation and began to yield some return.

The main water-pipes have all been laid, and house connections and fittings put into about one-third of the houses in the town. Temporary public stand pipes supply an additional portion of the inhabitants. The daily delivery at present is stated to be under 100,000 gallons, or 7 gallons per head of the whole population; but it is probable that not more than 7,000 or 8,000 people yet use the water.

This supply has been obtained by sinking a well in a meadow close to the River Ouse, and about a mile out of the town.

The water was not found in any quantity until certain fissures in the rock were reached; and it is, practically, entirely from the rock that the supply is obtained. Overlying the rock was a stratum of almost impervious clay. The well does not appear to draw from the river, as the level of the water in the supply-well ordinarily stands at 3 feet above the river level at this point, and there is quite a sufficient water shed to account for the ample supply hitherto obtained.

The water is somewhat hard.

From the supply-well the water is led into a pumping-well, and is thence lifted by a 40-horse compound condensing engine, driving a bucket and plunger pump, the bucket being 17¼ inches in diameter, and the plunger 12 inches, and having a stroke of 3 feet.

This pump discharges the water, by means of a 12-inch rising main, into a covered service reservoir, at an elevation of 160 feet above the pumping-well.

This reservoir will contain 400,000 gallons, or a four days' supply for the whole town, at the present rate of consumption, but when all the houses are supplied and a regular street watering and flushing are carried on, the storage capacity will probably equal about two days' supply.

The engine is capable of filling the reservoir in about thirteen hours.

From this reservoir the town supply is given, and an ample store is evidently always at command in case of a fire occurring.

At the engine-house a second boiler has been provided, and it

is also proposed to put up a smaller additional engine, in case of an accident occurring or repairs being required: this is very desirable.

The water supply is available for flushing the new sewers, as may be necessary.

In carrying out the sewage arrangements, the following principles have been adopted:—

1. To lay down a new system for the town generally.

2. To make the old system of town drains available to relieve the streets, as well as the roofs discharging into or towards the streets, of the storm and surface water.

3. Such water as falls on back courts or roofs, and is not received by house cisterns or tanks, has been allowed to enter the new system of drains (mainly on economical principles of construction).

4. The sewers have been ventilated by gratings in the streets, very much as in London.

It is understood that provision is made for ventilating all house drains by means of existing down-spouts, but if such do not exist, or are unfavourably situated, by means of special ventilating pipes, having their upper ends at a safe distance from windows or other openings into houses.

5. The main outfall sewer is egg-shaped; 4 feet by 2 feet 8 inches in dimensions.

For a distance of about 300 yards out of the whole length of 1,500 yards, between the bridge over the river and the sewage pumping station, it has been conducted under a terrace embankment, formed with excavated earth, running parallel to the river, and receiving the sewage of the portion of the town on the left bank by means of a branch sewer passing under the river.

At the date of the inspection, about 1,200 house connections with the new system, out of 3,300 had been completed.

The water-closets adopted generally throughout the town are by Guest and Chrimes; each is provided with a small cistern containing one flushing charge, which is set free by pulling a chain, in place of the ordinary system of drawing up a handle. When the chain is released, the flushing cistern is closed at the outfall and opened at the supply, to be recharged from the service pipe.

The main sewer is carried to a pumping-station, well clear of the outskirts of the town, where two 12-horse horizontal non-condensing engines, actuating two 8-inch "Appold's" centrifugal pumps have been established.

It is calculated that there is sufficient power to lift the ordinary flow of sewage, which is not likely to exceed from 250,000 to 300,000 gallons in the course of twenty-four hours.

The sewage from the main, flows into a receiving tank, adjoining which is the pumping-well.

At present, both fluid and solid matters are pumped up in combination, but hair and other extraneous matters are drawn into the pumps, and necessitate frequent cleaning.

It is expected, that to a great extent, this inconvenience may be overcome, by additional screens or grates at the foot of the suction pipes.

The sewage is lifted into an iron cylinder, by which means a sufficient fall is obtained for the discharge of the sewage, through a 1 foot 6 inches delivery iron pipe.

The height to which the sewage is lifted, does not exceed 25 feet.

The iron delivery pipe supplies the sewage to the area set apart for irrigation.

At present 54 acres have been leased for this purpose, at a cost of 4*l.* per acre, but more land will be required, and can easily be obtained in the same locality.

The carriers have been laid down, and the land entirely prepared for irrigation at the cost of the town.

The expense of laying out the land, exclusive of supplying and laying the pipes, has been about 8*l.* per acre,

The distribution of the sewage has been arranged by laying down from the outfall of the iron discharge-pipe, two main stoneware pipes, each of 15 inches diameter, and passing right and left along the outer boundaries respectively of the land to be treated.

The joints of the pipes forming these carriers have been secured by puddling.

A central road has been formed midway between the carriers, so as to divide the land into two parts, each of which has been formed into ridges and furrows, so as to be easily flooded by the carrier which bounds the field.

The main carriers (15-inch pipes), are provided with junctions, having valves, by means of which the sewage is discharged into lateral gutters, running at right angles to the main carriers, and from which the sewage is allowed to flow over the ground, which has been artificially formed into beds or slopes, of about 70 feet wide, measuring from ridge to ridge.

The second crop of Italian rye grass has just been cut from the portion of the land which has been completely laid out, irrigated and cultivated.

The price obtained by auction was four guineas per acre.

(Signed) C. B. EWART,
Lieutenant-Colonel, R.E.

With the Translator's kind regards.

Reprinted from the Dublin Quarterly Journal of Medical Science, May, 1869.

