Report on recent prevalence of erysipelas in the wards, 1874 / The Radcliffe Infirmary, Oxford.

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Radcliffe Infirmary.
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Publication/Creation

London : Robert Hardwicke, printer, 1875.

Persistent URL

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John Marshall Esq FRS &c
with Mr. Radcliffe's kind regards.

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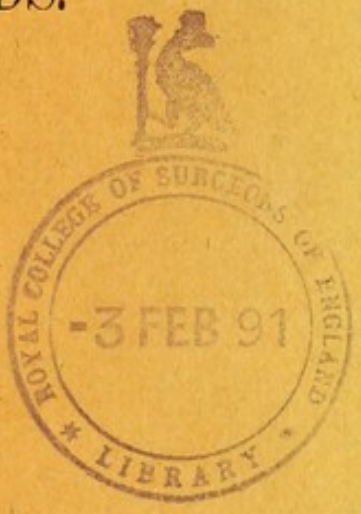
THE RADCLIFFE INFIRMARY, OXFORD.

REPORT

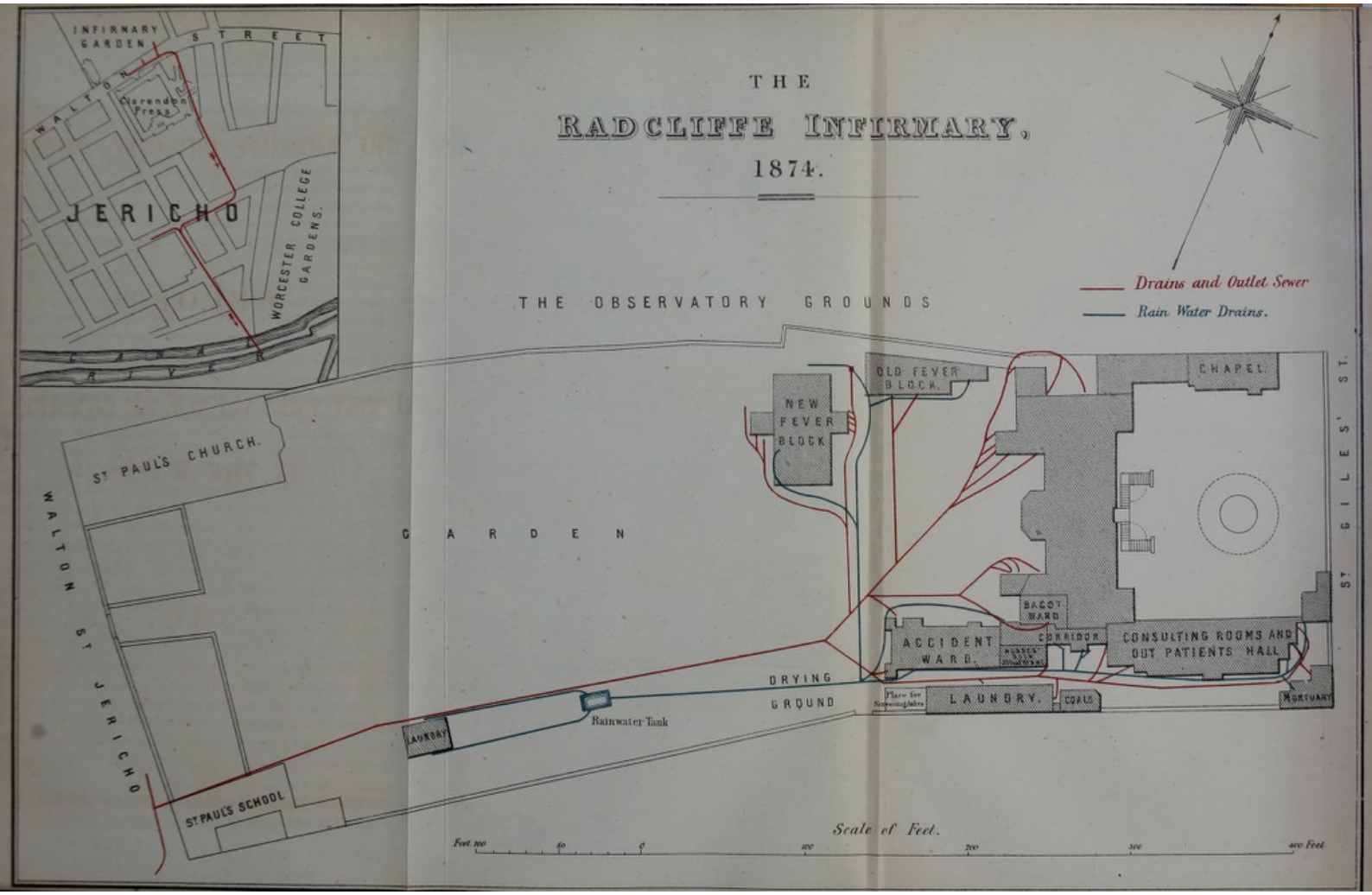
ON

RECENT PREVALENCE OF ERYSIPELAS IN THE WARDS.



1874.

LONDON:
ROBERT HARDWICKE, PRINTER, 192, PICCADILLY, W.
1875.


THE
RADCLIFFE INFIRMARY,
1874.
INFIRMARY GARDEN
STREET
WALTON
Clarendon Press
JERICHO
WORCESTER COLLEGE GARDENS.
THE OBSERVATORY GROUNDS
Drains and Outlet Sewer
Rain Water Drains.
OLD FEVER BLOCK.
NEW FEVER BLOCK
CHAPEL
ST GILES' ST.
ST PAUL'S CHURCH.
GARDEN
BAGOT WARD
CORRIDOR
ACCIDENT WARD.
CONSULTING ROOMS AND OUT PATIENTS HALL
DRYING GROUND
Place for Stopping Jobs
LAUNDRY.
COALS
MORTUARY
LAUNDRY
Rainwater Tank
WALTON ST
JERICHO
ST PAUL'S SCHOOL
Scale of Feet.
Feet 100 40 0 100 200 300 400 Feet

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IN THE

RADCLIFFE INFIRMARY, OXFORD.

To the Committee of Management.

GENTLEMEN,

ON the 5th December I submitted personally to you a provisional statement of the results which, to that time, I had obtained in the inquiry which had been intrusted to me, concerning recent prevalence of erysipelas in the Infirmary, with suggestions respecting such matters as appeared to me to call for immediate attention. I now submit a detailed report of the inquiry.

Subject of Inquiry.—The inquiry was directed to ascertain the conditions under which erysipelas had been produced in a series of cases under treatment in the Infirmary during the summer and autumn months, and beginning of the winter, of 1874. The first attack of erysipelas occurred on the 10th June, the last included in this inquiry on the 9th December. Within this period, twenty-six cases admitted into the Infirmary for other forms of disease or for injuries, had been attacked with erysipelas, and five of these cases had died in consequence of the superinduced malady. With three exceptions, all the cases attacked were surgical cases; and of the three exceptions, two had required surgical interference, and the third had contracted erysipelas in a surgical ward, to which the patient had been removed from a medical ward while the

latter was being cleansed. The erysipelas which had been prevalent in the Infirmary during the period under consideration, had, in fact, been that form of the disease which has been designated "traumatic," and which, when it shows itself in successive cases in hospital wards, is held to be one of the most significant indications of their unhealthiness or mismanagement.

I append a tabulated statement of the different cases attacked with erysipelas, and of such other cases (two of erysipelas admitted into the hospital, and one of diffuse cellulitis) as I shall have to refer to in the course of this report.

Traumatic Erysipelas.—It may be serviceable to preface further details by a brief account of traumatic erysipelas in its relation to hospital hygiene, and for this purpose I prefer to quote certain observations on the subject by the Medical Officer of the Privy Council and Local Government Board, Mr. John Simon. He writes:—

"In ill-kept hospitals wounds go on badly. Instead of running their normal course of repair and recovery, they—whether accidental wounds, or wounds made by operative surgery—undergo certain characteristic morbid changes. Erysipelas will frequently attack them. So will other morbid processes akin to erysipelas—such morbid processes as those of gangrene and phagedæna, and putrefactions of effused and otherwise stagnant blood, and reopening of half-healed arteries and veins, and septic and suppurative infections of the system, and so forth: morbid processes, which, with erysipelas, may, for my present purpose, conveniently be generalized under the one name of traumatic infections. . . . Traumatic erysipelas is a true zymotic disease,*—a disease in which the affected materials of the body furnish a specific contagium. On but too many occasions the contagiousness of the disease has been convincingly and fatally proved;—enough, perhaps, had there been only such evidence as is adduced from hospital surgery; but still more by evidence, again and again given, that a surgeon, going to a puerperal woman from attendance on a case of erysipelas, may convey the specific contagion to the uterine surface of his new patient, and occasion death by that form of puerperal

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* "This is equally true of the non-traumatic erysipelas, the pathology of which disease, however, needs not here be particularly discussed."

