Thirteenth report of the Medical Officer of the Privy Council. With appendix. 1870.

PUBLIC HEALTH.

THIRTEENTH REPORT

OF

THE MEDICAL OFFICER OF THE PRIVY COUNCIL.

WITH APPENDIX.

1870.

Presented pursuant to Act of Parliament.

LONDON:
PRINTED BY GEORGE E. EYRE AND WILLIAM SPOTTISWOODE,
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CONTENTS.

MEDICAL OFFICER'S REPORT.

TO THE LORDS OF HER MAJESTY'S MOST HONORABLE PRIVY COUNCIL.

My Lords,

In obedience to the Public Health Act, 1858, I have the honor of submitting to your Lordships for presentation to Parliament my Report of the proceedings which your Lordships under that Act directed to be taken during the year 1870. And for the present purpose I treat as within the Statute all other proceedings which your Lordships during the year directed to be taken in this Department.

I. Special Diseases of the year.

I. In introduction I have to state that the two epidemic diseases which in 1869 had required particular attention from this department continued seriously prevalent in 1870: namely, that *Relapsing Fever* which at the date of my last report had scarcely excited much apprehension except in London, where then it had begun to decline, afterwards increased very considerably in other of our great centres of population—particularly at Liverpool, and, in a less degree, at Leeds and Merthyr-Tydfil; and that *Scarlatina*, which also at the date of my last report had begun to diminish in London after an epidemic of extreme severity, has till now continued ravaging other parts of England with its extraordinarily fatal prevalence. Besides these causes of anxiety in relation to the public health in 1870, there began early in the year signs of a recommencing ascendency of *Small-pox* in England; and before the close of the year it had become evident that, at least for the three and a quarter million inhabitants of the metropolis, the severity of this epidemic of small-pox would be beyond any recent experience we had had of the disease.

II. Supervision of Nuisances-removal and Diseases-prevention Authorities

II. During the year 1870 there were 200 cases where communication with local authorities was necessary in regard of questions of *common sanitary administration;* and in 66 of these cases the communication involved local inquiry by a medical inspector of the department. I subjoin (App. No. 1) a list of (*a*) the 66 cases in which inspectors' visits were made, and of (*b*) the 134 cases in which the communication was by letter; and this list shows compendiously on what ground in each case the department had to intervene.

It will be seen, on reference to the table, that almost invariably the matter calling for inquiry was the local prevalence of some dan-

MEDICAL OFFICER'S REPORT.

gerous infectious disease. It deserves notice that in the greater number of cases the local prevalence of disease became known to this department through the more detailed enumeration of deaths which the Registrar General now gives every three months, for each sub-district of England, in the admirable new series of his Quarterly Returns; and I am the more glad to point to this illustration of the utility of the detailed Returns, because it justifies the opinion which I expressed two years ago, that if such an extension could be given to the Returns, "the quarterly publication would represent one of the most important aids which could be rendered to the health-administration of the country."

As regards the 66 cases, where it was practicable to send a departmental inspector to the locality, the first division of the table exhibits in its last column, as briefly as possible, the conditions which in each case the inquirer found existing: conditions, in no case satisfactory, and very rarely other than of the grossest local neglect. I think it probable that the conditions, which this first division of my table exhibits with regard to the 66 inspected localities, would have been found in very large proportion in the 134 other localities, if the departmental inspection could have extended thither.

The inadequacy of the present staff of this department to supervise the local administration of the Diseases-Prevention and Nuisances-Removal laws, and to meet (or even nearly to meet) by medical inspection the demands which are made by local outbreaks or apprehensions of dangerous infectious disease, became in 1870 extremely evident: as may here already have been inferred from the fact that inspectors visited only a third part of the number of cases where communication with local authorities was necessary: and the inadequacy would have been far more evident, were it not that, in our entire lack of public returns of (not fatal) sickness, the field where sanitary supervision is needed remains in one large part of its extent shut out of view. In these circumstances the Lords Commissioners of the Treasury approved that the Estimates (now before Parliament) for the financial year 1871–2 should include a proposal to increase the staff of this department; and the increase which is proposed, if it has the sanction of Parliament, will so far diminish the above-described defect as to enable a large part of the country to be under fair sanitary supervision.

III. Regulation and superintendence of public Vaccination.

III. In 1870, as in previous years, this department superintended the *Public Vaccination* of England: including the proceedings of local authorities and officers under the Vaccination Act, and the provisions by which the national supply of vaccine lymph is maintained, and the arrangements which give effect to the Order of Council regulating the qualifications of public vaccinators.

In the several divisions of Appendix No. 2., I give particulars with regard to the various matters of this branch of our departmental work; and the first division of that Appendix also contains

particulars with regard to the awards of money, amounting altogether to 5,685*l.* 8*s.*, which were made to meritorious public vaccinators in the inspected unions and parishes, out of the sum which Parliament had granted for such distribution.

IV. Constitution of the Medical Profession.

IV. In my last report I described in detail certain communications which this department had had with the *General Council of Medical Registration and Education* on the subject of the working of the Medical Act of 1858, and stated the determination to which your Lordships, at the date when I was reporting, had come, to propose to Parliament a Bill for the radical amendment of the Medical Act. Proceedings connected with this purpose formed in 1870 a large share of the work of the department. On the 8th of April the Lord President introduced in the House of Lords a Bill to provide for the object in view; and on the 7th of July this Bill, somewhat modified, but with no essential change, as the result of its discussion in the House of Lords, had its first reading in the House of Commons. Here, unfortunately, there was such pressure of other public business that the Bill could not till long afterwards be brought under consideration; and when at last its turn for consideration had arrived, the end of the session was so close that no measure requiring much discussion could be considered. In this state of the case claims were put forward for the introduction of a new and very controversial subject-matter into the Bill; and as the promoters of those claims (which related to the constitution of the General Medical Council) would not consent to postpone them for consideration to the present session of Parliament, the Minister in charge of the Bill was of course obliged to withdraw it.

I subjoin as Appendix No. 3 the following papers:—(*a*) a departmental memorandum, written at the time in explanation of the Lord President's Bill, and now supplemented by a note on each of the two chief questions which were discussed while the Bill was in progress; and (*b*) a tabular statement as to the constituencies which are at present represented by delegates in the Medical Council.

V. The practice of Pharmacy in Great Britain.

V. Under the provisions of the *Pharmacy Act*, 1868, described in my last year's report, I conveyed to the Pharmaceutical Society, in 1870, your Lordships' approval of the society's annual list of examiners for the purposes of the Act, and have now to submit to your Lordships the satisfactory report made by Dr. Greenhow on the London examinations of the society in 1870, as visited by him for your Lordships' information. (*See* App. No. 4.)

I regret to report to your Lordships that the power which, for the public protection, the first section of the Act vests in the Pharmaceutical Society, to prescribe (with consent of the Privy Council) regulations as to the keeping, dispensing, and selling of poisons, is still entirely unexercised. I believe it to have been by an accidental oversight in legislation, that, while all other powers to be exercised for public purposes by the Society under the Act were

vested in the Council of the Society, the language of the first section vested in the Commonalty, and not in the Council, the very important power which that section confers, and to which my present observations relate. It is perhaps not surprising that a large body of tradesmen should be slow to take the initiative in imposing even the most reasonable penal restrictions on themselves: but I have to submit to your Lordships, as a fact which you may deem deserving the consideration of Parliament, that this non-fulfilment of the society's duty, to make rules against dangerous slovenliness in the keeping, dispensing, and selling of poisons, is a breach of the implied contract under which the Legislature in 1868 gave powers and privileges to the society.

VI. Auxiliary scientific investigations.

VI. The *pathological work* of the department was in 1870 carried on in its two branches, as described in my last year's report, by Dr. Sanderson and Dr. Thudichum respectively. In neither of the two branches of investigation is the matter of study such that results can easily be published in fragments; and on the present occasion I think it better, as regards one of the branches, not to submit the results of 1870 till they can be extended by the present year's work. But as regards the other, I am able to lay before your Lordships the subjoined report by Dr. Sanderson (App. No. 5.) in continuation of his studies of the process of contagion; and I am glad to state, on the evidence of this report, that, even at the present very early stage of work, Dr. Sanderson's investigation is giving results which are of direct interest to the practice of medicine and surgery.

Conclusion.

§. At the present date, when according to Statute the departmental proceedings of 1870 must be reported to your Lordships, the proceedings from day to day are such as to leave little opportunity for retrospect. An epidemic of small-pox, greatly more severe than any in the last 30 years, is prevailing throughout this metropolis; while at the same time, in virtue of an engagement made in the last Session of Parliament, a Select Committee of the House of Commons, appointed for the purpose, is taking evidence as to the working of the Vaccination Act of 1867, and as to the value of various objections which have been agitated against the practice of vaccination. These exceptional circumstances, with the large daily claims which they of course make on the staff of this department, forbid my dealing in the present report with any subject-matter which can properly be postponed. And having above laid before your Lordships, as the Statute requires, my summary of the work of 1870, I find only one further matter which in my opinion is at once so important and so urgent that, even now, I must submit it for your consideration.

I refer namely to the extremely unsatisfactory state of the laws which concern the general sanitary administration of the

country: a subject, concerning which I two years ago submitted the chief facts to your Lordships,* and on which the Royal Sanitary Commission has recently made its final report.

I would beg leave to represent to your Lordships that the unamended state of those laws, especially as regards the constitution of local authorities and the powers which they ought to have and exercise for the prevention of disease, is not only an extreme difficulty and discouragement to persons engaged in sanitary administration, but also involves a large and constantly-increasing waste of human life; and that since the resources which might be utilised for the better protection of life are also with the progress of knowledge constantly increasing, so, almost month by month, the contrast becomes more and more glaring, between the little which is done and the very much which with amended law might be done, to reform the sanitary circumstances of the masses of our population.

I believe that your Lordships will deem this matter to be, in various points of view, deserving of the particular notice of Parliament.

In the first place, there is the largeness of the continuing waste of human life. It seems certain that the deaths which occur in this country are fully a third more numerous than they would be if our existing knowledge of the chief causes of disease were reasonably well applied throughout the country; that, of deaths which in this sense may be called preventable, the average yearly number in England and Wales is now about 120,000; and that of the 120,000 cases of preventable suffering which thus in every year attain their final place in the death-register, each unit represents a larger or smaller group of other cases in which preventable disease, not ending in death, though often of far-reaching ill-effects on life, has been suffered. And while these vast quantities of needless animal suffering, if regarded merely as such, would be matter for indignant human protest, it further has to be remembered, as of legislative concern, that the physical strength of a people is an essential and main factor of national prosperity; that disease, so far as it affects the workers of the population, is in direct antagonism to industry; and that disease which affects the growing and reproductive parts of a population must also in part be regarded as tending to deterioration of the race.

Then, my Lords, there is the fact that this terrible continuing tax on human life and welfare falls with immense over-proportion upon the most helpless classes of the community: upon the poor, the ignorant, the subordinate, the immature: upon classes, which in great part through want of knowledge, and in great part because of their dependent position, cannot effectually remonstrate for themselves against the miseries thus brought upon them, and have in this circumstance the strongest of all claims on a Legislature which can justly measure, and can abate, their sufferings.

There are also some indirect relations of the subject which seem to me scarcely less important than the direct. For, where that grievous excess of physical suffering is bred, large parts of the

* Eleventh Annual Report.

same soil yield, side by side with it, equal evils of another kind; and your Lordships will often have seen illustrated in my reports, that, in some of the largest regions of insanitary influence, civilisation and morals suffer almost equally with health. At the present time, when popular education (which indeed in itself would be some security for better physical conditions of human life) has its importance fully recognised by the Legislature, it may be opportune to remember that, throughout the large area to which these observations apply, education is little likely to penetrate unless with amended sanitary law, nor human life to be morally raised while physically it is so degraded and squandered.

The above various considerations, taken together, seem to me to invest the subject which I am bringing under your Lordships' particular notice with a degree of national importance to which very few subjects can pretend. Its relative position among such subjects is not a point on which I would presume to speak. But, considering the trust which is reposed in my office with regard to this great national interest, I cannot in too strong terms express my official knowledge that it most urgently needs the attention of the Legislature. And I venture to hope and believe that your Lordships' full cognisance of the case will lead you to accord to that conclusion your authoritative sanction and furtherance.

I have the honor to be, My Lords,
Your Lordships' obedient servant,
JOHN SIMON.

Medical Department of the Privy Council Office:
March 31st, 1871.

APPENDIX.

No. I.—Inquiries with regard to Local Administration of Common Sanitary Law.

a.—By Inspectors.

Cases inquired about, and Date when each first came before the Department.	Ground of Inquiry.	Authorities concerned.	Name of Inspector and Précis of Report.
1. Annesley, Notts. (Aug. 27).	Prevalence of fever -	Annesley Vestry.	Dr. Buchanan. — Arrangements for excrement disposal and water supply such that people must drink their own excrement.
2. Appledore and Northam, Devon. (November).	Registrar General's return. Epidemic enteric fever, and scarlet fever.	Northam Local Board.	Dr. Thorne.—Epidemics chiefly in Appledore, where streets and courts extremely ill-constructed and ill-drained, with excrement and refuse lying about everywhere. Water-sources befouled. At Northam, polluted water and excrement nuisances. In neither case any provision for isolating infectious disease.
3. Blaenavon, Mon. (April).	Rumour of serious and fatal epidemic.	Blaenavon Local Board.	Mr. Radcliffe.—Intense epidemic of measles; 85 deaths in 10 weeks among 10,000 people. Exceptionally bad overcrowding. Much want of house ventilation. Defective water supply, sewerage, and excrement removal.
4. Banbury, Oxon. (May).	Registrar General's return. Several fever deaths in a town where fever had previously been much reduced by sanitary action.	Banbury Local Board.	Dr. Buchanan.—Some of the fever found to have been imported; room for further sanitary improvement. In regard of nuisance removal, many conditions worse than on 1866 inspection.
5. Barlborough, Derbyshire (Feb. 16).	Prevalence of fever -	Barlborough Vestry.	Dr. Thorne. — Nuisances from drains, privies, and waterclosets, and impure water supply in certain parts of the parish.
6. Bedford, Beds. (November).	Registrar General's return. Much fever.	Bedford Guardians; Bedford Local Board; Wootton Vestry.	Dr. Thorne. — Endemic enteric fever. Foul and scanty water, with excrement nuisances.

Cases inquired about, and Date when each first came before the Department.	Ground of Inquiry.	Authorities concerned.	Name of Inspector and Précis of Report.
7. Bideford, Devon. (November).	Registrar General's return. Much fever.	Bideford Local Board.	Dr. Thorne.—Prevalence of fever and scarlet fever. Pollution of earth, air, and water by excremental soakage. Badly constructed and unventilated cottages. Abundant other nuisances. Disinfection and isolation of contagious disease required.
8. Bridport, Dorset. (Feb. 22).	Continued prevalence of fever, and unsatisfactory answer from board respecting action taken on former advice of Department.	Bridport Local Board.	Dr. Buchanan.—Increased prevalence of epidemic disease; continuance of former unwholesome conditions; general foulness of water; accumulations of excrement; general neglect of sanitary functions by board.*
9. Camborne, Cornwall (November).	Registrar General's return. Prevalence of scarlatina.	Redruth Guardians; Camborne Vestry.	Dr. Buchanan. — Unventilated houses; overcrowding; insufficient water supply; nuisance from slaughter-houses; want of proper privy accommodation; general neglect of authorities.
10. Cardigan, Card. (May).	Registrar General's return. Much fever.	Town Council.	Mr. Radcliffe.—Insufficient privy accommodation; imperfect sewerage; nuisances from collections of manure, from ash-heaps, and from pigsties; foul brook through the town.
11. Chatham. *See* Rochester.	——	——	——
12. Chippenham, Wilts. (Mar. 11).	Prevalence of enteric fever and other epidemics.	Chippenham Local Board.	Dr. Buchanan.—Insufficient and impure water supply; want of privy accommodation and of a proper system of excrement disposal; faulty house construction.
13. Colney Hatch, Middlesex (Feb. 12).	Letter through Home Office from visitors of lunatic asylum, reporting prevalence of scarlatina in neighbourhood of asylum.	Barnet Guardians.	Dr. Thorne.—Scarlatina, believed have been imported, had attacked 30 persons (with five deaths) in the village. No means of disinfection used.
14. Coventry, neighbourhood of. (Red Lane estate.) (Jan. 1 from 1869).	Newspaper report sent by local registrar as to great prevalence of typhoid fever.	Coventry Guardians; Coleshill Guardians; Coventry Local Board; Coleshill Vestry.	Dr. Thorne.—Enteric fever found seriously prevalent, and ascribed to use of polluted water, want of efficient sewerage, and various filth accumulations.‡
15. Cwmbran and Pontnewydd, Mon. (Mar. 1).	Alleged prevalence of enteric fever.	Pontypool Guardians; Lanvrechva and Llantarnam Vestries.	Mr. Radcliffe. — Defective and sometimes impure water supply and insufficient means of excrement removal.†

* Case reported to Home Secretary for action under § 49 of the Sanitary Act, 1866.
† Local Government Act has now been adopted.
‡ Special drainage district since formed.

Cases inquired about, and Date when each first came before the Department.	Ground of Inquiry.	Authorities concerned.	Name of Inspector and Précis of Report.
16. Dartmouth, Devon. (Nov. 28).	Letter from the Admiralty respecting zymotic disease in the town, alleged to have spread to the cadets of the Britannia training ship.	Dartmouth Local Board.	Dr. Buchanan.—Allegations made to the Admiralty only partially established. Defects reported in construction of town and of houses, in sewer system, and in amount of privy accommodation. Want of place for isolating infectious fevers.
17. Eastbourne, Sussex. (Jan. 19).	Alleged prevalence of fever, supposed to result from improperly ventilated sewers.	Eastbourne Local Board.	Dr. Thorne.—In the new town, sewers not properly ventilated, waterclosets not supplied with water. In the old town, drinking water polluted.
18. Eastwood. *See* Greasley.	—	—	—
19. Forest Hill, Kent. (June 18).	Alleged prevalence of zymotic diseases, with bad drainage.	Lewisham Board of Works; Camberwell Vestry.	Mr. Radcliffe.—Allegations confirmed; disease produced by deficient and imperfect sewerage, and by foul cesspools.
20. Frogmore and Two Waters, Herts. (July 12).	Alleged prevalence of typhoid and scarlet fevers.	Hemel Hempstead Guardians; Hemel Hempstead Vestry.	Dr. Thorne.—Enteric fever found to be endemic. Drains choked and ground saturated with filth; privies and ashpits foul, and polluting drinking water.
21. Glastonbury, Somerset. (Oct. 7).	Reported prevalence of scarlatina, and alleged neglect of local authority to provide proper drainage.	Wells Guardians; Glastonbury Town Council.	Mr. Radcliffe.—Excessive mortality from scarlatina and enteric fever. Water supply insufficient, sewers defective, arrangements for excrement disposal utterly bad.*
22. Greasley and Eastwood, Notts. (June 23).	Registrar General's return. Much fever.	Basford Guardians; Eastwood Vestry; Greasley Vestry.	Dr. Buchanan.—In both parishes enteric fever had prevailed, along with general pollution of air and water by excrement; insufficient water supply, and various nuisances. The vestries had practically decided not to perform their duties under the Sanitary Acts.†
23. Heanor, Derbyshire (August).	Registrar General's return. Much fever.	Heanor Local Board.	Dr. Buchanan.—Offensive privies; water supply very precarious, and in some cases of doubtful purity.
24. Helston, Cornwall. (Nov. 22).	Alleged prevalence of typhus fever.	Helston Corporation.	Dr. Buchanan.—Enteric fever (not typhus) had been prevalent. Water supply scarce and of doubtful quality; little or no drainage; want of privy accommodation; bad arrangements for excrement removal; the town generally filthy.

* Local Government Act has now been adopted.
† Case reported to Home Secretary for action under § 49 of the Sanitary Act, 1869.

Cases inquired about, and Date when each first came before the Department.	Ground of Inquiry.	Authorities concerned.	Name of Inspector and Précis of Report.
25. Hennock, Devon. (Apr. 26).	Alleged prevalence of typhoid fever, arising from the absence of drainage, and nuisances.	Hennock Vestry.	Dr. Hunter. — Enteric fever in Hennock hamlet and in Chudleigh Knighton hamlet; 47 cases of diphtheria, 10 fatal, in six months. Want of privy accommodation and ashpits. Water supply of doubtful purity, and not duly accessible.
26. Ilkeston, Derbyshire (July 15).	Alleged prevalence of typhoid fever, stated to be caused by imperfect drainage.	Ilkeston Local Board.	Dr. Buchanan. — Enteric fever found to be endemic. Imperfect drainage; air and drinking water polluted by excrement; filthy ashpits.
27. Ingham, Lincoln. (Feb. 5).	Alleged outbreak of fever.	Ingham Vestry.	Mr. Radcliffe.—Fever, chiefly enteric, had been prevalent, and had been caused by polluted water; excremental pollution of earth about houses from defective house drains and bad privies. Overcrowding.
28. Jump, Yorkshire (July 7).	Alleged prevalence of malignant typhus, and neglect on part of local authority.	Wombwell Local Board.	Mr. Radcliffe.—The disease was scarlatina, not typhus fever. Board had used disinfectants, and was attempting to take other action. Mode of excrement removal observed to be radically defective.
29. Kilgerran, Pembrokeshire (May).	Registrar General's return. Much fever.	Kilgerran Vestry.	Mr. Radcliffe.—Very scanty water supply; liable to become polluted. No proper provision for excrement or refuse disposal. Imperfect sewerage.
30. Leicester (November).	Registrar General's return. High mortality from scarlatina, fever, and diarrhœa.	Leicester Local Board.	Dr. Buchanan. — Provisional report made, pending further inquiry into statistical facts, and into state of public water supply.
31. Llanelly, Carmarthenshire (May).	Registrar General's return. Much fever.	Llanelly Local Board.	Mr. Radcliffe.—Provisions for excrement disposal and refuse removal fundamentally defective. Drainage defective, and water supply inadequate for the wants of the sewer system.
32. Ludgershall, Bucks. (Oct. 15).	Information respecting scarlatina epidemic there.	Aylesbury Guardians; Ludgershall Vestry.	Dr. Buchanan. — Disease spread by unrestrained intercourse of sick with healthy; no efficient disinfection. Bad cottages and polluted drinking water.
33. Merthyr Tydfil, Glamorganshire (Jan. 11).	Report from Officer of Health as to an extensive epidemic of fever of disputed type, and as to providing medical relief for the sick.	Merthyr Tydfil Guardians; Merthyr Tydfil Local Board.	Dr. Buchanan.—Epidemic found to be true typhus fever, and referred to overcrowding and want of ventilation in the houses of the poorest people. Further hospital accommodation wanted.

