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ON THE

TREATMENT

OF

BURNS AND SCALDS,

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BY

SAMUEL CROMPTON.

1851.

REPORT

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It is my design, in this Report, to give an analysis of the facts on the treatment of burns, which are contained in those communications which were collected during the years 1847-8, with the sanction, and on behalf, of the Provincial Medical and Surgical Association. To this analysis I have ventured to add some remarks of my own.

In November, 1847, I printed in the *Provincial Medical Journal* a few remarks on the necessity for an inquiry into the treatment and prevention of burns and scalds. In that letter the members of the Association were asked to state briefly the results of their experience, in order that the treatment which is generally adopted might be ascertained. The communications which were received prior to July, 1848, were printed, as far as practicable, at full length in the *Provincial Medical Journal.* The rest are embodied in this Report.

The following is a list of the names of those gentlemen who have contributed the results of their experience towards this Report, or who have assisted me in obtaining information :*—

Francis Adams, L.L.D., Banchory.
James Arnott, M.D., Brighton.
Charles Barham, M.D., Truro, Cornwall, Senior Physician to the Cornwall Infirmary.
T. Herbert Barker, M.D., Bedford, late House-Surgeon to University College Hospital, London.

* From by far the greater number of these I have received written information; with a few I have had verbal communication. I am under great obligation to Dr. Lyon, of Manchester, for the interest which he has taken in the inquiry, and for his valuable advice and assistance.

Benjamin Barrow, Esq., late House-Surgeon to St. Bartholomew's Hospital, London, now of Ryde, Isle of Wight.
Glass Black, M.D., Torquay, Devon.
B. J. Boulton, M.D., Horncastle.
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George Bowring, Esq., late House-Surgeon to King's College Hospital, and to the Manchester Royal Infirmary.
Robert Brown, Esq., Preston, Lancashire.
Thomas Brown, Esq., Castle Donington.
Francis Arthur Bulley, Esq., Surgeon to the Royal Berkshire Hospital.
John Casey, Esq., St. Helen's, Lancashire.
G. W. Charleton, Esq., House-Surgeon to the Gloucester Infirmary.
James Chapman, Esq., late Coroner of Manchester.
Charles Clough, Esq., Southport.
Herbert Cole, Esq., House-Surgeon to the Worcester Infirmary.
— Crossley, Esq., the Infirmary, Derby.
George Daglish, Esq., Honorary Surgeon to the Dispensary, Wigan.
J. C. Davie, Esq., Haddenham, Cambridge.
Daniel Dorning, Esq., Swinton, near Manchester.
William Eddowes, Esq., Pontesbury, Salop, Coroner for Shropshire.
George Edwardes, Esq., Surgeon to the Wolverhampton Dispensary.
Evan Evans, Esq., Bath.
J. E. Erichsen, Esq., Surgeon to University College Hospital, London.
William Farr, Esq., General Register Office, Somerset House.
J. D. Fidler, Esq., Surgeon to the Whitehaven Infirmary, and to the Earl of Lonsdale's Coal Mines.
James Fisher, Esq., Wigan.
John Gabb, Esq., Bewdley.
A. C. Gall, Esq., Ripley, Surrey.
Thomas Gaskell, Esq., St. Helen's, Lancashire.
T. M. Greenhow, Esq., Surgeon to the Newcastle Infirmary, &c.
R. Hampson, Esq., Bolton-le-Moors.
— Harding, Esq., House-Surgeon to the Leicester Hospital.
David Hartley, Esq., Resident Surgeon to the Cheltenham General Hospital.
Edward Herford, Esq., Coroner for Manchester.
John Higginbottom, Esq., Nottingham.
J. Barton Hilton, Esq., Swinton, near Manchester.
P. H. Holland, Esq., late of Manchester, now of London.
G. M. Humphry, Esq., Surgeon to Addenbrooke's Hospital, Cambridge.
P. A. Jackson, Esq., House-Surgeon to Bolton Dispensary.
G. King, Esq., Bath.
Jesse Leech, Esq., Heywood.
W. J. Lomax, Esq., of the Lincoln Dispensary.
A. Markwick, Esq., London.
James Mash, Esq., late House Surgeon to the Northampton General Infirmary.
F. Milne, Esq., Surgeon to the Chorlton Dispensary, Manchester.
Henry Mudge, Esq., Bodmin.
Washington Murphy, Esq., the General Hospital, Belfast.
William Newnham, Esq., Farnham, Surrey.

G. Norman, Esq., Senior Surgeon to the United Hospital, Bath.
W. B. Page, Esq., Surgeon to the Cumberland Infirmary.
A. Partridge, Esq., Senior Surgeon to the Essex and Colchester Hospital, Colchester.
Thomas Pope, Esq., Cleobury Mortimer, Salop.
J. M. Robinson, Esq., Bolton-le-Moors, Lancashire.
Edward Ross, Esq., House Surgeon to the West Herts Infirmary.
J. S. Sharp, Esq., Warrington.
Samuel G. Sloman, Esq., Farnham, Surrey.
Robert Smith, Esq., Ph. D. Professional Chemist, Manchester.
R. Snape, Esq., Surgeon to Bolton Dispensary.
Edward Stanley, Esq., F.R.S., President of Royal College of Surgeons of England.
J. C. Steele, Esq., Superintendent of the Glasgow Royal Infirmary.
Joseph Stone, Esq., late House Surgeon to the Ancoats Dispensary, Manchester.
William Strange, M.D., Bridgnorth, Salop.
W. Sweeting, Esq., Abbotsbury, Dorchester.
Thomas Sympson, Esq., House Surgeon to the Lincoln County Hospital.
— Towers, Esq., Hertford.
John Thompson, M.D., Surgeon to the Whitehaven Infirmary and Fever Hospital.
Professor Warren, Boston, United States.
James Whitehead, Esq., Surgeon to the Manchester Lying-in Hospital.
A. Wood, Esq., Rochdale.

It was not expected by me that this inquiry would elicit a series of papers containing entirely *new* views on the subject under consideration, nor would any one look for such a result from it, if he considered how difficult it is to throw fresh light upon practical subjects. The real object of the inquiry was to try to ascertain which of the numerous plans of treating burns, recommended in systematic treatises, are adopted by the profession, and what are the prevailing opinions respecting their value. The knowledge that is needed most is not what has been recommended in a given disease, but what has been found to answer, and is adopted in practice. The materials placed at my disposal constitute a mass of practical information of very great value. The gentlemen who have contributed it, have probably possessed more opportunities of witnessing examples of burns than will be readily believed by those surgeons who are ignorant of the frequency and severity of these accidents in some districts of England. Mr. Farr does not think that the deaths from burns and scalds in the United Kingdom can be less than 4,000 per annum. In the large manufacturing towns children are frequently burnt to death during the absence of their parents at work. In coal districts explosions frequently take place, and the surgeons attending the

workmen possess, perhaps, the best opportunities of making observations on burns. A very large proportion of these cases fall to the care of provincial private surgeons; who, therefore, possess the largest experience in the treatment of these accidents. It is true that in our large hospitals there are abundant materials for observation, and the house surgeons of those institutions might furnish much useful information on the subject, were there an efficient system adopted of registering cases. But most of the returns which I have received from the English hospitals are very incomplete, and do not admit of rigid analysis. I must except the return made out by Mr. Charleton, House Surgeon to the Gloucester Infirmary, which is printed entire in the appendix. The best and most complete register, however, is that furnished by Professor Warren, of America, of the cases occurring in the Massachusetts Hospital.* In addition to the usual information (which is given with a completeness and fulness which I have never seen equalled in any English hospital-registers), the time is stated which has expired before the treatment was commenced, and in some instances the extent, in inches, of the burns. Unfortunately the number of cases treated in that institution is too small for any important deduction, but had English registers been kept with similar care and discrimination, they would have afforded data of great value; in proof of which, I may mention the number of cases treated at the Manchester Royal Infirmary:—

Year.	Burns.	Scalds.	Total.
In 1840	168	125	293
1841	155	147	302
1842	175	173	348
1843	126	118	244
1844	170	165	335
1845	181	134	315
1846	172	108	280
1847	134	90	224
1848	115	102	214
1849	114	130	244

For the above table the Association is indebted to Mr. Watson Beever, Surgeon to the Infirmary. Mr. Hilton,† in his essay, enumerates twenty-seven cases of burns from coal-pit explosions,

* *Provincial Medical Journal*, 1849, page 353.

† *Provincial Medical Journal*, 1848, page 155.

(most of them *severe*), as occurring in his private practice during the twelve months preceding the date of his paper, being a much larger number than are treated annually in some city hospitals, and rather more than half the number treated in the Hotel Dieu during a like period of time. Mr. Dorning, who resides in the same village, and who has given an interesting paper on the employment of flour, has also had extensive experience in burns. But the surgeons in Staffordshire, in some parts of Lancashire, and in the neighbourhood of Newcastle-upon-Tyne, have probably had much more extensive practice. One practitioner calculated that he could not have treated fewer than some thousand cases of burn; he told me that they were of daily occurrence in the town where he dwells:—sometimes to the extent of fifteen or sixteen fresh cases a day, either in the coal mines, chemical works, or glass works. A hospital surgeon rarely sees a case of burn when it is first admitted, and it is seldom that he is present whilst it is being dressed on the succeeding days of treatment; whereas the cases occurring in private practice are more strictly under the eye of the medical attendant. He superintends the dressing and watches the cases throughout. Hence, in the course of a long life, these private practitioners living in burn-districts must have had such extensive opportunities of exact observation as to render their opinions on this question of great value.