fever, which, under a special name, is in fact but intra-abdominal erysipelas. But to say that the disease is contagious, is not to say that no case of it can arise without contagion from a previous case. Indeed, in this respect erysipelas has a peculiar place among the zymotic diseases. Probably of all the specific contagia, the contagium of erysipelas stands in nearest affinity to the ferments of common cadaveric decomposition, and is, therefore, aptest to arise *de novo* whenever certain animal textures and juices, or the effluvia from such textures and juices, are falling into common putridity. Immense mortality from puerperal fever in one division of the Vienna Lying-in-Hospital, varying from about a fourth to about a ninth part of all the deliveries which took place there, was believed by Dr. Semelweiss, the head of the department, to depend on an infection of which 'the real *source was to be found in the hands of the medical men in attendance, contaminated with cadaveric poison.*' The other division of the hospital (reserved for the practical instruction of midwives, whose training does not require them to be brought into contact with dead bodies) suffered only about a tenth part as much as the first; and this was the more noticeable as the second division was inferior to the first in the size and airiness of its wards. Dr. Semelweiss, acting upon his supposition as to the cause of the disease, required that the male attendants of the first division should, as much as possible, avoid contact with cadaveric matter; that after such contact they should never make a vaginal examination till the following day; and that, besides very thoroughly cleansing their hands, they should systematically *disinfect them with a solution of chlorine.* The latter precaution was not introduced till some months after the more general precautions had been adopted. The result of these measures was, that the mortality of the first division at once fell to the usual average of the second division. In 1846 the death-rate per cent. had been $13\frac{2}{3}$; in 1847 it was $5\frac{1}{2}$; in 1848 it was $1\frac{1}{3}$. And the relation of this fact to the possible 'spontaneous generation' of erysipelas contagium is not, I think, far to seek. For any wound in the unhealthy state which is technically called 'foul,' is, in fact, a surface of decaying animal matter; that which surgeons call a 'slough,' or 'mortified part,' is a dead bit of the animal body undergoing just such putrefactive changes as it might undergo in the dissecting-room; and, accordingly, if cadaveric decomposition can easily furnish the contagium of erysipelas, every surgical ward of an active hospital must (in respect of the natural processes of disease going on in it) be a likely birthplace for that contagium. Thus, for instance, if a patient has been admitted with a contused wound of such severity as involves local mortification, that mortification would include in itself an essential liability to the formation of erysipelas contagium. Whether the contagium, if thus engendered, produces in that particular patient the spreading surface-inflammation which characterizes erysipelas, may depend on his personal susceptibility, and especially, no doubt, on the then-existing chemical

state of his live textures next adjoining the wound; but whether his general mass of body be or be not infected by the specific contagium which has been engendered in his wound, in any case contagium would be set free, and would act on the atmosphere of the ward. Its influence in this atmosphere would be determined by circumstances: if the ward were well ventilated, dilution or oxidation would probably have rendered the contagium inert before it had travelled far from its source; but if, on the other hand, the ward were ill-ventilated, either absolutely, or in proportion to its contained quantity of ill-conditioned surgical cases, then, probably, the unclean atmosphere would abound with material which the contagium could convert into its own likeness; and such an atmosphere, continuous through the whole length of the ward, and perhaps receiving increments of new-formed contagium from other beds than the first, would be so very dangerous an influence to even the best-conditioned wounds, that probably there would be in the ward what is called an 'epidemic' of erysipelas; and, in addition to the danger that the contagion might thus by continuity of atmosphere spread from one patient to others, there is also danger, except with the cleanliest and most careful nursing, that attendants will convey it from one part of the ward to another in the successive wound-dressings which they perform."*

Previous Prevalence of Erysipelas in the Infirmary.—In attempting to elucidate the causes of the recent prevalence of erysipelas in the Infirmary, it is important to ascertain the ordinary history of the wards with reference to this disease. Unfortunately, no record has been kept of the different maladies which are liable to originate, in hospitals, the so-called traumatic infections, namely, erysipelas, diffuse cellulitis, softening of clot, pyæmia, gangrene, and phagedæna.† It has been impracticable, therefore, to determine with such precision as was desirable, and which should have been possible, the usual state of the wards with reference to these diseases. It would appear, however, to be certain that, for the past twenty-five years, there has been no such con-

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* Sixth Report of the Medical Officer of the Privy Council, 1864, pp. 59 and 60.

† In thus placing together the various names under which hospital infections may be recorded, I would not be held to express any judgment on the pathology of the disease that is known as pyæmia. It is enough for my present purpose that some forms of the disease thus designated are of a nature cognate to erysipelas.

siderable prevalence of erysipelas in the Infirmary as that which forms the subject of the present inquiry. During the four years 1847-50, erysipelas was so seriously prevalent in the wards, that twenty-eight deaths were occasioned by the disease among the patients. Of these deaths twelve took place in 1847, the year in which the prevalence began. In this year it is to be inferred that erysipelas was widely diffused also in the district from which patients are sent to the Infirmary, for eight cases of erysipelas were admitted into the wards—the largest number of admissions for this disease recorded from 1837 to the present time. The great prevalence of erysipelas which began in the Infirmary in 1847, was indeed, very probably, part of a more general outbreak affecting the surrounding district; but while the disease would appear, judging from the admissions, to have rapidly diminished outside the building, it persisted with much severity in the wards until 1850. For the admissions of cases of erysipelas into the Infirmary, which in 1847 had numbered 8, in 1848 fell to 1, none taking place in the two subsequent years 1849–50. But the deaths from erysipelas in the Infirmary, which in 1847 had been 12, in 1848 were 5, in 1849, 6; and in 1850, 5. In 1851, no death from erysipelas occurred.*

This protracted and very fatal prevalence of erysipelas in the Infirmary, was connected with an uncleanly condition of the wards, particularly filthy beds, with insufficient ward-space and defective ward arrangements, the latter especially impeding ventilation, and with very imperfect drainage. After the uncleanly condition of the wards had been removed, and the defective drainage and ventilation largely amended, erysipelas does not appear again to have originated or spread to any considerable extent in the Infirmary until the recent prevalence.

It would have been instructive to compare the occurrences of erysipelas and other traumatic infections in the wards,

* I am indebted to Mr. Briscoe for the number of deaths caused by erysipelas in the Infirmary during the several years 1847-50.

with the successive improvements which have been effected in their sanitary arrangements, but, as already stated, data do not exist for the purpose. From want of these data, moreover, it is impossible to estimate as clearly as could be wished, the respective influence exercised by the several conditions which appear to have co-operated in determining the recent prevalence of erysipelas. It is stated to me that during the period from 1851 to 1874, instances of traumatic infections had not been of unfrequent occurrence, although they had shown little tendency to multiply, and, in fact, had not multiplied until the year just past. In 1873, for which year I have recovered some of the facts as to such infections, there seem to have occurred in the Infirmary, 5 cases of erysipelas (2 in the Marlborough Ward, of which 1 was fatal, and 3 in the Accident Ward), and 3 cases of pyæmia, all fatal, in the Marlborough Ward. These occurrences suggest either that there were some growing conditions of unwholesomeness in the Infirmary which culminated in 1874, or that the liability to traumatic infections in the wards had in past years been greater than has been considered. In the absence of positive data, an opinion must be formed on this question from an examination of the conditions which would promote such liability, and these, as will subsequently be shown, lead to the inference that neither alternative can, perhaps, be wholly rejected.

The instances of traumatic infections in 1873 have an important bearing upon the early history of the recent prevalence of erysipelas which I now proceed to consider.

Prevalence of Erysipelas, 1874.—The patient first attacked with erysipelas in 1874 was a little boy named Jesse Hill, three years old, who had been admitted into the Accident Ward, from Summertown, on the 27th May, with a severe scalp wound. Erysipelas appeared on the 10th June, fourteen days after the admission of the case, and on the 21st June the boy died from its effects, he lying then in the Bagot Ward, to which he had been removed that day.

This was the first case of the series which forms the

subject of inquiry, and it formed the starting-point of that exceptional diffusiveness which characterized the subsequent progress of erysipelas in the wards. In view of this peculiar diffusiveness it became necessary to determine, if that were possible, in what respect this case had differed in its origin from the cases occurring in the wards in 1873, and in preceding years which had exhibited no such tendency. Or, in other words, to ascertain why traumatic erysipelas, which for some time had given rise to no great anxiety in the Infirmary, should in 1874—the hygienic condition and management of the wards being apparently the same—have become a formidable and fatal malady. One highly important consideration suggested itself at once. At the time when Hill was admitted into the Infirmary, erysipelas was present in several parts of Oxford, and had begun to assume an epidemic character. Hill's case concurred, in fact, with the early indications of epidemic diffusiveness of erysipelas in the city, and it was not improbable that the infection of the disease, under circumstances favouring its diffusion, might have been introduced into the Infirmary from without. Careful inquiry has failed to discover sufficient grounds for the belief that such introduction took place, and, although it is difficult to exclude all the possibilities of conveyance of so subtle an infection as that of erysipelas, I am of opinion that the explanation of the origin of Hill's case and of the peculiar diffusiveness of the erysipelas of which it was an example, is to be sought in another direction.

Failing infection from without, there can be little if any doubt, that erysipelas in Hill's case originated from the operation of similar conditions to those which gave rise to the cases of erysipelas and pyæmia in the preceding year. The concurrence of this case, and of succeeding cases, with epidemic erysipelas in the city, suggests that the difference in diffusive quality of the erysipelas observed in 1874, as compared with 1873 and several previous years, was probably a result of the co-operation of the local conditions favourable to erysipelas in the Infirmary, with the more general conditions which had conduced to the epidemic prevalence of the

disease in the city. That, indeed, the Infirmary, in a way to be discussed hereafter, was in 1874 exposed to the combined influence of the conditions which were operative in producing erysipelas in its neighbourhood and of certain conditions operative to the same end existing in its wards.