Cases inquired about, and Date when each first came before the Department.	Ground of Inquiry.	Authorities concerned.	Name of Inspector and Précis of Report.
Milton and Sittingbourne, Kent. (May).	Registrar General's return. Much fever.	Milton Guardians; Milton Commissioners; Sittingbourne Local Board.	Dr. Buchanan.—In Milton town great defects in drainage, in excrement disposal, and in water supply, with need for "almost "all sanitary improvements "which it is possible to enumerate." In Sittingbourne inefficient arrangements for excrement removal, and wells polluted. But here new sources of water supply were being got.
Newlyn, Cornwall. (July).	Alleged want of drainage and privy accommodation, with existence of nuisances.	Penzance Guardians; St. Paul, Newlyn, Vestry.	Dr. Buchanan.—Serious want of drainage and privy accommodation, and defects in existing drainage. Abundant filth accumulations and other nuisances. Natural soil drainage impeded by a shingle bank.
Northam. *See* Appledore.	—	—	—
Oldbury, Staffordshire (November).	Registrar General's return, prevalence of fever and diarrhœa.	Oldbury Local Board.	Dr. Thorne.—The place almost absolutely destitute of drainage; water supply very defective, and largely polluted. Nuisance from pigsties, foul privies, middens, and refuse heaps.
Oxford (November).	Registrar General's return, large mortality from epidemics, especially scarlatina, enteric fever, and diarrhœa.	Oxford Local Board.	Dr. Buchanan.—Saturation of soil in lowlying parts. Sewer system incomplete. Pollution of streams by sewage. Questions about public water supply. Other water sources all dangerous. Bad construction of poor houses. Insufficient sanitary supervision. Inadequate measures for preventing contagion.
Penally, Pembrokeshire (August).	Registrar General's return, much fever.	Pembroke Guardians; Penally Vestry.	Mr. Radcliffe.—Water sources liable to pollution. Privy accommodation bad or absent. No proper means of refuse disposal.
Penryn, Cornwall. (Jan. 28).	Alleged long continued prevalence of fever.	Falmouth Guardians; Penryn Town Council; St. Gluvias Vestry; Budock Vestry.	Dr. Thorne.—Considerable outbreak of enteric fever. Streets lined with excrement and refuse. Want of sewers, privies, and ashpits. Water sources polluted. Overcrowding.
Pontnewydd. *See* Cwmbran.	—	—	—
Radford, Notts. (November).	Registrar General's return, prevalence of fever and diarrhœa.	Radford Guardians; Radford Vestry.	Dr. Thorne.—Want of privies. Sewers insufficient and ill-ventilated. Water, air, and soil generally contaminated by excrement.

Cases inquired about, and Date when each first came before the Department.	Ground of Inquiry.	Authorities concerned.	Name of Inspector and Précis of Report.
43. Rochester and Chatham, Kent. (February).	Registrar General's return. Prevalence of fever.	Medway Guardians; Rochester Town Council; St. Margaret's Paving Commissioners; Rochester Paving Commissioners; Chatham Local Board; Gillingham Vestry, and various other bodies.	Dr. Buchanan.—Division of tary functions among num authorities. Absence of drainage in various low parts. Bad arrangements excrement disposal. Poll of many private wells. overcrowding. Insufficien vision for removal of nuisa These conditions more in chester than in Chatham.
44. Rolvenden, Kent. (Feb. 1).	Alleged prevalence of typhoid fever, with polluted water and excrement nuisances.	Tenterden Guardians; Rolvenden Vestry.	Dr. Thorne.—Enteric fever epidemic. Water supply luted. Want of drainage proper means of excremen posal. Abundant nuisance
45. Ross, Herefordshire. (November).	Registrar General's return. Much scarlet fever.	Ross Improvement Commissioners.	Dr. Thorne.—Epidemic scar and frequent enteric fever. of means for excrement refuse removal. Water s polluted. Cattle nuisances.
46. Rugby, Warwickshire. (May).	Registrar General's return. Epidemic diseases in a sub-district where good sanitary work had formerly been reported.	Rugby Local Board; New Bilton Vestry.	Dr. Buchanan.—Scarlatina chief epidemic. Want of tion and disinfection. Que able quality of public supply. Insufficient public vision for nuisance rem The suburb of Bilton gro up without sanitary regulat
47. St. Dogmaels, Pembrokeshire. (August).	Registrar General's return. Prevalence of fever.	St. Dogmael's Vestry.	Mr. Radcliffe.—Insufficient supply, liable to pollution. perfect drainage. Bad p and want of privy and arrangements.
48. St. Just, Cornwall. (August).	Registrar General's return. Epidemic scarlatina.	Penzance Guardians; St. Just Vestry.	Dr. Buchanan.—Scarlatina fatal. Enteric fever habi present. No precautions a infection. Almost uni foulness of soil and air houses. Want of provisi excrement-removal. Scant impure water supply. Unv some houses.
49. Scothern, Lincolnshire. (Jan. 24.)	Alleged outbreak of fever.	Lincoln Guardians; Scothern Vestry.	Mr. Radcliffe.—Enteric feve valent for last two years. G sodden with filth from imp drains. Bad privies and receptacles. Water pro polluted.

* Case reported to Home Secretary for action under § 49 of the Sanitary Act, 1866.

Cases inquired about, and Date when each first came before the Department.	Ground of Inquiry.	Authorities concerned.	Name of Inspector and Précis of Report.
50. Sheerness, Kent. (May.)	Registrar General's return. Fever deaths in Sheppey Union.	Sheppey Guardians; Sheerness Local Board.	Dr. Buchanan.—Universal accumulations of excrement. Imperfect water supply. Deficient supervision over sub-let and lodging houses. Inefficient dealing with nuisances. Want of hospital accommodation.
51. Sittingbourne. *See* Milton.	—	—	—
52. Stamford, Linc. (Mar. 11.)	Complaint of fever being habitual and caused by sanitary defects.	Stamford Town Council.	Mr. Radcliffe.—The complaint in substance confirmed. Drinking water found polluted. Privies badly constructed; excrement accumulating in enormous cesspools. No proper system of sewers.*
53. Spinkhill (Eckington), Derbyshire. (May 5.)	Alleged prevalence of fever stated to be caused by sanitary defects.	Eckington Vestry.	Dr. Thorne.—Habitual prevalence and present outbreak of enteric fever. Water of public and other wells polluted. Drains defective. Want of privies and ashpits, and accumulations of filth.
54. Tenby, Pembrokeshire. (August.)	Registrar General's return. High mortality from fever.	Tenby Local Board.	Mr. Radcliffe.—Water supply insufficient, perhaps locally polluted. Sewers unventilated. Bad system of excrement and refuse removal. Ill-kept fish market.
55. Thetford, Norfolk. (Cont. from 1869.)	Office inquiry as to action of local authority upon former inspection.	Thetford Local Board.	Dr. Stevens.—Town found as unwholesome and ill-managed as formerly, the local board having neglected to make any sanitary improvement.†
56. Tredegar, Monmouthshire. (May.)	Registrar General's return. Mortality from fever.	Bedwellty Guardians.	Mr. Radcliffe.—There had been a severe epidemic of fever, probably not less than 1,200 cases, mostly of Relapsing Fever, but with some typhus, in the past 12 months, in the families of labourers employed by the Tredegar Iron Company. Much overcrowding and very ill-constructed houses. Imperfect sewerage, and ill-kept privies and sewers, with insufficient water supply. Inefficient nuisance removal.
57. Two Waters. *See* Frogmore.	—	—	—
58. Warwick. (May.)	Registrar General's return. Mortality from fever in a town formerly reported to have done sanitary work.	Warwick Local Board.	Dr. Buchanan.—The public water supply of the town scandalously filthy. Sewers inefficiently ventilated. Unsatisfactory arrangements for refuse and nuisance removal.

* Local Government Act has now been adopted.
† Case reported to Home Secretary for action under § 49 of the Sanitary Act, 1866.

Cases inquired about, and Date when each first came before the Department.	Ground of Inquiry.	Authorities concerned.	Name of Inspector and Précis of Report.
59. West Ham, Essex. (Jan. 19.)	Alleged prevalence of scarlatina.	West Ham Guardians; West Ham Local Board.	Mr. Radcliffe.—Scarlatina prevalent and fatal. Over-crowding in sub-let houses. Disinfection done and some other action taken by local authority.
60. Weymouth, Dorset. (June.)	Registrar General's return. Twelve deaths from fever, and other deaths from scarlatina reported in first quarter.	Weymouth Local Board.	Dr. Buchanan.—Error of local registrar as to number of fever deaths; two only had occurred. Scarlatina prevalent. General sanitary arrangements being carried out, but particular defects observed. Want of isolation and disinfection in cases of infectious disease.
61. Whitehaven, Cumberland. (February.)	Registrar General's return. High mortality from, and extensive epidemic of, typhus.	Whitehaven Local Board.	Dr. Buchanan.—Severe epidemic of true typhus. Radically bad construction of the poorer quarters of the town, with much filth, destitution, and overcrowding. Widespread fouling of earth and air with excremental filth. Neglect by the local authority of many of its sanitary functions.
62. Wigan, Lancashire. (May.)	High rate of mortality, especially from fever and diarrhœa.	Wigan Local Board.	Dr. Buchanan.—Local want of sewer. Extensive nuisance from very ill-constructed middens. Want of privies and means of refuse removal. Bad construction and dirtiness of lanes, courts, and houses. Overcrowding. Inefficient sanitary inspection.
63. Wing, Bucks. (Oct. 10.)	Reported prevalence of scarlatina.	Leighton Buzzard Guardians. Wing Vestry.	Dr. Buchanan.—Severe epidemic. Overcrowding. Defective ventilation and dirtiness of cottages. Packing of children in plaiting schools. No means of isolating infectious cases. Wells polluted. Filthy privies and cesspools.
64. Wycombe, Bucks. (May 2.)	Prevalence of fever reported to vaccination inspector.	Chipping Wycombe parish Local Board; Chipping Wycombe borough Local Board.	Mr. Wagstaffe.—High mortality from scarlatina and other fevers. Drainage and sewerage defective. Serious want of privy accommodation. Water supply scanty, and largely contaminated by excrement. Combined action of the two authorities recently obtained.
65. Yarmouth, Great, Norfolk. (August.)	Registrar General's return, reporting 15 deaths from fever in a quarter.	Yarmouth Local Board.	Dr. Stevens. — Error in local Registrar's return; fever not prevalent. Want of a proper system of excrement removal.
66. Ystrad-y-fodwg, Glamorgan. (May 27.)	Alleged prevalence of typhoid fever.	Pontypridd Guardians; Ystrad-y-fodwg Vestry.	Mr. Radcliffe.—Great prevalence of enteric fever. Extreme neglect of all sanitary precautions. No due provision for excrement or refuse disposal. Water supply insufficient, and liable to pollution.

b.—BY CORRESPONDENCE.

No.	Cases inquired about.	Date when each case first came before the Department.	Ground of Inquiry.	Authorities concerned.
1	Abingdon and neighbourhood, Berks.	November	Reg. Gen. return. High death rate from fever scarlatina, and diarrhœa.	Abingdon guardians.
2	Altrincham, Cheshire	November	Reg. Gen. return. High death rate from scarlatina and diarrhœa.	Altrincham guardians; Altrincham local board.
3	Ashton, Lancashire -	November	Reg. Gen. return. High death rate from diarrhœa and fever.	Ashton town council.
4	Aston, Warwickshire	November	Reg. Gen. return. High death rate from scarlatina, fever, and diarrhœa, in Deritend, Duddeston, and Erdington sub-districts.	Aston guardians; Aston local board.
5	Axbridge, Somerset -	August	Reg. Gen. return. Deaths from fever in three parishes.	Axbridge guardians.
6	Barnet, Herts -	May 21	Allegation in letter from locality that a death had occurred from choleraic diarrhœa, caused by using polluted water.	Barnet guardians.
7	Barnoldswick, York, W. R.	November	Reg. Gen. return. Epidemic scarlatina and fever.	Skipton guardians.
8	Barton, Lincolnshire	November	Reg. Gen. return. High death rate from fever and diarrhœa.	Glanford Brigg guardians.
9	Beddington, Surrey -	June 7	Report from a local medical officer as to scarlatina in relation to Croydon sewage works.	Croydon guardians; Croydon local board.
10	Bethnal Green, London.	May 24	Complaint of night soil nuisance injuring health.	Bethnal Green vestry.
11	Billingshurst, Sussex	October	Report from Reg. Gen. of prevalence of scarlatina.	Horsham guardians.
12	Birkenhead, Cheshire	Aug. 12	Application, in view of epidemic fever, from the guardians, for the Diseases Prevention Act.	Birkenhead guardians.
13	Blackburn, Lancashire.	July	Reg. Gen. return. High death rate from fever.	Blackburn town council.
14	Bolton, Lancashire -	November	Reg. Gen. return. High death rate from fever and diarrhœa in Farnworth and Little Bolton sub-districts.	Local boards of Kearsley, Farnworth, and Bolton.
15	Bobbingworth, Essex	November	Reg. Gen. return. High death rate from fever.	Ongar guardians.
16	Braybourne, Kent -	June	Reg. Gen. return. High death rate.	East Ashford guardians.
17	Brixworth, Northamptonshire.	August	Reg. Gen. return. High death rate from fever.	Brixworth guardians
18	Buckfastleigh, Devonshire.	November	Reg. Gen. return. High death rate from fever.	Totnes guardians
19	Bullington, Lincolnshire.	Mar. 3	Allegation in a medical journal that a disease resembling Asiatic cholera prevailed there.	Lincoln guardians

No.	Cases inquired about.	Date when each case first came before the Department.	Ground of Inquiry.	Authorities concerned.
20	Bury Lancashire -	June	Reg. Gen. return. High death rate from scarlatina and fever.	Bury guardians; Bury improvement commissioners; Radcliffe local board; Heywood local board.
21	Camberwell, London	Jan. 5	Neglect of scavenging in a border street.	Lambeth vestry.
22	Carlisle, Cumberland	November	Reg. Gen. return. Deaths from diarrhœa in St. Cuthbert sub-district.	Carlisle guardians; Carlisle local board.
23	Charley, Leicestershire.	June	Reg. Gen. return. High death rate from scarlatina.	Charley improvement commissioners.
24	Chorlton, Lancashire	June	Reg. Gen. return. High death rate from fever, diarrhœa, and scarlatina in the sub-district.	Chorlton guardians, and five local boards.
25	Cirencester, Gloucestershire.	November	Reg. Gen. return. High mortality from scarlatina, with other epidemics.	Cirencester guardians. Do. improvement commissioners.
26	Colchester, Essex -	June	Deaths from scarlatina and fever.	Colchester town council.
27	Covent Garden, London.	July 13	Complaint of nuisance arising from dung carts in the market.	Strand board of works.
28	Dalton, Lancashire -	November	Reg. Gen. return. High death rate from fever and diarrhœa.	Ulverstone guardians; Dalton-in-Furness vestry.
29	Dewsbury, Yorkshire	May	Reg. Gen. return. High death rate from scarlatina and fever.	Dewsbury guardians; Batley town council; and four local boards.
30	East Dereham, Norfolk.	November	Reg. Gen. return. High death rate from scarlatina.	Mitford and Launditch guardians.
31	Enfield, Middlesex -	Aug. 19	Alleged prevalance of scarlatina and complaint of nuisances.	Enfield local board.
32	Eton, Bucks - -	May	Reg. Gen. return. High death rate from fever.	Eton guardians; Eton local board.
33	Exeter, Devon -	November	Reg. Gen. return. High death rate from fever and diarrhœa.	Exeter local board.
34	Farnworth, Lancashire. *See* Bolton.	—	—	—
35	Folkestone, Kent -	November	Reg. Gen. return. High death rate from scarlatina.	Elham guardians; Elham town council; Sandgate local board.
36	Gloucester, Gloucestershire.	Oct. 10	Alleged prevalence of fever, with bad drainage, in South Hamlet district. Also Reg. Gen. return. High death rate from scarlatina and diarrhœa.	South Hamlet special drainage board; Gloucester local board.
37	Great Grimsby, Lincolnshire.	August	Reg. Gen. return. High death rate from scarlatina and fever.	Caistor guardians; Great Grimsby local board.
38	Great Harwood, Lancashire.	Oct. 31	Alleged prevalence of scarlatina and typhoid fever.	Great Harwood local board.
39	Guildford, Surrey -	Sept. 14.	Alleged prevalence of fever	Guildford local board.
40	Hanley and neighbourhood, Staffordshire.	November	Reg. Gen. return. High mortality from scarlatina, fever, and diarrhœa.	Stoke-on-Trent guardians; local boards of Hanley, Stoke, Fenton, and Longton.

No.	Cases inquired about.	Date when each case first came before the Department.	Ground of Inquiry.	Authorities concerned.
41	Harrow, Middlesex -	Nov. 18	Alleged prevalence of scarlatina and complaint of nuisance.	Harrow vestry.
42	Hartlepool, Durham	Nov. 28	Reg. Gen. return. High epidemic death rate in district.	Hartlepool guardians West Hartlepool Commissioners; Hartlepool and Seaton Carew local boards.
43	Harwich, Essex -	June	Reg. Gen. return. Deaths from fever.	Harwich town council.
44	Haslingden and Accrington, Lancashire.	June	Reg. Gen. return. Deaths from fever.	Haslingden guardians; Accrington local board.
45	Hereford, Herefordshire.	February	Reg. Gen. return. High death rate from fever and diarrhœa.	Hereford town council.
46	Hertford, Herts -	November	Reg. Gen. return. High death rate from fever and diarrhœa.	Hertford guardians.
47	High Packington, Devon.	November	Reg. Gen. return. High death rate from fever.	Torrington guardians.
48	Hillington, Middlesex.	June	Reg. Gen. return. Deaths from fever.	Uxbridge guardians and local board.
49	Hornchurch, Essex -	November	Reg. Gen. return. Deaths from fever and diarrhœa.	Romford guardians; Hornchurch and Dagenham vestries.
50	Huddersfield, Yorkshire, W.R.	November	Reg. Gen. return. High death rate from fever in Kirkheaton sub-district.	Huddersfield improvement commissioners.
51	Hungerford, Berks -	November	Reg. Gen. return. High death rate from diarrhœa.	Hungerford guardians.
52	Huntingdon, Hunts -	March	Reg. Gen. return, and statement of local registrar as to prevalence of enteric fever.	Huntingdon guardians; Godmanchester local board.
53	Ipswich, Suffolk -	August	Reg. Gen. return. High death rate from fever.	Ipswich local board.
54	Isleworth, Middlesex	July 30	Alleged prevalence of diarrhœa from want of proper water supply to certain cottages.	Isleworth vestry.
55	Kidderminster, Worcester.	November	Reg. Gen. return. High death rate from diarrhœa.	Kidderminster local board.
56	Kilburn, Middlesex -	Nov. 3	Complaint of nuisance and neglect of local authority.	Willesden vestry.
57	Kingsbridge and Stokenham, Devon.	November	Reg. Gen. return. Epidemic scarlatina.	Kingsbridge guardians.
58	King's Sutton, Northampton.	Feb. 24	Alleged prevalence of typhus and typhoid fever.	Brackley guardians.
59	Kingswinford, Stafford.	Jan. 7	Fever, ascribed to use of polluted water and neglect of local authority.	Brierly Hill local board.
60	Kinver. *See* Wolverhampton.	—	—	—
61	Kirkheaton, York, W. R.	November	Reg. Gen. return. High death rate from fever.	Huddersfield guardians; Whitley and Kirkheaton local boards.
62	Leake, Leicestershire	August	Reg. Gen. return. Deaths from fever.	Loughborough guardians.
63	Leigh, Lancashire -	June	Reg. Gen. return. Deaths from fever.	Leigh guardians; West Leigh local board; and four other local boards.
64	Llangefelach, Glamorgan.	May	Reg. Gen. return. High death rate from scarlatina.	Swansea guardians.

No.	Cases inquired about.	Date when each case first came before the Department.	Ground of Inquiry.	Authorities concerned.
65	Looe, Cornwall -	November	Reg. Gen. return. High death rate from scarlatina.	Liskeard guardians.
66	Loughton, Essex -	July 20	Complaint of nuisance from open ditch used as a sewer.	Loughton vestry.
67	Luton, Bedfordshire	August	Reg. Gen. return. Deaths from fever.	Luton guardians; Luton local board.
68	Lytchett, Dorset -	May	Reg. Gen. return. High death rate from scarlatina.	Poole guardians.
69	Macclesfield, Cheshire.	May	Reg. Gen. return. Deaths from diphtheria and fever in a town where good sanitary work had been done.	Macclesfield town council.
70	Maidstone, Kent -	Sept. 27	Reg. Gen. return. High death rate from scarlatina.	Maidstone town council.
71	Manchester, Lancashire.	May	Reg. Gen. return. Deaths from fever.	Manchester guardians; Manchester town council; and two local boards.
72	Mells, Somerset -	Jan. 24	Letter from local registrar (through Reg. Gen.) reporting "typhus fever."	Frome guardians.
73	Melton Mowbray, Leicestershire.	Jan. 28	Letter from local registrar (through Reg. Gen.) reporting outbreaks of fever in Waltham and other parishes.	Melton Mowbray guardians.
74	Middlesbrough, York, N.R.	July	Reg. Gen. return. Deaths from fever.	Middlesbrough local board.
75	Myton, York, E.R. -	November	Reg. Gen. return. High death rate from scarlatina, diarrhœa, and fever.	Kingston - on - Hull local board.
76	Neath, Glamorganshire.	July	Reg. Gen. return. High death rate from scarlatina.	Neath guardians; Swansea local board.
77	Newbury, Berks -	August	Reg. Gen. return. Deaths from fever and diarrhœa.	Newbury guardians Newbury local board.
78	Newcastle, Northumberland.	June	Reg. Gen. return. Deaths from fever.	Newcastle guardians; Newcastle town council.
79	New Cross, London -	April 22	Complaint of open sewer, and inattention of local authority.	Greenwich board of works.
80	North Meols, Lancashire.	November	Reg. Gen. return. Deaths from fever and diarrhœa.	Ormskirk guardians.
81	Norton, Derbyshire -	Jan. 26	Letter from local registrar (through Reg. Gen.) reporting scarlatina outbreak.	Ecclesall Bierlow guardians.
82	Norwood, Surrey -	September 8	Alleged imperfect sewerage of an hotel.	Croydon local board.
83	Olney, Bucks - -	June	Reg. Gen. return. Deaths from fever.	Newport Pagnel guardians.
84	Otterton, Devon -	June	Reg. Gen. return, and note that Otterton is unhealthy with much fever.	St. Thomas' guardians.
85	Pollington, Yorkshire	March 3	Alleged prevalence of scarlatina, with nuisance.	Goole guardians.
86	Preston, Lancashire -	November	Reg. Gen. return. High death rate from diarrhœa.	Preston local board.
87	Puckeridge. *See* Standon.	—	—	—
88	Salford, Lancashire -	June	Reg. Gen. return. Deaths from fever.	Salford town council.