On the Relation between Typhoid Fever and the Height of the Underground Water; (from various papers in the Zeitschrift f. Biologie) Translated from the *Ugeskrift for Læger*, Copenhagen, January 30, 1869; by WILLIAM DANIEL MOORE, M.D., Dub. et Cantab.; M.R.I.A., L.K.Q.C.P.I.; Honorary Fellow of the Royal Medical Society of Copenhagen.

WE gave in a former number of the "Ugeskrift"[a] an abstract of an essay in the "Zeitschrift für Biologie" by Buhl, in which that writer endeavoured to demonstrate, with respect to Munich, a decided connexion between the variations which in a long period had taken place in the mortality from Typhus,[b] and the height of the underground water. It will be remembered that he based his results upon the dissections performed by him in the General Hospital, whereby he not only attained to an absolutely certain diagnosis, but at the same time was in a position, from the condition of the intestinal ulcers to fix the date of the occurrence of the disease. We shall briefly recapitulate the most important results he arrived at:—

1. The variation which takes place in the mortality from typhus in Munich, necessitates the assumption of a cöoperating cause, sometimes assisting, sometimes counteracting the specific cause of typhoid fever, and which must be considered as its quantitative side, as the basis of the extension and force of the disease.

2. Of all elements in Munich accessible to investigation, the oscillations in the underground water especially exhibit relations, unmistakably indicating their connexion with the spread and violence of typhoid fever.

3. So long as the underground water continues to rise, the number of fatal cases of typhoid fever steadily falls, and *vice versâ*.

[a] 3rd Series, Vol. iv., p. 41.

[b] The sequel will show that it is to the ileo- or abdominal typhus, or typhoid fever, exclusively, that the writer refers in this paper.—*Translator.*

4. The duration and rapidity of movements in the underground water, contain the measure of the violence and extension of typhoid fever.

The line upon which Buhl has here entered, has been received very differently, though most frequently with a certain reservation, and in Munich itself not merely with mistrust, but even with dislike. Nevertheless he has also met with important support from various scientific men,—a support which every subject deserves which, like this, is closely connected with the public weal. Thus Seidel has in two papers in the "Zeitschrift f. Biologie"[a] subjected the coincidence between the numbers of typhus cases and the varying height of the underground water in Munich to an accurate mathematical investigation, based on the principles of the doctrine of chances. He has in this manner arrived at essentially the same results as Buhl:—

1. The variation in the number of the cases of typhus compared with the variation of the underground water, indicates, after elimination of the period of the year, a coincidence, whence with a probability of 36,000 to 1 a connexion between the two phenomena is deducible.

2. All the investigations show, that when in Munich a month presents a greater rainfall than the normal according to the season, it will also be more probable that we shall find in it a diminution of the number of cases of typhoid fever than an increase.

3. If we would suppose the phenomena mentioned (the variation of the underground water and the number of typhus cases) to be dependent on a third unknown phenomenon, the height of the underground water, the quantity of the meteoric rainfall and the frequency of the cases of typhoid fever must be at the same time dependent thereon, and be brought into a certain agreement. Now as this cannot be the influence of the seasons, which is everywhere eliminated, no other plausible explanation remains but this, that under the local circumstances existing in Munich the water contained in the soil, when it is present in sufficient quantity, hinders or limits certain processes, whereon the frequency of the cases of typhus depends.

4. It is further evident, that these processes take place in the soil itself. Thus that an increase of the atmospheric rainfall exercises a favourable influence by saturating the porous earth with moisture, and not by a direct operation of the weather on the system, must necessarily follow from the facts, that this operation can be shown to extend even through months, and that the higher position of the underground water is in and by itself, accompanied by an equally favourable, or even still more evident action.

Willars Jessen[b] of Kiel has subjected Buhl's numbers to a similar

[a] 1 Bd., p. 221 and 2 B., p. 145.
[b] "Zeitschrift für Biologie," iii., p. 128.

mathematical test,—only he employed another method of calculation; he has arrived at the same result as Seidel.

Thomas of Leipsic[a] tested Buhl's and Seidel's proposition with reference to the monthly mortality from typhus in Munich and found it quite confirmed.

In the first number of the fourth volume of the "Zeitschrift für Biologie," Max Pettenkofer has laid hold of the question partly to oppose the objections expressed both privately and publicly against the propositions laid down by Buhl and Seidel, partly to direct attention to and to explain a chart constructed by "Polizeiingenieur" Wagus from the lists supplied by all physicians. This chart, in addition to other satistics of mortality in Munich, gives also the mortality from typhus for each month in the period from 1850 to 1867. Moreover he has given in curves the monthly rainfall, and, since March, 1856, at the same time the height of the underground water according to Pettenkofer's observations. It will be remembered that Buhl has treated only of the period 1856-64, while Wagus takes in both the time before (1850-56), and the time after Buhl's observations, namely, from 1864 to the close of 1867. We are thus in a position to try, whether the results deduced by Buhl and Seidel from their materials up to 1864, hold good also in the following period. This is in fact the case; there is a strict agreement between the curves constructed by Buhl and Wagus, not merely so far as the great epidemics are concerned, but also with reference to the yearly and monthly mean mortality of typhoid fever, the greatest mortality being found in both in February, and the least in October. The result shows at the same time, that Buhl was justified in looking upon the mortality in the general hospital as a type of that in all Munich. That it is not upon the season that the varying mortality of typhus depends, appears also from Wagus' chart; thus for example in January, 1858, the deaths from typhoid fever were 97; and in January, 1867, they were 10.