The progress of erysipelas in the Infirmary, after Hill's case, may be explained either by some special circumstances favouring communication of the disease from case to case by contagion, or from an augmented susceptibility of the patients to infection from it. An examination of the different cases which have occurred, in their order of succession and relationship, indicates that contagion played an important part in the dissemination of the disease in the wards; but the inquiry has not disclosed any grounds for believing that the opportunities for transmission by contagion from case to case were greater during the recent prevalence of erysipelas than they had been during the period when the disease had not shown such diffusiveness. On the other hand, as this report will show, conditions of the wards existed at the time which would render surgical patients treated in them very liable to the development and diffusion of erysipelas.

Order of Succession and Relationship of Cases.—The first case (1), *Jesse Hill* (Accident Ward), has already been discussed. The second case (2), *Edwin Slade*, was admitted, from Banbury, into the North Attic on the 15th April, with disease of the bones of the foot. The foot was removed by amputation of the leg on the 14th May. On the 19th June erysipelas appeared on the buttock in an aggravated form, and was followed by a large abscess there. At that time Jesse Hill had been lying ill from erysipelas nine days in the Accident Ward. Both cases were under the care of the same surgeon, and were also attended to by the house-surgeon, and it is more probable that the contagion of erysipelas had, in some way, been carried from Hill and communicated to the unhealed stump of Slade, than that it arose from any general condition of the wards. The

third case (3), *Charles Kilby*, was admitted from Oxford, on the 30th June, into the Accident Ward, with compound fracture of a leg, and a scalp wound. On the 2nd July, in consequence of being noisy and troublesome, he was removed into the Bagot Ward, where there was a patient (*Frederick Fuller*) suffering from diffuse cellulitis at the time, and where Jesse Hill had died ten days before. This ward is practically a part of the Accident Ward, the nurses of the last-named ward attending the cases in the Bagot Ward. On the 7th July erysipelas appeared in the scalp wound, and subsequently it attacked the wounded leg. Kilby had been exposed, for a short time, in the Accident Ward, to the same general ward conditions that Hill had been exposed to before contracting erysipelas. He had then been removed to the ward where Hill had died, and where Fuller was lying. This last-named case had been admitted from Lyford, Berks, into the Accident Ward, with compound fracture of a leg, on the 24th April, and four days afterwards (the 28th) the injured limb was attacked with diffuse cellulitis, which subsequently spread to the trunk, and caused much destruction and sloughing of tissue. The patient was a confirmed drunkard, and the cellulitis probably arose from the unhealthy condition he was in at the time of the accident, from his intemperance. Diffuse cellulitis is now commonly included among the traumatic infections, but this case does not appear to have exercised any certain influence upon the origin of erysipelas in Hill's case. Fuller, before the admission of Hill, had been removed to the Bagot Ward. Here Hill had been placed several hours before death, and here Kilby was also placed. In this ward Kilby was exposed to danger from probable retention of the contagion of erysipelas in the ward, and from liability to infection of his wounds in consequence of sharing the same atmosphere and the same attendants with the case of diffuse cellulitis. The likelihood that Kilby contracted erysipelas by contagion from one or other of the sources mentioned is so great, that, without ignoring other possible exciting or co-operating causes presently to be described, the disease is

most reasonably assigned to this source. Kilby was a patient of the same surgeon (Mr. Symonds) who had had under care Hill and Slade (Slade having been discharged cured the 1st July). He was removed the day of appearance of the erysipelas to the "Old Fever Block," and there isolated.

The next case (the fourth) which happened, (4) *James Cox*, was admitted with urinary disease, into the Rowney (Medical) Ward, under the care of Dr. Gray, on the 17th June. Catheterism was necessary, and the house-surgeon passed a catheter daily. On the 9th July, erysipelas appeared in the penis. The first explanation which presents itself to the mind of this occurrence of erysipelas (having regard to previous occurrences in the Infirmary, and the circumstances under which they had happened), is the probability of its having arisen from inoculation; but there are other considerations which suggest a different explanation.

The fifth case (5), *George Thame*, was admitted from Abingdon, into the North Attic, on the 1st July, with an abscess in the abdominal wall, under the care of Mr. Hussey. This abscess was opened (date not recorded), and on the 11th July erysipelas appeared. The sixth case (6), William Collett, was admitted (from Appleford) into the Accident Ward, on the 31st March, with compound fracture of a leg. An abscess formed on the face, and this being opened erysipelas appeared (11th July) around the incision.

The four cases last mentioned (Kilby, Cox, Thame, and Collett) all occurred in different parts of the Infirmary, during the five days from the 7th to the 11th July inclusive. The quick succession of the cases, and in two, the contemporaneous occurrence, suggest the question whether they may not have arisen from some general unwholesome state of the wards, concurring with the attacks, rather than from successive infections.

It will be observed that when Kilby was attacked, on the 7th July, in the Bagot Ward, there had been no case of erysipelas in that ward since the 21st June, and no case in the Infirmary for six days; that the case of Cox followed

so rapidly upon the case of Kilby, as almost to exclude contagion from that source; and that the cases of Thame and Collett occurred on the same day (the 11th July). On the other hand, Thame was admitted to the North Attic on the day when Slade (the second case in the series) was discharged; and Collett was exposed to most of the dangers of infection to which Kilby had been exposed. All the cases, indeed, were exposed to very defined chances of infection, but their almost contemporaneous occurrence, and the break of sixteen days between the cases which preceded them, and of sixteen days also between the cases which succeeded, suggest that each may have been an indication of an unwholesome condition of the wards, apt to engender erysipelas in surgical cases, and which was known to have existed in the Accident Ward. It will subsequently be seen that such a condition of the wards must have existed at the time; but it is impossible to state the respective parts played by this condition and by infection, in the development of the different cases of erysipelas.

The seventh case (7), *Charlotte Dix*, was admitted (from Oxford) into the Litchfield Ward, with hæmorrhoids, on the 22nd July. At that time there was a case of erysipelas (Thame) in the North Attic, and two others (Kilby and Collett) in the Old Fever Block. On the 27th July, no operation having been performed, Dix was attacked with erysipelas, from which she died. Whether the attack arose from infection, or from some unwholesome condition of the ward, each being probable, cannot be said.

The eighth case (8), *James Sheppard*, was admitted (from Stanton Harcourt) into the Accident Ward, on the 16th July, with fractured thigh-bone, under Mr. Briscoe. On the 3rd August erysipelas appeared in the face, indicating general infection of the ward. At this time *Dix* was ill of erysipelas in the Marlborough Ward, and the two cases already mentioned were lying in the Old Fever Block. Sheppard died on the 15th August. He was not removed from the Accident Ward. The ninth case (9), *Mark White* was admitted into the Marlborough Ward, with abscess of

leg, on the 22nd July, under Mr. Hussey. On the 30th July he was transferred to the Accident Ward, Sheppard lying there at the time, and on the 4th August he was attacked with erysipelas. He also was not removed. The tenth case (10), *Ann Floyd*, was admitted (from Oxford) with abrasion of the knee, into the Marlborough Ward, where Dix was lying ill, on the 30th July, and was attacked with erysipelas on the 10th August. She was removed to the Old Fever Block. The eleventh case (11), *William Day*, was admitted (from Oxford) on the 14th August, with severe contused and lacerated thigh, into the Accident Ward, under Mr. Hussey's care. White (9) and Sheppard (8) were then lying there affected with erysipelas. On the 18th August, Day was attacked with erysipelas. He also was treated in the ward. The twelfth case (12), *Sarah Smith*, was admitted (from Stonefield) on the 9th July, into the Litchfield Ward, under the care of Mr. Symonds, with a fracture into the ankle-joint. A portion of dead bone was removed (date not recorded), and she was attacked with erysipelas on the 30th August. Dix (7) had been attacked with erysipelas in the Litchfield Ward on the 27th July, and had died there on the 13th August. Both cases had been removed into the Marlborough Ward from the 30th July to the 11th August, during which time the Litchfield Ward was cleansed throughout. On the day preceding the removal of the two cases back to the Litchfield Ward (the 10th August), Floyd (10) had been attacked with erysipelas in the Marlborough Ward. Floyd and Smith were both removed to the Old Fever Block. The thirteenth case (13), *James Castle*, was admitted on the 10th August, with bronchitis, into the Rowney (a medical) Ward. On the 25th August, the Rowney Ward being vacated for cleansing, he was removed to the Marlborough (a surgical) Ward. There Floyd (10) had been attacked with erysipelas on the 10th August, and Dix (7) had lain ill with erysipelas from the 30th July to the 11th August. Castle was attacked with erysipelas on the 31st August. He was removed to the New Fever Block.

The next two cases (the 14th and 15th) occurred in the

North Attic, under the following circumstances: — *James Jackson* (14) was admitted (from Whichwood) into this ward, with suppuration in the palm of the hand, on the 5th September. He was the first patient received into it after the annual cleansing, two cases of erysipelas having occurred in the ward before that process, namely, one in June (Slade, 2), and one in July (Thame, 5), the latter case having been discharged on the 12th August. Jackson was attacked with erysipelas on the 8th September. On the 2nd September, (15) *Henry Freeman,* the fifteenth case of the series, was admitted (from Ilford), with a diseased finger, into the same ward. He occupied a bed nearly opposite to that occupied by Jackson, and was attended by the same nurse. On the 14th September he was attacked with erysipelas. Both these cases were severe, and both were treated in the ward.