No.	Cases inquired about.	Date when each case first came before the Department.	Ground of Inquiry.	Authorities concerned.
89	St. Helen's, Lancashire.	November	Reg. Gen. return. High death rate from fever and diarrhœa.	St. Helen's improvement commissioners, and two local boards.
90	Selby, Yorkshire, W. R.	November	Reg. Gen. Return. Deaths from fever and diarrhœa.	Selby guardians; Selby local board.
91	Shoreditch, London -	Sept. 9	Complaint of tripe-dressing nuisance.	Shoreditch vestry.
92	Shrivenham, Berks -	August	Reg. Gen. return. High death rate from fever.	Faringdon guardians.
93	Slough, Bucks -	Oct. 7	Alleged high death rate from defective drainage and polluted water, with complaint of a particular nuisance.	Slough local board.
94	Somerby, Leicestershire.	July 5	Alleged prevalence of typhoid.	Melton Mowbray guardians; Somerby vestry.
95	Southampton, Hants	November	Reg. Gen. return. High death rate from fever and diarrhœa.	Southampton local board.
96	South Minster, Essex.	June	Reg. Gen. return. Deaths from fever and report of bad sanitary state of district.	Maldon guardians.
97	South Shields, Durham.	November	Reg. Gen. return. Deaths from fever and diarrhœa.	South Shields guardians; South Shields town council; Jarrow local board.
98	Southwark, London	Sept. 15	Complaint of nuisance from manufacture of manure.	Saint George the Martyr vestry.
99	Standon and Puckeridge, Herts.	Oct. 3	Alleged prevalence of typhoid fever, and complaint of a foul ditch.	Ware guardians; Bishop's Stortford board of guardians.
100	Stockport, Cheshire -	Novmber	Reg. Gen. return. High death rate from fever and diarrhœa.	Stockport local board.
101	Stockton-on-Tees, Durham.	June	Reg. Gen. return. High death rate from scarlatina and fever.	Stockton guardians; Stockton local board; Redcar local board.
102	Stoke, Devonshire -	November	Reg. Gen. return. High death rate; fever.	Devonport local board.
103	Sturminster, Dorsetshire.	Aug. 27	Alleged prevalence of typhoid fever.	Wimborne and Cranborne guardians.
104	Swaffham, Norfolk -	May	Reg. Gen. return. High death rate from scarlatina.	Swaffham local board.
105	Tattershall, Lincolnshire.	August	Reg. Gen. return. High death rate from fever.	Horncastle guardians.
106	Tenbury, Worcestershire.	November	Reg. Gen. return. High death rate from scarlatina.	Tenbury guardians.
107	Tottenham, Middlesex.	June	Reg. Gen. return. Deaths from fever. Local complaint of nuisance.	Tottenham local board.
108	Towyn, Merionethshire.	Mar. 11	Statement by local registrar (through Reg. Gen.) respecting deaths from fever.	Towyn local board.
109	Truro, Cornwall -	November	Reg. Gen. return. Epidemic, scarlatina and diarrhœa.	Truro guardians Truro corporation.
110	Tunstall, Staffordshire.	August	Reg. Gen. return. High death rate from fever and diarrhœa.	Wolstanton and Burslem guardians; Tunstall and two other local boards.
111	Ventnor, Isle of Wight.	Nov. 21	Report transmitted by Reg. Gen. as to prevalence of scarlatina.	Isle of Wight guardians; Ventnor local board.

No.	Cases inquired about.	Date when each case first came before the Department.	Ground of Inquiry.	Authorities concerned.
112	Walsall, Staffordshire.	November	Reg. Gen. return. Deaths from fever and diarrhœa.	Walsall guardians; Walsall town council.
113	Waltham. *See* Melton Mowbray.	—	—	—
114	Ware, Herts - -	August	Reg. Gen. return. Prevalence of fever and diarrhœa.	Ware guardians; Ware local board.
115	Warrington, Lancashire.	November	Reg. Gen. return. High death rate from fever and diarrhœa.	Warrington local board.
116	Wavertree, Suffolk -	Feb. 17	Alleged prevalence of fever from absence of proper drainage.	Wavertree local board.
117	Wellingborough, Northamptonshire.	June	Reg. Gen. return. Seven deaths from fever in a quarter.	Wellingborough guardians; Wellingborough local board.
118	Wells, Norfolk -	November	Reg. Gen. return. Deaths from fever and report of typhoid at Stiffkey village.	Walsingham guardians.
119	Welwyn, Herts	June 1	Alleged prevalence of fever from bad drainage and polluted water.	Welwyn guardians.
120	Westbourne, Sussex -	November	Reg. Gen. return. High death rate from diarrhœa.	Westbourne guardians; Westbourne vestry.
121	West Ashford, Kent -	Aug. 4	Alleged epidemic of fever -	Ashford local board.
122	West Bromwich, Staffordshire.	June	Reg. Gen. return. High death rate from fever and scarlatina.	West Bromwich guardians; do. do. improvement commissioners.
123	Wickford, Essex -	June	Reg. Gen. return. Deaths from fever.	Billericay guardians.
124	Willesden, Middlesex	May	Reg. Gen. return. Deaths from fever.	Hendon guardians.
125	Wimbledon, Surrey -	Nov. 17	Alleged prevalence of scarlatina.	Wimbledon local board.
126	Winchester, Hants -	November	Reg. Gen. return. High mortality from scarlatina and other epidemics.	Winchester local board.
127	Wolverhampton and Kinver, Staffordshire.	November	Reg. Gen. returns. Mortality from fever and diarrhœa.	Seisdon guardians; Wolverhampton town council; Kinver vestry.
128	Worcester, Worcestershire.	November	Reg. Gen. return. High death rate from fever and diarrhœa.	Worcester local board.
129	Worksop, Notts -	November	Reg. Gen. return. High mortality from scarlatina, fever, and diarrhœa.	Worksop guardians; Do. local board.
130	Worthing, Sussex -	November	Reg. Gen. return. Mortality from fever and diarrhœa.	Worthing local board.
131	Wouldham, Kent	Oct. 11	Alleged prevalence of typhoid fever from overcrowding, manure nuisance, and other unhealthy conditions.	Malling guardians.
132	Yeadon, Yorkshire, West Riding.	June	Reg. Gen. returns. High mortality from fever and scarlatina; complaint of defective drainage.	Wharfedale guardians; Yeadon local board; Guisley local board.
133	Yealmpton, Devonshire.	November	Reg. Gen. return. Deaths from fever.	Plympton St. Mary guardians.
134	Yeovil, Somersetshire	June	Reg. Gen. return. High mortality from fever.	Yeovil guardians; Yeovil town council.

No. 2.—Proceedings under the Vaccination Act, 1867, and otherwise, in relation to Vaccination and Small-pox.

a.—List (alphabetically arranged) of 259 Unions and Parishes inspected during the year 1870 with reference to their respective Proceedings under the Vaccination Act, 1867; and an Account of the Awards made to the respective Public Vaccinators out of moneys voted by Parliament for that purpose.

N.B.—In some of the under-mentioned cases, the fact that the Union or Parish had its vaccination-arrangements not in conformity with the Act of 1867 made it impossible to entertain, with a view to awards, any question of the merits of individual vaccinators.

Union or (if so marked) Parish.	Number of Vaccination Contracts in Union or Parish.	Number of respective Vaccination Contractors recommended for Awards.		Range of Awards in each Union or Parish.		Total Sum awarded in the Union or Parish.	Name of Inspector.
		First Class Awards.	Second Class Awards.	Minimum.	Maximum.		
				£ s. d.	£ s. d.	£ s. d.	
Abergavenny -	3	1	—	—	—	37 5 0	Mr. Wagstaffe.
Alresford - -	1	—	—	—	—	—	Mr. Wagstaffe.
Alton - -	4	1	—	—	—	19 4 0	Mr. Wagstaffe.
Altrincham - -	6	—	—	—	—	—	Dr. Beard.
Ampthill - -	4	2	1	3 8 0	12 9 0	22 5 0	Dr. Stevens.
Andover - -	5	1	1	8 19 4	10 8 0	19 7 4	Mr. Wagstaffe.
Ashbourne - -	7	—	1	—	—	7 5 4	Dr. Blaxall.
Ashby-de-la-Zouch -	6	1	2	9 18 0	11 11 0	32 10 4	Dr. Stevens.
Ashton-under-Lyne	12	6	2	8 11 0	40 0 0	176 12 4	Dr. Beard.
Axbridge - -	12	1	—	—	—	17 13 0	Dr. Blaxall.
Axminster - -	12	1	1	3 8 0	6 17 0	10 5 0	Dr. Hunter.
Aylsham - -	7	2	1	3 6 8	7 12 0	17 1 8	Dr. Stevens.
Bakewell - -	8	1	2	3 4 8	6 12 0	15 6 8	Dr. Blaxall.
Barnet - -	5	1	2	4 14 8	6 8 0	17 2 8	Mr. Wagstaffe.
Barnstaple - -	11	—	3	1 10 0	14 16 8	22 11 4	Dr. Blaxall.
Barrow-on-Soar -	5	1	2	4 6 8	11 13 0	23 1 0	Dr. Stevens.
Basford - -	14	—	3	4 17 4	15 1 4	25 11 4	Dr. Rogers.
Basingstoke - -	6	1	—	—	—	4 14 0	Mr. Wagstaffe.
Bath - - -	5	3	1	4 10 0	38 4 0	59 6 4	Dr. Hunter.
Bedford - -	8	3	1	4 0 8	10 9 0	27 5 8	Dr. Stevens.
Bedminster - -	9	—	—	—	—	—	Dr. Blaxall.
Bedwellty - -	5	4	1	9 1 0	29 17 0	100 11 8	Mr. Wagstaffe.
Belper - -	9	1	3	2 18 0	39 15 0	63 17 8	Dr. Blaxall.
Berkhampstead -	3	2	—	11 10 0	16 12 0	28 2 0	Mr. Wagstaffe.
Bideford - -	6	—	—	—	—	—	Dr. Blaxall.
Biggleswade -	5	2	1	5 1 4	19 12 0	43 2 4	Dr. Stevens.
Billericay - -	6	—	1	—	—	1 14 0	Dr. Stevens.
Billesdon - -	3	1	—	—	—	8 8 0	Dr. Stevens.
Bingham - -	4	—	—	—	—	—	Dr. Rogers.
Birkenhead - -	3	—	1	—	—	17 8 8	Dr. Beard.
Birmingham -	1	1	—	—	—	145 10 0	Dr. Seaton.
Bishops Stortford -	7	2	—	8 8 0	8 18 0	17 6 0	Mr. Wagstaffe.
Blaby - -	3	—	—	—	—	—	Dr. Stevens.
Blofield - -	3	—	2	4 12 8	5 8 8	10 1 4	Dr. Stevens.
Blything - -	8	3	1	4 18 0	13 17 0	34 5 0	Dr. Stevens.
Bodmin - -	7	1	1	3 1 0	5 18 0	8 19 0	Dr. Blaxall.
Bootle - -	3	—	—	—	—	—	Dr. Blaxall.
Bosmere - -	5	—	—	—	—	—	Dr. Stevens.
Boston - -	7	1	—	—	—	7 7 0	Dr. Rogers.
Boughton, Great -	3	1	—	—	—	11 10 0	Dr. Beard.

APPENDIX No. 2.

Vaccination and Small-pox.

Union or (if so marked) Parish.	Number of Vaccination Contracts in Union or Parish.	Number of respective Vaccination Contractors recommended for Awards.		Range of Awards in each Union or Parish.		Total Sum awarded in the Union or Parish.	Name of Inspector.
		First Class Awards.	Second Class Awards.	Minimum.	Maximum.		
				£ s. d.	£ s. d.	£ s. d.	
Bourn - -	7	1	2	2 10 8	7 16 0	13 0 8	Dr. Rogers.
Brackley - -	4	—	—	—	—	—	Dr. Stevens.
Braintree - -	4	1	2	7 4 8	9 3 0	24 15 0	Dr. Stevens.
Brampton - -	1	—	—	—	—	—	Mr. Wagstaffe.
Brentford - -	9	—	—	—	—	—	Dr. Seaton.
Bridgwater - -	10	1	2	2 2 0	10 18 0	16 1 4	Dr. Blaxall.
Brixworth - -	6	2	2	1 6 0	8 17 0	13 19 0	Dr. Stevens
Buntingford -	2	1	—	—	—	6 12 0	Mr. Wagstaffe.
Bury - - -	1	1	—	—	—	29 12 0	Dr. Stevens.
Caistor - -	9	1	—	—	—	4 11 0	Dr. Rogers.
Cambridge - -	3	—	—	—	—	—	Dr. Stevens.
Camelford - -	3	—	2	2 1 4	4 4 8	6 6 0	Dr. Blaxall.
Carlisle - -	5	4	—	1 16 0	44 17 0	57 0 0	Mr. Wagstaffe.
Caxton - -	5	2	1	4 6 0	5 14 0	14 6 0	Dr. Stevens.
Chapel-le-Frith -	3	—	—	—	—	—	Dr. Blaxall.
Chard - -	7	—	—	—	—	—	Dr. Blaxall.
Chelmsford - -	10	—	7	2 4 0	7 13 4	26 8 8	Dr. Stevens.
Cheltenham - -	3	—	—	—	—	—	Mr. Wagstaffe.
Chepstow - -	5	1	1	3 17 4	4 10 0	8 7 4	Mr. Wagstaffe.
Chester - -	1	—	—	—	—	—	Dr. Beard.
Chesterfield - -	12	3	3	3 16 0	20 18 0	64 19 8	Dr. Blaxall.
Chesterton - -	7	2	2	5 12 8	12 4 0	36 5 4	Dr. Stevens.
Chipping Norton -	4	—	—	—	—	—	Mr. Wagstaffe.
Chipping Sodbury -	5	1	—	—	—	13 13 0	Mr. Wagstaffe.
Chorlton - -	11	2	—	47 9 0	62 0 0	109 9 0	Dr. Beard.
Christchurch -	2	—	—	—	—	—	Mr. Wagstaffe.
Cirencester - -	3	1	—	—	—	23 8 0	Mr. Wagstaffe.
Clifton - -	6	4	1	9 16 0	55 5 0	138 7 0	Mr. Wagstaffe.
Clutton - -	5	2	1	5 14 8	26 7 0	44 9 8	Dr. Blaxall.
Cockermouth -	5	1	—	—	—	19 1 0	Mr. Wagstaffe.
Colchester - -	1	1	—	—	—	19 11 0	Dr. Stevens.
Congleton - -	4	1	—	—	—	31 9 0	Dr. Beard.
Cosford - -	5	5	—	5 13 0	13 16 0	43 19 0	Dr. Stevens.
Coventry - -	1	1	—	—	—	34 16 0	Dr. Seaton.
Daventry - -	7	—	—	—	—	—	Dr. Stevens.
Depwade - -	7	3	1	5 5 0	6 14 0	23 2 8	Dr. Stevens.
Derby - -	2	—	1	—	—	22 16 8	Dr. Blaxall.
Docking - -	4	1	1	5 9 0	9 14 8	15 3 8	Dr. Stevens.
Downham - -	6	3	2	5 11 4	9 10 0	37 5 4	Dr. Stevens.
Dulverton - -	3	—	—	—	—	—	Dr. Blaxall.
Dunmow - -	6	4	1	3 17 4	11 4 0	36 0 4	Dr. Stevens.
Dursley - -	3	1	—	—	—	4 15 0	Mr. Wagstaffe.
East Retford -	7	2	—	7 5 0	8 5 0	15 10 0	Dr. Rogers.
East Ward - -	6	1	1	2 12 8	3 3 0	5 15 8	Dr. Blaxall.
Edmonton - -	13	5	3	1 0 0	7 6 0	38 2 4	Dr. Seaton.
Ely - - -	7	—	—	—	—	—	Dr. Stevens.
Erpingham - -	4	2	1	3 14 0	12 6 8	26 6 8	Dr. Stevens.
Falmouth - -	4	1	—	—	—	12 9 0	Dr. Hunter.
Flegg - -	4	1	1	3 14 8	7 19 0	11 13 8	Dr. Stevens.
Fordingbridge -	2	—	—	—	—	—	Mr. Wagstaffe.
Forehoe - -	6	1	2	0 12 8	4 13 0	8 11 0	Dr. Stevens.

Union or (if so marked) Parish.	Number of Vaccination Contracts in Union or Parish	Number of respective Vaccination Contractors recommended for Awards.		Range of Awards in each Union or Parish.		Total Sum awarded in the Union or Parish.	Name of Inspector.
		First Class Awards.	Second Class Awards.	Minimum.	Maximum.		
				£ s. d.	£ s. d.	£ s. d.	
Freebridge Lynn -	6	2	1	2 15 0	3 8 8	9 8 8	Dr. Stevens.
Frome - -	5	1	1	7 10 0	18 16 0	26 6 0	Dr. Blaxall.
Gainsboro' - -	8	—	—	—	—	—	Dr. Rogers.
Glanford Brigg -	9	4	4	5 1 0	11 9 0	56 18 4	Dr. Rogers.
Glossop - -	2	—	—	—	—	—	Dr. Blaxall.
Gloucester - -	2	1	1	12 10 8	54 14 0	67 4 8	Mr. Wagstaffe.
Grantham - -	8	1	3	2 13 4	4 17 0	14 16 4	Dr. Rogers.
Guiltcross - -	5	3	—	5 0 0	9 14 0	21 14 0	Dr. Stevens.
Halstead - -	5	1	1	2 12 0	6 2 0	8 14 0	Dr. Stevens.
Hardingstone -	3	1	—	—	—	9 0 0	Dr. Stevens.
Hartismere - -	6	4	1	2 12 0	15 10 0	41 1 4	Dr. Stevens.
Hartley Wintney -	6	2	—	8 15 0	9 17 0	18 12 0	Mr. Wagstaffe.
Hatfield - -	4	—	1	—	—	2 0 0	Mr. Wagstaffe.
Hayfield - -	4	—	—	—	—	—	Dr. Blaxall.
Headington - -	2	—	—	—	—	—	Mr. Wagstaffe.
Helston -	4	—	1	—	—	5 8 8	Dr. Hunter.
Hemel Hempstead -	4	—	—	—	—	—	Mr. Wagstaffe.
Hendon - -	7	—	—	—	—	—	Dr. Seaton.
Henstead - -	4	1	1	4 1 4	4 6 0	8 7 4	Dr. Stevens.
Hertford - -	5	—	1	—	—	2 0 0	Mr. Wagstaffe.
Hinckley - -	5	1	—	—	—	5 9 0	Dr. Stevens.
Hitchin - -	5	—	—	—	—	—	Mr. Wagstaffe.
Holbeach - -	6	—	—	—	—	—	Dr. Rogers.
Holborn (part) -	1	—	1	—	—	45 4 0	Dr. Seaton.
Holsworthy - -	5	—	—	—	—	—	Dr. Blaxall.
Horncastle - -	6	1	2	3 9 4	8 10 0	20 4 0	Dr. Rogers.
Hoxne - -	7	2	1	0 15 4	13 5 0	21 13 4	Dr. Stevens.
Huntingdon -	5	3	—	5 3 0	14 13 0	27 4 0	Dr. Stevens.
Hursley - -	1	—	—	—	—	—	Mr. Wagstaffe.
Ipswich - -	1	1	—	—	—	57 17 0	Dr. Stevens.
Kendal - -	8	3	1	5 6 0	28 4 0	56 10 0	Dr. Blaxall.
Kettering - -	4	3	1	4 1 4	22 4 0	48 10 4	Dr. Stevens.
Keynsham - -	1	—	1	—	—	33 7 4	Dr. Hunter.
Kings Lynn -	1	1	—	—	—	11 6 0	Dr. Stevens.
Langport - -	5	1	1	2 6 8	17 11 0	19 17 8	Dr. Blaxall.
Leeds - -	6	2	3	8 6 0	83 17 0	150 19 0	Dr. Seaton.
Leicester - -	5	4	1	18 10 0	31 8 0	117 18 0	Dr. Stevens.
Leighton Buzzard -	1	—	—	—	—	—	Dr. Stevens.
Lexden - -	9	4	2	1 14 0	8 17 0	33 15 8	Dr. Stevens.
Lincoln - -	11	—	—	—	—	—	Dr. Blaxall.
Linton - -	3	2	1	6 8 8	11 17 0	27 1 8	Dr. Stevens.
Liskeard - -	7	2	3	4 0 0	16 13 4	50 0 4	Dr. Hunter.
Loddon - -	4	3	1	2 4 8	8 19 0	23 19 8	Dr. Stevens.
Loughton - -	2	—	—	—	—	—	Dr. Beard.
Loughboro' - -	4	2	1	4 8 0	9 12 0	21 7 0	Dr. Stevens.
Louth - -	11	—	2	2 7 4	5 2 0	7 9 4	Dr. Rogers.
Luton - -	5	1	2	5 0 8	23 10 0	35 12 0	Dr. Stevens.
Lutterworth -	5	—	3	1 15 4	4 4 8	8 14 0	Dr. Stevens.
Lymington - -	4	—	—	—	—	—	Mr. Wagstaffe.
Macclesfield - -	4	—	—	—	—	—	Dr. Beard.
Maldon - -	7	1	4	3 6 0	13 0 8	36 11 4	Dr. Stevens.