We are naturally embarrassed in seeking the cause of this varying mortality in typhoid fever. The causes generally assigned in daily life and in practice, as bad food, errors in diet, cold, want of cleanliness, damp and insufficient ventilation of rooms, &c., do not explain why in January, 1858, so many, and in January, 1867, so few died of typhoid fever. All these conditions, which are all mentioned by Buhl, have certainly a hygienic signification both for the particular individual and for the course of an epidemic; but they are not liable to such changes as the extension and violence of the typhoid fever, which therefore cannot be dependent on them; they indicate no causal connexion with the flow or ebb of the specific course of typhus which is still unknown to us, and the existence of which is assumed only from its effects.

[a] "Archiv der Heilkunde," viii., p. 385.

If we compare on Wagus' chart the curve, indicating the mortality from typhus, with that exhibiting the yearly rainfall, we observe a coincidence resembling that which Seidel has demonstrated, the one curve ascending when the other falls, and *vice versâ*. This is, however, far from being invariable,—it presents considerable exceptions. But it appears that we might assume as a rule, which in every case holds far better than any of those previously admitted, that an increase of the atmospheric rainfall is attended with a diminution in the number of typhus cases. But now in Munich in the years 1856-'57-'58, the rainfall was about the same, namely, 282, 312, and 306 Parisian lines. If the rainfall in and by itself had any influence, we might in these years expect about the same number of typhus cases; but this is far from being the case; from November, 1857, until May, 1858, the most severe typhus epidemic of all raged in Munich.

We might also assume that it was the rainfall of the preceding year which was the agent, and that therefore the most severe epidemics of typhoid fever might follow the driest years. 1856 and 1865 were the two driest years, with respectively 282 and 255 Parisian lines of rain; the first year was followed by a much slighter epidemic than the second, which therefore seems to agree with what has been assumed. But from 1856-57 the rainfall rises from 282 to 312 lines, and nevertheless the most severe epidemic of all now ensues, even far surpassing that from 1865 and 1866, which yet followed the driest year of all with only 255 lines of rainfall. All these facts have likewise been all quoted and investigated by Buhl; but Pettenkofer has detailed them at greater length, for which reason we have introduced them, notwithstanding the repetition.

Pettenkofer now comes at last to the underground water, as the atmospheric rainfall cannot, without the aid of it, which indeed ultimately depends thereon, be brought into any true connexion with the epidemics. This underground water seems, however, to have caused people some trouble notwithstanding Pettenkofer's accurate definition, and many will always see something mysterious in it. The underground water is a definite state of moisture in the porous soil; where the pores in such a soil are filled partly with air, partly with water, Pettenkofer calls the soil damp; when the pores in a layer of the soil are filled with water alone and all air is expelled, underground water is present. The state of the underground water is therefore a kind of standard, so to speak a zero, for the moisture of the ground, and the rising and falling of this standard, which takes place beneath the surface, is the subject of observations of the underground water.

From a hygienic point of view we are concerned only with the underground water found in the upper, porous layer of earth. Now where this porous layer is so deep, that all wells have their supply of water from it, the state of the water in the wells affords the measure of the height of the underground water. This holds good perfectly so far as

Munich is concerned; but in other places, where the nature of the soil is different, the state of things may also be quite different. Where for example there is a waterproof layer of marl or clay under a comparatively thin, porous layer, so that the former must be perforated before we meet with sufficient water, the state of the water in the wells of course cannot indicate the height of the underground water, which contribute only little or nothing to the supply of the wells. We must therefore accurately investigate the state of things in each individual place, if we wish by our measurements to obtain results of really scientific value.

Pettenkofer further shows, that the height of the underground water in different years and at different seasons does not depend directly on the yearly rainfall, and that the same rainfall may act quite differently in different localities, even with soil of the same nature. In this latter respect many elements have an influence: 1. The quantity of rain; 2. how much of the latter penetrates the earth or evaporates on the surface; 3. how much is retained by adhesion in the superior, dry layer or again evaporates; 4. how much flows to the locality on the waterproof substratum from higher points; and finally, 5. what fall has the waterproof stratum on which the water collects.

The first element, the rainfall, is the most important, but may be greatly modified by the others; when the layer lying over the underground water is very much dried up, it may rain for several weeks and the underground water may still continue to sink. If this layer, on the other hand, is already very damp, and the superficial evaporation be only very slight, almost every drop sinks down to the underground water.

Prof. Pfaff of Erlangen has for a year undertaken many instructive investigations respecting the penetration of the rainfall into the soil. He has shown of what great importance the depth or extent of the porous layer resting on the waterproof stratum is; that a porous layer four feet in depth, has a totally different signification from one of half a foot or a foot. These investigations will soon be published in the "Zeitschrift f. Biologie." Pfaff has found that of the summer half-year's rainfall only 7% penetrates down to the waterproof layer, when the porous layer is half a foot in thickness, while 37% does so, when that layer is four feet in thickness. This paradox is explained by the drying from superficial evaporation; the thicker layer receives during evaporation much water from below, and can therefore never be so much dried up that it can absorb the subsequent gradual rainfall so completely as the thin layer.

If we now inquire in the chart published by Wagus, when, on the whole, the lowest position of the underground water was observed in Munich, it appears at once, that this was contemporaneous with the most violent epidemic of typhoid fever in the period investigated, namely, 1857-58. The next lowest state of the underground water corresponds to the next most severe epidemic, 1865-66. And if we apply a counter-test and

inquire when the underground water stood highest, we find that it was in 1867, the very year in which we had the smallest number of typhus cases, namely 96, the lowest number observed in Munich since 1856, when the observations of the underground water commenced. Such a coincidence cannot possibly be attributed to mere chance.