The sixteenth case (16), *William Sanders,* was admitted (from North Merton) with fracture (Colles) of both arms, into the Accident Ward, on the 25th August, under Mr. Symonds. White (9), attacked with erysipelas on 4th August, was a patient in the ward at the time, and Day (11), another case of erysipelas in the ward, had died there on the 20th August. Sanders was attacked with erysipelas on the 14th September, and was removed to the New Fever Block. The seventeenth case (17), *Thomas Norris,* was admitted (from Wolverton) with a tumour on the cheek, into the West Attic, under Mr. Symonds, on the 9th September. He was one of the earliest cases received into the ward after its annual cleansing. On the 8th September, Thame (5), had been attacked with severe erysipelas, in the North Attic (same floor); and on the 14th, Freeman (15), had also been attacked severely, in the same attic. The tumour was removed from Norris's cheek on the 13th September, and on the 16th erysipelas appeared in a very aggravated form. The case was removed to the New Fever Block. The eighteenth case (18), *Matilda Constable,* was admitted (from Whitney) with disease of foot, into the South Attic, on the 2nd September, under Mr. Hussey's care. On the 18th

September the leg was amputated. At this time there were two cases of severe erysipelas on the same floor, namely, Jackson (14), and Freeman (15), in the North Attic, and another severe case, Norris (17), had been removed on the 16th from the West Attic. On the 20th September, erysipelas appeared in Constable's stump, and afterwards spread extensively over the trunk, and down the opposite leg. The attack was a very severe one. The nineteenth case (19), *Frederick Crozier*, was admitted (from Oxford) with empyæma, into the lower ward of the New Fever Block, on the 19th September, under Dr. Tuckwell, there being two cases of erysipelas in the ward at the time. The chest was tapped the same day, and seven days afterwards erysipelas appeared in the wound, and spread to the back. The twentieth case (20), *Sarah Grisfield*, was admitted (from Oxford) into the upper ward of the New Fever Block, with an abscess following erysipelas, from which she had suffered at home. This abscess was opened, and one month afterwards, when she was convalescent, but before the aperture had quite closed, erysipelas appeared in the incision, and she had another attack of the disease. She was attended to by the nurse who had charge of the cases of erysipelas in the lower ward.

The remaining cases, 21—26, need only be briefly referred to. Any attempt to unravel the respective influence of direct contagion, infected wards, or general sanitary state of the Infirmary or of the several wards, at this period of the prevalence, would be hopeless. (21), *James Castle*, who had been a patient in the Marlborough Ward, in August and September, and had then suffered severely from erysipelas, was admitted and placed in the Rowney Ward, with abscess in the neck, early in November, and was again attacked with erysipelas on the 22nd November. (22), *Thomas Bolter*, admitted (from Chipping Norton) to the same ward, on the 20th October, with caries of femur and tibia, was attacked with erysipelas on the 25th November. (23), *George Young*, admitted (from Oxford) also to the same ward, with caries of phalanges, on the 11th November, was attacked with erysipelas on the 29th. (24), *Charles*

Cooper, admitted (from Headington) to the Accident Ward, with injury to ankle, on the 25th November, was attacked with erysipelas of the face on the 1st December. (28), *Thomas Edwards*, admitted (from Oxford) to the same ward, with thecal abscess and œdema of arm, on the 3rd December, was attacked with erysipelas, affecting the head, on the 9th. Both the last-named cases were severe.

The foregoing cases do not include all the cases of erysipelas treated in the Infirmary at the time of the prevalence. Two cases (*Walter Rogers* and *William Chapman*) were admitted, from the city, late in September, three months after erysipelas had become prevalent in the wards. Both were placed in the New Fever Block, and this brief reference to them is all that is required, so far as the present inquiry is concerned. I have excluded from consideration a case (*John L. Dixon*) described as "mild fugitive erysipelas."

The attacks of erysipelas occurring in the different wards were in the numbers following :—

Accident	9
Bagot	1
North Attic	4
West Attic	1
South Attic	1
Rowney	4
Marlborough	2
Litchfield	2
New Fever Block	2

Sources of Prevalence.—Reviewing the facts and inferences which have been stated, the conclusions at which I have arrived as to the sources of the recent prevalence of erysipelas in the Infirmary, are :—

(1.) That it originated in certain unwholesome conditions, partly peculiar to the wards, and partly common to the Infirmary and the city; and

(2.) That the extension of the disease within the building was largely the result of its propagation by contagion.

The conditions peculiar to the wards which might have been operative in causing the prevalence were first subjected to examination, and especially the state of the Accident Ward, in which erysipelas had first appeared, and where the disease had most frequently occurred. The infection of this ward, I may be permitted to state, was to me an especial inducement to undertake this investigation, and for the following reasons :—

The Accident Ward was one of the earliest buildings, constructed on the pavilion system, opened for hospital use in England. Except in a few minor particulars, it is a model of hospital construction, and, in several details, unrivalled. The infection of this ward with erysipelas, was a circumstance which apparently rendered doubtful some of the principles of hospital construction which were held to be most certainly settled, and an investigation of the conditions under which such infection had happened, promised results of wider interest than the immediate object for which the inquiry had been instituted. I have not been disappointed in the anticipation I had formed, and the facts I am about to relate appear to me fully to account for that unwholesomeness of the ward of which the erysipelas has been one indication, and to remove all suspicion of any error in its principles of constructien.

It is well to observe, however, before proceeding further, that a surgical ward, devoted particularly to the reception of accidents, notwithstanding excellency of construction, can hardly escape long without cases of erysipelas or other form of traumatic infection occurring in it; for there are certain kinds of accidents which are apt, under individual states of health, to be followed by erysipelatous or pyæmic mischief. Occasional cases of this kind do not necessarily indicate any unwholesome state or defective

management of a ward. On the other hand, the concurrence of several cases is a clear indication that the one condition or the other* probably exists.

It may happen that a ward will contain, at the same time, several cases of grave, suppurating injuries, each contributing largely to pollution of its atmosphere, and together fouling it to a most injurious extent. The accumulation in the same ward of injuries of the kind referred to, while the ordinary bed-space, and the number of patients received into it, remain unaltered, is a fertile source of traumatic infection. Part of the present inquiry was directed to ascertain whether there had been any unusual number of cases of this kind in the Accident Ward at the time when Jesse Hill was attacked with erysipelas. The register shows that during the months of April and May, 1874, in addition to three compound fractures (two of long bones, and one of the lower jaw), a larger number of severe lacerated wounds had been admitted into the ward than in the corresponding periods of the four preceding years.† I should have inferred from examination of the register that ward-fouling, from the character of the cases treated in it at the time of and immediately preceding the appearance of erysipelas, was not improbable; but the surgical staff is of opinion that no exceptional condition of the ward arose from these cases.

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* "It ought to be accepted as an axiom in hospital management, that any *concurrence of cases* of traumatic infection originating within the hospital, or any spreading of febrile or other contagion to even a single *patient* within the hospital, is conclusive reason for inquiring whether the fundamental difficulty of hospital management has not here been unskilfully met." The fundamental difficulty here referred to is "the difficulty of providing that throughout the whole of a really active hospital the means of cleanliness, and, foremost, the means of ventilation, shall be proportionate to the many special sources of foul and infective material." —*J. Simon, Sixth Report*, pp. 53 and 65.

† The cases of lacerated wounds were nine in number, and the parts lacerated were the thigh, the buttock (2), the scalp (2), the knee (2), the wrist, and the fingers.

The conditions which have chiefly co-operated in producing the unwholesome condition of the Accident Ward under consideration, have all acted by fouling its atmosphere in certain ways. The several conditions to which I refer, are as follows :—

1. The position of the laundry, closely adjoining the south face of the Accident Ward and its approaches, must exercise a harmful influence upon the atmosphere of the ward. When the south windows of this ward, as is very commonly the case, are freely open, the atmosphere of the ward becomes practically part of the atmosphere immediately surrounding the laundry. The amount of moisture passing into the air surrounding the laundry, when washing is in progress, and, consequently, passing more or less into the ward also, would alone make the contiguity objectionable; for a moist atmosphere tends to foster the development of erysipelas in wounds. But the moisture given off from a laundry is largely laden with organic filth from the fouled linen. In ordinary laundry processes no provision is made for the application of boiling heat to all portions of the materials washed at the same time, and so destroying the adherent organic filth; as a consequence, much of this filth, exposed to a less degree of heat than the boiling-point, is carried off by evaporation, and diffused in the atmosphere. Hence a very special danger to a surgical ward contiguous to a laundry.

The contiguity of the drying-ground of the laundry to the west windows of the Accident Ward is also objectionable.