The evidence which I have received is of a conflicting character, and it has been a task of great difficulty to arrange my materials in their present imperfect form. I find plans of treatment of opposite kinds pronounced to be very successful; and, what is still more perplexing, I find the same treatment commended by one person and condemned by another. Perhaps on no other surgical subject would it be possible to collect such conflicting opinions. There are almost insuperable difficulties in the way of arriving at a correct judgment of the relative value of remedies. The first is the difficulty of registering cases of burns in such a manner as to admit of rigid analysis, and the greatest obstacle to this is the want of a good classification. All the classifications of burns which are founded on the pathological effects produced in the injured parts, seem to me to be incomplete and of little practical utility. As a burn may produce simple erythema, or vesication, or mortification extending to various depths, and as these conditions may

be combined in various ways, so as to constitute many varieties of skin disease (which, if they arose from internal causes, would receive different names, and be treated as distinct complaints), it follows that any classification of burns founded, like Dupuytren's, on the tissues affected, is for practical purposes nearly useless. His degrees serve as no tests of the severity of the case, viewed in relation to the system at large, though they define the local severity of the burn. Hence his first degree, as he expressly states, while it embraces all cases in which there is simply erythema, includes equally cases in which the erythema is of so small an extent as to terminate by resolution in a few hours, or of so great an extent as to end in death.* His definitions do not so much as take into account the superficial extent. Now, suppose that a case occurred in which the erythema (without vesication) was of such an extent as to be fatal, and was published as having been treated with cotton or flour, or any other remedy, would not the profession be misled if some other surgeon were to publish cases of *cures* of persons burnt in Dupuytren's *first* degree, when their burns were of so small an extent as hardly to require treatment? Yet some English surgeons speak of cases of burn as being of Dupuytren's first degree or second degree, &c., but it seems that they are not aware that a case may contain all his six degrees, yet such is the fact. His words are, "Enfin, dans les brûlures generales on trouve ordinairement tous les degrés sur differentes regions du corps."† Further, he adds that which appears to me to be fatal to the *practical* value of his classification, that is, if viewed as a guide to the treatment of the case,—"Il est à remarquer que les caractères de ces degrés d'altérations organiques produites par les brûlures, quoique bien tranchés, *sont neanmoins, dans beaucoup de cas, difficiles à distinguer aussitôt après l'accident.*—La plupart des brûlures se montrent, après la chute des escarres, et plus profondes et plus larges *qu'on ne l'avait cru dès le premier abord.* De ces faits nous devons déduire une conséquence très-importante en médecine légale: c'est que, dans les brûlures du troisième degré et au-delà, il convient presque toujours d'attendre, *pour porter un jugement sur leur gravité, que les escarres ayant commencé à se détacher,*

* Leçons Orales de Clinique Chirurgicale, Bruxelles, 1836, tome i., 209.

† Dupuytren, p. 213.

l'étendue du désordre soit enfin fixée."*† Again, he observes, that "each of these degrees, according to the extent of surface implicated, may present itself as a purely local affection, or produce such effects as may be attended with more or less risk to the patient's life." Hence, I think it may be safely inferred that M. Dupuytren did not mean by his "degrees" to express the severity of the burn *in relation to the safety of the patient*, but simply the degree of injury done to the tissues in each spot. His division renders the local injury the great object of attention, and yet it is so imperfect that (as he admits) it is impossible to tell in most cases, in the first instance, what is the degree of the burn. Besides, the burnt surface is momentarily undergoing changes: erythema at three o'clock may be vesication at ten minutes past. But though his division of burns seems to be not sufficiently practical, still he has thrown such important light on the pathological conditions found in the head, chest, and abdomen of those who have died from burning, that it will hereafter be considered that a new era in the management of these accidents originated with his investigations. Without professing to give a perfect classification of burns, I may denote those points which are essential to a sound practical classification, which are, firstly, the effects produced on the constitution of the patient; and, secondly, the extent of the burn. My meaning will be better understood by an illustration derived from the analogy which there is between the human body and a kingdom, rather than by the employment of the vague terms which are in use to explain, or express, the various conditions of the system called shock. If any influence is brought to bear upon the human body, and produces effects which are not compatible with the easy and due performance of the vital functions, the nervous system has the power of so adjusting the action of the injured part, or of those which are adjacent, as to compensate for the mischief, by either restoring the part to health, or making its loss or injury as little prejudicial as may be. So in a kingdom, if an insurrection takes place in (we will suppose) some distant part, the local authorities,

* Dupuytren, p. 214.

† Dr. Lyon reminded me that Cullen had some pertinent remarks on this point:—"Characteres autem, non nisi post longum morbi decursum, fortassis non nisi post morbum finitum, statuendi, nequaquam in Nosologia usurpari debent. Ita apud Ill. Linnæum, *Febrium continentium*, quas vocat, characteres a diuturnitate totius morbi desumpti prorsus inepti sunt."—Cullen, by Thompson; 1827, vol. i., p. 240.

holding their power from the higher, may, if it be of small extent, suppress it without requiring the help of the central government, and the latter may scarcely feel it or be affected by it; but if the magnitude of the danger be such as to require greater force for its removal, the central or governing power may be so far affected by it as to be paralysed, or it may feel the magnitude of the danger so acutely as to be roused to the most strenuous action: everything else being set aside except the suppression of the insurrection. So it is in the body: if the injury done by a burn be—

1. *Local;* that is, of so small an extent as not to affect the nervous centres, so as to produce any of those symptoms which are usually spoken of under the generic term *shock;* the adjusting power of the parts adjacent to those injured, seems to be nearly sufficient to repair the mischief, and what the nervous centres contribute does not interfere with their other relations. In these cases, the pain from the burn is usually very severe; the patient acts for himself, his perceptions and sensibilities are neither lessened nor perverted, nor is the circulation much quickened or depressed, nor are there shiverings.

But if the mischief done to the injured part be of greater importance, the condition of the system is the best, and certainly the only sure guide to us in judging of its gravity. Here the local affection is secondary in importance, and the management of the burned part is to be regarded less than the derangements of the nervous centres, and the train of symptoms which immediately begin to spring from the shock communicated to them. These, it seems to me, form a distinct class, which may be termed:

2. *Constitutional* or vital burns, which are capable of several sub-divisions, according to the severity of the *constitutional symptoms.* These, chiefly, and not the condition of the burnt parts, (except, perhaps, the *superficial extent,* or the implication of blood-vessels, &c.,) being the points to be watched; in comparison with which the local injury is of very secondary importance.

The grades of this influence on the constitution derived from burns, are very various, and it is not easy to define them; but they may be enumerated generally as great weakness and frequency of pulse, so that frequently it can scarcely be counted or detected when the patient is seen immediately after the injury; the extremities cold; the face bluish; the respiration frequent; the stomach irritable,

and perhaps rejecting what is administered; intense thirst. In more severe cases, loss of sensibility of the skin, and instead of complaining of the burning sensation, there seems to be insensibility to pain; in some cases the application of hot spirit of turpentine not giving pain, but rather relief; violent shivering, like that in the cold stage of a fit of ague, repeated too at intervals; insensibility of the sound skin when pinched; coma, convulsions, &c.

Shivering, (though not enumerated by Dupuytren among the symptoms of burns, nor mentioned, according to Kentish, by any writer before himself,) is one of the most striking features in cases which come under the observation of English surgeons, and it seems to me to be the most important of the early symptoms as a guide in shewing whether, and how far, the constitution suffers from the burn. If the pain in the burnt part is complained of as a very severe burning pain, and there is no shivering, the case is generally one which will recover. If, however, there is shivering, and the patient does not seem to suffer much burning pain in the part, there is danger, and the case is one in which the treatment must be mainly constitutional. In proportion to the severity of the shivering, and the frequency of its recurrence, will usually be the danger of the burn. These are the words of that able observer, Dr. Kentish: "The cold shivering is a symptom which I have always observed in such accidents, and, according to its violence and its frequent repetition, I have been enabled to estimate the degree of violence done to the general system. The more frequent and violent the shivering fits are, the greater the febrile re-action."* In another place he remarks, "I have invariably found them occurring as the first marked symptoms, and I have been much aided in forming a prognosis of the extent of mischief done to the general system by the accident. The irritative fever is in proportion to the violence and the frequent recurrence of the shivering fits."† Hence, then, the importance of the existence of shivering, and its recurrence, as a test of the severity of a burn, and therefore as a line of demarcation by which we may separate those cases which require *constitutional* treatment chiefly, from those which require merely *local* treatment. It is curious that, as a result of the application of heat to the body, it should be possible to draw such a distinction,

* Kentish, 1817. p. 59.