The year 1867 shows also that we cannot from the rainfall directly deduce the height of the underground water. In 1866 374,‴ and in 1867 406‴ fell in Munich, and so early as April in the last named year the highest point of underground water was attained; but in 1859 392,‴ and in 1860 416‴ fell there, and it was not until July, 1861, that the highest point of the underground water was reached.

The chart, therefore, constructed by Wagus from entirely different materials, confirms in every respect the law previously indicated by Buhl and Seidel, and corroborated by Jessen and Thomas. And it at the same time shows very distinctly, that the atmospheric rainfall influences the cause of typhus only so far as it alters the height of the underground water, as also Seidel and Buhl have established.

To attain to perfect certainty it is however necessary that observations of the same nature as those carried out at Munich should be made also in other places visited by typhoid fever. Accurate statistics of typhoid fever, and in connexion therewith a continued investigation of the rainfall and heights of the underground water, are the requisites; and we see already from the facts obtained in Munich, that it is only through a period of several years that we can calculate on decisive results and on a discovery of the local rhythm. It is not to be expected that the results should everywhere be the same as in Munich. Thus much is however ascertained from other seats of typhus, that there also the severest epidemics in general follow the driest years. This was the case with the epidemic at Windsor, which became so notorious, in consequence of its having carried off the Prince Consort. The same has been reported to Pettenkofer respecting the frequently recurring epidemics of typhoid fever in Liverpool. Dr. Pfeiffer has communicated similar observations as to Thuringia, and Dr. Jürgensen has done the same for Kiel. The opposite has been reported for Königsberg, namely that typhoid fever is there most severe in damp years. If this be confirmed it ought not, thinks Pettenkofer, to be looked upon as contradictory to the result obtained from Munich. But he is of opinion that such cases may, on the contrary, forward the matter, inasmuch as they will lead to an explanation of the circumstances which are the same in both places, but which in Königsberg come into action when the underground water rises; in Munich on the contrary, when it falls.

Pettenkofer warns us especially against too hasty and precipitate conclusions, and recommends an accurate and careful investigation of the facts, before we look upon our results as certain. He likewise warns us

against the old mistake in medicine, of ascribing without inquiry the same disease now to one, and again to another cause, in one case blaming the soil and its humidity, in another cucumbers or brandy, or when no dietetic error is known, uncleanliness, poverty, or fear, in a word, assuming everything and therefore nothing, as essential. This method may indeed be convenient, especially in practice, when it can never lead us into embarrassment; but it is incompatible with the spirit of science; and if medicine is, and is to be a science, it must lay aside this habit, which has become a practice, not to say second nature; and we must say only:—"in such a case this has occurred instead of that," when we can really state how and why the one may produce the same effect as the other.

An accurate diagnosis is also necessary, as it is only ileo- or abdominal typhus which is in question, and not other diseases, unfortunately often confounded with it.

The theory of the underground water can, according to our present knowledge of facts, rest only on weak and arbitrary hypotheses. The underground water alone with its rising and falling can evidently not produce any disease,—it can in any case only conditionally affect their occurrence. Whether this alternation in the moist condition of the soil effects the formation of vegetable or animal organisms, putrefaction or depreciation of the water or of the air, is as yet undecided. Only thus much Pettenkofer believes may positively be admitted, that it is essentially an organic process, which goes on in the soil; but where in the soil these organic matters occur, and how the process goes on, remains to be investigated. That the process does not take place in the water itself is evident from the fact that this is the very thing which checks it, while drying up promotes it. It seems incomprehensible, how it can be asserted, that it is not the moisture in the soil, the underground water, but on the contrary the atmospheric moisture, the rain, which has an influence on typhoid fever and cholera, while we nevertheless may often see, how in one and the same town (for example Weimar), one part of the town is visited by typhoid, while the other parts are free, or, as in Nürnberg, the one side of the town is devastated by cholera, while in the other part only sporadic cases are met with. Are we really to believe, that more rain can fall in one part of the town than in the other?

Little admissible as is the assumption, that specific typhus is developed in the water, its reference to the surface is, according to Pettenkofer, equally inadmissible. If the theory that it is an organic process be correct, we cannot suppose, so far as Munich is concerned, that this takes place on the surface of the soil, for experience shows, that the severest epidemics have occurred precisely at the coldest season, when the earth has often been frozen for weeks consecutively. We cannot imagine any organic process which should be active in the middle of winter, in the

hardest frost. It will be necessary at least provisionally to place the focus of typhoid fever beneath the line of frost of the soil.

But if we place the seat of the formation of the typhus germ beneath the surface, we must also account for how it reaches us. Under ordinary circumstances we are connected with the underground layer only in two modes, namely, through the water in our wells and springs and through the air, which permeates the porous layer. Many look upon the former as the only probable mode, and this is Pettenkofer's view, and several well observed facts in the progress of cholera in England place it beyond all doubt, that the germs of these diseases may be disseminated through the water, though they are not developed therein; but for this a peculiar soil is required. The typhus-corpuscles formed in the porous, damp soil may also pass over into the underground water, and after being brought up to the surface through wells and springs, may be further developed and swallowed by us.

We know indeed, that the air above and beneath the surface of the earth may hold numerous organic germs floating in it, and carry them with itself though very narrow canals. Now if the air in the porous soil, and the open atmosphere be partly of a somewhat different composition, partly of a somewhat different temperature, the former will constantly mix with the latter, and they will thus be able to exchange matters.