2. At the western extremity of the laundry, directly beneath the windows of the Accident Ward, all the ashes of the Infirmary, and such dry house-refuse as is mingled with them, are screened, and, when this process is being carried out, a considerable amount of the fine dust which arises during the operation must necessarily find its way into the ward. Probably few facts have been more clearly established than the mischievous influence upon injuries of

an atmosphere charged with the effluvia or the dust of mixed ashes and house-refuse.*

3. The drains of the lavatories, closets, and slop-sink of the Accident Ward, have been cut off from direct communication with the principal drains of the Infirmary, so as to obviate any risk of sewer air passing back through them into the ward; but no such precaution has been taken with the drains of the nurses' scullery and water-closet in the corridor of the ward. These latter drains communicate with a drain which runs along the south sides of the Out-Patients' Hall and Accident Ward (see *Plan*), and which receives the drainage of the water-closets and urinals of the Out-Patients' Hall, of the post-mortem room, of the laundry, with its water-closet, and, as already stated, of the nurses' scullery and water-closet, attached to the Accident Ward. This drain, throughout its whole extent, is not provided with

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* In illustration of this point the following may be quoted. "The atmosphere may be vitiated by causes so slight as to escape observation, and yet be abundantly productive of erysipelas. An instructive example of this was seen in one of the male accident wards of the Middlesex Hospital, a few years ago. It was observed that erysipelas commonly attacked the patients in two beds in particular, while it did not occur in any other patient in the ward, or in the hospital generally. The constant repetition of this occurrence led to the conclusion that some special cause of vitiation of the atmosphere was in operation in the neighbourhood of these beds, and it appeared probable that the presence of a dust-bin in the area below the window, on each side of which they were placed, must have had to do with the phenomenon. The dust-bin was cleaned and whitewashed, its door was kept closed, and directions were given that the window should not be allowed to remain open. The erysipelas at once disappeared. A couple of years afterwards, the disease was again found to attack the patients in the same beds. It appeared that the precautions had been neglected, the dust-bin had again become foul, and the door had been allowed to remain open. The adoption of the same measures again rendered the beds healthy, and they have since remained so. It may be remarked, that no unpleasant effluvia was detected in the neighbourhood of the window which could lead to the impression that the atmosphere was in any way tainted."—Mr. Campbell de Morgan: art. *Erysipelas*, *Holmes's System of Surgery*, vol. i. p. 229.

any means of ventilation or of flushing, and such offensive gases as may form in it (and having regard to the use to which it is put must almost necessarily form) will diffuse inside the walls of the buildings through the traps of the different water-closets and sinks, or through the junctions of the pipes, into the adjacent soil. Moreover, the frequent passage of hot water into the drain, beneath the point of entrance of the various water-closet drains, must tend to force the traps by the sudden expansions of the sewer air they will cause, and otherwise to facilitate the exit of air from the drain. Such a state of the principal drain in the immediate vicinity of the Accident Ward, and connected with some of its offices, is certainly most undesirable, and may very probably have contributed, by the occasional overflow of sewer air into the corridor of the ward, and in another way presently to be mentioned, to the unwholesome state of the ward.

4. The foregoing conditions are in operation more or less at all times. The operation of the condition now to be described is limited to the winter months. The Accident Ward is partly warmed by a hot-air shaft passing longitudinally along the centre of the ward, and having openings at intervals. No arrangements have apparently been made for cleansing this shaft from end to end, and it is to be inferred that during the several years it has been in use much dust, mostly surface-dust, containing organic matter, will have collected within it, and that some of this dust will be carried by the current of air which passes along the shaft into the ward. But this shaft, in addition, contributes in a special manner to vitiate the air of the ward from the relations of its inlet to the laundry. The air to supply this shaft is, in fact, obtained from an aperture on the surface of the ground, almost directly opposite the door of the laundry, 12 feet distant from this door, and 10 feet from a stand adjoining the door, on which is placed the dirty and infected linen removed from the wards, before being taken into the laundry. The shaft, indeed, obtains its air from the one

spot in the Infirmary premises where the atmosphere is most fouled, and is most liable to be fouled. At the time of one of my examinations of this inlet of the shaft, three baskets filled with foul linen were placed on the stand adjoining the laundry door, and one of these baskets contained the bed-linen used for a case of erysipelas. These baskets had been there several hours, and were likely to remain several hours longer. That morning, indeed, I satisfied myself that the air passing into the shaft for the supply of the Accident Ward, in addition to ordinary surface-dust, and the dust from recent ashes-sifting, was charged also with steam from the laundry, and with the emanations of foul and infected linen. Probably, also, it contained some sewer air, for if, as I suspect, part of the air of the drain into which the laundry drains is diffused into the surrounding soil, some of this is likely to find its way into the hot-air shaft; for the inlet of the shaft, in its course to the heating furnace, is sunk between the Accident Ward and the drain, within a few inches of the latter.

Such are the different conditions which I believe to have co-operated in producing that unwholesome state of the Accident Ward which is indicated by occurrence of erysipelas in it. It is quite possible that the influence they have exercised upon the ward may have been accumulating from year to year, as certain facts I have stated in a previous part of the report might indicate. In regard to this question, the structural deterioration which buildings are liable to undergo in the course of years, is not to be overlooked. As for example, in such cases as the one under consideration, deterioration of walls and floors, however excellently constructed, admitting of increasing lodgments of dirt; or the deterioration of the mechanism and metal fixings of closets, sinks, &c.; or again, and especially, deterioration of drains.* The different conditions described,

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* The drain receiving the sewage of the Rowney and Marlborough Wards passes beneath the corridor leading to the Accident Ward, and

however, must, from the first have exercised an unfavourable influence upon the ward, and consistently with this view I find that members of the surgical staff are, and have been, dissatisfied with the ordinary progress of severe injuries in the Accident Ward, from the time when it was opened.

The particular conditions I have described as affecting injuriously the Accident Ward, do not affect any of the other wards in the Infirmary. In the remaining wards, all parts of the old building, the water-closets, lavatory, bath, and scullery arrangements are of recent construction, and of peculiar excellence; and the provision for ventilation, with certain exceptions in the attics, is perhaps as good as may be, having regard to the original design of the wards. The condition in these wards which chiefly arrests attention in regard to the present inquiry, is overcrowding.* This is such, that, the ordinary complement of patients being maintained, the treatment of serious surgical cases in any

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close to the door giving entrance from this corridor to the Bagot Ward. In view of deterioration, this drain should be examined from time to time. It would be well, indeed, that another line of direction should, if possible, be found for it.

* *Bed-Space in Each of the Wards.*

Ward.	No. of Beds.	Bed-Space.	
		Superficial Feet.	Cubic Feet.
Accident.....	20	103	1860
Bagot	5	108	1188
Marlborough	17	81	1148
Litchfield	17	81	1148
Rowney	17	82	1006
Frewin	17	82	1006
Mordaunt	8	91	1149
North Attic	13	85	939
South Attic.....	13	85	939
East Attic	7	81	810
West Attic.....	4	84	843

of them must be attended with risk; and I have little doubt that in several of these wards it exercised a decided influence in promoting the recent prevalence of erysipelas. This appears to me to have been certainly the case in the Attics, which were not originally designed for the reception of patients, and where the ventilation is in some respects defective, owing to the form of the ceilings.

Overcrowding may be actual or relative,—actual when the space allotted to the several patients under treatment, irrespective of the nature of the diseases or injuries, is insufficient; relative when the space is insufficient with reference to particular diseases or injuries treated. I have already expressed a suspicion that the Accident Ward at the time of, and immediately before, the appearance of erysipelas, may have been overcrowded relatively from the number of serious lacerated wounds then under treatment in it. There would be overcrowding in the Marlborough, Litchfield, Rowney, and Frewin Wards, relative to cases of erysipelas, or other traumatic infections treated there, unless the number of patients ordinarily received into the wards were diminished. Absolute overcrowding is unavoidable in the Attic Wards, if the ordinary complement of beds be maintained; unless, indeed, the beds be reserved for cases hardly needing hospital treatment, which does not appear to be the case. These wards are wholly unfitted for the treatment of erysipelas and other traumatic infections, except the number of beds in them be diminished at least one-half, even if then.

The preceding considerations refer to such of the conditions, capable of fostering erysipelas, as were peculiar to the Infirmary. I have now to describe the conditions, likely to have the same effect, which were common to the Infirmary and the city. It is not necessary for me, in dealing with this part of the inquiry, to enter into a general discussion of the causes of epidemic prevalence of erysipelas. It is simply requisite for me to state that our knowledge of those causes is practically limited to various local conditions of houses,

places, and populations, the existence of which appears to be necessary to any marked development of the obscure phenomena designated "epidemic." My inquiry here, therefore, was directed to ascertain the conditions of this kind, which were common to both the city and the Infirmary. These are three in number, namely, drainage, water-supply, and intercommunication of population. To take the two latter conditions first.

It has already been stated that no cases of erysipelas from the city were admitted into the Infirmary until some time after the disease had become prevalent in the wards. Certain facilities for the carriage of contagion into the wards are presented by the relations of the Out-patients' Hall, and especially of the Dispensary medicine-hatch, to the Accident Ward, the visits of friends to patients, and the community of city and Infirmary in the surgical and medical staff. Such search as it has been possible to make on this subject has yielded no evidence to show that introduction of infection into the wards in any of these ways had taken place.

There is no reason to suppose that the water-supply, derived from the public-service of the city, contributed to the outbreak. The water of this supply, when my colleague Dr. Buchanan made an official inquiry concerning the sanitary state of Oxford, in 1870, was of doubtful quality, and I am not aware that the quality has undergone improvement since that year. It would be well, I think, that this fact should not be lost sight of in the event of any lengthened persistence of erysipelas in the wards, as it might then be desirable to supplement the sand filtration at the waterworks with charcoal filtration at the Infirmary.