† Kentish on Burns, 1817, p. 150.

as that one class of cases should be complaining of the intense heat in the injured part, whilst the other class should be shivering. It is probable that the conflicting and perplexing statements respecting the efficacy of remedies in burns, depend mainly on this difference in the condition of the system. If there be the feeling of burning heat in the part, we can understand how cold applications would be grateful; and, further, how the case would get well, even though they were not the best, for the powers of the nervous system are intact. But surely no one would recommend the continued application of cold to a patient labouring under the depression and shivering attendant upon a severe burn. The importance of some such line of demarcation as that which I have just pointed out, will be more obvious when we take into consideration the facts ascertained during late years, respecting the condition of the internal organs, and the mortality from burns during the first forty-eight hours after the injury. In the *Provincial Medical Journal*, 1848, pp. 73, &c., there is a rather full abstract of the facts contained in a pamphlet on the "Pathology of Burns," forwarded to me by Mr. Erichsen, in which he gives "a Table of the Pathological Appearances observed in fifty Cases of Burn." He arranges those cases under three heads, viz: those that died, 1st, during the period of *congestion;* 2nd, during the period of *inflammation;* and 3rd, during the period of *suppuration.* The period of congestion is limited to 48 hours, in which death occurs before inflammatory action comes on, or, at all events, is fully established; and he enumerates 16 cases as having died in this stage, in 15 of which the brain and its membranes were found congested, with more or less serous effusions into the ventricles and arachnoid; in the 16th case the head was not examined. There was congestion of the lungs, with more or less redness of the bronchial membrane, and effusion into the pleuræ in 8 cases; and in 12 there was congestion of the abdominal organs, more particularly of the mucous membrane of the stomach and ilium. Thus, it appears, that in all the patients who died during the period of congestion (irritation of Dupuytren) there were found sufficient structural lesions, more particularly of the brain and its membranes, to account for death, without attributing the event to the operation of so obscure a cause as excess of pain, or too great a loss of sensibility.*

* Erichsen, page 9.

In those persons who died during the period of inflammatory re-action and inflammation, (that is from the second day to the end of the second week), and including 25 cases; the state of the brain and its membranes is not mentioned in 8 cases. Of the remaining 17, there was congestion or evidence of inflammation, with more or less effusion of serous fluid, principally of a bloody character, in 11 cases; there was serous effusion only in 3; and a healthy condition in 3. The state of the thoracic viscera is not mentioned in 6 cases; in the remaining 19, there was congestion, (probably in many cases inflammatory), in the lungs, with more or less effusion of serum or lymph in the pleuræ, with redness of bronchial mucous membrane in 10; lungs hepatized in 5, and healthy in 4. The state of the abdominal organs is not mentioned in 3 cases; of the remaining 22, there was increased vascularity, chiefly of the mucous membrane of the small intestines, with, in some cases, evidences of peritonitis in 11; ulcers in the duodenum in 6; abdominal organs healthy in 5. Thus, it will be seen, that the cases in this class differ in some very important respects from those in the preceding one. The cerebral lesions are found to be not quite so frequent, but, when they do occur, they present more unequivocal evidences of inflammatory action. The lungs are rather more frequently affected, and show decided marks of pneumonia or of intense bronchitis; as manifested by the former disease having, in several cases, advanced to hepatization, and by the inflamed state of the bronchial mucous membrane, which is usually coated with a thick frothy mucus. Appearances indicative of pleuritis are also by no means uncommon in those cases that prove fatal during this period. The most marked characteristics of it, however, are to be found in the lesions of the abdominal organs, which, although not so frequent as in the stage of congestion, are, unquestionably, of a far graver nature: that very remarkable and serious sequela of burns, perforating ulceration of the duodenum, being found in no less than 6 of the 22 cases, or one of every 3.6 deaths that occur during this period. I may here state that in one instance, ulceration of this portion of the intestinal canal was found in a patient who died on the fourth day after the infliction of the injury; the only case on record, I believe, in which this lesion has been noticed at so early a period; Mr. Curling not mentioning in his collection of cases any that occurred before the seventh

day. Beside the lesion just mentioned, there are abundant evidences of the existence of peritonitis and of congestion, very probably inflammatory, of the intestinal mucous membrane of those who die during this period.

The cases contained in the third class (those in which death occurred during the period of *suppuration,*) are nine in number; and these we shall find to be distinguished by several interesting peculiarities.

The *brain* and its membranes were not examined in four cases. Of the remaining five,—

There was effusion with congestion in...	1
There was effusion without congestion in	2
Preternatural dryness in	1
Healthy condition in	1

State of the *thoracic* viscera not mentioned in two cases. Of the remaining seven,—

There was congestion of the lungs, with effusion into the pleura, in ...	2
Purulent infiltration of the lungs in	2
Hepatization of the lungs in	1
Recent lymph effused into the pleuræ in	1
Lungs healthy, but exsanguine, in	1

The condition of the *abdominal* viscera not mentioned in two cases. Of the remaining seven,—

Inflammation of duodenum, and congestion of ileum, in ...	1
Congestion of ileum in	1
Cicatrized ulcer in stomach; otherwise healthy, in	1
Healthy in	4

Thus it will be seen that, in the third class of cases, lesions of the lungs are the most common;—of the brain, least; whilst those of the abdominal viscera are but of infrequent occurrence.

Of six cases in which morbid changes were found in the lungs or pleuræ, one died on the 24th, and the remaining five between the 30th and 39th days. The pneumonia will at this period be found to be in a more advanced stage, having, out of the five cases in which it occurred, gone on to purulent infiltration in two, and to hepatization in one. There is one case of peculiar interest in this class, viz: that in which a recently cicatrized ulcer was found in the stomach, which lesion must, like the duodenal ulcers, have occurred during the second period, the patient dying in the third of pneumonia and bronchitis.

Thus then it will be found, that of the cases that occurred during the first period,—

The cerebral organs were diseased in ...	15 out of 15 or 100 per cent.
The abdominal organs were diseased in ...	12 out of 14 or 85.7 per cent.
The thoracic viscera diseased in	9 out of 14 or 64.2 per cent.

In the second period the comparative ratio is as nearly as possible the same; if anything the cerebral organs are a little more frequently affected.

The brain and its membrances diseased in..	14 out of 17 or 82.3 per cent.
The thoracic viscera diseased in	15 out of 19 or 78.9 per cent.
The abdominal organs diseased in	17 out of 22 or 72.2 per cent.

In the third period—

The cerebral organs diseased in	4 out of 5 or 80 per cent.
The thoracic viscera diseased in	6 out of 7 or 8.57 per cent.
The abdominal viscera diseased in	2 out of 6 or 33.3 per cent.

On taking the total amount of the whole of the cases, and reducing it to decimals, it will be found that—

The cerebral organs were diseased in ...	33 out of 37 or 89.1 per cent.
The thoracic viscera diseased in	30 out of 40 or 75 per cent.
The abdominal viscera diseased in	31 out of 42 or 73.8 per cent.

The period at which death may be expected to occur varies, necessarily very considerably, according to the nature of the individual case, the extent or severity of the burn, and the age or constitution of the patient. On taking, however, the aggregate of the 50 cases, without reference to these modifying circumstances, we shall find that 33 or 66.0 per cent. prove fatal during the first week. Of these 33, no less than 27 died during the first four days, and the remaining six on the three following days.

Of the 17 that were left—

8	died	during the	2nd week.
2	,,	,,	3rd ,,
2	,,	,,	4th ,,
4	,,	,,	5th ,,
1	,,	,,	6th ,,

Thus it will be seen that the greatest number of deaths occur during the first few days, in the stage of congestion, or whilst that condition is passing into an inflammatory one. After this period the mortality diminishes progressively until the fifth week, the

period of suppuration, when the chief dangers to be apprehended arise from exhaustion, purulent infiltration of the lungs, and inflammation of those organs.

The relative frequency with which different organs are affected at different ages, varies somewhat, though but to a very trifling degree. On dividing the whole of the cases into two classes, those which occur below the age of puberty or fourteen years, and those which occur above that age, it will be found that 29 cases fall into the first division, and 20 into the second,—the age not being mentioned in one.

Of the 29 cases, or those that occurred below the age of puberty—

The brain, &c., not examined in	8
,, ,, healthy in	4
,, ,, diseased in	17 or 80.9 per cent.
The thoracic viscera were not examined in ...	5
,, ,, healthy in	6
,, ,, diseased in	18 or 78.2 per cent.
The abdominal viscera not examined in ...	2
,, ,, healthy in	6
,, ,, diseased in	21 or 77.7 per cent.

Of the 20 cases that occur above the age of fourteen—

The brain and its membranes not examined in	5
,, ,, healthy in	0
,, ,, diseased in	15 or 100 per cent.
The thoracic viscera were not examined in ...	3
,, ,, healthy in	3
,, ,, diseased in	14 or 82.3 per cent.
The abdominal viscera were diseased in	13 or 81.2 per cent.
,, ,, healthy in	3
,, ,, not examined in	4

Mr. Erichsen then proceeds to point out the analogy between the morbid appearances observed after death from burns, and those which are observed in death after some of the eruptive febrile diseases, such as small-pox, measles, scarlatina, and erysipelas, in which the functions of the skin, as an eliminating organ, are more or less extensively suspended.

Both after burns and the eruptive febrile diseases, "nothing is more common than to find the mucous membrane of the stomach and bowels congested or inflamed, the follicles being enlarged and prominent; together with evidences of meningitis, whether consisting in the deposition of lymph, or the effusion of serum, with more or

less congestion of the cerebral substance. Inflammation of the bronchial membrane is also of very frequent occurrence, and inflammatory congestion of the tissue of the lungs, in its different stages, is by no means rarely met with. Thus, then, the lesions that occur, as a consequence of the eruptive febrile diseases, are very similar, in many respects, to those that are found in fatal cases of burns."