APPENDIX No. 2.

Vaccination and Small-pox.

Union or (if so marked) Parish.	Number of Vaccination Contracts in Union or Parish.	Number of respective Vaccination Contractors recommended for Awards.		Range of Awards in each Union or Parish.		Total Sum awarded in the Union or Parish.	Name of Inspector.
		First Class Awards.	Second Class Awards.	Minimum.	Maximum.		
				£ s. d.	£ s. d.	£ s. d.	
Mansfield -	5	1	1	5 0 0	21 3 0	26 3 0	Dr. Rogers.
Market Bosworth -	6	2	2	1 10 0	5 1 4	16 6 4	Dr. Stevens.
Market Harbro' -	5	2	3	2 14 0	12 10 0	29 2 4	Dr. Stevens.
Melton Mowbray -	6	3	—	6 10 0	12 13 0	27 6 0	Dr. Stevens.
Mildenhall - -	2	1	1	6 2 8	15 0 0	21 2 8	Dr. Stevens.
Mitford - -	9	—	3	4 12 0	5 16 8	15 4 8	Dr. Stevens.
Monmouth - -	6	1	—	—	—	9 13 0	Mr. Wagstaffe.
Mutford -	3	—	—	—	—	—	Dr. Stevens.
Nantwich - -	8	2	1	3 12 0	8 3 0	17 0 0	Dr. Beard.
Newark - -	10	1	1	5 17 4	6 11 0	12 8 4	Dr. Rogers.
Newcastle-on-Tyne-	7	2	1	10 5 4	46 0 0	71 0 4	Dr. Seaton.
Newent - -	3	1	1	3 12 8	13 16 0	17 8 8	Mr. Wagstaffe.
New Forest - -	5	—	1	—	—	3 9 4	Mr. Wagstaffe.
Newmarket - -	9	3	1	3 2 0	9 15 0	24 2 0	Dr. Stevens.
Newport (Mon.) -	5	2	—	11 14 0	15 17 0	27 11 0	Mr. Wagstaffe.
Northampton -	4	1	—	—	—	6 9 0	Dr. Stevens.
Northleach - -	5	1	2	3 2 0	5 14 0	12 9 0	Mr. Wagstaffe.
Northwich - -	7	—	3	8 14 8	17 10 0	41 13 4	Dr. Beard.
Northwitchford -	4	2	1	7 9 4	10 16 0	27 16 4	Dr. Stevens.
Norwich - -	8	—	—	—	—	—	Dr. Stevens.
Nottingham - -	2	—	—	—	—	—	Dr. Rogers.
Oakham - -	4	2	1	3 5 4	12 14 0	22 3 4	Dr. Stevens.
Okehampton -	4	—	—	—	—	—	Dr. Hunter.
Oldham - -	6	5	1	8 3 4	47 14 0	174 6 4	Dr. Beard.
Oundle - -	4	3	—	6 17 0	9 7 0	24 17 0	Dr. Stevens.
Oxford - -	1	—	—	—	—	—	Mr. Wagstaffe.
Paddington (parish)	4	2	—	9 15 0	11 1 0	20 16 0	Dr. Seaton.
Penrith - -	5	—	—	—	—	—	Dr. Blaxall.
Penzance - -	4	1	1	4 10 0	15 17 4	20 7 4	Dr. Hunter. Dr. Blaxall.
Peterborough -	7	4	—	6 14 0	16 5 0	39 3 0	Dr. Stevens.
Plomesgate - -	6	2	2	3 12 8	7 14 0	22 15 4	Dr. Stevens.
Pontypool - -	3	—	1	—	—	28 6 0	Mr. Wagstaffe.
Poplar - -	4	1	2	13 19 4	38 6 0	68 18 8	Dr. Seaton.
Potterspury - -	4	—	—	—	—	—	Dr. Stevens.
Prestwich - -	4	2	—	23 15 0	73 8 0	97 3 0	Dr. Beard.
Radford -	2	—	—	—	—	—	Dr. Rogers.
Redruth - -	5	—	1	—	—	12 3 4	Dr. Hunter.
Ringwood - -	1	—	—	—	—	—	Mr. Wagstaffe.
Risbridge - -	5	2	2	5 13 4	11 6 0	31 9 4	Dr. Stevens.
Rochford - -	5	—	2	5 12 0	11 0 0	16 12 0	Dr. Stevens.
Romford - -	7	4	—	2 13 0	22 1 0	46 8 0	Dr. Stevens.
Romsey -	—	1	1	0 16 0	3 14 0	4 10 0	Mr. Wagstaffe.
Royston - -	6	3	—	5 17 0	14 1 0	29 19 0	Mr. Wagstaffe.
Saffron Walden -	8	4	2	1 14 0	6 5 0	21 11 4	Dr. Stevens.
St. Albans - -	3	—	—	—	—	—	Mr. Wagstaffe.
St. Austell - -	6	1	2	1 15 0	12 9 4	20 11 0	Dr. Hunter.
St. Columb - -	6	1	1	3 3 4	7 3 0	10 6 4	Dr. Blaxall.
St. Faith - -	5	—	2	1 10 8	5 3 4	6 14 0	Dr. Stevens.
St. George's, Hanover Square.	4	3	—	15 17 0	48 12 0	103 19 0	Dr. Seaton.

Union or (if so marked) Parish.	Number of Vaccination Contracts in Union or Parish.	Number of respective Vaccination Contractors recommended for Awards.		Range of Awards in each Union or Parish.		Total Sum awarded in the Union or Parish.	Name of Inspector.
		First Class Awards.	Second Class Awards.	Minimum.	Maximum.		
				£ s. d.	£ s. d.	£ s. d.	
St. Ives - -	5	2	1	2 14 0	15 18 0	27 6 8	Dr. Stevens.
St. Neots - -	6	2	1	5 4 0	13 6 0	26 12 0	Dr. Stevens.
Salford - -	3	3	—	44 4 0	82 19 0	182 12 0	Dr. Beard.
Samford - -	5	3	2	2 0 8	13 0 0	28 6 4	Dr. Stevens.
Shardlow - -	8	1	—	—	—	15 18 0	Dr. Blaxall.
Sheffield - -	8	—	—	—	—	—	Dr. Seaton.
Shepton Mallet -	4	1	1	1 16 0	18 14 0	20 10 0	Dr. Blaxall.
Sleaford - -	7	—	1	—	—	5 2 0	Dr. Blaxall.
Smallburgh - -	4	—	—	—	—	—	Dr. Stevens.
South Molton -	10	—	3	3 5 4	6 7 4	13 4 0	Dr. Blaxall.
Southwell - -	8	1	1	3 0 0	6 8 0	9 8 0	Dr. Rogers.
Spalding - -	11	2	—	5 9 0	8 18 0	14 7 0	Dr. Rogers.
Spilsby - -	7	—	—	—	—	—	Dr. Rogers.
Staines - -	6	1	2	1 17 0	4 19 4	9 10 4	Dr. Seaton.
Stamford - -	5	—	2	2 1 4	9 6 8	11 8 0	Dr. Rogers.
Stepney - -	2	2	—	11 4 0	18 7 0	29 11 0	Dr. Seaton.
Stockbridge - -	2	1	1	6 18 8	14 1 0	20 19 8	Mr. Wagstaffe.
Stockport -	5	1	1	44 2 0	50 0 0	94 2 0	Dr. Beard.
Stow - - -	8	3	1	1 16 0	8 13 0	23 9 4	Dr. Stevens.
Stow-on-Wold -	3	1	—	—	—	9 4 0	Mr. Wagstaffe.
Strand - -	1	—	1	—	—	22 6 8	Dr. Seaton.
Stratton - -	2	—	—	—	—	—	Dr. Blaxall.
Stroud - -	6	3	—	7 0 0	23 15 0	44 1 0	Mr. Wagstaffe.
Sudbury - -		3	2	6 4 0	13 3 4	42 11 0	Dr. Stevens.
Swaffham - -	6	1	3	0 16 0	5 7 4	13 6 8	Dr. Stevens.
Taunton - -	8	1	—	—	—	8 10 0	Dr. Blaxall.
Tendring - -	13	3	4	1 9 4	6 6 0	31 17 8	Dr. Stevens.
Tetbury - -	2	—	—	—	—	—	Mr. Wagstaffe.
Tewkesbury -	4	1	—	—	—	6 16 0	Mr. Wagstaffe.
Thetford - -	8	3	2	0 16 0	7 0 0	20 2 4	Dr. Stevens.
Thingoe - -	8	2	5	1 10 0	8 8 0	28 17 0	Dr. Stevens.
Thornbury - -	4	—	2	8 0 0	10 15 4	18 15 4	Mr. Wagstaffe.
Thrapston - -	5	1	2	5 2 0	16 11 0	29 1 8	Dr. Stevens.
Torrington - -	5	—	—	—	—	—	Dr. Hunter. Dr. Blaxall.
Towcester - -	4	1	1	3 6 0	4 16 0	8 2 0	Dr. Stevens.
Truro - -	7	1	2	3 7 4	8 8 8	15 13 0	Dr. Hunter.
Uppingham - -	4	2	1	1 16 0	7 6 0	13 6 0	Dr. Stevens.
Uxbridge - -	7	2	—	6 12 0	7 4 0	13 16 0	Dr. Seaton.
Walsingham -	6	—	—	—	—	—	Dr. Stevens.
Wangford - -	2	—	—	—	—	—	Dr. Stevens.
Ware - - -	7	—	—	—	—	—	Mr. Wagstaffe.
Watford - -	5	—	1	—	—	4 10 0	Mr. Wagstaffe.
Wayland - -	2	1	1	9 17 0	10 9 4	20 6 4	Dr. Stevens.
Wellingboro' -	4	3	—	7 7 0	30 0 0	47 2 0	Dr. Stevens.
Wellington (Som.) -	6	—	—	—	—	—	Dr. Blaxall.
Wells - -	4	—	2	6 8 8	9 3 4	15 12 0	Dr. Blaxall.
Welwyn - -	1	—	—	—	—	—	Mr. Wagstaffe.
Westbury-on-Severn	3	2	—	12 3 0	21 5 0	33 8 0	Mr. Wagstaffe.
West Ward - -	4	—	—	—	—	—	Dr. Blaxall.
Wheatenhurst -	2	2	—	8 8 0	11 19 0	20 7 0	Mr. Wagstaffe.

APPENDIX No. 2.

Vaccination and Small-pox.

Union or (if so marked) Parish.	Number of Vaccination Contracts in Union or Parish.	Number of respective Vaccination Contractors recommended for Awards.		Range of Awards in each Union or Parish.		Total Sum awarded in the Union or Parish.	Name of Inspector.
		First Class Awards.	Second Class Awards.	Minimum.	Maximum.		
				£ s. d.	£ s. d.	£ s. d.	
Whitchurch - -	3	1	1	2 4 0	6 4 0	8 8 0	Mr. Wagstaffe.
Whitehaven - -	6	—	—	—	—	—	Dr. Beard.
Whittlesey - -	2	2	—	5 10 0	8 7 0	13 17 0	Dr. Stevens.
Wigton - -	7	—	—	—	—	—	Dr. Beard.
Williton - -	7	—	—	—	—	—	Dr. Blaxall.
Wincanton - -	6	—	1	—	—	3 13 4	Dr. Blaxall.
Winchcombe -	2	—	—	—	—	—	Mr. Wagstaffe.
Winchester, New -	4	1	—	—	—	13 4 0	Mr. Wagstaffe.
Wirrall - -	4	2	—	8 9 0	13 18 0	22 7 0	Dr. Beard.
Wisbeach - -	11	—	1	—	—	5 10 0	Dr. Stevens.
Witham - -	3	—	—	—	—	—	Dr. Stevens.
Witney - -	5	2	—	8 18 0	21 9 9	30 7 0	Mr. Wagstaffe.
Woburn - -	4	—	—	—	—	—	Dr. Stevens.
Woodbridge -	4	2	1	7 18 8	13 9 0	29 6 8	Dr. Stevens.
Woodstock - -	5	1	4	4 2 0	5 6 0	24 2 8	Mr. Wagstaffe.
Worksop - -	7	3	—	5 10 0	20 18 0	36 11 0	Dr. Rogers.
Yarmouth - -	1	—	—	—	—	—	Dr. Stevens.
Yeovil - -	7	—	1	—	—	6 7 4	Dr. Blaxall.

b.—List (alphabetically) of 130 Unions and Parishes, the ordinary Vaccination Arrangements of which were in 1870 matter of correspondence with the Poor Law Board, or (if so marked) directly with boards of Guardians, with a view to improvement of the arrangements.

Union or (if with letter P) Parish.

Aberystwith.
Ampthill.
Andover.
Atcham.
Barnet.
Barnstaple.
Bedwellty.
Berkhampstead.
Bethnal Green (P.).
Bideford.
Biggleswade.
Billesdon.
Bishop's Stortford.
Bramley.
Brampton.
Brecknock.
Brentford.
Bridge.
Builth.
Buntingford.
Burnley.
Carmarthen.
Chesterfield.
Chipping Norton.
Chipping Sodbury.
Christchurch.
Cockermouth.
Darlington.
Daventry.
Dulverton.
Dursley.
Edmonton.
Erpingham.
Faringdon.
Forden.
Freebridge Lynn.
Glandford Brigg.
Gloucester.
Grantham.
Halifax.
Hardingstone.
Hartley Wintney.
Hastings.
Hatfield.
Haverfordwest.
Hayfield.
Headington.
Hemel Hempstead.
Hendon.
Hertford.
Hitchin.
Holborn.
Hollingbourne.
Horncastle.
Horsham.
Hursley.
Isle of Thanet.
Islington (P.).
Kettering.
King's Norton.
Lambeth (P.).
Launceston.
Leicester.
Leighton Buzzard.
Leominster.
Lewisham.
Lincoln.
Linton.
London, City.
Louth.
Lutterworth.
Macclesfield.
Maidstone.
Mansfield.
Morpeth.
Newcastle-on-Tyne.
New Forest.
Newmarket.
Newport (Mon.).
Norwich.
Nottingham.
Oakham.
Orsett.
Paddington (P.).
Penistone.
Pickering.
Pontypool.
Poplar.
Preston, East.
Royston.
St. George's, Hanover Square.
St. Marylebone (P.).
St. Saviours.
Sedgefield.
Shardlow.
Sheffield.
Shoreditch (P.).
Skirlaugh.
Spalding.
Staines.
Stamford.
Stockbridge.
Stoke-upon-Trent.
Stroud.
Tetbury.
Tewkesbury.
Thakeham.
Thetford.
Thornbury.
Tisbury.
Tiverton.
Torrington (Guardians).
Uppingham.
Uxbridge.
Ware.
Wareham.
Wellingborough.
Westbury-on-Severn.
Whitchurch.
Whitechapel.
Whitehaven.
Whittlesea.
Wigton.
Winchcombe.
Winchester.
Wisbeach.
Witchford, North (Guardians).
Woburn.
Wolstanton and Burslem (P.L.B. and Guardians).
Wortley.

c.—List (alphabetically) of 72 Unions and Parishes, the Enforcement of Vaccination in which, under section 27 of the Vaccination Act, 1867, was, in 1870, matter of special correspondence with boards of guardians.

Union or (if so marked) Parish.	Tenor of Communication.
Aylsham - -	Inquiry.
Barnet - -	Do. Remonstrance against inaction.
Barnstaple - -	Inquiry and suggestions. Remonstrance against inaction.
Barrow-on-Soar -	Inquiry.
Bideford -	Suggestions. Remonstrance against inaction.
Birkenhead - -	Suggestions.
Blaby - -	Inquiry.
Boston - -	Do.
Brackley - -	Suggestions and remonstrance against inaction.
Brampton - -	Inquiry.
Brentford - -	Do.
Bromwich, West -	Remonstrance against inaction.
Bromyard - -	Do.
Caistor - -	Inquiry.
Camberwell - -	Do.
Cambridge - -	Do. Remonstrance against inaction.
Cardiff - -	Inquiry.
Carlisle - -	Remonstrance against inaction.
Caxton - -	Inquiry and suggestions.
Chapel-en-le-Frith -	Do. and remonstrance against inaction.
Cheltenham - -	Inquiry.
Chesterton - -	Do. Remonstrance against inaction. Peremptory remonstrance.
Chipping Sodbury -	Inquiry.
Clifton - -	Do.
Dudley - -	Do.
Dursley - -	Do.
Ely - - -	Do.
Erpingham - -	Do. Remonstrance against inaction.
Freebridge Lynn -	Remonstrances against inaction.
Gainsborough -	Inquiry. Remonstrance against inaction.
Hastings - -	Remonstrance against inaction. Mandamus threatened.
Headington - -	Inquiry.
Hemel Hempstead -	Inquiry and suggestions.
Hendon - -	Inquiry.
Hertford - -	Inquiry and suggestions.
Haverfordwest -	Inquiry. Remonstrance against inaction.
Hitchin - -	Inquiry and suggestions. Remonstrance against inaction.
Holsworthy - -	Inquiry.
Horncastle - -	Inquiry and suggestions. Remonstrance against inaction.
Hoxne - -	Remonstrance against inaction. Peremptory remonstrance.
Hursley - -	Remonstrance against inaction.
Leek - - -	Do.
Lincoln - -	Inquiry.
Linton - -	Do.
Liskeard - -	Inquiry. Remonstrance against inaction. Mandamus threatened.
Loughborough -	Inquiry.
Luton - - -	Peremptory remonstrance against inaction.
Lymington - -	Inquiry. Remonstrance against inaction.
Mitford and Launditch	Inquiry.
Newmarket - -	Do.
New Forest - -	Do.
Newport (Mon.) -	Inquiry. Remonstrance against inaction.
Northampton - -	Peremptory remonstrance against inaction.
Northleach - -	Inquiry. Remonstrance against inaction.
Oakham - -	Inquiry.
Oxford - -	Inquiry. Remonstrance against inaction.
Penrith - -	Inquiry.

Union or (if so marked) Parish.	Tenor of Communicatio n.
Peterborough - -	Inquiry. Remonstrance against inaction. Peremptory remonstrance.
Pontypool - -	Inquiry.
Shardlow - -	Do.
Smallburgh - -	Do.
Stow-on-the-Wold -	Do.
Tewkesbury - -	Do.
Walsingham - -	Do.
Wandsworth - -	Remonstrances against inaction.
Ware - - -	Inquiry.
Winchcombe - -	Inquiry.
Winchester - -	Remonstrance against inaction.
Wisbeach - -	Inquiry. Peremptory remonstrance against inaction.
Woburn - -	Inquiry. Peremptory remonstrance against inaction.
Woolwich - -	Inquiry.
Yarmouth, Great -	Inquiry. Remonstrance against inaction.

d.—List (arranged in Registration Divisions) of 90 Unions and Parishes in regard of which special proceedings were in 1870 made necessary by reason of the presence of Small-pox.

Registration Division.	Union or (if so marked) Parish.	Authority addressed.	Tenor of Communications. Remarks.
I. London. [On the 26th March, a letter was addressed to the Poor Law Board as to the necessity, in view of a threatened epidemic of small-pox in the Metropolis, that certain measures should be taken to promote vaccination. The Poor Law Board upon this issued a circular to the metropolitan boards of Guardians, embodying the recommendations of the Privy Council.]	Bethnal Green (parish).	Guardians.	Inquiry and suggestions. Inspector sent. Remonstrance against inaction. Approving modification of vaccination arrangements.
	Holborn(parish).	,,	Approving modification of vaccination arrangements.
	London (city).	,,	Inspector sent; appointment of vaccination officers urged.
	Mile End, Old Town (parish).	,,	Inquiry and suggestions.
	St Pancras (parish).	Poor Law Board.	To facilitate appointment of vaccination officers.
	All metropolitan unions & parishes.	Asylums Board.	Urging provision of additional hospital accommodation.
II. South-eastern.	Abingdon.	Guardians.	Inquiry and suggestions.
	Brighton	,,	Inquiry. Remonstrance against inaction.
	Cookham.	,,	Inquiry and suggestions. Remonstrance against inaction.
	Easthampstead.	,,	Inquiry and suggestions.
	Faringdon.	,,	Ditto.
	Guildford.	,,	Suggestions.
	Wantage.	,,	Inquiries and suggestions.
	Windsor.	,,	Ditto.
III. South Midland.	Brentford.	Poor Law Board.	As to outbreak in workhouse.
	Edmonton.	Guardians.	Suggestions as to outbreak at Cheshunt.
	Eton.	,,	Inquiry and suggestions.
	Wycombe	Local Committee.	Pressing for hospital accommodation. Inspector sent.
IV. Eastern.	Epping.	Guardians.	Inquiry and suggestions.
	Plomesgate.	,,	Pressing for enforcement of Act.
V. South-western.	Barnstaple.	,,	Inquiry and suggestions.
	Mere.	,,	Ditto.