The common condition of drainage, to which reference has been made, very probably forms the chief link of connection between the exceptional prevalence of erysipelas in the Infirmary and its epidemic prevalence in the city. The main drain of the Infirmary (see *Plan*) is continuous with the city sewers in the district named Jericho. The Infirmary main drain, after leaving the Infirmary premises, crosses

Walton Street, and is connected with a sewer which runs along the south face of the Clarendon Press. This sewer is connected with a sewer which traverses Jericho, and which opens into the river opposite that suburb, after having been carried beneath the Canal by means of a "siphon," so-called. The outfall here described has only existed since February last. Previous to that time the sewage of Jericho, of the Clarendon Press, and of the Infirmary, was carried by a sewer running southerly from Jericho to an outfall lower down the river. The present outfall, it should be added, is a temporary one, pending the completion of certain drainage works now being carried out by the Corporation. The sewer with which the Infirmary main drain communicates is an old barrel-shaped one, constructed of brick; and its course within is liable to be much interrupted by the roots of trees which penetrate into the interior. As this sewer passes the Clarendon Press, it receives the sewage of that building, and with this sewage certain solid waste matters. In this part of its course the sewer is apt to become blocked, and the City Authority has, twice within the past three years, had to cause it to be opened and cleansed. The last time this operation was performed was at the close of September, or beginning of October, 1874, when blocking of the drain was made manifest from sewage forcing its way to the surface above the point of stoppage. Eighteen months before, that is to say, in the spring of 1873, a similar stoppage had taken place, requiring like interference. Below the Clarendon Press the continuation sewer runs without obstruction until the siphon beneath the Canal is reached. There much deposit of road detritus, and of filth (chiefly brew-house) takes place, and it is necessary to flush the siphon once a week to keep it clear.

Along the whole course of the Infirmary main drain and its branches, and the old sewer with which the main drain communicates, the sole provision made for ventilation consists of the ventilating-pipes attached to the soil-pipes of the different water-closets in the Infirmary and the New

Fever Block, and carried above the roofs of the respective buildings. The continuation of the sewer through Jericho is ventilated by means of the road-gullies which open into it, and which are untrapped.

It would appear, then, that throughout the whole period of that development of erysipelas which forms the subject of inquiry, and preceding it, the solid filth sent by the Infirmary, by the Clarendon Press, and by such other houses as have the same drainage outlet, into the old sewer which has been described, was slowly accumulating there until, nearly four months after erysipelas had begun to spread in the wards, the stoppage was complete. During all that time the Infirmary drainage was passing into a cesspool, in which decomposition of the retained filth was facilitated by the warm condensing water poured into it from the Clarendon Press engines, and the hot water occasionally thrown in when the engine-boilers were flushed out. The gases evolved from the decomposing filth had no outlet from the sewer except by diffusion through its walls, or by escape along the Infirmary drains and outflow upon the roof of the main building and the New Fever Block. It can hardly be doubted that there must have been frequent large, if not continuous, outflow of sewer air and gases from the soil-pipe ventilators during the growing accumulation of filth in the sewer, and at the time of its stoppage. For the warming of the upper portion of the main drain by the hot water poured into it from the laundry would, apart from the tendency of the sewer gases to rise to the highest point of the drain, determine an up-current in it; and under a rapid fall of the barometer, the atmosphere above the hospital would be flooded with sewer air. It is unlikely, moreover, that the traps of the drains from the Accident Ward should, under such conditions, at all times have remained unbroken, and that, more or less, sewer air would not at times be diffused under its western windows. It is unlikely, also, that some diffusion of sewer air would not take place through the water-closet traps elsewhere within the Infirmary. In-

deed, it may be inferred that, during the period under consideration, the condition of the atmosphere about and within the Infirmary differed little as to pollution with sewer air, from that which would exist in other parts of the city where the drainage and sewerage are imperfect. Such pollution is one of the most powerful causes determining traumatic erysipelas, and its coincidence with the recent prevalence of that disease in the Infirmary, appears to me to explain the concurrence of the prevalence in the wards with the prevalence of erysipelas in the city. In other words, it gives an explanation of the Infirmary not being exempted, as it most probably would have been if its hygienic arrangements had been such as they were believed to be, from the epidemic influence which determined the prevalence in the city, and which in the Infirmary showed itself in increased susceptibility of injuries and injured persons to the disease.

It remains for me now to consider the conditions which admitted of infection becoming an active agent in the diffusion of erysipelas within the wards. These were as follows :—

1. The removal of cases of erysipelas from the wards, and their isolation, after it became evident that transmission of the disease was probably taking place from case to case, was not carried out in any systematic manner. A glance at the table will show, that notwithstanding the removal and isolation of many cases,* others were treated in the wards in sufficient number to perpetuate contagion there, and to maintain an infected state of the wards.

2. The long freedom of the Infirmary from highly infectious erysipelas had led to several of the precautions usually adopted by surgical staffs and attendants to fall into disuse, such, for example, as the careful cleansing and disinfection

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* Removal of a patient from the Accident Ward to the Bagot Ward cannot rightly be considered as isolation.

of hands and instruments in passing from cases of traumatic erysipelas to other surgical cases.

3. The use of absorbent materials for dresses by nurses when on duty, each nurse being allowed to wear what kind of dress she likes in the ward, if it admits of being washed.

4. The rotation of night service, by which every nurse takes duty in turn in the Accident Ward, a regulation which may make them carriers of infection to other parts of the hospital in the event of a case or cases of erysipelas, or other traumatic infection, being present in the ward.

5. The use of infection-traps, called bed-curtains.

6. The juxtaposition of infected and dirty linen, and their washing in the same laundry.

It will be observed that the opportunities for the transmission of the contagion of erysipelas to the different parts of the hospital were so numerous, that at the first aspect it would appear as if this alone were sufficient to account for the prevalence of the disease after it had once declared itself. A study of all the phenomena of the prevalence leads, however, to the conclusion, as being more probable, and as I have endeavoured to show, that these are most clearly accounted for by the combined and continued action of the causes which first determined the outbreak and of infection.

Before passing to the recommendations I have to make, there is another question to which it is requisite that I should direct particular attention. I refer to persisting infection of wards in which erysipelas has occurred. It is one of the phenomena of this disease, when it shows itself in an infectious form in surgical wards, that the ward may become infected for an indefinite period by it, newly-admitted patients being from time to time attacked long after the removal of the original infecting case or cases. The probability of such persisting infection, undoubtedly dependent upon the facilities which the ward and its furniture afford for retaining, or, in other words, for the adherence of the

infection of the disease, must not be lost sight of in the measures taken for obviating further mischief from the recent prevalence of the disease.

Summary of Conclusions.—If the statements I have made of the results of this inquiry are as clear as I should wish them to be, the measures necessary to prevent a recurrence of serious prevalence of erysipelas in the Infirmary will be sufficiently obvious. The conclusions at which I have arrived respecting the origin and development of the recent prevalence of erysipelas in the wards, are, briefly recapitulated, as follows:—

As to Origin.

This, in the first instance, is to be attributed to an impure state of the atmosphere of the Accident Ward, arising from (*a*) the contiguity of the laundry; (*b*) the screening of ashes and house-refuse beneath the windows; and (*c*) imperfect arrangement of the drain and its connections adjoining the ward, and of the outlet drain (the main drain) of the Infirmary with which that drain communicates.

As to Subsequent Development.

This was due to a combination of hygienic faults, and of defective ward regulations.

1. With regard to the *hygienic faults*, these, as to the Accident Ward, consisted of the conditions already named, with the addition, in the colder months, of the heated air used for warming the ward being liable to pollution, and, in all probability, being ordinarily much polluted. As to other wards, these were exposed, more or less, to fouling of their atmosphere with sewer air from want of ventilation and otherwise defective arrangement of the main drain of the Infirmary, and from the utterly bad state of the sewer with which the main drain communicates.

2. With regard to *defective ward regulations*, the deficiencies referred to as tending to exceptional fouling of the wards, or to the diffusion of erysipelas by contagion, or to both, were (*a*) the absence of a definite system of isolation or separation of the several cases as they occurred; (*b*) the liability to relative or actual overcrowding of wards; (*c*) the want of proper provision for preventing the dissemination of contagion by the fingers of the surgical and medical staff or attendants, by the dress of the nurses, and by the use of the same laundry for infected and uninfected linen and bed-furniture; and (*d*), finally, the likelihood of the different nurses, in the event of traumatic infection existing in the Accident Ward, becoming in succession carriers of the infection from that ward to other parts of the building.

The recommendations I have to make for the removal of the various faulty arrangements which have been described, are as follows :—

(*A.*) *As to Hygienic Defects other than of Drainage and Ward Regulations.*

1. The laundry should be removed from its present position, as also the drying-ground, to some other part of the Infirmary premises, at a distance from the Accident Ward, and other wards.

2. The place for screening ashes should also be removed, and so placed that the dust diffused in the process of screening should not find its way into any of the wards.

3. The hot-air shaft of the Accident Ward (if hot-water pipes and coils be not substituted for it, which would be better), should be so arranged that it can be readily swept from end to end. The inlet of this shaft should, moreover, be transferred to the north side of the building, and there carried up above the eaves, where

the air is less likely to be charged with dust and other dirt. The vertical shaft, as the horizontal, should be arranged so as to admit of ready cleansing within.