"When we consider that the average quantity of the cutaneous secretion amounts in a healthy adult to eleven grains in the minute, or between two and three pounds in twenty-four hours, (Seguin,) we cannot suppose that this secretion could be suddenly arrested to the extent of one half, or even more, as it necessarily must be, when a corresponding portion of the skin is injured by the action of caloric, without its being absolutely necessary that one of two things should happen; either that an antagonistic secretion, to a corresponding amount, be set up from some other tissue or organ, or else that a degree of plethoric distension of the whole vascular system, giving rise to congestions of internal organs and membranes, and effusions into serous cavities, take place. Now, the first does not occur in most cases of burns to a sufficient extent, but the system becomes hyperæmic. Congestions ensue in the mucous membranes, partly from the condition that is common to all the tissues, and partly from the increased afflux of blood that is always attendant upon increased functional activity of a part. The brain and lungs, as well as other large organs, occasionally become engorged, effusion of a more or less bloody fluid takes place into the different serous sacs, the arachnoid amongst the rest, and death ensues from causes that are themselves the immediate effects of suppression of the natural secretion of the skin. By this means we may account for the occurrence of death in the earlier period of burns, before there has been time for inflammation to be lighted up, and also for the fatality of those injuries of this nature, that are extensive but superficial,—burns of the first and second degree,—in which cases the functions of the skin injured are entirely and suddenly arrested.

"The practical bearing of the facts that have been mentioned in the first part of this paper, on the constitutional treatment of burns, is sufficiently obvious. If, as has been stated, the immediate cause of the occurrence of internal congestions and consecutive inflamma-

tions be the suppression of the cutaneous transpiration to a greater or less extent, and consequent retention in the system of a large quantity of fluid that ought to pass off by the skin, we should, in order to prevent the supervention of these secondary diseases, endeavour to set up such a drain on the system as would, as rapidly as possible, compensate for the arrest of the secretions of that tissue, and have a tendency to restore the balance of the circulation, disturbed by the accumulation of an unusual quantity of fluid in the system. This may either be effected by the employment of diuretics, so as to induce an increased action of the kidneys, by guarded blood-letting, carried to such a length as the powers of the patient would allow, or else, (what would be better, if time and the nature of the case would admit of it,) by encouraging the process of suppuration as quickly as possible. It is a question whether diuretics or blood-letting might not be of advantage in preventing internal congestions in extensive *superficial* burns, in which the suppurative process would, probably, not be established; the injury not being sufficiently deep for that purpose. On the other hand, when the burn extends to a greater depth, if there be no immediate occasion for the loss of blood, from the actual occurrence of visceral mischief, the process of suppuration should be hastened and maintained, consistently with the powers of the patient, as a useful drain, and as perhaps the best mode of relieving the system from the pressure of the fluid retained within."

Mr. Erichsen then points out the necessity of watching carefully for the occurrence of any cerebral symptoms in cases of burns, and of meeting them with vigorous measures, on account of the rapid progress of the inflammatory congestion and effusion in such cases. He says that there can be no doubt that this may be frequently accomplished by prompt venesection or bleeding; and he quotes a case which occurred in Mr. Cooper's practice, at University College Hospital, in a child of six years of age, who was admitted "for an extensive burn, (of the first, second, and third degrees,) of the upper part of the trunk, arms, and face. Symptoms of encephalitis, followed by violent convulsions, and complicated with an extensive bronchitis, set in, a few days after admission; for these she was bled twice in the jugular vein, and treated in an active antiphlogistic manner, and notwithstanding the injury for which she was admitted, and the serious nature of the affections with which it was complicated,

she recovered perfectly, although there can be little doubt that, had less energetic and prompt measures been had recourse to, a fatal result would have occurred." A somewhat similar case is reported in the *Lancet*, by Mr. Thomas: it occurred at the Middlesex Hospital. Next to the brain, it is necessary to observe the condition of the lungs; any symptoms of mischief in them, however trifling, must be anxiously watched, and promptly treated. If mischief is perceived in the chest, as active treatment as the case admits of must be adopted to meet it. Mr. Erichsen puts in a caution against forgetting the reduced condition of the patient after the burn, and the need he will have for strength to support him through the suppurating stage. He thinks there is greater risk from inactive treatment in the early stages of visceral inflammation caused by burns, than from too great a depression of the vital powers at a more advanced period, from too energetic depletory measures. It is easier "to build up the strength" than to "check the course of inflammation without due depletion."*

Mr. Erichsen concludes with the following words:—"On taking, then, a general review of the constitutional treatment of burns, it may be stated that the first object should be to relieve the system of the abnormal quantity of fluid that must have accumulated in it, in consequence of the arrest, to a greater or less extent, of so important a secretion as the perspiration. This may be accomplished either by the administration of diuretics, by guarded blood-letting, or by encouraging the process of suppuration, if it be deemed prudent to wait till this be established. Secondly, that any appearance, however slight, of the supervention of inflammation in the organs contained within the head, chest, or abdomen, should be watched with the utmost anxiety, and treated, if it do occur, as the circumstances of the case will admit. And, thirdly, that the process of suppuration should be maintained or arrested with a due regard to the state of internal organs, and the condition of the powers of the system."

From these *post-mortem* examinations, we derive most important information respecting the causes of death from burns. If we entirely exclude from our consideration the external sores, we find enough in the brain, lungs, and abdominal viscera to account for

* Nearly the whole of the foregoing abstract is in the words of Mr. Erichsen, though inverted commas are generally omitted.

death, and to prove to us that, to treat severe burns successfully, we must chiefly direct our attention to the constitutional symptoms. By an examination of the Coroner's depositions at inquests held on persons who had died of burns and scalds in the borough of Manchester, the following facts have been ascertained, which show the necessity of early treatment. In order to obtain these facts, the whole of the depositions, in upwards of 300 cases, were read twice, and the day and hour of the accident were ascertained precisely from the evidence, (sometimes however with great difficulty,)* as well as the hour of death, so that these data may be relied upon as exhibiting accurately the facts they profess to show respecting 300 cases. Some more general facts were ascertained respecting *all* the inquests, amounting to 701.

Between the 19th day of April, 1839, and the 21st of February, 1850, it appears that inquests have been held, in this borough, on 701 persons who have died from burns and scalds.

Of these 701 persons—

311	were males.	
390	were females.	
There were, under one year of age		21
,, one year and not two		55
,, two and not three		58
,, three and not four		85
,, four and not five		88
Total, under five years old		307
Between five and ten, there were		191
Total deaths under ten years of age		498
,, between ten and twenty		76
,, ,, twenty and sixty		88
,, ,, sixty and upwards		38
		700
Age of one not known		1
		701

Mr. Barrow, in his communication on burns, directs attention to the following statement contained in the Registrar-General's

* A witness would depose that on Friday last, at four o'clock, as he was passing along a street he saw a child in flames, &c. In order to ascertain what day of the month *Friday last* was, it was necessary to procure an almanack of that particular year, and so ascertain the date; afterwards the calculation was made of the interval between the accident and the death.

TABLE I.,

EXHIBITING THE NUMBER OF DAYS OR HOURS THAT THE PATIENTS SURVIVED THE ACCIDENT.

Under One Year.		One and under Two.		Two and under Three.		Three and under Four.		Four and under Five.		Five and under Ten.		Ten and under Twenty.		Twenty and under Sixty.		Sixty and upwards.	
Days.	*Hours.*	*Days.*	*Hours.*	*Days.*	*Hours.*	*Days.*	*Hours.*	*Days.*	*Hours*	*Days.*	*Hours.*	*Days.*	*Hours.*	*Days.*	*Hours.*	*Days.*	*Hours.*
5	-	4	-	17	-	2	-	-	?	-	6½	31	-	8	-	-	4½
4	-	2	-	15	-	-	10	-	5	21	-	-	5½	11	-	-	7
-	14	1	-	1	-	1¼	-	-	3½	-	11	63	-	13	-	3	-
14	-	1⅓	-	-	2½	56	-	57	-	-	3	-	7½	74	-	1	-
-	17	15	-	-	7	-	7	-	15	7	-	1¼	-	-	13	8	-
13	-	1½	-	-	3	4	-	10	-	4	-	-	9	18	-	-	19
2⅓	-	-	10	1½	-	40	-	2	-	1	-	14	-	52	-	-	16
		1½	-	1½	-	-	18	-	5	1	-	-	7½	4	-	4	-
		11	-	5	-	4	-	-	2½	-	7	-	1	10	-	21	-
		-	18	-	6	21	-	-	3	8	-	-	12	1½	-	1½	-
		-	21	16	-	7	-	-	9	2	-	3	-	-	10½	2	-
		2	-	-	5	1½	-	-	6	-	3½	23	-	14	-	1¼	-
		9	-	5	-	-	20	2	-	2	-	1½	-	-	20		
		5	-	-	21	-	3½	1	-	-	16	21	-	61	-		
		1⅛	-	2	-	-	12	-	⅓	-	14	-	15	-	5½		
		-	2¼	9	-	-	19	-	13	-	7½	1½	-	-	16		
		1⅙	-	-	20	2	-	2⅓	-	-	20	2	-	-	6		
		5	-	-	13	1	-	6	-	-	13½	-	17	3	-		
		24	-	-	7	12	-	2	-	1⅓	-	-	22	-	8		
		1 1/12	-	-	¾	-	9	-	6	-	15	3	-	12	-		
		16	-	4	-	7	-	-	12	-	11	23	-	-	5		
		11	-	19	-	-	22	-	12	-	13	-	14	-	7		
		2½	-	15	-	2	-	-	11	-	3	6	-	-	15		
		1¼	-	22	-	-	13	3	-	37	-	1½	-	12	-		
		-	6			-	23	25	-	15	-	4	-	4	-		
		22	-			-	16	-	9	-	3½	3	-	-	15		
						5	-	1	-	-	18	1⅙	-	47	-		
						1½	-	1⅓	-	3	-	70	-	-	13		
						5¼	-	6	-	-	5½	30	-	-	7		
						15	-	28	-	-	10	26	-	9	-		
						-	18	7	-	-	15	1⅓	-	-	19		
						3	-	18	-	1 1/12	-	8	-	20	-		
						4	-	10	-	-	5	-	9	6	-		
						1	-	-	14	-	15	8	-	5	-		
						1½	-	1¼	-	1 1/12	-			20	-		
						13	-	-	16	1	-			-	1?		
						-	17			-	22						
						-	12			-	19						
						1½	-			41	-						
						3	-			1½	-						
						3	-			1¾	-						
										-	20						
										30	-						
										-	4						
										20	-						
										-	17						
										1½	-						
										-	23						
										4	-						
										-	7						
										2	-						
										6	-						
										2	-						
										-	3						
										2	-						
										-	15						
										-	4½						
										-	20						
										-	19						
										-	11						
										7	-						
										-	17						
										-	12						
										1 1/12	-						
										3	-						
										31	-						
										2	-						
										-	6						
										3	-						
										5	-						
										-	6						
										-	21						
										-	20						
										-	17						
										-	18						
										5	-						
										-	18						
										1½	-						
										26	-						
										15 (?)	-						
										1⅛	-						
										16	-						