Registration Division.	Union or (if so marked) Parish.	Authority addressed.	Tenor of Communications. Remarks.
V. South-western—(*continued.*)	Alderbury.	Guardians and local board.	Pressing for enforcement of Act. Salisbury local board to act with guardians and to provide hospital accommodation.
	Do.	Poor Law Board.	Hospital wanted for paupers.
	Tavistock.	,,	Approving domiciliary vaccination during epidemic.
	Tiverton.	Guardians.	Inquiry and suggestions.
	Wareham.	,,	Ditto.
	Wells.	,,	Ditto.
	Williton.	,,	Ditto.
VII. North Midland.	Boston.	,,	Ditto.
	Gainsborough.	,,	Ditto.
VIII. North-western.	Barton-upon-Irwell	,,	Ditto.
	Birkenhead.	Guardians and local board.	Ditto. Remonstrance against inaction.
	Blackburn.	Guardians.	Inquiry and suggestions.
	Bury.	,,	Inquiry and suggestions. Remonstrance against inaction.
	Chorlton.	,,	Remonstrance against inaction.
	Oldham.	,,	Inquiries and suggestions.
	Ormskirk.	,,	Ditto.
	Rochdale.	,,	Ditto.
	Salford.	,,	Ditto.
	Ulverstone.	,,	Ditto. Remonstrance against inaction.
	Warrington.	,,	Ditto. Ditto.
	West Derby.	,,	Inquiry.
IX. Yorkshire.	Barnsley.	,,	Inquiry and suggestions. Remonstrance against inaction.
	Dewsbury.	,,	Inquiries and suggestions.
	Gainsborough.	,,	Ditto.
	Huddersfield.	,,	Inquiries and suggestions. Peremptory remonstrance.
	Keighley.	,,	Inquiries and suggestions. Remonstrance against inaction.
	Wakefield.	,,	Inquiry and suggestions.
X. Northern.	Auckland.	,,	Ditto. Remonstrance against inaction.
	Durham.	,,	Inquiry and suggestions.
	Hartlepool.	,,	Ditto. Pressing for continued action.
	Lanchester.	,,	Inquiry and suggestions.
	Stockton.	,,	Ditto.
	Weardale.	,,	Ditto.
XI. Monmouthshire and Wales.	Bridgend.	,,	Ditto.
	Cardiff.	,,	Ditto.
	Carmarthen.	,,	Ditto.
	Gower.	,,	Ditto.
	Llandilofawr.	,,	Ditto.
	Llandovery.	,,	Ditto. Remonstrance against inaction.
	Llanelly.	,,	Inquiry and suggestions.
	Merthyr Tydvil.	,,	Ditto.
	Neath.	,,	Pressing for enforcement of Act. Inquiry and suggestions.
	Pwllheli.	,,	Inquiry and suggestions.
	Pontypridd.	,,	Ditto.
	Swansea.	,,	Ditto. Inspector sent.

c.—Statistics of the National Vaccine Establishment, and Educational Vaccinating Stations.

i. STAFF at end of 1870.

N.B.—The Stations named in *italics* are Educational Vaccinating Stations, authorised by the Lords of the Privy Council, for the purposes of their Lordships' Order of December 1, 1859.

—	Name.	Vaccinating Stations.	Days and Hours of Attendance.
Vaccinators supplying lymph for the public service, and salaried from the Parliamentary Grant.	1. Mr. J. F. Marson	*Surrey Chapel.*	Tuesd.,Thursd.; 1.
	2. Mr. G. L. Cooper	Battle Bridge.	Tuesday ; 12.
	3. Dr. R. Sharpe	Bermondsey.	Tuesday ; 10.
	4. Mr. W. E. G. Pearse	*Tottenham Court Chapel.*	Mond.,Wednesd.; 1.
Parochial and other Vaccinators, not salaried from the Parliamentary Grant, but furnishing Lymph at a fixed rate of payment.	1. Mr. Ellis S. Guest	*Manchester.*	Monday ; 2.
	2–5. Dr. Edward Robinson.	*Birmingham.*	2. Monday ; 3. Tuesday ; 4. Wednesd. ; 5. Thursday ; } 11.
	6. Dr. H. A. P. Robertson	*Bristol.*	Wednesday ; 10.
	7. Mr. A. B. Steele	*Liverpool.*	Thursday ; 2.
	8. Dr. E. L. Webb	*Pimlico.*	Monday ; 10.
	9. Mr. G. C. Gilchrist	*Newcastle-on-Tyne.*	Tuesday ; 2.
	10. Mr. W. E. G. Pearse	*Westminster.*	Tuesday ; 2.
	11. Mr. J. G. Gerrans	*Marylebone.**	
	12. Mr. Frederick Holmes	*Leeds.*	Tuesday ; 3.
	13. Dr. Edward Lynes	Coventry.	Tuesday ; 12.
	14. Dr. James Dunlop	*Glasgow.*	Monday ; 12.
	15. Mr. C. Harriot Roper	*Exeter.*	Thursday ; 3.
	16. Mr. Robert Dunn	*Strand.*	Monday ; 10.
	17. Dr. Matthew Brownfield.	Bromley, Middlesex	Tuesday ; 11.
	18. Dr. William Stuart	Woolwich.	Thursday ; 3.
Teachers of Vaccination, not supplying lymph.	Dr. W. Husband	*Edinburgh.*	Wed., Sat. ; 12.
	Dr. R. D. Tannahill	*Glasgow.*	Mon., Thurs. ; 12.

* This station has been temporarily closed.

Statistics of the National Vaccine Establishment and Educational Vaccinating Stations—*continued.*

ii. SOURCES and AMOUNT of LYMPH SUPPLY in 1870.

N.B.—The Stations named in *italics* are Educational Vaccinating Stations, authorised by the Lords of the Privy Council, for the Purposes of their Lordships Order of December 1, 1359.

—	Vaccinating Stations.	No. of Vaccinations performed at the Stations respectively.		No. of charges of Lymph supplied from the Stations respectively.	Remarks.
		Prim.	Re-vac.		
Vaccinators salaried from the Parliamentary Grant.	1. Fitzroy Street - -	596	—	3,350	Discontinued in September
	2. *Surrey Chapel* - -	1,217	227	14,700	
	3. Battle Bridge - -	781	—	7,204	
	4. Bermondsey - -	1,015	39	14,293	
	5. Dean Street, Soho - -	361	1	6,010	Ditto
	6. King Street - - -	255	7	3,206	Ditto
	7. Spital Square - -	242	—	8,585	Ditto
	8. *Tottenham Court Chapel* -	1,083	101	18,750	
	9. *Wellclose Square* - -	234	—	7,575	Ditto
Total - -	9 stations reduced during the year to 4.	5,784	375	83,672	
Parochial and other Vaccinators not salaried from the Parliamentary Grant, but contributing lymph at a fixed rate of payment.	1. *Manchester* - - -	1,273	—	21,679	
	2–5. *Birmingham** - -	4,324	12	24,263	
	6. *Bristol* - - -	843	—	6,260	
	7. *Liverpool* - - -	1,164	—	22,670	
	8. *Pimlico* - - -	584	44	14,973	
	9. *Newcastle-on-Tyne* - -	373	57	11,801	
	10. *Westminster* - -	1,103	41	23,618	
	11. *Marylebone* - - -	562	43	3,872	Appointment terminated at end of year.
	12. *Leeds* - - -	951	—	12,217	
	13. Coventry - - -	1,083	—	5,173	
	14. *Glasgow* - - -	665	—	1,820	
	15. *Exeter* - - -	583	—	3,612	Commenced in July.
	16. *Strand* - - -	273	—	1,350	Ditto in
	17. Bromley, Middlesex -	199	—	4,014	October.
	18. Woolwich - - -	114	—	2,010	Ditto
Total - -	18 stations reduced during the year to 17.	14,094	197	159,332	
General total -	27 stations, reduced during the year to 21.	19,888	572	243,005	

* At Birmingham, in the first quarter of 1870, only one station supplied lymph; and during April (when changes to the present system were in progress) no lymph was supplied. At present the Birmingham vaccinations are in the hands of one vaccinator, Mr. Robinson, who acts at four stations in the town.

Statistics of the National Vaccine Establishment and Educational Vaccinating Stations—*continued.*

iii. Distribution of Lymph, 1870.

Number of Applications :—

From medical practitioners in England and Wales	11,868
„ Ireland - - - - -	2,116
„ Scotland - - - - -	432
„ the Army - - - -	449
„ the Navy and from the Emigration Department - - - - -	88
„ Colonies - - - - -	200
„ Diplomatic and other Foreign services -	75
Total - - - -	15,228

Supplies Sent Out :—

Charged ivory points (each a single charge) -	126,060
„ squares of glass (each equal to 4 points)	1,031
„ capillary tubes (each equal to 7 points)	13,836

iv. Summary for the Years 1856–1870.

Year.	Total Vaccinations performed at the Stations which supply Lymph.	Re-vaccinations included in preceding Column.	Number of Charges of Lymph received for Distribution.
1856 - -	7,039	?	210,942
1857 - -	6,327	?	213,207
1858 - -	6,445	?	234,150
1859 - -	9,030	?	237,801
1860 - -	13,849	?	228,347
1861 - -	12,009	?	225,000
1862 - -	13,149	?	211,475
1863 - -	20,600	?	239,432
1864 - -	13,727	?	203,250
1865 - -	14,648	515	219,832
1866 - -	14,319	372	207,014
1867 - -	14,911	584	216,637
1868 - -	16,092	173	226,825
1869 - -	15,790	127	210,417
1870 - -	20,460	572	243,005

No. 3.—Papers relating to the Medical Profession.

a.—Departmental Memorandum on the Lord President's Medical Acts Amendment Bill of 1870.

The bill has two main objects* :—one, that the many authorities which at present confer license for professional practice shall for the future only confer such license by acting conjointly with one another, in their respective divisions of the United Kingdom, under co-ordination by the General Medical Council ; and the other, that in future there shall not be given any license for professional practice, which does not imply (to the required minimum amount) qualifications both for medicine and for surgery.

It is intended that the existing authorities should have every proper opportunity to effect the required consolidation by voluntary arrangements with one another ; which arrangements notoriously may have to be different in the different divisions of the United Kingdom. As, however, differences of opinion or conflicting interests among the authorities may absolutely require arbitration, and as each divisional arrangement will in great part be of common public concern, and may even in certain cases require to be explained and justified in Parliament, the bill proposes—first, that the constitution of each of the new boards shall be subject to the approval of the general council, and, secondly, that both these divisional constitutions, and also the regulations which the general council will have to establish for their common working, shall be subject to the approval of Her Majesty's Government.

As regards the question what privileges and titles shall be conferrible by the new boards, and under what sort of limitation, the bill distinguishes between that least degree of qualification which shall give admission to the medical register, and, on the other hand, those higher titles of professional honour which various of the licensing bodies have in their award. As regards the latter, the bill does not propose to interfere in any way whatever with the discretion of the individual authorities, except (if indeed this can be called an exception) that the higher titles will be awardable only to persons already members of the profession ; † but, with the aim of exciting a more general ambition for the attainment of the higher titles, the bill proposes that, for each future practitioner, the general council shall have power to state such higher titles in a separate column of the register, as distinct from the practitioner's minimum qualification. With regard to the minimum qualification itself, the principle of the bill is that each of the new boards must be deemed to represent, for the division of the United Kingdom in which it acts, all separate licensing boards which have hitherto been in action there ; and that, so far as relates to the privilege of giving a legal qualification for practice, thus far the old boards are to be understood as merging themselves completely in the new board, and as exercising their powers solely through it. The bill, therefore, proposes that every candidate who passes a satisfactory examination before the new board shall thereupon immediately be admitted a member of the medical profession as by law constituted. As regards the title under which this new member of the profession shall be enrolled in the medical register, regard has been had to two considerations ; first, that for common popular apprehension it is highly desirable to have a minimum title which can be the same in each division of the United Kingdom ; and secondly, that in the present case it is quite impossible to express in any single title the joint responsibility of the five or six or seven public bodies which will have contributed to constitute the examining board ; and, on these grounds, the bill proposes that the legal title under which the new practitioner is to be registered shall be the title of "Licentiate in Medicine and Surgery."

* [See, below, observation i.] † [See, below, observation ii.]

The proposal of the bill, that, when a candidate has satisfied his examiners, his right to be registered shall not be contingent on the further fact of his being admitted as member by some medical corporation or university, is one so intimately related to the main principles of the bill that even its form could not easily be varied. But as some of the bodies concerned, and especially some of the medical corporations, are understood to attach importance to privileges which this proposal seems to touch, some collateral proposals of the bill are intended to secure those privileges against any unnecessary interference. In the first place, as regards the financial interests concerned, the principle is accepted that the fees of persons entering the medical profession may fairly be expected, not only to pay the expenses of the divisional examining boards, and of the council and branch councils by which these boards are superintended, but also to a reasonable extent (as measured by what has heretofore been done in the same matter) to supply a surplus out of which various of the bodies may be enabled to support museums and libraries for the general professional advantage, and to promote higher professional culture in their respective departments of practice. And, in the second place, though the future licentiate will not be bound to have relations of personal enrolment with any of the former licensing bodies, the bill contains provisions specially intended to facilitate the voluntary esiablishment of such relations, and to give them where they shall be established the highest reasonable degree of recognition. It is proposed that the universities and medical corporations may, at their option, accept the examinations of the new boards as equivalent to any examinations which have heretofore had to be undergone by candidates for the respective minor titles of those bodies; further, as regards cases where the surplus of examination fees is allotted to particular institutions for the furtherance of professional objects, that such institutions may be required to enrol as members the licentiates who have contributed towards such fees; and, finally, that these optional relations with institutions, though not to be of any legal force beyond such as the byelaws of the particular institution would confer, may, at the desire of the institution, be noted by the general council in a special column of the medical register.

Subsequent Observations on the Bill.

i. The fact that the bill did not aim at the further object of altering the constitution of the General Medical Council was, from a particular point of view, objected to it as a defect. But—apart from all question whether the constitution of the Medical Council ought or ought not to be altered, and what alteration, if any, it ought to undergo, impartial persons duly informed of the circumstances, will I believe admit that the bill, as it stood, was one of extreme difficulty, by reason of the sectional interests which it affected, and that this difficulty would have been enormously aggravated, though with little prospect of equivalent advantage, if the bill had further opened the collateral and almost interminable question of a *de novo* constitution for the Medical Council. It is true that the voices which last year were loudest for a new constitution of council were calling only for one particular sort of change; that, namely, of adding to the council a certain number of persons who should be chosen by the universal suffrage of the members of the medical profession in the United Kingdom. But there is no reason to suppose that, if this proposal had come under parliamentary notice, the change would have been accepted *sub silentio*, as, by common consent, an improvement in the present constitution of the council, or as something which, if incorporated in the Lord President's bill, might be viewed as not greatly

modifying the remainder. The present construction of the council, as fixed by the Act of 1858, represents a kind of compromise between the profession and the public, arrived at with difficulty after long and renewed discussion, which, while it lasted, effectually prevented all legislation to amend the license system of the medical profession ; and if that compromise were put forward for reconsideration, probably a new settlement would be scarcely less difficult than the old. The two objects at which the Lord President's bill of 1870 actually aimed were, I believe, universally admitted to be of great and urgent importance to the public ; and experience suggested that the attainment of those objects might be quite indefinitely delayed if, in endeavours to compass them by legislation, the constitution of the General Medical Council must also be treated as an open question.—J. S., 1871.

ii. Some of the universities objected to this provision that it would limit their privileges beyond the positive requirements of public safety, for that it would debar them from conferring medical degrees (which they contended might be merely titles of honour) on persons not intending to practise medicine. They insisted on retaining the independent liberty to confer, though on persons not registered under the Act, such medical degrees as they might see fit ; but they were ready to accept as law that their degrees should not constitute any claim for registration, nor be a legal qualification for practice, nor even be publicly usable by the possessor (unless otherwise qualified) if practising medicine for gain. The universities which claimed this exemption had perhaps not duly considered what conflict of law and common sense it might popularly appear, that, in a country where the most illiterate and unskilled of unregistered persons are not as such prohibited from practice, a man legally holding a medical degree, given (and perhaps the highest which could be given) after examination by an university of the United Kingdom, might be under penalty for practising his profession. Nor perhaps had they fully seen how difficult it would be for courts of justice in case of need to enforce so paradoxical a law, or how probably this partial exemption, if it were granted, would tend to perpetuate just such by-ways into the medical profession as the bill had for its main object to close. Practically, however, for reasons which need not here be entered on, there was no alternative but to yield to the wishes of the universities ; and consequently *the granting* (whether by universities or by medical corporations) *of mere titles*, not giving the holder a claim to registration, was exempted from restriction by the bill.

This change was, I think, to be regretted, as making the bill logically less complete in its subject matter, and therefore less popularly intelligible, and less susceptible of successful working as law, than it aimed at being ; but the damage was immeasurably overrated by persons who represented the change to be one of cardinal importance to the bill. Those who asked for the exemption I have described did not gainsay the principle of the bill, that every one seeking to be recognised at law as a medical *practitioner* must enter the profession by the common portal. And their claim for exemption was confessedly subject to the condition that no side-door into medical *practice* should be established by it. Therefore, of two alternatives, one:—either this condition would have been observed, and then the essential public object of the bill would have been attained; or else, the exemption being abused, the case for at once further amending the law would be irresistible. At the compromise of leaving unchanged and on trial that very small fraction of our present system, all the main practical mischief of the system would have been immediately brought under control.—J. S., 1871.

b.—TABULAR STATEMENT (according to Returns made in 1870) as to the Nineteen Bodies by which the representative Members of the General Medical Council are elected.

N.B.—Each of the under-mentioned Bodies is separately represented in the Council, except that one member represents jointly the two Universities of Edinburgh and Aberdeen, and one member the two Universities of Glasgow and St. Andrews. In addition to these 17 delegates from institutions, there are in the Council six members appointed by the Crown, and an additional member, the President, appointed by the above 23: the total number being 24.

Bodies represented in the Medical Council.	Board or Body of Persons acting as the Body mentioned in the previous column in choosing a Person to act on behalf of the same in the General Medical Council.	Number of Members of the Electoral Board or Body.	Constituency by which the Members of the Electoral Board or Body are appointed, or other qualification giving a vote.
Royal College of Physicians, London.	"The commonalty or fellowship of the faculty of physic," incorporated by royal charter of Henry VIII. in 1518, confirmed by Act of Parliament, 14 & 15 Henry VIII. cap. 5.	On Feb. 26, 1870, 235 persons or fellows.	The constituency and the electoral board or body are one and the same.
Royal College of Surgeons of England.	The council of the college.	The council, when complete, consists of 24 members.	The fellows of the college, in number exceeding 1,300.
The Apothecaries' Society of London.	The master warden and assistants of the society, who are constituted the governing body of the society by the charter of incorporation granted by James I., and confirmed by Act of Parliament, 55 Geo. III. cap. 194.	24 persons - -	The members of the body are appointed by the body itself.
The University of Oxford.	The convocation of the university.	4323, in 1870.	A person to be entitled to vote in Convocation, must have taken the degree of Master of Arts, or of Doctor in Laws, Divinity, or Medicine.

Bodies represented in the Medical Council.	Board or Body of Persons acting as the Body mentioned in the previous column in choosing a Person to act on behalf of the same in the General Medical Council.	Number of Members of the Electoral Board or Body.	Constituency by which the Members of the Electoral Board or Body are appointed, or other qualification giving a vote.
The University of Cambridge.	The senate of the university.	Of about 5,500 persons. Although all members of the senate are entitled to vote, non-residents rarely do vote at the election. There are about 280 resident members of the senate.	A member of the senate is a person who (1), has taken the degree of master of arts, master of laws or of doctor in some faculty; (2), retains his name on the boards of some college or on the university register; and (3), has declared himself a bonâ fide member of the Church of England. Masters of surgery of *three years* standing who have fulfilled conditions (2) and (3) are also members of the senate.
The University of Durham.	The convocation of the university.	280 at the present time.	A person to be entitled to vote in convocation must have :— (1.) Taken a degree of D.D., D.C.L., M.D., or M.A., in the university. (2.) Continued without interruption to be a member of the university from the date of his admission to such degree. (3.) Declared in writing that he is a bonâ fide member of the United Church of England and Ireland as by law established; and (4.) Discharged the duties and payments required from him. The payments are 1*l.* annually, or, in lieu of it, a composition of 5*l.*
The University of London.	The senate of the university.	The senate consists of 36 members, inclusive of the chancellor and vice-chancellor.	The members of the senate are nominated by the Crown, but every fourth appointment is made from a list of three persons nominated by the convocation of the university.

Bodies represented in the Medical Council.	Board or Body of Persons acting as the Body mentioned in the previous column in choosing a Person to act on behalf of the same in the General Medical Council.	Number of Members of the Electoral Board or Body.	Constituency by which the Members of the Electoral Board or Body are appointed, or other qualification giving a vote.
The College of Physicians of Edinburgh.	The fellows of the college on the roll of attendance.	At present of 61 (Feb. 26, 1870).	By the fellows from the members of the college. No other qualification gives a vote.
The College of Surgeons in Edinburgh.	The fellows of the college.	About 250 at present.	All fellows, except those who claim the privilege of the widows' fund, and who are examined, are elected by ballot. All fellows must have been licentiates of the Royal Colleges of Surgeons of England, Edinburgh, or Ireland, or of the Faculty of Physicians and Surgeons of Glasgow.
The Faculty of Physicians and Surgeons of Glasgow.	The fellows of the corporation.	At present (Feb. 28) 110.	The fellowship is the only qualification which gives a vote.
The University of Edinburgh, *conjointly with*	The senatus academicus.	34 - - -	The Crown. Board of curators. University Court. Under ordinance of Universities Commission (21 & 22 Vict. c. 83).
The University of Aberdeen.	The senatus academicus.	22 - - - The principal 1 - Professors in arts 6 Do. law 1 Do. divinity 4 Do. medicine 10	The principal and professors are appointed for life as follows :— By the Crown 17 By the University Court 4 By a special body of electors nominated by the synod of Aberdeen and the University 1
The University of Glasgow, *conjointly with*	The senate of the University.	The principal and 25 professors.	Of the 26 members, 17 are appointed by the Crown; eight are appointed by the University Court. One is appointed by the Dean of Council of the Faculty of Procurators of Glasgow.
The University of St. Andrew's.	The senatus academicus of the University of St. Andrew's, which is composed of the professors of both colleges.	14.	——

Bodies represented in the Medical Council.	Board or Body of Persons acting as the Body mentioned in the previous column in choosing a Person to act on behalf of the same in the General Medical Council.	Number of Members of the Electoral Board or Body.	Constituency by which the Members of the Electoral Board or Body are appointed, or other qualification giving a vote.
The King and Queen's College of Physicians in Ireland.	The president and fellows of the college.	47 members -	Licentiates of the college are from time to time elected fellows by the existing fellows.
The Royal College of Surgeons in Ireland.	The president, vice-president, and council of the college.	21 - - -	Annually elected by the fellows.
The Apothecaries Hall of Ireland.	The general court or council.	At present 35, the number being limited to 60.	The shareholders of the joint stock of the hall, who must be licentiates of the body residing in or near Dublin.
The University of Dublin.	The provost and senior fellows of University College.	Eight - -	The fellows are elected by the provost and senior fellows after a competitive examination.
The Queen's University in Ireland.	The senate of the university.	25 members, the chancellor and 24 senators.	Two of the present senators were elected by the convocation of the university, and the rest were appointed by the Crown. Ultimately there will be six senators representing convocation, and 18 appointed by the Crown.