(*B.*) *As to Defects of Drainage.*

4. The drain which runs to the south of the Out-Patients' Hall and Accident Ward should, after careful examination into its present state, and the putting right of any deterioration which may be found, have its upper end freely opened to the air. This may be effected by carrying a ventilating pipe (of at least four inches diameter) from this end up to the roof of the Out-Patients' Hall, the outlet being at some convenient spot on the ridge.

Provision should also be made for the frequent flushing, at regular intervals, of this drain. For this purpose a flushing-tank should be placed at the upper end, or the drain might be extended to the fountain in front of the Infirmary, and flushed from the basin. The former plan, I think, would be best, for, if the drain were extended to the fountain, unless an opening for ventilation were made on the surface of the ground, close to the basin (which from the locality would be undesirable, even if a charcoal diaphragm were used), a blind end, always objectionable, would be formed above the point where I believe ventilation can be most readily effected without detriment to the neighbouring wards.

Further, the several soil-pipes communicating with this drain should be fully ventilated independently; and the sink and other pipes connected with the drain should not communicate directly with it. These latter pipes, as in the case of the lavatory-pipe, and soil-pipe of the Accident Ward, should terminate at the outer wall of the building from which they come. There they should end in a small chamber, covered only by a freely perforated grating (open, in fact, to the air); the inlet of

the pipe communicating with the drain, properly trapped, being on the further side of this chamber.

The same arrangement should be made for all sink, lavatory, and bath pipes in the Infirmary not connected with soil-pipes, provision being made for the ventilation of all drains trapped at the inlet in the manner described.

The cutting-off of direct communication between the drains within a building and the drains outside, also of the drains with the common sewers, with free ventilation of soil-pipes and drains, constitute the greatest safeguards against fouling of the atmosphere in and about buildings with sewer air. This arrangement of drains does not appear to have been adopted at the Infirmary, except in the case of the drains of the water-closets, slop-sink, and lavatories of the Accident Ward. The only precaution which appears to have been taken to prevent diffusion of sewer air into other parts of the Infirmary has been the ventilation of the soil-pipes, and this, as I have had to describe, not uniformly. I am not prepared to suggest a re-arrangement of the drains of the kind referred to, except in so far as it may be effected without reconstruction being requisite, or where there is direct evidence of its necessity. Such necessity exists in the drain running south of the Accident Ward, which has already been considered, and in the main drain of the building.

It is indispensable that the main drain should be cut off from direct communication with the sewer into which it opens. A break should be interposed in some part of its course, preferably, at the lower part of the garden, so arranged that it would interpose an obstacle to the upward passage of sewer air from below, and if such passage should be effected, would direct the sewer air harmlessly into the open air. Professor Reynolds, of Owen's College, Manchester, has designed an arrangement to meet these objects which appears

to me excellently adapted for the purpose. It consists of a man-hole, about two feet square, sunk to the drain. Above, the man-hole is covered by a perforated grating; at the bottom, it is traversed by an open depressed channel which takes the place of the closed drain, and into which the upper and lower openings of the drain, at the point of interruption, dip, so that the drainage in all states of flow covers both openings. The double water-trap thus formed protects the upper portion of the drain, if sewer air should be forced through the trap from below, and any such upward flow of sewer air, or diffusion through the water of the trap, passes upwards along the man-hole to the outer air. Professor Reynolds has described this arrangement with illustrations in a readily accessible work, and to this I refer for further details.*

It must be obvious that if the main drain of the Infirmary had been broken in its course to the outlet sewer, as is here suggested, no such evil influence would have been exercised upon the wholesomeness of the Infirmary by the state of the outlet sewer, as I believe to have taken place. Certainly the condition of the outlet sewer ought no longer to be tolerated, and representations should be made to the City Authority on this subject. Meanwhile, by adopting the precaution suggested, the Infirmary drains may be wholly cut off from any harmful effects from the city sewers, and it ought not then to be difficult to keep these drains in proper order.

To this end, the cutting off in question having been effected, it is possible that the free ventilation of the soil-pipes, with the introduction of three or four surface ventilators along the course of the main drain, may suffice for the efficient ventilation of the whole series of drains. The surface ventilators of the main drain

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* "Sewer Gas." By Osborne Reynolds, M.A., Professor of Engineering at Owen's College, Manchester. 1872. Spon, Charing Cross.

may have charcoal diaphragms if it be thought fit, but this should hardly be necessary if the drain is in good order. Any marked odour from a ventilator should be regarded as an indication that the drain had got out of order, and wanted attending to by flushing or otherwise, rather than as an indication for deodorization of sewer air. The ventilating-pipes attached to the soil-pipes in the main building should be enlarged to four inches diameter, and they should be carried up to the ridge of the highest adjoining roof. The existing ventilating-pipes have their outlets in dangerous proximity to the ventilating openings of ward offices.

(*C.*) *As to Defects of Ward Regulations.*

5. The systematic isolation of cases of erysipelas appears to me to be essential to the successful limitation of the disease. Treated in a ward with other kinds of disease, whether surgical or medical, it is usually found prudent, even when the malady shows least indication of infectiveness, to give a patient suffering from erysipelas greater bed-space, by disusing the adjacent beds, or one of them, in addition to the various special measures for preventing the diffusion of infection from it, which are necessary parts of successful ward management. It is found prudent, in fact, to do at least imperfectly what can be done completely by isolation. The occurrence even of a single case of infection from the neglect of an available precaution is to be deprecated. The history of the little groups of cases which are apt to occur in surgical wards, during periods when traumatic infections show little disposition to prevail, is very commonly a history of transmitted infection.

It must be apparent that the isolation of cases of erysipelas and allied infections, while of itself one of the most important means of preventing diffusion of the disease, favours enormously the use of other mea-

sures, and involves the least disturbance of the ordinary ward regulations. For example, to bring the different nurses of the Infirmary successively into relations with the Accident Ward or other ward, at times when erysipelas or other traumatic infections are being treated in it, and to maintain the free communication by the different attendants and officials between the various wards, seems to me indefensible. Obviously, isolation of the cases of traumatic infection as they occur, would involve less inconvenient disturbance of the ordinary arrangements of the Infirmary, and besides being more effectual as a means of preventing transmitted mischief, it would obviate almost altogether a diminution of the number of available beds.

Further, in the interest of the patient, it is desirable that each case of traumatic infection should have larger bed-space given to it than even the Accident Ward affords, except by diminishing the number of beds in it. In no class of diseases is abundant ventilation more necessary than in the traumatic infections, and no class so readily responds to the beneficial influence of free change of the air about the patient. It is matter of experience that in ordinary infectious diseases such freedom of ventilation as is desirable cannot certainly be obtained in permanent buildings if each occupied bed have less than 2,000 cubic feet of air-space, and 144 square feet of floor-space, with correspondingly large facilities for ingress and egress of air. What is true of ordinary current infections, is true also, according to my experience, of traumatic infections; and I am of opinion that until the measures which are held advisable for the limitation of ordinary current infections are stringently applied to traumatic infections, there can be no reasonable hope of their being brought under such control as should be aimed at in hospitals.

6. In all the wards, with the exception of the Accident Ward, the liability to relative overcrowding is

imminent, and even in the Accident Ward, from its particular purpose, as indicated by the name, the chance of such overcrowding should not be overlooked. The floor-space and cubic space for each patient, with corresponding free ventilation, which form the ward conditions most favourable to the beneficial progress of infectious cases, constitute also the ward conditions most favourable to the prevention of the morbid changes known as traumatic infections, and of which erysipelas is an example. Certain kinds of injuries are apt to undergo these changes, such as lacerated wounds, particularly of the scalp and extremities, and compound fractures. All such wounds, and also injuries involving much suppuration, or mortification or sloughing of tissue, should have given to them, irrespective of any indication or existence of a traumatic infection in a ward, much more floor-space and cubic-space than the best constructed surgical hospital allows as an average for its beds, when the full complement is filled. In other words, the usually stated bed accommodation of wards should be regarded as the accommodation for the ordinary run of cases. Within this limit no hard-and-fast rule of occupation should be insisted on, but the number of used beds should depend wholly on the nature of the cases admitted, with reference to their liability to foster traumatic infections.

It is not necessary for me to do more than state these general principles of ward management as to overcrowding. Their application in detail is only possible with a knowledge of the intimate working of the Infirmary, which is not to be gathered from a brief inquiry like this I have been engaged in. I would suggest, however, as to the attics (if they are to be retained for use as wards), that besides a necessary redistribution of beds to diminish overcrowding, it might be desirable to introduce other dormer-windows into the roofs.

7. The provision of abundant means for the removal and destruction by fire of all absorbent materials used in the dressing of wounds, and for the cleansing and disinfection of the hands of the surgical staff and attendants, I need only refer to briefly. For the practice as to dressings is in force in the wards, and materials (such as sponges) at one time used in common for several patients, have long been disused. To disinfection of the hands, and even of instruments (as, for example, by chlorinated solutions), after dressing cases of traumatic infection, I attribute considerable importance; and free provision for such disinfection should be made in the wards, the ward attendants being required to make uniform use of it. It is desirable that definite provision should also be made for the destruction of surgical dressings, and that they should not be left, especially during the summer months, to any haphazard use of fires or furnaces. A gas furnace, constructed for the purpose, attached to each surgical ward, would perhaps best meet this provision.