Report for 1845:—"That whilst 3305 persons were killed in one year by every kind of mechanical injury,—in the same period 3057 were lost by fire, (viz., 148 by explosions, 2577 by burns, and 332 by scalds,) and upon analysing the 2909 deaths by burns and scalds, there were, of—

Males, between the ages of 5 and 10	275
" under the age of 5	799
Total,	1,074
Females, between the ages of 5 and 10 ...	528
,, under the age of 5	672
Total	1,200
Total males and females under 10 years	2,274

leaving the small proportion of 635 for both sexes above the age of 10."*

The opposite table (TABLE I.) shows the interval between the accident and death in 300 cases, at different ages, specifying the number of *hours* of life in those cases in which the patient lived less than twenty-four hours, and the number of *days* when he lived longer than twenty-four hours. It is read as follows: under one year of age, the seven deaths took place, respectively at 5 days, 4, 14, 13, and 2⅓ days, and in 14 and 17 hours.

TABLE II.

AGE IN RELATION TO FREQUENCY OF DEATH.

Deaths occurring under one year of age						7
,,	,,	at one and under two years of age ...				26
,,	,,	two	,,	three	,, ...	24
,,	,,	three	,,	four	,, ...	41
,,	,,	four	,,	five	,, ...	35
,,	,,	five	to	ten	,, ...	85
,,	,,	ten	,,	twenty	,, ...	34
,,	,,	twenty	,,	sixty	,, ...	36
,,	,,	sixty and upwards				12
						300

* *Provincial Medical Journal*, 1848, p. 210.

TABLE III.

DURATION OF LIFE IN RELATION TO AGE.

	Died within 24 hours.	Survived longer than 24 hours.	Total.	Died at 2 days and under.
Under one year of age.....	2	5	7	2
One year and under two years...	5	21	26	15
Two ,, three ,, ...	10	14	24	14
Three ,, four ,, ...	15	26	41	25
Four ,, five ,, ...	17	18	35	24
Five ,, ten ,, ...	43	42	85	63
Ten ,, twenty ...	11	23	34	18
Twenty ,, sixty ...	15	21	36	16
Sixty and upwards	4	8	12	8
	122	178	300	185

These facts show how large a proportion of cases die before suppuration takes place, and that in the majority, it is by the shock, and not by the discharge from the burnt surface, that the patient is weakened and destroyed; indeed, the occurrence of suppuration in severe burns is a most favourable sign. Further, it certainly is not from the pain in the injured parts, that death arises, for in the worst cases the patient does not complain of pain, but even tolerates the topical application of stimulants which, in burns of a less degree, would produce much pain. In severe burns, then, the condition of the nervous system is the chief subject to be considered, and the applications to the parts ought to be, not only such as are suitable for their altered physical condition, but such also as will, at the same time, answer for the train of symptoms which belong to the nervous system. Accordingly, as shivering is usually the most striking symptom, it is the universal custom to cover up a burned part. The first and most important point, therefore, to be settled in the treatment of burns, is the *principle* on which those external remedies act which are beneficial. The general opinion is that *exclusion of the atmospheric air* is the chief point to be attended to in the external treatment of burns; and the beneficial action of flour, cotton, &c., is supposed to depend very much on their property of excluding the atmospheric air. They do good likewise by affording an appropriate mechanical defence to the injured parts. It seems to me that, though this explanation of the mode of action of most of the approved remedies may be accurate enough

not to mislead the practitioner, yet that *it is not philosophically correct* to account for their action by saying that they do good by excluding the atmospheric air. Cotton wool, which is generally represented as acting in this manner, *does not exclude the air*, and is itself a substance which contains a larger quantity of air than most others. And the same may be said of many others. It would appear to be more philosophical to say that they act beneficially by reason of their high powers of resisting the transmission of heat; in other words, that they are *non-conductors*.

I am led to this conclusion by a variety of circumstances. It appears to me to be incorrect to regard the air which we can take into the minute texture of our lungs as an irritant to an external sore. If the air is as injurious to the skin when it is excoriated, (as it is commonly supposed to be,) might we not expect that it would be *very irritating* to a mucous membrane, even when in a healthy state? But it is not so; and, further, if the air which passes over an inflamed mucous membrane *be warm*, it does not appear to harm it. But when the air is exceedingly cold it does harm, not only to the inflamed but to the healthy mucous membrane, especially to the lining of the respiratory organs. As an example of the irritant effect of cold air on the healthy mucous membrane of the nostrils, I may instance the increased discharge of mucus from them on a cold frosty morning, and the pain which is then felt when the cold air first enters the nostrils immediately after sneezing or blowing the nose. I need not remind you, that in warm weather, the air produces no such effect on the nostrils. Therefore, it is manifest that it is the accidental circumstance of its COLDNESS which is pernicious. Air of itself, *air as air*, produces no irritation; but *cold* air, that is, air destitute of a given proportion of caloric, produces much irritation. If we bear in mind the analogy which exists between skin and mucous membrane, we can hardly suppose that air will be more injurious or irritating to the skin, than it is to the mucous membrane of the respiratory organs. And if *warm* air can continually pass in a current, and in large quantity, over the inflamed mucous membrane of the mouth, nostrils, and bronchi, without producing much irritation, (if any,) can we suppose that air, if warm, does harm to any sore or wound of the skin? Is it not more just to suppose that it is the fact of its possessing a greater or less amount of sensible heat which renders it injurious

or the contrary? But by appealing to the process of nature in the healing of wounds, we find a confirmation of these views: blood or serum coagulates upon a wound, and forms a dry scab, which is not only an excellent mechanical defence to the sore, but a powerful non-conductor of heat. Further, we find a close agreement between what we observe in nature and the results of experience; for surgeons take as the basis of their dressings such animal and vegetable substances as are known to be the best non-conductors of heat, e.g., spermaceti, wax, suet, resin, animal and vegetable fixed oils, isinglass, mucilage, &c. So exact is the agreement between theory and practice that, according to Dr. Duncan, the three classes of outward applications,—"ointments, cerates, and plasters, are *all* combinations of fixed oil or animal fat with other substances." That is to say, their basis consists of those substances which in the living animal or vegetable resist sudden changes of temperature, and, in the former, play a most important part in the maintenance of the animal heat. Such external applications as lint, simple poultices, and the water-dressing, do not appear to be exceptions to this law. But in order to make myself better understood, it is necessary that I should say a few words on the non-conducting power of water and other fluids, and more particularly on the retardation of the convection of heat in them, by the addition to them of certain substances. I need not do more than allude to the facts, that it is possible in a short time to make a large bulk of water hot by the application of heat to the bottom of the vessel in which it is contained; and that, on the other hand, it is difficult to heat it at all by the application of heat to the surface of the water; and that though water is not absolutely a *non-conductor* of heat, yet that it conducts so badly as to have made Rumford conclude that it is an absolute non-conductor. But it is to the experiments of Rumford, on the retarding of the cooling of water when some substance has been added to it which prevents the free motion of the particles of water, that I wish to call more particular attention. He found, on drying 960 grains of stewed apples, that the solid or fibrous residuum weighed $18\frac{9}{10}$ grains only, consequently that apples consist almost entirely of water. He had previously observed that stewed apples are much longer in cooling than plain water; he, therefore, inferred it was from the solid matter retarding the motion of the particles of water upon each

other on which the greater slowness of cooling depended. In order to prove how far this takes place, he placed a thermometer in stewed apples raised to 200° F.; the cup in which the apples were contained was then plunged into melting ice, and the number of seconds was observed which it took to fall from 200° to 40° F. He then substituted pure water for the stewed apples, and noted the time of cooling:—

The mean time of cooling from 160° to 80° in stewed apples was 520″.
" " " water was ..... 277″.