No. 4.—Dr. Greenhow's Report on the Examinations of the Pharmaceutical Society, conducted in London.

During the year 1870 the Board of Examiners of the Pharmaceutical Society held 26 meetings: four for the preliminary examination in Latin, English, and arithmetic, and 22 for the technical examinations.

At the preliminary examinations 742 candidates presented themselves, of whom 521 passed, and became thereby qualified to present themselves for the minor examination, whilst the remaining 221 were rejected. I have carefully read the papers set for these examinations, and also many of the answers written both by successful and unsuccessful candidates, and am of opinion that the examination is not too severe nor the mode of conducting it too rigid, and that the value of the written answers has been estimated with accuracy and impartiality. In these circumstances, the rejection of so large a proportion of the candidates, on the score of defective attainments in the main subjects of middle-class instruction, indicates the low standard of general education prevalent among those classes of society from which the candidates are chiefly derived; and renders it obvious that, until some improvement takes place in this respect, the standard of preliminary examination by the Pharmaceutical Society is pitched as high as can be attempted with practical advantage.

Of the 22 meetings held for the examination of candidates in technical subjects, 13 were devoted to the major and minor examinations, and 9 to the modified examination.

During the year 1870, 258 candidates presented themselves for the *minor* examination, of whom 178 passed and were registered as chemists and druggists, and 80, or nearly one-third, were rejected as incompetent. Of these 80 unsuccessful candidates 50 failed to obtain the number of marks requisite for passing the examination as a whole; the remaining 30 obtained the requisite total number of marks calculated on all the subjects collectively, but failed to obtain the numbers requisite for passing in all the separate subjects. Of these 30 candidates, 7 failed in one of the six subjects comprised in the examination, 18 in two, 4 in three, and 1 in four subjects respectively, and by the regulations of the Pharmaceutical Society they must present themselves for re-examination in those separate subjects in which they failed to pass, before they can become qualified for registration as chemists and druggists.

I should, perhaps, briefly repeat here what I explained in my report of last year, that in order to pass any of the examinations a candidate must obtain not less than half the number of marks given for the examination as a whole, and is even then only entitled to pass provided that in none of the separate subjects comprised in the examination his number of marks has fallen below one-fourth of the standard number allotted to the subject. It is true that even though a candidate may have failed to obtain one-fourth of the standard number of marks in a single subject, if his excellence in all the other subjects be remarkable he may still possibly be allowed to pass by a special vote of the Board of Examiners; but practically such a case very rarely occurs. Further, a candidate who has obtained the required total number of marks calculated on all the subjects of examination collectively, but has fallen below one-fourth of the standard number in one or more of the separate subjects, is required to present himself for re-examination, not only in those subjects, but also in any of the other subjects in which he may have failed to obtain one-half of the standard number of marks. By

these arrangements, which appear to me to be equitable, superior excellence in some branches of the examination is to a certain degree set against any weakness in others which does not involve incompetence in essentials.

For the *major* examination 75 candidates presented themselves during the year, of whom 59 passed and were registered as pharmaceutical chemists, whilst 16, or more than one-fifth, were rejected. Nor can this be regarded as otherwise than a large proportion, when it is considered that all these candidates must have previously passed the minor examination, and were thereby already qualified to carry on business as chemists and druggists. The examination of candidates for the major qualification is conducted partly by means of written papers; partly by *vivâ voce* questions and answers upon the nature, quality, composition, and preparation of drugs and chemicals placed before the candidates; and partly by practical examination in the dispensing and compounding of prescriptions, and in the application of the requisite chemical tests for determining the nature of one or more of the definite chemical compounds employed in medicine. The papers written in answer to questions set by the examiners show that the candidates have received very different degrees of elementary and technical education. Some of the papers evince a really high degree of cultivation, whilst others fall below mediocrity. The practical examination in testing is conducted on the same day as the written examination, and each candidate is required to determine, by means of the appropriate chemical tests, the presence, in a given solution, of some chemical comprised in the British Pharmacopœia. The candidate is not made aware until the moment what solution will be presented to him for examination, and he applies his tests under the eye of the examiner, who takes each candidate in turn at a counter upon which are placed the requisite apparatus and tests. Solutions of such salts as the perchloride of mercury, sulphate of copper, perchloride of iron, bromide of potassium, acetate of lead, and alum were given to be tested on the occasions on which I was present. Of the 16 candidates who were unsuccessful in the major examination 13 failed to obtain the number of marks necessary in order to pass the examination as a whole; the remaining three obtained the requisite total calculated on all the subjects collectively, but fell below the standard minimum of marks in one or more of the separate subjects, and will, therefore, be required to undergo a re-examination in those subjects before they can be registered as pharmaceutical chemists.

The *modified* examination was instituted, as I explained last year, for the benefit of such persons as, being of full age, had been actually engaged in the dispensing and compounding of prescriptions as assistants to pharmaceutical chemists, or to chemists and druggists, for a term of not less than three years previous to the passing of the Pharmacy Act of 1868.

The modified examination entitles such candidates, if they can give proof of reasonable practical competence, to be registered as chemists and druggists without havng attained the standard of scientific knowledge now fixed for the minor examination which confers the same title. It will therefore be discontinued so soon as the class of persons for whose benefit it was instituted shall have all been examined. During the past year 348 candidates presented themselves for this examination, of whom 231 passed and were registered as chemists and druggists, and 117 were rejected. Of these latter, 102 failed to obtain the number of marks required to enable them to pass the examination as a whole; the remaining 15 obtained the total number, but failed to obtain the required minimum in one or more of the separate subjects. Two of the 15

failed in two subjects and 13 in one subject each; but the four subjects which alone are comprised in this examination are all so indispensable, that incompetence in any one of them would render a person quite unfit to be trusted with the responsible duty of compounding and dispensing prescriptions. The candidates in these modified examinations have appeared to me to be treated by the examiners with equal consideration and tact, so that while on the one hand they are not rejected on matters of minor importance or technical form, on the other hand they are not passed unless their practical competence be proved sufficient to guarantee the safety of the public. The fact, therefore, of the rejection of fully one-third of the whole number of candidates, affords conclusive evidence of the danger to which the public must have been exposed, by the employment of so large a proportion of unskilled persons as assistants in the business of selling drugs and compounding prescriptions, previously to the passing of the Pharmacy Act.

During the year 1870 I was present at the pharmaceutical examinations on 13 occasions, namely, on January 7th and 19th, on February 16th, April 20th, May 6th and 25th, July 1st and 13th, October 19th and 20th, and on December 2nd, 21st, and 23rd. Four of these were modified examinations, and the remaining nine major and minor examinations.

No change requiring mention has been made during the past year in the mode of conducting any of the examinations, but I observe some minor improvements in method, and I am led to believe that it is the intention of the Board of Examiners gradually to raise the standards of competence both for the minor and major examinations. I have no suggestions to offer on this head with reference either to the minor or the modified examination, both of which appear to me to be as high as could be enforced with advantage at the present moment. But with reference to the major examination I would venture to suggest that, as the candidates for this examination are already qualified to carry on business as chemists and druggists, there would be no hardship in fixing the standard for passing it somewhat higher; thus making a greater difference than now exists between the grade of chemist and druggist and that of pharmaceutical chemist, and ensuring in those who bear the latter title a higher degree of pharmaceutical skill. I am of opinion further that, inasmuch as the increase of practical pharmaceutical skill is what will most conduce to the service of the public, the standard of the major examination should be heightened principally in its practical aspects, and that especially a profounder acquaintance with practical chemistry and a more thorough grammatical knowledge of Latin should be required. With this view I would recommend that candidates for this examination should be required to estimate practically, by means of the volumetric test solutions appended to the British Pharmacopeia, the strength of such officinal preparations as are directed to be so estimated, and also to show considerable proficiency in reading difficult or unusual prescriptions written in the Latin language. I have, indeed, reason to believe that it is the intention of the Board of Examiners to carry out these improvements as they shall find practicable, but I hope that this expression of opinion on my part may strengthen their hands and assist them to realize their intentions more speedily.

In conclusion, I have much satisfaction in being able to report that the examinations of the Pharmaceutical Society, as conducted during the past year, afford a sufficient guarantee for the competence of persons admitted during that period to registration under the Pharmacy Act of 1868.

Appendix No. 5.

No. 5.—Dr. Sanderson's Further Report of Researches concerning the Intimate Pathology of Contagion.

Studies of Contagion.

The Origin and Distribution of Microzymes (Bacteria) in Water, and the Circumstances which determine their Existence in the Tissues and Liquids of the Living Body.

Introduction.

In my previous report on the intimate pathology of contagion, microzymes were defined as living particles which in their earliest state are spheroids, and do not exceed $\frac{1}{20000}$ of an inch in diameter, but subsequently elongate into rods. As regards the conditions of their development, their existence was said to be associated with the commencement of putrefactive decomposition of nitrogenous compounds. The question of their origin and destiny was left unanswered. It was left undecided whether on the one hand "they constitute a race of "more or less similar individuals, each of which springs from and "reproduces its like," or, on the other, are "germs in which a specific form is wrapped up," capable of developing to the higher organisms from which they spring.

It is to this question principally that the experiments we have now to bring before the reader relate. Our purpose is to examine into the origin, growth, and development of microzymes, to investigate the conditions which are fatal or favourable to their existence in the liquid and gaseous fluids by which we are surrounded, in the hope that by doing so we may be enabled to approach one degree nearer to an understanding of their influence on the processes which go on in the living body.

In dealing with the question of origin, we again encounter the more general question of what is called "spontaneous generation." I have no intention, however, of entering upon it. I shall be able to prove in the most decisive manner that as regards the animal liquids and tissues, and the liquids which will be used as tests for the presence of microzyme germs, no spontaneous evolution of any organic form ever takes place; but it will be quite unnecessary either to deny or to assert its possibility under other and different conditions.

Before proceeding to state the results of our experiments, a more complete account must be given of microzymes, and something must be said as to the views entertained by naturalists of their nature, origin, and relation to other organic forms. The methods of investigation which have been employed must also be explained.

Bacteria or microzymes are placed by most naturalists in the animal kingdom, and have a position assigned to them next to the monads. Hallier, on the other hand, believing that they originate by the cleavage and multiplication of nuclei in the cells of fungi, and that they develop to the same forms from which they spring, regards them as plants. Their claim to be considered animals is founded partly on their motions, partly on the fact that their chemical reaction on air, when alive, resembles rather the respiration of animals than that which is associated with vegetation. The question is of importance only in so far as it involves that of origin and development. If it can be shown that they neither spring from higher forms nor grow to them, the discussion of their animal or plant nature may be left to those interested in verbal definitions.

Microzymes grow either in liquids or moist air. In liquids they present different appearances, as they are observed in the depth or on the surface. In the former case they show no tendency to assume any

special arrangement to each other if they are motionless; nor if they are active are their motions governed by any mutual relation. At the surface of the liquid, on the other hand, although the individual bacteria show no definite arrangement when they first appear, they soon place themselves in such a manner as to form a membrane, the beginning of the bacterium scum, to which we shall have frequent occasion to refer. In this membrane, when it first appears, each rod stands vertically, one end forming part of the free surface, the other part of the deep surface of the membrane. The rods adhere together by their sides after the manner of the elements of columnar epithelium, but there is, I think, strong reason to believe that this adhesion is not direct, *i.e.*, that they are not in actual contact, but glued together by a viscous intermediary substance. Consequently on this arrangement, the "scum," when first formed, presents under the microscope the aspect of an evenly dotted surface, the distance between each dot and its neighbour corresponding approximately to the diameter of a rod. This appearance, indeed, is so deceptive, that for a long time I supposed, as others have done, that the constituent particles were round; nor was it until it was discovered that the membrane could be resolved by mechanical means into rods that I understood the real nature of the membrane. As the structure (if one may call it so) becomes thick enough to form a visible scum, the arrangement of the particles can no longer be made out, for it is not possible to subject it to examination without dislocating it to such a degree as to render their relative positions indistinguishable.

When common microzymes grow on moist surfaces, they with their intervening jelly sometimes form viscous masses of sufficient size to be cognoscible by the unaided senses, these consisting of a material similar to that of the "scum" which forms on the surface of liquids in which microzymes are growing. This fact is expressed by the term *Zooglæa* applied to such masses or colonies of microzymes by Cohn.

It is on observations made as to the growth of microzymes in colonies that the little which can be stated as to the *form* in which they originate is based. In the spheroidal masses above referred to, and indeed whenever microzymes occur in a gelatinous matrix which can be distinguished, we observe foci of growth at which the particles are indefinitely minute and spheroidal; around these foci there are zones of matrix, already obsolete and disintegrating, which are inhabited by staff-shaped microzymes of larger size, which eventually become free and display their proper movements. Here therefore it seems probable that bacteria come into distinguishable existence not as rods but as spheroids. Subsequently they multiply, as is well known, by division.

As to the *conditions of their origin* there is even less knowledge and more difference of opinion. There being an immense preponderance of evidence that they do not spring into existence of themselves in the media in which they grow, most observers have looked for germs in the atmosphere, but with no success. Nor has anyone excepting Professor Hallier even suggested a plausible theory on the subject. Liquids which contain no particle distinguishable under the highest powers of the microscope can often (as will be hereafter shown) be proved to possess the property of evolving microzymes without contact with external media, and must therefore contain the germinal substance from which these organisms spring. In interpreting this fact it may be supposed either that the germinal substance is universally and equally distributed, *i.e.*, dissolved in such liquids, or that it is unequally distributed or particulate. That any living substance is soluble in water is not at present admissible, we must therefore accept the other alternative,

and believe that we have to do with particles so minute that they do not interfere with the homogeneity of the liquid. In so far as relates to the ultra microscopical origin of bacteria, this inference harmonizes entirely with what has been stated above as to their development in gelatinous masses from foci. Here, as in the other case, it would surely be an error to suppose that in these proliferous foci the apparently hyaline material is really homogeneous. It appears to be so, merely because the particles are so extremely minute. Hence when we apply the term matrix to this substance, we must guard against the word being understood to imply that in the present instance bacteria arise out of an amorphous jelly. What is meant is, that the jelly is itself so organized throughout, that the smallest conceivable bit of it, if separated from the rest, would still possess structure, and consequently the power of reproduction.

Chemical composition of Microzymes, and their relation to the media in which they grow.—Of the chemical composition of microzymes we know very little. It is assumed that the particles are albuminous, because they are readily stained with carmine and browned by iodine; but of the matrix little can be said, excepting that it is probably also albuminous. Chemistry can as yet give no account of the difference between them. As regards their action on the liquids in which they live the most important facts are: (1.) That their growth is attended with absorption of oxygen and discharge of carbonic acid. (2.) That they are remarkably independent of the chemical constitution of the medium, provided that they are supplied with oxygen; and (3.) That they take nitrogen from almost any source which contains it, and use it for the building up of their own protoplasm.

It is this last power which specially indicates what may be called their place in nature as the universal destroyers of nitrogenous substances, acting as the pioneers if not the producers of putrefaction. They exercise this function not by virtue of any special relation of their own nutritive processes to putrefaction as such, but simply by their extraordinary power of seizing on the elements which they require for the construction of their own bodies.

The necessity of oxygen to bacteria is so great that they cannot grow even for a short time without it. Thus, if liquid containing living bacteria be placed under a cover glass for microscopical examination, it is seen that towards the centre of the cover glass their movements become sluggish and eventually cease, although towards the edges they are still lively. If bacteria are confined in a tube without air they soon die. If the supply of air is limited they continue to live only so long as the air to which the liquid is exposed still contains sufficient oxygen. If microzymes exist in great numbers in the liquid, air which has remained for a length of time in contact with it has a large excess of carbonic acid, and occupies less volume than it did originally under the same conditions of pressure and temperature. We have found that in such air a taper is immediately extinguished, whence it would seem that microzymes are able to use up nearly the whole of the oxygen which is supplied to them.

When microzymes grow at the expense of disintegrating organic substance, it cannot be supposed that they avail themselves of the albuminates already existing in it to build up the material of their own bodies. If this were the case it would be impossible to understand the fact that they grow quite as luxuriantly when the nitrogen they require is supplied to them in the form of salts of ammonia, as when it is in the form of ready-made albumen; for clearly it must require a much greater expenditure of plastic energy to build up protoplasm of elements derived

from such sources, than merely to convert one albuminous compound into another. It therefore seems probable that bacteria do not use the material on which they feed until it has already been converted by oxidation or by splitting into lower chemical combinations.

The question how far microzymes are the cause of putrefaction will I think be elucidated by the results of the following experiments. It will be shown that so long as the germinal matter of microzymes is excluded, animal fluids or tissues withstand decomposition for very long periods, while the slightest contact with media containing this material at once determines septic changes. Consequently it can be asserted positively that under certain circumstances the presence of microzymes excites putrefaction; but the facts do not afford grounds for stating that they are the cause of putrefaction, or that if it were not for them the process would be postponed indefinitely. It is indeed asserted by chemists, and we do not propose to deny, that organic matter may under the influence of heat and moisture alone, undergo decompositions which present all the chemical characters of putrefaction, even though no microzymes be present.

Method.—As regards the questions which form the principal subject of this report, we at present possess no exact information. As has been already stated, there is a general belief that microzymes exist potentially in the air, and it is also admitted that they may be met with in the blood in certain septic diseases. Hallier, on the other hand, finds them not only in septic, but in all contagious fluids, while Béchamp imagines that they form part of healthy structures. To determine these questions it was necessary (1) to subject the media to the action of some qualitative test by which the presence of the germinal matter of microzymes could be detected; and (2) to make experiments in which their action on the animal liquids and tissues would be observed under conditions similar to those which exist in the living body. As a test for the presence of microzyme germs we have used first, Pasteur's solution, and secondly animal fluids, either diluted with pure water or undiluted. These liquids were selected on the ground first that they contain nitrogen, in the one case in the form of an ammonia salt, in the other in that of an albuminous compound, and secondly that although transparent and free from visible particles when fresh, they become in a short time peopled with microzymes when kept under ordinary circumstances and at ordinary temperatures. Before using them, however, for the purpose intended, it was necessary to determine that they do not in themselves contain the conditions of evolution; in other words, that they can be prepared and kept in a state of absolute barrenness without prejudice to those qualities by which they are fitted to be employed as tests. These requirements could only be satisfied by a preliminary series of experiments having for their purpose to determine the question of so-called "spontaneous generation," not in general, but with respect to the particular liquids to be used. In approaching a question of such difficulty, even with the limitation above stated, there are two methods of inquiry which suggest themselves; one consists in the comparison of results obtained when the cause to be investigated is present, with those which are produced when it is absent, all other conditions remaining unaltered (method of crucial experiment); the other in the comparison of variations in the results with variations in the circumstances that lead to them (method of concomitant variations). We shall find that the first of these methods, which is clearly the most conclusive, is as applicable as the other to the particular question before us, that of the spontaneous evolution of

organic forms in any given medium. But even if it had not been so, the other method would still have been open to us, for if it could be shown that the appearance of microzymes in a given liquid is either delayed or diminished, in a degree proportionate to the degree of exposure to external influences, it might be safely inferred that exposure to the air is the efficient cause of their development. In the present instance it is possible to exclude all conceivable sources of contamination, and so to obtain a positive answer to the question, but this does not render it the less advantageous to compare the varying effects of contamination with the conditions to which they correspond, for by so doing we acquire a better knowledge of the nature of these causes, and of the means of obviating them.

The experimental results are stated under three headings, according as they relate to the conditions which limit the evolution of organic forms, and particularly microzymes, in test liquids; to their distribution in ordinary water and in most substances; and lastly to their occurrence in the tissues and liquids of the animal body.

While considering myself exclusively answerable for the accuracy of every statement contained in the report, I am anxious that in so far as the investigation has been a successful one, my assistant, Dr. Ferrier, by whom many of the experiments were both planned and carried out, should participate in whatever credit may be accorded to me.

Section I. — Experimental Determination of the Conditions which govern the Development of Microzymes in certain Organic Liquids to be used as Tests.

I.

Experiments with superheated liquids. Serum.

July 22d, 1870.—A large number of capillary tubes prepared for the purpose were filled with serum of blood obtained from a guinea pig a few hours before. According to the mode of filling, and the conditions under which they were subsequently placed, the tubes were divided into five batches, designated respectively *a*, *b*, *c*, *d*, and *e*. The tubes *a* were exposed, unsealed, to the air of the laboratory; *b* were hermetically sealed; *c* were sealed, and thereafter placed in the incubator, in which a temperature of about 40° C. was maintained during the whole period of the investigation, with the aid of a Geissler's regulator; *d* were sealed and heated in the oven to 180° C., and thereafter exposed to the air of the laboratory by breaking off one end; *e* were sealed and heated in the same manner as *d*, and then placed in the incubator. The tubes were examined at various periods within a month after they were prepared. Bacteria were found in numbers in *a*, *b*, and *c*, but no organic forms could be detected in *d* and *e*. The remainder of these two batches were therefore preserved for further examination, until the beginning of March 1871. They then exhibited the appearances always observed under the microscope in superheated serous liquids,* but on the most scrupulous examination no organic forms could be discovered either in the tubes which had been kept at the ordinary temperature, or in those which had remained in the incubator.

Alkaline serum.

On August 11 the experiments were repeated under similar conditions, with the exception that the serum employed to fill the tubes was first rendered alkaline by the addition of 0·5 per cent. of soda. In

* The most remarkable peculiarity of such liquids is that they contain masses of apparently semi-fluid material resembling oil drops. These masses are of a distinctly yellow colour, and vary indefinitely in size. They are found in superheated liquids immediately after they are prepared.

this case no organic forms had appeared in any of the tubes at the end of a month, nor could any be discovered afterwards. The superheated tubes were examined with the rest in March 1871, with the same result. Two quantities of the same serum were kept in glasses side by side in the laboratory, to one of which only, soda had been added in the proportion already mentioned. In the one containing no soda a luxuriant growth of bacteria and leptothrix appeared in a few days, but nothing whatever could be found in the other. Soda, therefore, in the proportion of half per cent., appears to prevent the development of microzymes.

II.

Albumen of egg.