8. The nurses should be required to wear, when on duty in the wards, dresses of material neither apt to absorb moist nor to collect solid filth, and which should also be washable. Several kinds of material exist having these characters, and fitted for ward use.

9. The rotation of night-service by which nurses in the different wards take duty in turn in the Accident Ward, if not changed for some different system, should be interrupted, as long as cases of erysipelas or other traumatic affections exist in that ward, or there is reason to believe that traumatic infection persists in it.

10. Bed-curtains, if at all continued in the wards, should at least be done away with in all cases of erysipelas or other traumatic infection, and in cases liable from their nature to be attacked with such infection.

11. The matting placed upon the bed-frame, beneath

the bed, should in all cases when it is necessary to stove the bed, be stoved also.

As to Washing of Linen, &c.

12. The laundry already built for infected linen should at once be brought into use, and such linen should under no circumstances be brought into proximity with uninfected linen.

As to Persisting Infection of Wards.

13. In the event of infection persisting in any of the wards, as indicated by cases of erysipelas occurring there at intervals among the patients admitted, it will be necessary, after thoroughly cleansing the infected wards, to disuse them for three or four months, repeating the cleansing from time to time, and exposing the ward during disuse to continuous free ventilation. If such a measure should be requisite, it would be well also, while the wards are out of use, to treat all surgical cases admitted into the Infirmary in hospital marquees or huts erected in the garden, according to convenience or state of season.

Independently of the foregoing consideration, it may deserve consideration whether, in the present state of the hospital, all cases requiring operation should not be dealt with in tents or huts.

As to Registration of Traumatic and other Infections.

14. Until a definite registration is established of the various diseases, infectious and others, originating in the Infirmary and its different wards, it will be impossible to gauge with precision the sanitary condition of the building, and to ascertain whether the constant and necessary tendency to fouling of the wards is effectually controlled.

It is requisite that all diseases originating in the Infirmary (whether among patients or attendants) should

be carefully registered, distinguishing the infectious from the non-infectious. I would suggest that the weekly report presented to the Committee should show these cases, as also cases of infectious disease admitted into the Infirmary, and the nature of the cases in each surgical ward.

As to the Sanitary Supervision of the Infirmary.

15. I disbelieve in the effective sanitary supervision of a hospital except some officer or officers on the spot are made definitely responsible for the duty. I venture to suggest that the house-surgeon and house-physician should be made responsible for the sanitary regulation of the wards under their respective observation, and for such of the general sanitary arrangements of the Infirmary as are connected therewith. To this end, as well as for the assistance of the Committee, detailed plans of the drainage and water arrangements should be prepared. The plans of drains should show the position, and indicate the nature, of every trap and of every ventilating aperture. These plans ought to be framed, and hung up either in the Board-Room or the Secretary's Room, or elsewhere (but preferably the first-named Room) where they can be readily consulted. The conspicuous exposure of the plans is necessary to familiarize the various responsible persons with the details to which they refer.

In concluding this Report, I would express my regret that its completion has been unavoidably much delayed. If any apology be necessary for its length, I trust that it will be sufficient for me to say that I have been afraid to substitute brevity for clearness.

I have the honour to be, Gentlemen,

Your obedient Servant,

J. NETTEN RADCLIFFE.

LONDON, 1*st February*, 1875.

TABLE—*showing Cases of Erysipelas and other Traumatic Infections, originating in or admitted into the Radcliffe Infirmary, Oxford, in* 1874, *to the* 12*th December.*

(Cases admitted, or other than Erysipelas, printed in Italics.)

No.	Date of Admission.	Date of Discharge.	Name.	Age.	Residence.	Disease for which admitted.	Ward.	Supervening Disease.		Medical Attendant.	Isolation.		Result.	Remarks.
								Nature.	Date of Appearance.		Isolated, and Name of Isolation Ward.	Not Isolated.		
				Years										
1	*April* 24	*July* 25	*Frederick Fuller*	...	*Lyford, Berks*	*Compound fracture, leg*	*Accident*	*Diffuse cellulitis*	*April* 28	*Mr. Briscoe*	*Isd.—Bagot*		Recovered	Much subcutaneous sloughing.
2	May 27	June 21	Jesse Hill	3	Summertown	Severe scalp wound	Do.	Erysipelas	June 10	Mr. Symonds	Do.		*Died*	Not isolated until day of death.
3	April 15	July 1	Edwin Slade	33	Banbury	Disease of bones of foot	North Attic	Do.	,, 19	Do.		Not	Recovered	Amputation, May 14th. Severe case.
4	June 30	Aug. 26	Charles Kilby	13	Oxford	Compound fracture, leg	Bagot	Do.	July 7	Do.	Isd.—Old Fever Block		Do.	
5	June 17	July 29	James Cox	52		Urinary disease	Rowney	Do.	,, 9	Dr. Gray		Not	Do.	
6	July 1	Aug. 12	George Thame	28	Abingdon	Abscess	North Attic	Do.	,, 11	Mr. Hussey		Not	Do.	
7	March 31	Aug. 5	William Collett	34	Appleford	Compound fracture, leg	Accident	Do.	,, 11	Mr. Symonds	Isd.—Old Fever Block		Do.	Severe case.
8	July 22	Aug. 13	Charlotte Dix	71	Oxford	Hæmorrhoids	Marlborough	Do.	,, 27	Mr. Hussey		Not	*Died*	
9	July 16	Aug. 15	James Sheppard	59	Stanton-Harcourt	Fractured thigh-bone	Accident	Do.	Aug. 3	Mr. Briscoe		Not	*Died*	
10	July 22	Oct. 7	Mark White	6	Denton	Abscess, leg	Do.	Do.	,, 4	Mr. Hussey		Not	Recovered	
11	July 30	Sept. 16	Ann Floyd	22	Oxford	Abrasion on knee	Marlborough	Do.	,, 10	Mr. Symonds	Isd.—Old Fever Block		Do.	
12	Aug. 14	Aug. 20	William Day	61	Oxford	Contused and lacerated thigh (severe).	Accident	Do.	,, 18	Mr. Hussey		Not	*Died*	
13	July 9	Oct. 21	Sarah Smith	40	Stonefield	Fracture into ankle	Litchfield	Do.	,, 30	Mr. Symonds	Isd.—Old Fever Block		Recovered	
14	Aug. 19	Oct. 7	James Castle	55	Islip	Bronchitis	Marlborough	Do.	,, 31	Dr. Gray	Isd.—New Fever Block		Do.	Severe case.
15	Sept. 5	Oct. 21	James Jackson	57	Whichwood	Abscess in hand	North Attic	Do.	Sept. 8	Mr. Hussey		Not	Do.	Do.
16	Sept. 2	Oct. 14	Henry Freeman	55	Ilford	Thecal abscess	Do.	Do.	,, 14	Do.		Not	Do.	Do.
17	Aug. 25	Sept. 30	William Sanders	24	North Merton	Fractured arms	Accident	Do.	,, 14	Mr. Symonds	Isd.—New Fever Block		Do.	
18	Sept. 9	Oct. 21	Thomas Norris	50	Wolvercote	Tumour (face)	West Attic	Do.	,, 16	Do.	Do.		Do.	Tumour removed. Erysipelas very severe.
19	Sept. 2	Oct. 28	Matilda Constable	23	Whitney	Disease of foot	South Attic	Do.	,, 20	Mr. Hussey		Not	Do.	Amputation. Very severe case.
20	*Sept.* 21	*Oct.* 17	*Walter Rogers*	20	*Oxford*	*Wound of wrist and erysipelas.*	*New Fever Block.*			*Mr. Briscoe*	Isolated		*Died*	
21	*Sept.* 30	*Nov.* 25	*William Chapman*	43	*Oxford*	*Erysipelas, leg*	*Do.*			*Mr. Symonds*	Do.		Recovered	
22	Sept. 19	Nov. 4	Frederick Crozier	15	Oxford	Empyæma	Do.	Erysipelas	Sept. 26	Dr. Tuckwell	Do.		Do.	
23	Sept. 1	Nov. 4	Sarah Grisfield	35	Oxford	Abscesses, after erysipelas.	Do.	Do.	Oct. (first week).	Mr. Briscoe	Do.		Do.	
24	July 1		John E. Dixon	35	Oxford	Multiple abscesses	North Attic	Fugitive erysipelas	At different times.	Mr. Hussey		Not		
25	Nov.		James Castle	55	Islip	Abscesses, neck	Rowney	Erysipelas	Nov. 22	Mr. Symonds	Isd.—New Fever Block			
26	Oct. 21		Thomas Bolter	17	Chipping Norton	Caries, bones of leg	Do.	Do.	,, 25	Do.	Do.			
27	Nov. 11		George Young	27	Oxford	Caries, bones of hand	Do.	Do.	,, 27	Do.	Do.			
28	Nov. 25		Charles Cooper	62	Headington	Injury, ankle	Accident	Do.	Dec. 1	Mr. Hussey	Do.			Severe, face.
29	Dec. 3		Thomas Edwards	19	Oxford	Thecal abscess (hand)	Do.	Do.	,, 9	Mr. Symonds	Do.			Severe, head.