These experiments prove that the addition of a very small weight of certain substances to water tends greatly to retard the cooling of water. And Rumford proved, further, that starch dissolved in the water, or eider-down added to it, both acted in the same manner. It is necessary that the substances thus added should be non-conductors. The same law seems to prevail respecting aeriform fluids. They carry away heat rapidly by *convection*, but exceedingly slowly by conduction, so slowly indeed that Count Rumford regarded them as perfect non-conductors. He thought he had proved that air, so long as it is imprisoned,—that is, is not in motion,—is a perfect non-conductor of heat; but it does possess a low conducting power. He observes, "But among all the substances of which coverings may be formed for confining heat, none can be employed with greater advantage than common atmospheric air. It is what Nature employs for that purpose, and we cannot do better than imitate her. *The warmth of the wool and fur of beasts, and of the feathers of birds,* is undoubtedly owing to the air in their interstices; which air, being strongly attracted by these substances, is confined, and forms a barrier which not only prevents the cold winds from approaching the body of the animal, but which opposes an insurmountable obstacle to the escape of the heat of the animal into the atmosphere." It is certain that all the tissues and fluids of the body are excellent non-conductors of heat; at any rate, the vesications which arise from burns are admirable examples of a *viscous* fluid, and one which, so far as the materials of the frame can contribute towards that end, is the most perfect non-conductor which they can supply. If Nature throws out a non-conducting fluid (as in the vesications which arise in burns and frost-bite), we surely may imitate her by the application of the same principle to the treatment

of burns and frost-bite, and feel assured in so doing that we cannot improve upon her example.

But it may be objected to this view, that inasmuch as the heat of the parts, after an injury, is morbidly increased, it is incorrect to apply anything which will still further increase it. But it must be remembered that though substances, such as I have mentioned, are very slow conductors of heat, yet that they have a large *capacity* for it; in short, that in order to keep them up to the temperature of the part, a much larger amount of heat becomes latent than in the case of an equal weight of a metal. So that, when applied in moderate amount, they may in reality absorb a large amount of heat, but they do this so slowly that the nervous system does not suffer by it. But the question is one that must be settled by experiment. The universal custom of mankind is to apply non-conductors to wounds, as the basis of the dressing; and Nature herself, in the scab which forms upon the surface of wounds, presents us with a highly non-conducting substance.

Another point, probably of great importance, is the fact that non-conductors of heat are for the most part non-conductors of electricity and idio-electrics.

For the foregoing reasons, it appears to me to be more correct to attribute the efficacy of the majority of the external applications, not to the exclusion of air by them, but to their non-conducting power, and that this explanation is more particularly true of such remedies as cotton, flour, cold poultices, &c. &c. Nearly all of those remedies agree in being non-conductors of heat, or if they possess any other property, they are applied in such a manner to the body that they exercise a non-conducting power in addition to that other property. By this theory, we may explain the action of many outward or surgical applications. Lint; simple plasters, cerates, and ointments; oiled silk, poultices, water applied on rags, are all excellent non-conductors, and serve to preserve uniformity of temperature in the part, or what is still more likely, they tend to soothe the nervous irritability of the affected part, by preserving the nerves from feeling the variations of temperature in the currents of air which would act upon the surface. That lint does not act by excluding air is very manifest; for according to Rumford, the better it is, the more air it contains. The linen and cotton from which the lint is prepared are already full of air, but by raising a nap upon their

surface they are rendered still fuller of it. So that lint, one of our principal applications to external sores, is, strictly speaking, imprisoned *atmospheric air*. This fact is a sufficient refutation of the old notion that it is necessary to shut out the air. But metallic foils, which would effectually exclude the air, and which are very cheap, are seldom if ever employed as dressings to wounds. This fact is a further proof of the incorrectness of the old notion; for metallic foils are very good conductors of heat. When we consider, moreover, that *life* seems to be correlative with the retention of *heat* in the frame, that to die is to grow *cold*; further, how entirely our existence depends on the preservation of the animal heat;—how large a part combustion plays in the human frame;—how much carbon the body requires for this end;—that the body is made up of non-conductors of heat;—that in every nation the value of clothing is appreciated;—I say, when we take into consideration all these circumstances, we must feel sure that if so large a portion of the powers of life is devoted to the keeping up the temperature of the body, it will be most important to carry out this indication in the treatment of both external and internal diseases, when the powers of life are endangered in a part. The instinct of mankind has accordingly taught them that it is necessary or desirable to cover up an injured part with clothing. Practically, therefore, mankind are quite right in their mode of procedure, but I am not aware that the principle on which this covering of parts is based, has been previously pointed out. If the view which I take be correct, *the thermometer becomes an important instrument in determining the therapeutical value of external applications,* and much of the apparent contrariety in topical applications disappears; the scepticism which some are disposed to entertain of the value of treacle, cotton, or flour in the treatment of burns, is shown to be unphilosophical; and the doubter learns that though these things differ greatly in their physical appearances, they all agree in possessing the important properties of being very perfect non-conductors of heat, as well as affording an appropriate mechanical defence for the injured tissues. I need not remind you that cotton has been used with great advantage in senile gangrene of the toes. You dust the face in erysipelas with hair-powder or flour; you apply finely carded cotton to an irritable surface after the application of a blister. In short, nearly all simple

external applications can have their efficacy explained on this principle, and on no other. I shall endeavour to show that the application of cold water on rags is generally no exception to this rule, and I believe that it will hereafter be found that what is called the "evaporating lotion" will be quite as efficacious, if not more so, by covering with oiled silk the rag saturated with the spirituous fluid used as a dressing. The spirit itself is a stimulant, and produces heat in the part: I do not doubt that it carries it away by evaporation, but in what degree, or whether in such a degree that it removes more heat than it produces, or whether it may not exhaust the nervous irritability in the part by its long-continued action, are questions which it is not easy to determine at present, though they are of the deepest interest and importance. The solution of them must be reserved for another time and place.*

Whether this theory be correct or not, as to non-conduction of heat being an essential principle in outward applications to the human body, it must be obvious that it can do no harm, for it does not suggest the employment of a class of bodies contrary in their nature to those which are in general use. It agrees with the results of experience; but, as the introduction of the pulse-watch led to a more accurate knowledge of the pulse, as respected its *number*, so will this theory, if true, lead to a more exact knowledge of the value of external applications, by the introduction of the thermometer as the measure of their *non-conducting* power. Further, it will serve as a thread to lead us through the mazes of the labyrinth of external applications.

To show the extent to which it can be applied in explaining the action of the various remedies which are employed in the treatment of burns, it is only necessary to draw up the following table of the

* The foregoing remarks on non-conductors are printed as they were read at the Anniversary Meeting of the Association, held at Worcester in 1849, with the exception of a few trivial, and chiefly verbal, alterations. At the risk of their being considered very diffuse, I have preferred printing my remarks as they were originally delivered, because an erroneous report of the purport of my paper was given in the journals. The essay was prepared to be read at the Anniversary Meeting at Bath, in 1848, but owing to the great number of other communications which had to be read within a very limited time, I contented myself with simply enunciating the principle which is here so fully entered upon. I have been led by the investigation into experiments which I consider will throw light on some physiological points. These will in due time be laid before the profession.

substances recommended by the different contributors to this Report.

The following is Dr. Warren's classification of the substances in use in America:—

I. *Applications calculated to Abstract Heat.*

Ice.	Evaporating liquids.
Cold water.	Affusion of cold water.
Cold poultices.	Solutions of the salts of lead.

II. *Applications intended to exclude the External Air.*

Solution of gum arabic.	Various ointments.
Cotton wool.	Linseed oil and lime-water.
Flour.	

III. *Anodyne Applications.*

Watery solution of opium.	Infusion of the leaves of hyoscyamus.
Infusion of the heads of poppies.	Weak infusions of tobacco.*

To these are to be added the following:—

Oil of turpentine.	Charcoal.
Oil of turpentine and resin cerate.	Linseed oil, and lime-water, and sulphur.
Hot water.	Treacle.
Spirit of camphor.	Honey.
Spirit. ammoniæ aromat.	Thin layers of India-rubber cloth.
Alcohol combined with essential oils.	Dextrine, or burnt flower.
Nitrate of silver.	*Boiled* linseed oil.
Warm water dressing (clothes saturated with warm water and covered with oiled silk.)	Warm poultices.
	Solution of chloride of lime.
White lead.	Thin flour paste.
White lead paint.	Diluted resin cerate.
Impermeable piline.	Gold beaters' skin.
	&c. &c.

Most of these, as they are generally employed, act to some extent as *non-conductors of heat*, but some of them have a further action: for example, turpentine acts as a stimulant, and tobacco, hyoscyamus, solutions of opium, &c., act as sedatives. But a large proportion of these are bodies which appear to possess no other common property except as a mechanical defence, than that of not abstracting heat rapidly from the body. The Americans use charcoal, in the form of powder, ointment, and poultice. Here we find in use that solid which is the most perfect non-conductor of heat. I have pointed out to you that water and air, under certain conditions, are very powerful

* *Provincial Medical Journal*, 1849, p. 353.

non-conductors; and I have shown that a large number of the popular remedies consist of water or air in combination, which serve that end,—that poultices, the water dressing, and all kinds of silk, woollen, and cotton coverings are examples of non-conductors. In short, the surgeon, in treating all external wounds, seems to be acting upon the same principle as the gardener, when he covers up his less hardy plants to protect them from the inclemency of the weather. The only difference is in the nature of the material used for the purpose; but whether the gardener employs matting or straw, it is for precisely the same end, viz., to save the vitality of the plant from the action, not of the atmospheric air, but of *cold*.

Having explained the *principle* on which most of the simple external applications to burns do good, I now proceed to an analysis of the evidence which has been forwarded to me.

The first question was, whether stimulants (spirits of turpentine, alcohol, ammonia, &c.,) are useful in burns and scalds; and if so, in what cases, and in what manner used?