Very few, however, have a correct idea of the porosity of the soil on which our dwellings stand, and of the motion of the air therein. If we strongly compress in a vessel, any quantity of the soil on which Munich stands, after having first dried it at 212° F., until no further diminution takes place, and then pour on water until all interstices are completely filled and all air driven out, the weight of the quantity of water used will indicate the degree of the porosity of the soil. With respect to Munich at least $\frac{1}{3}$ of the soil consists of pores or interstices, which are completely filled with air so long as the ground is dry; the buildings in Munich therefore rest on a soil of which at least one-third is atmospheric air. This to many will appear very strange, especially with respect to Munich, where one can work in the hard and firm crust of the earth only with pickaxes. But it will perhaps sound less incredible, when it is known, that a well burnt brick has 20% of interstices, filled with air, and that one can blow through it. Now if we even look upon the soil as a kind of lid to what lies below it, we must not forget that this lid closes only two-thirds of the opening and leaves one-third free. We cannot therefore in fact wonder more that such germs as in general may be carried in the air, can reach the surface from considerable depths in the soil, than that the smuts from our lamps and candles which stand upon the table, should collect on the ceiling, or that we may meet with the mineral constituents of the soil in the top of a tree one hundred feet high.

Although the author, as has been stated, will not for the present deny, that the cause of typhoid fever may be conveyed in water, especially in drinking water, he thinks that according to our present experience and the investigations which have been made we must look upon the air as the most usual and the most important medium of the communication of the typhus matter. An attempt has been made to explain Buhl's observation, that a low state of the underground water promotes, while a high state of the same is unfavourable to the occurrence of typhoid fever, by supposing that under the former circumstance the wells should contain more impure water, while this more concentrated extract of the soil is diluted under the latter. Plausible as this theory may at first sight appear, it has nevertheless very rarely proved correct. Accurate investigations at different heights of the water in wells have shown, at least in Munich, that spring water in damp weather, that is when the underground water is high, contains a larger quantity of solid constituents than in dry weather.

Theories which point to a certain influence of the wells are readily entertained and supported, because the latter must be essentially affected by the nature of the surrounding soil. Still in Munich we have never succeeded in demonstrating a positive influence of a particular kind of drinking water. Thus there is still the same supply of water as during the violent typhus epidemic of 1865-66, and yet there is at present scarcely any typhoid fever; in 1861 the drinking water was even much worse than in 1865-66, and yet there were then very few cases of typhoid fever. The author therefore considers the question of the influence of drinking water to be still *subjudice*, and he recommends that more weighty proofs should be sought for in its favour, than have as yet been brought forward.

ASSOCIATION

FOR PROMOTING THE EXTENSION OF THE

CONTAGIOUS DISEASES ACT, 1866,

TO THE

CIVIL POPULATION OF THE UNITED KINGDOM.

CONTRIBUTED BY

HAMILTON LABATT, A.B., T.C.D.;

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ROYAL COLLEGE OF SURGEONS, IRELAND;
LATE IN MEDICAL CHARGE OF THE 60TH ROYAL RIFLES;
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Reprinted from the Dublin Quarterly Journal of Medical Science, August, 1868.

DUBLIN:
JOHN FALCONER, 53, UPPER SACKVILLE-STREET,
PRINTER TO HER MAJESTY'S STATIONERY OFFICE.

1868.

ASSOCIATION

FOR PROMOTING THE EXTENSION OF

THE CONTAGIOUS DISEASES ACT, 1866.

THE above Association, which has been in active operation for some time, has issued a Report on "the extent of Venereal Disease, the operation of the Contagious Diseases Act, and the means of checking Contagion." And, before entering on the consideration of the important and valuable information presented in its pages, it may be well to refer briefly to the "objects" of the Association, and the great social benefits to be anticipated from its labours.

The "objects" of the Association appear to be two-fold—firstly, the isolation of those labouring under syphilitic diseases, whereby the propagation of the contagion may be prevented; and, secondly, yet first in importance, the moral and social improvement of the unfortunate women, whose condition so urgently calls for our most earnest sympathy and consideration. The Association is entirely opposed to the Continental system, by which prostitution would seem to be licensed; on the contrary, its chief end and aim is to discourage that fearful vice, by which so many unhappy females are brought to degradation and an untimely grave.

Such are the objects of the Association, clearly and unequivocally laid down, not only in their report, but also in all previous documents issued under their authority. And yet difficulties are raised and suggestions started as to its operations having an immoral tendency, and being calculated to engender a further incentive to vice. We are told, in fact, that the present movement will eventuate in the encouragement of prostitution! It has been boldly asserted that syphilis has been instituted, as it were, as a punishment for vice, and as a deterrent for the libertine, and that, as we value virtue, we cannot discard its aid! All this, and more,

has been put forward in opposition to the Association, but we venture to hope that results, which after all must stand as the best tests, will eventually disprove such views; and we moreover feel confident that if it should in time appear that, under the preventive system, not only prostitution and disease have diminished, but that the moral condition of the unfortunate females has been raised, the very originators of these mistaken views will be the first to congratulate the Association on the incalculable benefits they have achieved for humanity. Already have these gratifying results begun to appear under the operation of the Act now in force at some of our naval and military stations; and, previous to entering on any detail, we shall endeavour to explain very briefly the nature of the Act as it now exists, and the important sanitary and social improvements that have been secured by its provisions.