August 24, 1870.—The albumen of a fresh egg was collected in a clean dry test glass, and several tubes of tolerably large size were filled in the ordinary way and hermetically sealed. Some of them which were not heated were kept at the ordinary temperature, others were subjected in the hot-air oven to a temperature of 200° C. All of these tubes were kept until March 1871, when it was found that the unheated tubes were still perfectly clear, with the exception that on the side which was undermost as the tube lay on the shelf, its internal surface was lined with whitish granular deposit. The liquid showed no other change, and on a microscopical examination no organic forms could be found. The superheated tubes were in this respect in the same condition. From the negative results in the tubes which had not been heated, it might be inferred that white of egg is incapable of maintaining the life of microzymes, but we shall see hereafter that the fact admits of a totally different interpretation.

III.

Pasteur's solution.

August 30.—A large number of capillary and other tubes were filled with a solution of sugar, tartrate of ammonia, and yeast ash, according to M. Pasteur's formula, and divided into two batches, designated respectively *a* and *b*. Some of the tubes *a* after having been sealed, were kept either at the ordinary temperature or in the incubator. The rest were left open and kept in the laboratory. *b* were sealed and raised to a temperature of 200° C. Some of them were afterwards placed in the incubator, others remained at the ordinary temperature. Specimens of *a* and *b* were examined at various periods up to March 1871. All of the tubes *a* became turbid sooner or later, and were then found to be crowded in different degrees with bacteria and fungi (torula cells and mycelium). When the remaining tubes were finally opened it was found that in many of them gas had been disengaged in such quantity, that when the end of the tube was broken off the liquid was expelled with violence. In others this evidence of increased tension was wanting. On comparative microscopical examination it was found that the liquid in these last, contained no torula cells. *b* were kept till March 1871, at which time they were found to exhibit no trace of organic life, whether they had been kept in the incubator or at the ordinary temperature.

IV.

Experiments with liquids under diminished barometrical pressure.

August 18.—It has been imagined that the so-called spontaneous evolution of organic forms is materially increased when the air to which the liquid is exposed has a tension much inferior to that of the atmosphere, and conversely that in liquids subjected to pressures greater than that of the atmosphere the development of such forms is arrested. The following experiments were made to test this supposition. Several

capillary tubes were filled with fresh serum of blood of a rabbit, kept in an ordinary clean glass. These were sealed and placed in a larger glass tube closed at one end, which after having been drawn out at a short distance from its open end was attached thereby to one branch of a T tube by means of a vulcanite junction. The stem of the T tube was then connected with an air pump, and the other branch with a long barometer tube standing vertically in a cup of mercury. The air was then exhausted, and as soon as the mercury had risen in the barometer tube 15 inches, the flame of a blow-pipe was directed against the narrow drawn-out part of the experimental tube, which was thus sealed while the air which it contained had a tension not more than half that of atmospheric air. The tube was then shaken so as to break all the capillary tubes, so that the whole of the liquid which they contained was exposed to the pressure above indicated. It was then kept at the ordinary temperature. Another tube was filled with capillary tubes containing serum, exhausted to 15 inches, and closed hermetically in the same way. It was then placed in the oven and raised to a temperature of 200° C., after which the capillary tubes inside were broken as before, so as to expose the liquid to superheated air at 15 inches pressure. Both of the tubes were kept until March 1871. On opening the one which had not been heated, air rushed into it with great force. Its contents had a putrid smell, and the liquid on microscopical examination was found to contain numerous bacteria. When the superheated tube was opened, the ingress of air was equally forcible, but on microscopical examination no trace of organic forms could be discovered.

From this experiment it would appear that diminished tension has no very considerable effect on the process we are studying. It is further evident that the non-appearance of organic forms in superheated liquids cannot be accounted for by supposing that it is attributable either to the relatively large proportion of the liquid, as compared with the volume of the air which is enclosed with it, or to any other circumstance arising from its being contained in so small a receptacle. A third experiment of the same kind was made on August 30th. A number of capillary tubes were filled with Pasteur's solution, and then sealed and introduced into a large tube, closed in the same manner as in the previous experiment. The whole was then subjected to a temperature of 170° C., after which the contained tubes were broken by shaking. On examining the liquid contained in the broken capillary tubes after several months no organic form could be detected.

Non-appearance of microzymes in superheated liquids.

The above observations (I. to IV.) show conclusively that no evolution of organisms takes place in superheated liquids, provided that the air with which they are in contact has also been superheated, whether they are kept at an ordinary temperature or at that of the body ; and that the effect is not modified, either by the tension of the air or by its quantity as compared with that of the liquid ; and it is further shown that in all the experiments, organisms appeared in the same liquids kept under precisely similar conditions, which had not been superheated. Before, however, drawing any further conclusions from these facts it may be inquired, in how far the cause of the non-appearance of organic forms is dependent on the liquids having undergone chemical changes of such a nature as to render them incapable of supporting life, in which case the negative results obtained could not be attributed exclusively to the non-exposure of the liquids to external media. It will be shown in the sequel that this is true as regards microzymes, that is to say, that superheated organic liquids are incapable of supporting the life of these organisms. It is therefore clear that such liquids do not furnish a suitable soil for studying the question we have in view. With respect to

fungi, however, the case appears to be different; for numerous experiments show that superheated liquids, and particularly Pasteur's solution, when freely exposed to the air in a watch glass or an open tube, become eventually covered with tufts of penicillium.

In the further progress of the inquiry it was found entirely unnecessary to employ so high a temperature as 170° to 200° C. in order to prevent the evolution of organic forms, provided that the liquids are protected from contamination by external media. The experiments which led to this result were as follows :—

V.

Experiments relating to boiled liquids. Serum.

August 10.—A number of tubes were filled with serum of rabbits' or sheep's blood. They were then sealed and boiled for an hour or two in a water bath, in consequence of which the liquid contained in several of the tubes became gelatinous, still, however, remaining perfectly transparent. From time to time during the next few months a tube was broken for microscopical examination of its contents, the result being always negative. In March 1871 the remaining tubes were finally examined. No organic forms could be traced either in those which were gelatinous or in those which remained liquid.

Fig. 1. Tube used in this and the following experiments; the tube is shown in the closed state, and of the actual size.

VI.

Pasteur's solution.

October 5.—Pasteur's solution was prepared according to formula (the distilled water employed for the purpose being obtained from Messrs. Hopkin and Williams), and placed in a clean capsule. A number of tubes of various sizes were then filled, in the manner already described, with the solution (which had not been heated), and sealed. The solution was then boiled in the capsule for a few minutes, and another batch of tubes were filled in the same manner by breaking their points underneath the surface of the liquid while it was still in a state of ebullition. Each tube was sealed the moment it was withdrawn from the boiling liquid. The two sets of tubes were placed side by side in the laboratory under precisely similar conditions. Some of them were examined microscopically on the 17th. In those of the first batch microzymes in immense numbers, and torula cells, were found along with several filaments of *sporotrichum*. No organisms whatever existed in any of the tubes containing the boiled liquid. Single tubes of both batches were examined from time to time until March 1871, the results being always the same. Hence it was concluded that thoroughly boiled liquids, preserved in tubes first prepared and sealed, remain perfectly free from organic forms.

VII.

Effects of exposure of the liquids to the atmosphere.

October 5.—Four tubes, each a quarter of an inch in diameter, were prepared in the usual manner and filled with Pasteur's solution which had not been boiled. Tube *a* was placed vertically in a cork support, its end being truncated so as to expose the upper surface of the liquid to the air. Tube *b* was also

placed upright, its upper end having been previously drawn out to a long capillary beak, the tip of which was broken off, so that the interior of the tube communicated with the atmosphere by a small aperture. Tube *c*, of the same form as *b*, was also placed vertically, but its open point was bent downwards at a very acute angle. Tube *d* was sealed at both ends.

Four similar tubes marked respectively *a'*, *b'*, *c'*, *d'*, were then filled with boiling solution and placed side by side with the others, three of them having openings of the characters already described, the other being closed. On October 12 the only change which could be distinguished without the microscope was a very remarkable one. A tuft of penicillium had appeared on the surface of the liquid in tube *b'*, the interior of which communicated with the air only by a capillary aperture. Nothing was visible in the others; but a few days later it was observed that all the open tubes (*a*, *b*, *a'*, *b'*), excepting those of which the ends had been bent down, had similar tufts. In the course of the following six weeks the tufts increased considerably in size. On the 24th of November the liquid in tubes *c* and *d*, in which no penicillium existed, was observed to be hazy and had a slight scum on the surface. Tubes *c'* and *d'* remained perfectly unaltered. The liquid in the open tubes was examined microscopically from time to time during the period of observation, the drop required for this purpose being on each occasion transferred to the object glass of the microscope either by means of a glass rod, the end of which had been first passed through the flame of a Bunsen's burner, or a capillary tube which had been drawn out immediately before, so as to avoid all risk of contaminating the liquid.

In all of the open tubes containing unboiled solution torula cells and microzymes began to appear after the first week. On November 24 they existed in great numbers, in addition to mycelium and filaments and spores of sporotrichum. In the closed tube *d* there were bacteria but no torula or penicillium. At the same date the open tubes *a'* and *b'*, containing boiled solution, were free from microzymes, but contained numerous torula cells and mycelium. *c'* and *d'* were not examined until the 4th of January, at which time both liquids were perfectly clear and contained no organic forms of any description.

VIII.

October 5.—Two test glasses were placed side by side on a shelf under a glass shade, one of which, marked *a*, contained unboiled Pasteur's solution, the other, marked *b*, boiled solution. On October 10 glass *a* was turbid, and was found on microscopical examination to be teeming with bacteria; a thick whitish scum had formed on its surface. Glass *b* was perfectly clear; there were, however, great numbers of torula cells on its surface, but no bacteria. On October 12 *b* exhibited numerous tufts of penicillium, but the liquid still remained limpid and free from bacteria; five days later similar tufts appeared on the surface of *a*.

In the last two experiments it is seen that fungi (torula and penicillium) appeared in unboiled solutions whether they were exposed or not, but much more abundantly when they were exposed than when they were protected; and that in boiled solutions the growth of penicillium was somewhat more luxuriant than in unboiled under similar circumstances of exposure. Microzymes did not appear in the boiled liquids under any circumstances, but were quite as numerous in the tube *d* (Obs. VII.), which remained closed for many months, as in any other of the same series. From these facts it seemed clear, not merely that the conditions of origin and growth of microzymes and fungi are considerably different, but that as regards the former the germinal matter from which they

spring *does not exist in ordinary air.* The experiments to be next related, however, showed that it would have been wrong to have inferred from these facts that the boiling of a liquid is of itself sufficient to prevent the development in it of these organisms, or that their complete absence in the tubes of the second series of Observation VII. (*a'*, *b'*, *c'*, *d'*) was exclusively attributable to this condition.

IX.

Experiments as to the effect of contact of liquid with glass surfaces.

October 25.—A solution (A) according to Pasteur's formula, was prepared in the same manner as before, with the exception that water distilled on the same day in the laboratory was used instead of the ordinary distilled water, great care being taken to prevent its contamination. At the same time another solution (B) was made with the same water, of materials which had been previously heated in the hot-air bath to 110° C. Eight glasses were at the same time prepared, of which four, marked severally with the odd numbers 1, 3, 1′, and 3′, were washed and dried with a towel. The remainder, numbered 2, 4, 2′, and 4′, were immersed for some time in a vessel of boiling water and then dried as before. The two solutions were then distributed in these glasses as follows :—In 1 and 2 solution A unboiled; in 3 and 4 the same solution after previous boiling ; in 1′ and 2′ solution B unboiled ; in 3′ and 4′ the same after boiling. Glasses 1, 2, 1′, and 2′ were placed under one shade, and the other four glasses under another, On November 1, tufts of penicillium were obvious on 1, 2, 1′, and 2′, and were beginning to appear on the rest. The liquids were examined microscopically at this date and again on November 8, when the tufts had increased in size. All contained torula cells and mycelium, but microzymes were found only in 1, 3, 1′, and 2′. Thus it appeared that neither the boiling of the liquids, nor of the glasses, nor the superheating of the materials, had exercised any appreciable influence in preventing the development of microzymes. It was still more remarkable that in glass 2, which contained unboiled solution, none of these organisms could be discovered.

These facts, apparently so contradictory, were explained by subsequent experiments.

X.

Experiments as to the purity of distilled water.

November 11.—Pasteur's solution was prepared with ordinary distilled water obtained from Messrs. Hopkin and Williams, and distributed in five glasses designated by numbers, the conditions being as follows :— 1, a clean test glass, taken from the shelf, was filled without further cleansing with solution which had not been subjected to heat ; 2, a similar glass, previously rinsed with distilled water, was filled with the same liquid ; 3, a glass just before heated to 200°C. was also filled in like manner. The other two glasses (4 and 5) were charged with boiled liquid, the method used being to boil the solution in a test tube for a few minutes, then to cool it rapidly by dipping it in a stream of cold water, and transfer it at once to the experimental glass. Glass 4 was merely rinsed with distilled water ; 5 was previously heated to 200° C. The results were as follows :—On November 20, torula cells were found on the surface of all the liquids. On the 26th, bacteria had appeared in immense numbers in 1, 2, and 4, so that the liquid was milky. In 3 it was apparently clear, but was found on microscopical examination to contain bacteria. Subsequently it also became opalescent. At the same date all the glasses showed tufts of penicillium ; those on 3 and 5 were more advanced than the rest, and had become greenish from the development of heads of spores. At this time, and on all subse-

quent occasions, the liquid in 5 was found to be perfectly limpid and free from microzymes.

The conditions under which the liquid in glass 5 was placed differed from those to which that in glass 4 was subjected in one particular only, viz., in the fact that the former, instead of being rinsed with distilled water and dried, had been superheated. The teaching, therefore, of the experiment was, that the germinal particles from which the microzymes sprung must have been contained either in matter adherent to the surface of the glass, or in the distilled water used to cleanse it, or in both. That the former was not without its influence is rendered probable by the circumstance that in glass 3, which differed from 2 only in having been superheated, bacteria appeared latest. To determine this question was the purpose of the next experiments.

XI.

Comparative experiments relating to both of the conditions last mentioned.

December 1.—Pasteur's solution was prepared with water obtained from a well at Stevington, in Bedfordshire, which was sent to the laboratory for microscopical examination. The water in question was perfectly limpid, but after it was allowed to stand, a few microzymes could be discovered in the surface layer. None could be detected in the rest of the liquid. It contained a scanty deposit in which one or two *monera* occurred. The solution was distributed in five test glasses, the conditions being as follows :—1, the solution was boiled in a tube, cooled rapidly, and then poured into a test glass which had just been heated to 200° C.; 2, solution boiled in the same manner was transferred to a glass which had been rinsed and dried ; 3, the boiled solution was received in a superheated glass, but just before pouring it in, *the glass was rinsed with ordinary distilled water ;* 4, the conditions were exactly the same, excepting that the distilled water used for rinsing *had first been boiled ;* 5, the solution was not boiled, but the glass in which it was placed had been previously superheated. The five glasses were numbered in the order in which they have been referred to, and placed under one shade. On December 7, 5 was already milky, the turbidity being due to torula cells and bacteria ; 2 and 3 also contained bacteria. On December 8, the turbidity of 5 had increased, and 3 was opalescent. There were no microzymes either in 1 or 4. On the 13th, there were tufts of penicillium on all the liquids ; the tufts were more advanced in fructification in 1 and 4 than the rest, but these liquids were still entirely free from microzymes. The last examinations were made on the 21st of December, when 1 and 4 were still in the same condition.

Here the two liquids in which no development of microzymes took place differed from each other in the circumstance that the glass in which one of them was contained (4) was rinsed with boiled distilled water just before it was charged, both glasses having been superheated. On the other hand, 3, in which microzymes appeared, differed from 4 only in the omission of the boiling of the water used for cleansing. By the comparison of these two results we were enabled to conclude that ordinary distilled water may contain the germinal particles of microzymes in such profusion that even so small a quantity as is introduced into a glass in rinsing is sufficient to render a relatively enormous volume of liquid fruitful. The following is one of a series of experiments which were made to confirm this result :—

XII.

Control experiments.

December 3.—Pasteur's solution prepared with the same (Stevington) water was distributed in six glasses, all of which were superheated.

Of these three, marked *c*, were filled with solution which had not been boiled, the remainder, *b*, with boiled solution. They were placed in pairs, one of each series in each pair, in different rooms. On December 8, the glasses *c* were all hazy, and found to contain innumerable bacteria, *b* were perfectly transparent; as time went on the contrast became more and more striking in consequence of the increased turbidity of *c*. Subsequently tufts of penicillium appeared on the surfaces of all the glasses, which in this as in the previous experiments progressed more rapidly in the clear solutions than in the others.

This experiment was repeated several times with corresponding results.

In many preceding experiments it has been shown that although torula cells and penicillium appear invariably and without exception on all nutritive liquids of which the surfaces are exposed to the air, without reference to their mode of preparation, no amount of exposure has any effect in determining the evolution of microzymes. This conclusion although it is in complete accordance with what we have already learnt as to their relations both in the visible and invisible state to moisture, is of such importance that it seemed necessary to establish it by special experiments.

XIII.

Experiment showing the living microzymes are not contained in the atmosphere.

January 7.—The bent glass tube for the absorption of carbonic acid by potash, known as Liebig's bulbs, was heated to 200° C. and filled with boiling test solution. It was then attached by a vulcanite connecter which had been previously boiled, to an aspirator. During the following week air was drawn through it for a few hours daily. On the 23rd there were numerous torula cells with submerged tufts of mycelium in the liquid, especially in those bulbs to which the air had access first, but no trace of microzymes. On March 18 the surface of the liquid in the first bulb was crowded with a dense crust of penicillium; in the last bulb there were no tufts, and the liquid was still entirely free from microzymes. The result shows in a most striking manner not only that ordinary air is entirely free from living microzymes, but that the activity of the development of penicillium is in proportion to the degree of exposure.

XIV.

Another experiment yielding a similar result.

March 2.—A test tube, containing Pasteur's solution, in which there were immense numbers of microzymes and torula cells (penicillium), was plugged with cotton wool, boiled for a few minutes, and placed, still plugged, in a rack, where it remained for some time. The liquid which at the time of boiling was quite opalescent, gradually became clear, from the subsidence of the organisms it had contained. It remained perfectly clear and free from organic forms until the 18th of March. The plug of cotton wool was then removed, soon after which tufts of penicillium appeared on its surface; but up to the present time (March 31) the liquid is entirely free from microzymes.

Section II.—Distribution of the Germinal Matter of Microzymes in ordinary Water.

Having thus found in a number of cases that either contact with surfaces which had not been superheated, or the admixture of water which had not been boiled, was the exclusive cause of the growth of microzymes in the experimental liquid, it was not necessary to go far in order to arrive at the inference that water is the

primary source from which the germinal particles of bacteria are derived, whenever they seem to originate spontaneously in organic solutions. To prove this a number of experiments were made with different varieties of water in ordinary use, in order in the first place to confirm the observations already made, and to ascertain whether all waters possess the properties in question in a like degree.

XV.

Effects of impregnation of test liquid (*i.e.* Pasteur's solution) with various waters.

January 2, 1871.—A number of eprouvettes of the form shown in the margin were placed in the hot-air oven and heated to 200° C. They were then filled with Pasteur's solution made with ordinary distilled water, under the following conditions:—*a* Solution not subjected to heat. *b* Solution introduced boiling, which was then allowed to cool; immediately after, a single drop of cold distilled water was added to it. *c* The same as *b*, with the exception that water from the tap was used instead of distilled water. *d* The eprouvette was filled with boiled solution, as in *b* and *c*, but nothing was added to it. The glasses were then carefully plugged with cotton wool. On January 12, glass *a* was quite milky in appearance, and had a gelatinous scum on the surface. It contained myriads of bacteria and a few torula cells. Glasses *b* and *c* were also turbid, the former more than the latter. The microscopical appearances were the same in all. In *d* no change could be detected either by the naked eye or with the microscope. Some of the liquid which remained in a glass exposed to the air was covered with tufts of penicillium.

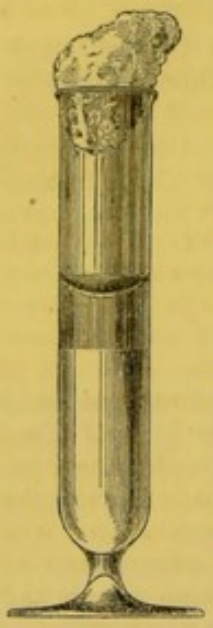

Fig. 2. Eprouvette used in this and the following experiments. It is plugged with cotton wool and charged with test liquid, to which distilled water has been added in the prescribed proportion, so as to avoid mixing. After standing a week the upper layer, with which distilled water is mixed, has become turbid.

In this experiment, which was confirmatory of the preceding, it is worthy of note that of the two waters used to impregnate the test solution the most decided effects were produced by the distilled water.

XVI.

Mode by which distilled water, originally pure, may acquire the zymotic property.

January 17.—Pasteur's solution was made with ordinary distilled water. A sufficient quantity was then boiled, and immediately distributed in four eprouvettes, all of which had been heated immediately before to a temperature of 200° C., the quantity of liquid in each being about equal. The conditions of experiment were as follows:—1, the liquid was allowed to cool, and then three drops of freshly distilled water were added to it with the aid of a small pipette which had just been heated in the flame of a Bunsen's burner. This water was collected in a superheated glass from the glass distilling apparatus, which had been previously thoroughly steamed out: 2, the same, excepting that three drops of ordinary distilled water were used: 3, three drops of water from the tap were added. To a fourth eprouvette no addition was made.

On January 24 the liquids in 1 and 4 were perfectly limpid, and showed no trace of organic forms; 2 and 3 were milky, especially the former. Both contained innumerable bacteria. Up to the present time the eprouvettes 1 and 4 remain perfectly barren.

This experiment shows that if due precautions are taken, distilled water may be obtained in such complete purity that it is free from germinal particles, whether of microzymes or fungi; and that the zymotic power (if I may be permitted to use this term to express the faculty to determine the development of organic forms in a test solution to which it is added) of ordinary distilled water is acquired after distillation, either by mixture with extremely small quantities of other waters, or by contact with the surface of the vessels in which it is contained. It was also evident that between waters of different kinds and of different sources there are corresponding differences in the degree of zymotic effect they produce, whence it seemed probable that a practical method of judging of the amount of zymotic impurity contained in any two waters might be founded on the comparison of the degree of opalescence produced by each in the same time and at the same temperature. In how far this surmise was justified may be judged of by the results of experiments to be hereafter referred to, relating to the zymotic powers of the waters supplied to the metropolis.