Professor Warren, of Boston, in the United States, observes,—"Spirits of turpentine, Dr. Kentish's favourite remedy, in conformity to his high recommendation, I used in the early part of my practice, but as its immediate effect was often terrible, and its ultimate influence not greater than that of other articles, I have not used it for many years, nor do I know any one here who has."*

Mr. Greenhow, Senior Surgeon to the Newcastle-upon-Tyne Infirmary, says,—"The application of oil of turpentine has, according to my experience and observation, afforded the greatest relief from suffering, and been most successful in establishing a new and healthy action in parts extensively and deeply injured by the application of excessive heat. The best form of application is thickened with unguent. resinæ; and I have found, in extensive burns, that lawn or silver paper dipped in this when warm, has been a very convenient and successful method of employing it. The paper adapts itself well to the injured parts, and may be replaced, or deficiencies repaired, as often as may be required. When suppuration has been established, an ointment of creta has been found by myself the most soothing and successful successor to the turpentine dressing; and, at a more advanced stage, when the healing process

* Letter to S. C., July 25, 1848, in *Provincial Medical Journal*, 1849, p. 353.

is apt to become nearly stationary, it often receives a useful stimulus from a lotion of one pound of camphor mixture, one drachm of tincture of opium, and one drachm of solution of lead. The part must be covered over with lint dipped in the lotion, and protected with oiled silk and a bandage."* He adds, that "the best preliminary treatment of burns is to bathe assiduously the injured parts with oil of turpentine."

Mr. Kentish, when he published the first edition of his book on burns, lived at Newcastle. The reader need not be reminded that Newcastle is in the centre of a district where severe burns have been, and still are, of very frequent occurrence. Mr. Greenhow's experience is well known to have been very great, and it is very interesting to receive from him so strong a testimony to the efficacy of Dr. Kentish's system of treatment, and the more so as he "has tried, or witnessed under the management of other surgeons, the effects of every plan of treatment hitherto proposed."

Mr. Benjamin Barrow, of Ryde, Isle of Wight, who attended St. Bartholomew's Hospital for ten years, as pupil, dresser, and house surgeon, and therefore had abundant opportunities of seeing the effects of turpentine (at that time the general treatment at St. Bartholomew's), says "that the turpentine dressings were of a decidedly soothing character, and were always attended with permanent relief to the patient."† The application here spoken of was the linimentum terebinthinæ.

Dr. Adams,‡ of Banchory,—"In the earlier part of my professional life I was accustomed to see burns generally treated on Kentish's plan, and I occasionally adopt it even now. When the patient at first could be got to endure the increased heat and pain produced by the turpentine for a short time, I have certainly thought that in the end it effectually removed the stinging pain of the burns, and, when persevered in, that cases thus treated usually got round more speedily than under most other methods of cure. But I have often been obliged to put away the stimulant dressings, and have recourse to something more congenial to the feelings of the sufferer. I still frequeutly use a combination of turpentine with the resinous ointment as a stimulating dressing to the indolent ulcers resulting from burns. I never prescribe alcohol myself, but

* *Provincial Medical Journal*, 1848, p. 101. † *Ibid*, p. 210. ‡ *Ibid*, p. 42.

have known it answer fully as well as turpentine in some cases where it had been tried. The only pernicious consequences which I ever knew to result from the application of stimulants, have been a temporary aggravation of the patient's sufferings, and some increase of the fever. An inconvenience attending the use of turpentine in certain cases is the smell, which to some persons becomes in time very offensive. As a general rule, I would say that when the patient is of a nervous temperament, and of an impatient disposition, the stimulant plan should not be risked."

Mr. Clough, of Southport; Mr. Eddowes, of Pontesbury; and Mr. Sweeting, of Abbotsbury, treat burns according to Dr. Kentish's plan. Mr. Sweeting says,—"That an experience of forty years has led to the conviction that the best possible method of dressing burns and scalds, is to carry out, *to its full extent*, the plan originally suggested by Dr. Kentish, which is not only valuable in practice, but founded on pure philosophical principles."*

The following case is communicated to me by my friend, Mr. P. H. Holland, late of Manchester, now of London†:—

"The cook of — P——, Esq., barrister-at-law, on the 17th of November, 1847, scalded both her feet with equal severity, by upsetting a pan of boiling water. She applied a rag dipped in *cold* spirit of turpentine to the right foot, covering it with a poultice of cow-dung. She had not turpentine enough in the house to apply to the other foot, she therefore covered it with a poultice of cow-dung only. Mr. Holland saw her about three hours after the accident, when she complained of severe burning pain in both feet, especially in the right. On examination, he found the right foot *not* vesicated, while the left was vesicated over nearly the whole instep. At this time the cow-dung was ordered to be removed, and flour applied to both feet. The feet were then enveloped in cotton wool, and both the cotton wool and flour kept applied for two days, at the end of which time the right foot (the one to which the turpentine had been applied,) was quite well, but the vesications on the left foot had been followed by a suppurating surface, which was very painful, and did not heal for three days."

The above case is particularly interesting. It is common to hear persons say that it is no proof of the superior efficacy of one plan

* *Provincial Medical Journal*, 1848, p. 18.

† *Provincial Medical Journal*, 1848, p. 17.

of treatment over another, when cases are mentioned of great success, obtained by different or opposite remedies. But no objection can surely be taken to an experiment like the above. The two feet were scalded equally severely, at the same moment, and under precisely similar circumstances. Both were treated alike, except that the first had been previously washed with *cold* turpentine. The one so washed healed much sooner than the other, and probably with less pain. If the feet of two *different* persons had been so scalded,—those of one person being treated *with* turpentine, and those of the other *without* it,—it might have been said that the difference in the habits of the persons' bodies, or in the severity of the scalds, was the cause of the difference in the results.

Mr. Gabb,* of Bewdley, gives a qualified approval of stimulants. He says that "they are no doubt useful as local applications in burns of the first degree, where we have only an erythema without vesication, and where the injured surface is not of very large extent; but in all other degrees of the injury, stimulants topically must do more harm than good, as the system suffers from over-stimulation already." He thinks that in other degrees of burn, the local applications should be cooling, and the stimulants be given internally. But he prefers what he terms "the cooling treatment," even in burns of the first degree, and he recommends flour, as will appear when the value of that application comes to be spoken of.

Mr. Wood, of Rochdale, after dwelling upon the necessity, when selecting a remedy, of taking into consideration the extent and degree of a burn, observes,—"My third class of cases is, alas! too often illustrated by children's clothes taking fire. Here we have both deep and extensive destruction of the life of the injured parts, the dusky yellow colour and total insensibility of the skin, showing too plainly that sloughing is inevitable. Surely no one who reflects on the requirements of such a case would apply flour and cotton here, much less cold water. The patient is in a state of perfect collapse, and laudanum, ammonia, and brandy, will be imperatively demanded internally, while hot spirits of turpentine on flannel bandages, or poultices of spirits of turpentine and oatmeal, will form the best external application, removing the bandages as seldom as possible. In a few days these may be changed for a mixture of

* *Provincial Medical Journal*, 1848, p. 130.

equal parts of linseed oil, lime-water, and spirits of turpentine, the quantity of the latter gradually decreasing; and at length ceratum resinæ or calaminæ, and when practicable, bandaging. I have little faith, however, in particular external remedies in these extreme cases. The treatment must be constitutional, and directed entirely to the alleviation of pain and support of the patient's strength.

"I have seen many cases of burns from coal-pit explosions, but I do not know that they call for particular remark; they are generally very extensive, but not deep. The constitutional symptoms are always severe, and in many instances the patients die comatose about the third day. Whether the *extent* of the injury,—often occupying the whole body,—by the shock it gives to the constitution, has any share in the fatal result, I will not say, but it seems probable. There is often also a great deal of bruising caused by the sudden expansion of the air driving the body of the sufferer against the roof and floor of the mine, and this may add to the danger. Generally speaking, they will fall into my third class of cases, and will require stimulants both externally and internally."*

Mr. Leach, of Heywood, by whose recommendation treacle was, I believe, first introduced as a remedy in burns, says that he "invariably uses terebinthinate applications in *deep-seated* burns and scalds, and believes them preferable to those of treacle."†

Mr. King, of Bath, adopts a modification of Kentish's treatment. "In all cases I have adopted the stimulating plan of treatment, using the linimentum terebinthinæ. I add a little more turpentine than is ordered in the London Pharmacopœia; with this addition it is more easily spread. Internally, tinctura opii and mistura camphoræ, which not only relieves the pain, but allays the nervous excitement; when the shock to the system is very great, brandy in gruel. When the arm, hand, leg, or foot are the parts burnt or scalded, I apply a bandage, first saturated with cold water, over the turpentine dressing, and request the patients to keep it wet with cold water so long as they find it agreeable and pleasant. I find the gentle pressure of the bandage support and add to their comfort. I do not remove the first dressing for a day or two, or longer, if no complaint is made. As soon as suppuration takes place, which is often very profuse, I apply dry lint; this and the pressure

* *Provincial Medical Journal*, 1848, p. 100. † *Ibid*, p. 44.

of the bandage keep in check the sprouting granulations, and do much to prevent those unsightly cicatrices which we often see after burns and scalds."*

Mr. Sloman, of Farnham, uses a dressing containing turpentine where there is sloughing or gangrene.†

Mr. Newnham:—"I have not seen Dr. Kentish's plan extensively tried, and when I have seen it, the result has been unfortunate."‡

Mr. James Barton Hilton, though strongly objecting to the use of turpentine as recommended by Kentish, nevertheless employed a modification of it, and of a stimulating nature. "Having been in practice for nearly seventeen years in a neighbourhood where explosions of carburetted hydrogen gas frequently occur, I have had abundant opportunities of seeing cases of burns, and for the last six years I have attended all the cases occurring in the collieries in this district, belonging to the Earl of Ellesmere, and a great proportion of those in the other numerous coal-pits in my neighbourhood. On referring to my day-book, I find that I have attended twenty-seven cases of burns during the last twelve months. The colliers are generally strong healthy men, most of them under forty years of age. The burns from explosions are chiefly situated on the face, neck, arms, hands, abdomen, back, and chest, as these are the parts most exposed to the action of the fire, in consequence of the men (as you are no doubt aware,) pursuing their calling in a state somewhat approaching to nudity. When an explosion takes place, the candles of the colliers are extinguished, and the men have to find their way in the dark to the mouth of the shaft in terror and confusion; hence it happens that the burnt surfaces coming in contact with the sides of the pit, have the cuticle destroyed, broken, or abraded in many places, more especially about the shoulders and fingers. When I commenced practice I adopted Dr. Kentish's plan of treatment, but the turpentine gave such horrible pain, that I was obliged to relinquish its use. If I gave anodynes in doses sufficiently large to allay the pain, they appeared to produce more harm to the system in general than the turpentine appeared to benefit the burns; I therefore

* *Provincial Medical Journal*, 1848, p. 45.