In the year 1866 the Act was passed by the Legislature, having for its object the prevention of contagious (venereal) diseases at certain of our naval and military stations in the United Kingdom. The absolute and pressing necessity for this measure became at once apparent on reviewing the deplorable consequences that resulted to two most important branches of the public service, from the dissemination and spread of the venereal poison. The civil practitioner can have no adequate conception of either the extent or effects of this great and destructive evil. It preyed upon the efficiency of our army, and its baneful influence equally interfered with the sanitary condition of our navy. The large number of men rendered temporarily unfit for duty in both services, and the numerous cases invalided from year to year from the effects of the contagion, presented an accumulated record of such magnitude as will enable us to estimate the vast expense that must have been entailed on the country by the disease spreading without check or control in our naval and military stations. Our readers will doubtless be surprised on learning that, according to the evidence of Admiral Sir W. Fanshawe Martin, K.C.B., no less than half of the invaliding in the navy was due to venereal; the multiplied facts deducible from the effects of the contagion in our army, strengthened the conviction as to the necessity for some preventive measures to control and counteract the spread of an evil so destructive to the efficiency of both branches of the service. And we have no doubt that now, as the Act is available, every possible advantage

will be taken of it by the able and efficient administrators at the Admiralty and War Office.

Under the Act 1866, it is provided that any woman in any place to which its provisions apply, found to be affected with contagious (venereal) disease, shall be liable to be detained in a certified hospital, until discharged therefrom on a certificate under the hand of the principal medical officer: and in the framing of the Act it will be seen that every caution has been displayed to avoid any possible abuse of its powers. No woman can be required to submit to medical examination until "information on oath is laid before a justice of the peace by a superintendent of police," to the effect that the informant "has good cause to believe that the woman is a common prostitute, and either is resident within the limits of any place to which the Act applies, or being resident within five miles of those limits, has, within fourteen days before the laying of the information, been within those limits for the purpose of prostitution." In such case "the justice may, if he thinks fit, issue a notice thereof addressed to such woman, which notice the superintendent of police shall cause to be served on her;" and "if the woman on whom such notice is served appears herself, or by some person on her behalf, at the time and place appointed in the notice, or at some other time and place appointed by adjournment," the justice present, "on oath being made before him, substantiating the matter of the information to his satisfaction, may, if he thinks fit," order the woman to be subjected to a periodical medical examination by the visiting surgeon, for any period not exceeding one year, for the purpose of ascertaining if she be affected with a contagious disease. The times and places for these examinations are regulated by the Admiralty or Secretary of State for War, and they are specified in the orders issued by the justices, copies of which orders are served on the woman by the superintendent of police. If the woman does not appear, and it is "shown (on oath) to the justice present that the notice was served on her a reasonable time before the time appointed for her appearance, or that reasonable notice of such adjournment was given to her"—in such case the justice proceeds on the matter of the information, being substantiated on oath, and, if he thinks fit, issues the order.

Under the Act, powers are given to the Admiralty or Secretary of State for War to provide certified hospitals in which the women found to be affected with a contagious disease are liable to be

detained on a certificate to that effect signed by the visiting surgeon. The certificate is to be in duplicate—one to be delivered to the woman, and the others to the superintendent of police. If the woman, after the certificate is delivered to her, refuses to go to the certified hospital named in the certificate, "the superintendent of police, or a constable acting under his orders, shall apprehend her," and convey her to the hospital for treatment on the authority of the above certificate of the medical officer. The detention in hospital is regulated by the visiting surgeon, on whose written certificate she is discharged.

The reception of a woman in a certified hospital involves an undertaking to provide for her care and treatment, lodging, clothing, and food during her detention in hospital, and while being conveyed or transferred to a certified hospital, she is deemed legally in the custody of the person conveying, transferring, or detaining her. But in order to make further provision against any abuse of the Act, clauses are introduced to limit the detention to three months in hospital under the same or any one certificate, and enabling the woman to apply to the justice for discharge if she considers herself entitled to it. This she obtains if the justice is satisfied on reasonable evidence that she is free from disease. Special clauses are introduced, setting forth various penalties instituted to secure the due fulfilment of the provisions of the Act. Nothing unreasonable or partaking of unnecessary severity will be found here; nothing that is not absolutely called for to carry out objects of such great importance to the public welfare.

With regard to the medical examination, it is satisfactory to know that this part of the Act, so far from meeting with any opposition from the women, has, according to the interesting report of Mr. Berkeley Hill, been accepted by them at Chatham and other stations, and conformed to as long as the examinations are conducted regularly, and not by singling out particular females, whereby they become objects of reproach to their companions. Indeed many of them voluntarily submit themselves for medical examination; for this, it may be observed, a special provision is introduced into the Act. This information affords a valuable hint to the medical officers, as to the necessity for conducting this part of their duty with the most scrupulous regard for the feelings of those poor misguided creatures, whom it ought to be our object, not only to relieve from their bodily ailments, but also to impress on, and

teach while under our treatment, that there is a public interest in operation for their good, and the permanent improvement of their moral and social condition. This will tend to convince them that they are no longer miserable outcasts, but that they constitute a class which has gained the sympathy of a large and influential section of the community.

The Act, as it is at present framed, applies to Portsmouth, Plymouth, Devonport, Woolwich, Chatham, Sheerness, Aldershot, Windsor, Colchester, Shorncliffe, the Curragh, Cork, and Queenstown. And the beneficial results that have accrued from its operations have been most encouraging. At Chatham, we learn, on the authority of Mr. Berkeley Hill, that "the hospital was considered a very good thing by all the women, one of whom declared she would always come back to Chatham if she ever became ill elsewhere." This is of importance as evidence of the efficiency of that institution, which we learn from the report has forty beds, and, in case these should be all occupied, additional accommodation is provided in London, where there are eighty beds for patients from Chatham, Woolwich, and Sheerness.