If the apparently inevitable contamination of originally pure water, when kept, is due not merely to admixture with other water, but also to contact with surfaces impregnated with living matter, it becomes of interest to inquire by what conditions the action of such surfaces is limited or determined. In the course of one of the observations already related it was observed that a boiled liquid contained in a superheated test glass, which had long remained perfectly limpid, and entirely free from organic forms, became turbid after a pipette employed in order to procure a specimen for microscopical examination had been dipped in it; and that the time which intervened corresponded with that which usually elapses after impregnation before the effect manifests itself. This occurrence suggested the following experiments, which were undertaken in order to ascertain how far it is necessary that a surface should be moist in order to its acting zymotically.

XVII.

Impregnation of test liquid by moist surfaces Effects of different degrees of desiccation.

January 30.—A glass rod was charged with bacteria by dipping it into a solution on the surface of which there was a viscous scum, consisting entirely of these bodies imbedded in gelatinous matrix. The rod was allowed to dry in the air for a few days; it was then introduced into boiled test solution contained in a superheated glass. On February 6 the liquid was already milky and teemed with microzymes. On the same day a portion of the same scum was introduced into a test glass and dried with a gentle heat. The glass was then filled with test solution which had just before been boiled and cooled in the usual way. The result was the same as in the previous experiment.

In these instances it may be readily understood that the drying was very imperfect. To determine the effect of more complete desiccation, an eprouvette containing one cubic centimetre of cold water previously ascertained to be zymotic, was evaporated to dryness in the incubator and kept for some days at a temperature of 40° C. On February 20 the dried glass was charged with boiled and cooled solution, and plugged with cotton wool in the usual way. The liquid was examined microscopically on March 2, when it contained numerous torula cells, but no trace of microzymes. It therefore appeared that the germinal particles of microzymes are rendered inactive by thorough drying without the application of heat. As, however, it could not be concluded therefrom that drying acted in a similar manner on the microzymes themselves, an experiment was made on this point also.

XVIII.

March 4.—As it appeared probable that in the previous experiments with bacteria scum, desiccation might be prevented by the gelatinous matrix, a portion of the same scum was thoroughly washed with water, collected in an eprouvette, and dried for some days in the incubator. The eprouvette was then (March 4) charged with boiled and cooled Pasteur's solution, and plugged with cotton wool. On March 11 the liquid was slightly hazy, but on microscopical examination was found to contain no trace of microzymes. The haziness was due to the presence of torula cells in great numbers. On the 18th the appearances were similar, but mycelium now existed in addition to torula. It thus appeared that fully formed bacteria are deprived of their power of further development by thorough desiccation; so that we may conclude that *the contamination of water by apparently dry surfaces happens only in those cases in which desiccation is incomplete.* It will be seen that this conclusion is quite consistent with the previous observations.

Method of testing the zymotic property of water.—As a test of the faculty possessed by all water which is not absolutely pure, of determining the growth of microzymes, Pasteur's solution gives results so constant and satisfactory that it appears scarcely necessary to seek for better, although there is no doubt that many other liquids would answer the same purpose, and that some would react with greater delicacy. The method consists, as already indicated, in the addition of a small quantity of the suspected water to a relatively large volume of the solution. As it is very desirable that the conditions of experiment should be subject to as little variation as possible, in our test experiments we add one drop of water to a centimetre of solution, always using the same dropping pipette. As the eprouvettes commonly employed contain five centimetres when half full, this quantity is preferred, so that in the following paragraphs the term "charged eprouvette" is understood to mean an eprouvette which has been first superheated and then filled to five cubic centimetres with boiling solution. After each testing the pipette is immersed for several minutes in boiling distilled water. In six days after impregnation with any zymotic water such an eprouvette becomes hazy. It need scarcely be added that in each experiment a second charged eprouvette must be placed beside the impregnated one for comparison. Both must be protected from the air by plugs of cotton wool.

From the most careful and repeated examinations of waters known to be zymotic, we have learnt that such waters often contain no elements or particles whatever which can be detected by the microscope; so that it may be concluded that the elements of which the germinal substance of microzymes consists are of extreme minuteness. It therefore appeared to be of great importance to extend our inquiries to water which is optically pure, not merely in the sense that it contains nothing which can be detected by the microscope, but in the much higher sense that when viewed in the electric beam by the method employed by Professor Tyndall it shows no haze. Unfortunately it is not as yet possible to procure such water. Professor Tyndall has, however, been good enough to give us the opportunity of testing specimens obtained by the fusion of ice which approach the standard of optical purity so nearly that the electric beam in passing through them displays a blue colour. Of the results of our examination of these specimens it is sufficient to state that they are as zymotic as many other varieties of water which in the beam are seen to be full of light-scattering particles.

To determine in how far the zymotic properties of water are affected

by chemical compounds which are believed to have the power of arresting the evolution of living forms in organic liquids, a series of experiments were made in which the zymotic power of water was tested before and after the addition of such compounds, the supposed anti-zymotic being contained sometimes in the water to be tested, sometimes in the test solution.

XIX.

March 2–10.—1. A quantity of water previously ascertained to be zymotic was ozonised by subjecting it to the action of air which had passed over fresh and moist phosphorus, the apparatus for this purpose consisting of (*a*) two Woulff's bottles containing sticks of phosphorus; (*b*) a washing bottle containing solution of caustic potash; (*c*) a flask containing the water to be ozonised. Air was made to pass slowly through *a*, *b*, *c* in succession, by means of an aspirator, for several hours, after which the liquid in *c*, and the air in contact with it, reacted strongly on iodide of potassium and starch paper. Charged eprouvettes were then (March 2) prepared in the usual way, to each of which a few drops of the ozonised water was added. On March 21 no organic forms whatever could be discovered in the liquid. The plugs were then removed. On the 27th the first tufts of penicillium appeared, which have increased up to the present time. There are no microzymes in the liquid. Experiments as to disinfectants. Ozone.

2. Water known to be zymotic was treated with Condy's liquid in quantity sufficient to colour it slightly. A few drops were then (March 2) added to a charged eprouvette. Up to the present time the liquid remains free from microzymes, but contains torula cells. On the same day a second charged eprouvette was treated with two drops of undiluted Condy's liquid and plugged It remained absolutely barren till March 21, when the plug was removed. In a few days torula cells appeared, and on the 27th there were tufts of penicillium. Permanganate of potash.

3. A charged eprouvette was impregnated (March 2) with ordinary distilled water containing 0·1 per cent. of carbolic acid. At the end of a week the liquid was hazy and teemed with bacteria and torula cells. Ultimately penicillium tufts appeared on the surface. On March 8 the experiment was repeated with water containing 0·5 per cent. of carbolic acid. It remains up to the present moment free from microzymes, but contains torula cells and mycelium. Carbolic acid.

4. A charged eprouvette was impregnated with ordinary distilled water (March 2) containing 0·1 per cent. of sulphate of quinia, and plugged. At the end of a week it was opalescent and full of bacteria; it also contained torula cells and mycelium. On March 8 the experiment was repeated with water containing 0·5 per cent. of the salt. At the end of a week it was hazy, but on microscopical examination this was found to be due exclusively to torula cells. Quinine.

5. March 11. A charged eprouvette was impregnated with distilled water containing 10 per cent of the solution of peroxide of hydrogen. The liquid remained free from microzymes until March 21, when the plug was removed. Tufts of penicillium had already appeared on the 27th. Peroxide of hydrogen.

6. March 11. A charged eprouvette was impregnated with distilled water containing five per cent. of liquor chlori. The liquid remained barren until March 21, when the plug was removed. It is now crusted with penicillium. Chlorine.

7. February 13. A superheated eprouvette was charged with some of the superheated Pasteur's solution which had been prepared five months before. The liquid was then impregnated with distilled water Superheated test solution.

known to be zymotic. On March 4 the liquid was examined and found to be entirely barren. It was then treated with boiled solution of pure sugar. As on March 21 the liquid was still entirely free from organic forms it was sown with some fresh spores of penicillium. Up to the present time there has been no change.

XX.

Experiments as to the zymotic property of water supplied to the metropolis.

February 23.—For the purpose of investigating the zymotic property of any water, it may be conveniently collected in a tube of the form and size shown in the margin. It is essential that it should be used in a state of absolute purity. As it is seldom possible to draw the tube at the time that it is to be filled, it must, as a rule, be prepared beforehand, in which case it is necessary to close it hermetically at both ends before it is removed from the flame. Such a tube obviously contains calcined air, of which the tension is very much less than that of the atmosphere; consequently it is very easily filled by breaking off its end under the surface of the water of which a specimen is to be collected. If the water is flowing from a tap or in a stream it must be received in a boiled capsule, in the contents of which the tube may be dipped.

Fifteen specimens of water supplied by the London companies were collected in this way during February last, and tested with reference to their zymotic power on the 23d of the same month. The results of the experiment are exhibited in the following table, in which the number printed below the designation of each specimen indicates the order in which it would have stood if the tubes had been arranged in a linear series according to the degree of turbidity which each manifested on the ninth day after impregnation.

Letter designating Water Company.	Water before filtration (from subsidence reservoir).	Water after filtration (from pump well).	Water as distributed (from main).
A	15	3	13
B	14	10	7
C	5	2	6
D	1	12	8
E	4	9	11

The specimens to which the numbers 15, 14, 13, 8, 7, 5, correspond, became hazy as early as the fifth day. On the ninth day it is noted that the eprouvettes to which the six highest numbers correspond were milky, while those in which the turbidity was least marked were merely hazy; the rest are described as being opalescent. All therefore acted zymotically in different degrees.

All of the eprouvettes were plugged with cotton wool. As in previous experiments, the quantity of water introduced was in each case measured with the same pipette, which was immersed in boiling distilled water for a few minutes between each impregnation. A check eprouvette was then impregnated in the same way as the rest with the water in which the pipette was washed. It remains to the present moment perfectly transparent and barren.

Excepting in so far as this experiment shows that filtration exercises no perceptible influence on the zymotic power of water, no conclusion can be drawn from the comparison of the results. It happens that the water designated C stands considerably higher than the rest, and that designated A considerably lower. It would be premature, however, to attach importance to this fact.

Section III.—Circumstances which determine the Existence of Microzymes in Organic Liquids and Tissues.

The experiments to be related in the following paragraphs were undertaken for the purpose of ascertaining whether the tissues and liquids of the living body participate in the zymotic property which has been shown to exist in ordinary water and moist substances: in other words, whether the living matter with which the body is in constant contact by its external surface penetrates into its interior.*

XXI.

Experiments showing that the normal liquids and tissues do not possess the zymotic property. Blood.

March 24.—A glass canula of suitable size, which had just been drawn, was introduced into the carotid artery of a rabbit, and secured with a ligature. The arterial blood as it flowed from the canula was received into four ordinary test glasses (marked *a*, *a*, and *b*, *b*), and into an eprouvette (marked *c*). The quantities of blood collected in *a a* were mixed with boiled and cooled distilled water, and left freely exposed under a bell jar. In two or three days bacteria appeared and the liquid became offensive. The quantity in *b*, *b* was left undiluted, and each glass was covered with a layer of cotton wool. On the 30th they remained unaltered, and contained no organic forms excepting those proper to the liquids. They were then carefully mixed with boiled distilled water by the aid of a freshly prepared pipette, and again covered with cotton wool. [On April 3 the liquid was entirely free from microzymes, and exhibited no sign of decomposition.] The blood contained in the eprouvette was allowed to coagulate, and yielded a clot and very limpid serum. Up to March 30 it remained quite unaltered, and on microscopical examination it was found to be quite free from microzymes. On that day the serum was transferred by means of a superheated pipette into another superheated eprouvette, and diluted with boiled and cooled distilled water: it was then placed in the incubator. To the clot distilled water was added in quantity corresponding to that of the serum which had been abstracted: it was placed in the incubator. [When these preparations were examined on April 3, the serum was still limpid and perfectly free from organic forms, and the clot-preparation showed no change.]

Other experiments were made, consisting in impregnating charged eprouvettes with drops of blood taken directly from the finger, great care being taken in each case to cleanse the surface of the skin where the puncture was made. In each case the blood corpuscles subsided to the bottom of the eprouvette, leaving a clear liquid in which no development of microzymes took place, although they were kept under observation for several weeks.

We have no hesitation in attributing the development of bacteria in the liquid in the test glasses marked *a*, *a*, to an accidental contamination (*e.g.*, to the falling into the glass of a hair of the rabbit, or possibly a drop of saliva), and in concluding that normal blood contains no microzymes potentially or actually.

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* As to the existence of *visible* microzymes in the liquids of persons affected with contagious diseases, I had already satisfied myself that I could not accept Hallier's observations; for on examining the blood of patients affected with scarlatina (in which, according to Hallier's statement, micrococcus is constantly observed and very abundant) at all stages of the disease, I had found that no such bodies existed in it. It does not, however, follow from this that organisms are not present potentially, *i.e.*, in the form of germinal particles not distinguishable by the microscope.

XXII.

Tissues.

February 24.—A guinea pig was killed, and immediately after, the integument was stripped off the back. Portions of the muscles and cellular tissue of the rump were then rapidly cut out with scissors which had just been heated in the flame of a Bunsen's lamp. The pieces were then seized with the aid of glass hooks which had just been made for the purpose, and transferred into charged eprouvettes (marked *a*). Others were placed in superheated test glasses, and covered with boiled and cooled distilled water, but by accident one of them fell from the hook on to the table (marked *b*). The skin was then stripped off the thighs, which were immediately separated from the body with the same precautions as before, and hung up under a bell jar by wires which had been heated and cooled. The liquid in the eprouvette *a* was subjected to repeated examination until March 3, when it was still perfectly limpid and entirely free from organic forms. A single drop of common distilled water was then added to it. In a few days it became milky and acquired a putrid smell. In the glass *b*, there were already signs of bacteria on March 2, and the liquid soon became offensive. The thighs which were hung up, shortly became covered with a crust of penicillium. One of them was examined on March 9. On removing the crust and cutting into the muscle it was found to be less moist, but otherwise of natural appearance. There was a musty but no putrefactive smell. The cut surface was neutral to test paper. The other thigh was examined March 27, and was in a similar condition, excepting that the muscular substance was drier and of darker colour.

XXIII.

Experiments showing that the normal secretions are not zymotic.

Urine.

February 1.—Five centimetres of urine were introduced into an eprouvette, which was then plugged with cotton wool and placed under a glass shade. It retained its acid reaction and limpidity till February 9, when a drop or two of ordinary cold distilled water was introduced from a fine capillary pipette prepared just before. On the 16th the liquid was hazy and crowded with bacteria. In the course of a few days more, a sediment subsided to the bottom of the eprouvette, and the liquid became alkaline and ammoniacal. This experiment was subsequently repeated with similar results.

It has been long known that the tendency of urine to undergo decomposition may be obviated by protecting it against contamination from without. The preceding experiments show that here, as elsewhere, water is the contaminating agent.

XXIV.

Saliva.

January 2.—An abundant flow of saliva having been determined by introducing a few drops of ether into the mouth, one or two drops were allowed to fall into a charged eprouvette. The liquid was repeatedly examined during the next three weeks, but no microzymes could be detected. The salivary secretion, as it is discharged from the salivary ducts, is no doubt inactive; but inasmuch as the mixed liquid with which the mucous membrane is moistened is exposed to several sources of contamination, and moreover can be often shown to contain leptothrix filaments, it would not have been surprising if the result of the experiment had been otherwise.

XXV.

Milk.

It is scarcely possible to obtain milk in a state of purity, for the liquid as it issues is exposed to contamination both from the hands of the milker and from the surface of the teat itself. It is not therefore surprising that the results of our experiments with this secretion were not uniform. Their variations, however, exhibit so complete a correspondence with the varying conditions of the experiments, that they are scarcely less confirmatory of the general conclusions we have arrived at than if they had been positive.

February 28.—Milk was received directly from the cow into two flasks (marked *a* and *b*) which had been previously superheated. The flasks were immediately plugged with cotton wool. Another specimen of milk "as delivered to customers," was brought from the dairy at the same time in a clean bottle which had not been superheated. All the specimens were alkaline. On March 4 it was found that the milk in the bottle was slightly acid and crowded with bacteria. On the 9th it was curdled and smelt offensively. The flask *a* was also acid on March 4, and contained a few groups of bacteria. In the flask *b* the acid reaction was scarcely appreciable, and no bacteria could be discovered in it. On the 9th the contrast between *a* and *b* was still very striking, the liquid in *a* having separated into whey and curd, while *b* remained apparently homogeneous. Charged eprouvettes were then impregnated with drops of the liquid in *b* in which no bacteria could be detected. After a few days bacteria appeared in the test liquid, and in the liquid which still remained in the flask.

The difference between *a* and *b* was of course accidental, for both were exposed to equal chances of impregnation.

XXVI.

Albumen of egg.

Feb. 21.—It has been already stated that superheated tubes containing egg albumen which had been kept from August 1870 to March 1871 were found absolutely free from organisms, and to all appearance unaltered. The liquid contained in one of these tubes which was perfectly limpid was emptied into a superheated eprouvette and impregnated with two drops of cold distilled water. On March 2 the liquid had acquired a yellowish green tint, a scum had formed on its surface, and the liquid was full of separate bacteria.

XXVII.

Experiments showing that the liquid products of inflammation are also occasionally zymotic, but not always so.

March 20.—Pus was collected from a deep-seated abscess in the thigh of a child by introducing the capillary end of a collecting tube into the path of the bistoury which had been used for opening it, the bistoury having been itself immersed in boiling water. It was then transferred to a small eprouvette and exposed to the air. On March 30 there were no bacteria. It was then diluted with boiled and cooled distilled water. [It was again examined on April 3, when it contained no organic forms whatever.]

February 7.—A pyæmic abscess of the elbow joint was opened; a full stream of pus issued from the incision. Several large but still capillary tubes were then filled by inserting their open ends into the track of the bistoury. The tubes were immediately sealed, and the contents used the same day to impregnate a charged eprouvette. After a few days the test liquid was teeming with bacteria.* In this

* This important experiment could not be repeated, for an attendant who entered the laboratory in my absence carelessly destroyed all the tubes excepting the one which had been already used. The single result was so satisfactory that I myself entertained no doubt of its significance.

case the knife was not previously immersed in boiling water, but the discharge of pus from the wound was so copious that I do not think there is the slightest doubt that the quantity used was collected without any contamination, whether arising from this source or from the surface of the skin.

XXVIII.

Blister fluid.

The collection of blister fluid is attended with much greater difficulties than that of pus, for it is almost impossible to abstract it from the vesicles without risk of contact with the surface of the skin. It can be best obtained by opening both ends of a collecting tube, and then introducing the capillary end into a vesicle after first snipping the epidermis. This done, the liquid must be drawn into the tube by suction. Liquid thus collected was used as follows :—

January 10.—Blister fluid was added in the usual proportion (one drop to one cubic centimetre) to a charged eprouvette. For a long time the liquid remained clear, but eventually bacteria appeared in small numbers.

February 13.—Blister fluid from another source was used in a similar manner and with a similar result.

March 27.—The same experiment was repeated with different fluid, but in this case the eprouvette was kept in the incubator. The development of bacteria was much more rapid. On the same day another quantity of the same liquid was diluted with boiled and cooled distilled water in a superheated eprouvette and also placed in the incubator. [In a few days it became turbid and swarmed with bacteria.]

The equivocal results of these experiments are to be attributed entirely to the difficulty of obtaining blister fluid pure, that is, to accidental contamination in the process of collection.

Proofs that fungi are not developed from microzymes.

From the consideration of a number of facts which presented themselves in the course of the experiments related in the previous pages, it has appeared certain that there is no developmental connexion between microzymes and torula cells, and that their apparent association is one of mere juxtaposition. The grounds of this conclusion may be shortly stated thus :—

1. The prompt appearance of torula cells in Pasteur's solution whenever it is exposed to the air, and the rapid development and luxuriant fructification of the higher form (penicillium), show that so far as the chemical composition of the liquid is concerned, there exist in it all the conditions favourable to the process.

2. Our experiments prove that when precautions are taken to prevent contamination by impure surfaces or liquids, the development which ends in penicillium goes on from first to last without the appearance of microzymes.

3. Whenever it is possible to impregnate the test liquid with microzymes without at the same time introducing torula cells or germs, the development of the former begins and continues by itself without any transformation into the latter.

Thus fungi are not developed, *notwithstanding the presence of microzymes* in the same liquid in which, *microzymes being absent*, but air having access, they appear with the greatest readiness.

This being the case we are enabled to eliminate the question of the quasi spontaneous evolution of fungi altogether in the present discussion

as lying beyond the limits of our inquiry. It can hardly, however, be considered out of place to state to the reader some of the results to which our observations have led us with reference to this question, especially considering that however improbable it may seem to ourselves that fungi have any important relation with the processes of disease, there are others who are of a different opinion.

Modes of detecting organic forms in the air.

To determine the forms in which germs of fungi exist in the air, the best method is that long ago used by Pouchet—that of projecting a jet of air on a glass plate moistened with glycerine or syrup. A few experiments were made, but the results were mostly negative, for in London the particles of soot and refuse fragments which are collected by this method are so numerous that organised particles, even if present, could scarcely be distinguished. We find it a much more successful plan simply to expose a glass surface covered with glycerine to the air. In examining such a surface it was always possible to discover a certain number of cells which resembled torula cells, and occasionally penicillium acrospores.

From this result we do not, however, conclude that it is by these forms that the cosmopolitan fungus (as Hallier calls it) is usually propagated; it frequently happens that liquids which have been once exposed, although they contain no visible cells whatever, rapidly germinate without further exposure. We are also certain that although air is the main source of what we may venture to call fungus impregnation, as distinguished from impregnation with microzymes, yet the two acts may take place at the same moment—germs of torula being often contained in the same liquid media as the germ particles of microzymes. That this is so is proved by instances already referred to, in which liquids protected from air filled with torula cells. Here we relinquish this question, although in a biological point of view it is of the greatest interest and importance.

[Note.—During the printing of this report, which bears date March 31st, Dr. Sanderson has added to the last section, in brackets, a few further observations made during the first week of April.—J. S.]

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