The information afforded by Dr. Anderson, Deputy Inspector-General of Melville Hospital, is most valuable as to the beneficial effects derived from the Act, both in alleviating the severity of the disease, and in diminishing the number of men attacked by it mongst the marines at Chatham. His statistics appear in the 35th page of the report, prepared by Mr. Berkeley Hill, and afford very satisfactory results. In the same page Mr. Hill gives us some highly gratifying information as to the operation of the Act in improving the social and moral condition of the women. At Chatham, Rochester, and Stroud, "the moral condition and feeling of the women," he tells us, "are greatly raised." The police, we learn from the same source, have become their protectors by rescuing them from the tyranny and brutality of the low beer shop keepers. But, whilst we dwell on these gratifying and encouraging facts, we must not conceal from ourselves that we are but in the beginning of our labours. The facts put forward so admirably by Mr. Hill, not only teach us what has been done, but emphatically point out to us what may yet be effected by judicious and persevering efforts. The mere perusal of the interesting report before us, which we have but lightly touched on, must satisfy us that there is a state of misery and appalling degradation wide-

spread and deep amongst our female population arising from prostitution and disease, which no private enterprise nor philanthropy can remedy. To the Legislature then we turn for the means of counteracting this great social evil which is undermining both the mental and physical condition of the people.

It is a remarkable fact that notwithstanding the agitation which has of late taken place regarding the destructive influence of the venereal disease, and the deplorable consequences resulting therefrom to our civil population, an impression is abroad that the poison has been deprived of much of its original virulence, and that it is by no means so widespread nor frequent as it was in former periods. No error can be greater nor more deceptive than this; and it is of the first importance that it should be corrected, because it is peculiarly calculated to deceive the public mind, and thereby render it indifferent to the urgent necessity that exists for the preventive measures now so urgently required for the health and well being of the community. In estimating, or rather describing, the subtle and poisonous influence of the contagion, we cannot do better than quote the following remarkable and impressive passages from the well known work of Parent-Duchatelet, "De la Prostitution dans la Ville de Paris":—

"De toutes les maladies qui peuvent affecter l'espèce humaine par voie de contagion, et qui portent à la société les plus grands préjudices, il n'en est pas de plus grave, de plus dangereuse et de plus à redouter que la syphilis. Sous ce rapport, je ne crains pas d'être démenti, en disant que les désastres qu'elle procure l'emportent sur les ravages qu'ont exercés toutes les pestes qui, de temps en temps, sont venues porter la terreur dans la société.

"La syphilis est chez nous, elle est chez nos voisins, elle est dans l'univers; elle ne tue pas immédiatement, il est vrai, comme beaucoup d'autres maladies, mais cela n'empêche pas que le nombre de ses victimes ne soit immense. Ses ravages n'ont pas d'interruption; elle frappe de préférence cette partie de la population qui, par son âge, fait la force aussi bien que la richesse des états. La syphilis vient énever cette population au moment méme de son existence, où, par les lois de la nature, elle se trouve en état de procréer des êtres vigoureux; et si elle ne rend pas cette population stérile, les malheureux qui en proviennent forment une race abâtardie, aussi impropre aux fonctions civiles qu'au service militaire, et qui, en définitive est un fardeau pour la société. Enfin, l'innocence et la vertu la plus pure ne sont pas, dans nos sociétés modernes, à l'abri de ses atteintes: que de nourrices mercenaires, que d'épouses vertueses, que d'enfans à la mamelle n'en sont pas tous les ans, cruellement attaqués!"

It has pleased an all-wise Providence, in his solemn and mysterious dispensation, to afflict the human race with divers diseases and bodily ailments; some of these are accompanied by unspeakable sufferings, and either with rapid strides or by slow degrees, but not less certain results, terminate in that death which may be looked on as a merciful release from bodily anguish. But of all the varied and complicated forms of disease that have come under our notice, we believe that not one—even one—of the fearful catalogue could present such awful features or consequences as the graphic description Parent-Duchatelet has presented to us of syphilis in the above passages. Every sentence therein is full of truth, and bears on it a lesson which no statesman nor philanthropist can be indifferent to. And doubtless it is such knowledge that has now awakened public attention and created the present movement in favour of some enactment which may save the present generation, and their children's children, from the terrible consequences described in the lines we have just quoted.

But, fearful as is the picture drawn by Parent-Duchatelet, he has not given all. He has omitted to notice that wretched and pitiable condition into which the miserable victim to the disease, in some instances, passes, after the subtle and insidious effects of the poison have involved all the tissues of the system, reducing the whole to an incurable wreck, the intellect becomes enfeebled and the mind weak, and all those nobler and higher qualities which stamped our nature in its primitive integrity seem to be impaired. Unquestionably we have seen a few, happily but a few such results. A very melancholy instance is at present under our notice. It is the case of a gentleman whom we knew in very early life. As an example of a man we have seen but few that surpassed him in noble form or physical condition; quick in intellect and possessed of remarkable conversational powers. He had been afflicted with the phagedenic form of the disease, which we believe to be incurable if neglected in the earlier stages.* Such was this gentleman's case

* Observations on Venereal Diseases. By Hamilton Labatt, p. 165.

when we saw him in consultation with the late Mr. Carmichael. We shall not attempt to detail his many long and tedious years of suffering; but he is now a wretched remnant of himself—stooped, distorted and disfigured, hideous to look on, and all his conversation and remarks characteristic of approaching imbecility. It is but an act of justice to the distinguished surgeon who saw this case with us, as well as to ourselves, to record in these pages that nothing could exceed the reckless indifference this unfortunate gentleman displayed in the earlier stages, both to the proper care of himself, as well as to the observance of the directions he received from his surgical attendants.

We may mention that, previous to the year 1866 (the year of the existing Act), certain preventive measures, in respect to the registration and inspection of prostitutes, authorized by the previous Contagious Diseases Prevention Act, 1864, were put into operation abroad, with the best results; and we have in the admirable report before us a very interesting letter, dated from Malta, addressed by Lieutenant-General Sir Henry Storks, K.C.B., to Mr. Skey, as Chairman of the Committee in London, in which it is stated that, under the above system, "the disease may be said to have almost disappeared in the Islands of Corfu, Zante, and Cephalonia." And, again, in the same communication, General Storks observes, "In Malta the same police regulations exist, and I know of no place so singularly free from venereal disease as regards the professional prostitutes." The letter closes with the following impressive passage:—"The amount of disease and misery that would be prevented by enforcing a sanitary inspection of prostitutes is incalculable, and it is a subject which earnestly claims the attention of the authorities competent to deal with it."

It would be needless to pursue farther the very convincing evidence which can be produced in favour of the great advantages that would result from an extension of the Act of 1866. We know that difficulties must be encountered at first in introducing it amongst our civil population; but we are confident that, under an administration duly tempered with a careful consideration for the feelings and prejudices of the people—all these would speedily subside. Only teach them that you are working for their individual good and they will be seen to unite and co-operate with you.

That the Association, as now organized, is fully equal to the importance of its mission, there can be little doubt. A few months

have scarcely elapsed since the first meeting was held in London. At that early period we augured most favourably as to the ultimate prospect of success, seeing the influential, though small number of individuals who had attached themselves to the movement. We then had Fergusson, Jenner, Anderson, Watson, Paget, Burrowes, and other eminent men of our own profession, as Vice-Presidents, and with them were associated other distinguished men who, though not connected with the medical profession, heartily co-operated in the labours of the Association. Subsequently, and through the untiring energy and perseverance of the able honorary secretaries for London, Mr. Berkeley Hill and Mr. Curgenvan, the numbers greatly increased, and the long list attached to the report, just published, presents a display of intellect and influence which cannot fail to have weight with the Legislature. But the Association is not confined to London. In Edinburgh and Dublin vice-presidents, committees, and honorary secretaries have been appointed, and the same has been effected in upwards forty other leading cities and towns throughout the United Kingdom. It would be invidious as well as unnecessary to select from the long list in the report any particular names—all, in our estimation, deserve equal prominence from their devotion to this noble cause. Indeed we should not have put forward the names we have already mentioned, but that we feel and believe there is a peculiar distinction due to those who have laboured in this great cause from the beginning, and who, by their high position and eminence, have attracted the support and co-operation of the many distinguished men who subsequently joined the Association.

It is a matter of congratulation that, during the present Session of Parliament, this important movement has engaged the serious attention of the Legislature. Questions connected with it have been put in the House of Commons to the Government; and very recently Lord Lifford (one of the vice-presidents, whose zeal in this good cause is beyond all praise,) has obtained a select committee of the House of Lords to inquire into the subject. That committee, which includes amongst its members some of our most influential Peers, has been sitting on the question, and we learn will soon issue their report.* Much will depend on the substance of that document, but from the knowledge we have of the energy, perseverance, and business-like habits of the noble chairman (Lord

* Since this Paper was sent to press, the author has learned that Lord Lifford's Report has been issued.

Lifford) we entertain confidence as to the result, provided he receive that support which he has a right to expect, and which it is our obvious interest to extend to him.

Contemporaneous with this legislative inquiry a very influential meeting has been recently held in London under the chairmanship of Sir Thomas Watson, Bart. The long list of noblemen and gentlemen, including Members of the Houses of Lords and Commons, who attended that meeting, fully attests the very great interest felt on the subject.

Although we have considered it inexpedient as well as unnecessary to enter into the particulars of the organization of the Association in the various localities, it would be a great omission to pass without some notice what has been done in this country in furtherance of the movement. In Dublin Mr. Porter, President of the College of Surgeons, with Professors Hargrave, Banks, Mapother, and Colonel Adamson, have been appointed Vice-Presidents of the Association, and a very able and efficient committee, composed of the following gentlemen, all well known and distinguished for their professional acquirements, has been formed:—Professor Geoghegan, Drs. Wilmot, Byrne, Head, Irvine, Lentaigne, and Robert MacDonnell, with our respected Magistrate and Town Councillor, Mr. Henry Maclean, who has ever evinced a sincere interest in everything calculated to advance the public good. At a very early period of the movement Mr. Hamilton Labatt, author of the work on Venereal, and several other publications on Syphilitic Venereal Diseases, was requested and consented to act as Honorary Secretary for Dublin. Under this organization a meeting was held at the private residence of the Honorary Secretary in Upper Fitzwilliam-street during the past winter, and some important resolutions passed, which were transmitted to London. In Cork and Belfast the movement has been adopted and officers appointed; Dr. Armstrong has been nominated honorary secretary in the former town, and Dr. Mac Cormac in the latter. And we have much satisfaction in stating that the office of vice-president in Belfast has been accepted by the Lord Bishop of Down and Connor.

We shall now close our remarks on this all-important subject, but not without a fervent and sincere hope that success may ultimately crown the efforts of the Association. We know of nothing more noble, nothing more exalted than the objects they have in view; and so, in proportion will, of a certainty, be to them the deep and lasting gratitude of mankind.

PAMPHLETS

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