† *Provincial Medical Journal*, 1848, p. 103.

‡ *Provincial Medical Journal*, 1848, p. 77.

speedily abandoned the use of the spirit of turpentine, and of the turpentine liniment, and substituted a cerate composed of equal parts of the unguentum resinæ and ceratum cetacei. I have read of cases in which the spirit of turpentine is said to have produced soothing effects, but I never witnessed such a case; on the contrary, in all the cases in which I have seen it used, it produced intolerable pain and suffering. I think that my cases are cured quite as speedily with the use of diluted unguentum resinæ as when I used turpentine; but I have an impression that the cure of burns does not depend so much on the remedies employed externally in the first instance, as on the subsequent vigilant watching, careful dressing, and after-treatment. I am satisfied that whoever wishes to gain credit in the treatment of burns, must pay particular attention during the suppurative stage, in order to insure the well-doing of his patient. As soon as I see an adult after a burn, I give him sixty drops of a solution of the acetate of morphia, equivalent to half a grain, and repeat the same every hour, if necessary for the relief of the pain, which generally subsides after one or two doses of the opiate. I consider it advisable to give a large dose of the morphia, having seen the best results from such a practice. As speedily as possible I cover all the burnt surfaces with the cerate above alluded to, spread upon linen or cotton, and when suppuration is established, instead of continuing the diluted resin ointment, I apply the pulvis calaminæ freely to the ulcerated surface, and cover it with the ceratum calaminæ spread upon linen or cotton as before. I dress my patients daily, and administer internally salines and opiates throughout the treatment, and castor oil as an aperient. Subjoined is a table of twenty-seven cases which have been treated by me within the last twelve months, on the plan above detailed. Of the two deaths which took place, one occurred on the second day, before re-action was established, and the other sank on the eighteenth day from a sudden attack of diarrhœa. In those which recovered, there were no marks or deformities.

(The names of the patients are here omitted, in order to economize space. They were all males. S. C.)

No.	Age.	Parts burned.	Result.	Days under treatment.
1	36	Back severely	Cured	28
2	13	Back, face, and arms	,,	28
3	14	Back and arms severely	,,	30
4	15	Whole body deeply burnt	Died	2
5	20	Hands, face, ears, and neck, severely	Cured	24
6	30	Face, ears, neck, and hands, severely burnt and lacerated	,,	17
7	27	Face, ears, neck, chest, abdomen, hands and arms, severely; and ankles slightly	Died	18
8	28	Hands and face slightly burnt	Cured	11
9	20	Face, neck, hands, & arms, severely; chest & back slightly	,,	27
10	21	Face slightly	,,	6
11	20	Whole of the back superficially	,,	11
12	24	Face, ears, neck, chest, abdomen, arms, and back, severely	,,	24
13	22	Back, slightly	,,	4
14	16	Face, neck, ears, and hands, severely; back slightly; and ankles severely	,,	27
15	22	Hands and face, severely	,,	13
16	26	Abdomen, chest, back, severely; face, slightly... ...	,,	18
17	21	Face, ears, and back, severely, and neck slightly ...	,,	15
18	24	Face and back, slightly	,,	5
19	28	Arm, slightly	,,	4
20	24	Back, shoulders, arms, and hands	,,	11
21	30	Face, shoulders, back, abdomen, chest, hands, and arms	,,	23
22	34	Face, severely	,,	8
23	36	Chest and face	,,	10
24	22	Face, back, chest, and arms, severely	,,	23
25	28	Face and hands	,,	9
26	20	Face, back, loins, and arms	,,	30
27	24	Face, back, abdomen, arms and hands, severely ...	,,	27*

Mr. Evans:—"The stimulant plan of treatment I think objectionable, except in enfeebled habits, or where there has been great destruction of parts."†

Mr. Hartley, House Surgeon to the Cheltenham Hospital, says that he "does not use the stimulant treatment if there is vesication or destruction of the skin, and that spirits of wine or turpentine will generally remove the pain of a burn or scald, when slight. In the subsequent stage of severe burns, dressings of turpentine or resinous ointments hasten the separation of the sloughs, and stimulate the granulations with good effect."

Mr. Sharp, of Warrington, in severe burns formerly used carron oil or saturnine lotions, but during the last ten or twelve years he

* *Provincial Medical Journal*, 1848, p. 155. † *Ibid*, p. 42.

has used spirits of turpentine with resin cerate, and his cases "have got on decidedly more quickly, with less pain, and much less sloughing."

Mr. Partridge, Senior Surgeon to the Essex and Colchester Hospital:—"I have for many years been in favour of the stimulating plan, and I find at the Hospital it is for all cases of burns and scalds, however severe, universally adopted. We find the most useful and convenient manner of doing it, is by rubbing the ol. terebinthinæ cum ung. resinæ flav., and spreading it on thick lint, and covering the whole surface, however extensive; united, of course, with such constitutional treatment as circumstances may require in young and old receiving the same treatment. And, after having given every other plan its fair trial, we have come to the conclusion that this one is the best."*

Mr. Brown, of Castle Donnington, adopts a modified Kentishian treatment.

Mr. Harding, House Surgeon to the Leicester Infirmary:—"The following treatment in cases of burns and scalds is adopted here. The parts affected are kept constantly covered with linen rag, saturated with the following liniment, warm: ol. terebinth., ol. olivæ, and aq. calcis, part. æqual. A full dose of tinct. opii is given on admission, and smaller doses at intervals of four hours, combined or not with ammonia, according to the existing state of depression. Diet consisting of milk, beef-tea, sago, and wine and arrowroot. The application is continued until the separation of the sloughs, and then ungt. calamin. applied, followed by stimulant dressing, according to the varying condition of the wound in its progress towards cicatrization. The number of cases admitted into the house during the last four years amounts to 30; of which 20 recovered, 10 died.

"Average duration of cases which died..... 3 days.
" " recoveries ..... 6 weeks."

Mr. Norman uses the turpentine in the *suppurative stage* of burns, when the integument has been extensively destroyed. As his views in the treatment of burns differ from those of most other surgeons, I quote the whole of the passage, to guard against the possibility of stating them incorrectly. "The opinion I have

* Letter to S. C, 12th August, 1848.

formed as the result of my practice in burns and scalds is, that each case must be treated according to its own peculiar circumstances,—that the constitutional treatment is the essential part,—that the local application is of minor importance; that which affords relief from pain is the best,—and that there is no real difference between a severe burn, and the destruction of the same extent of surface from contusion, laceration, or any other injury. Slight cases do not differ from the blister you produce by cantharides, and require only the same treatment. To more severe and more extensive cases, I generally apply cloths, wet with cold water; or, where a large extent of integument has been destroyed, cloths wet with warm water, frequently renewed. Opium, with stimulants, in the first instance, where the powers are much sunk, and strict antiphlogistic treatment afterwards; for I think the greater portion of deaths arise from inflammation of the throat, the pleura, or the peritonæum, according to the site of the injury. A severe burn over the throat and chest rarely recovers. *Where the integument has been extensively destroyed, I dress the parts with ointment, in which there is spirit of turpentine, so soon as suppuration commences, and not before;* and support the system with wine, bark, &c., so soon as the inflammatory symptoms have subsided. In this stage of severe burns it is that the patience, the care, and the nicety of dressing in the surgeon, will often make the difference between success and failure. The cleanliness, the early suppression of luxuriant granulations, the bandaging, the position of limbs, &c., will all tax the patience, and prove the ingenuity of the surgeon."*

Mr. Crossley, of the Derby Infirmary, says—"That in *slight cases*, a saturnine lotion, with spirits of wine, is applied; if not cured by that, they are dressed with the following ointment. ℞. calaminæ, ʒj., liq. plumbi diacetat., ♏xxx., ung. plumbi composit., ung. sambuci, utrq., ℥ss. M. fiat ung. In other cases (the most severe, I apprehend,) a liniment composed of two parts linseed oil to one part turpentine, was first used, being applied by means of cloths kept constantly wet with it, and laid over the injured parts; in one or two days this was discontinued, and they were dressed with the cerate in the usual manner.

"The unguentum picis, or unguentum creosoti, was sometimes used, to hasten the separation of the sloughs. The cupri sulphas

* *Provincial Medical Journal*, 1848, p. 436.

was used to check too luxuriant granulation. In two cases strips of lint, dipped in a saturated solution of the cupri sulphas, were applied, for the same purpose, but created greater pain, without any better result than the sulphate of copper.

"The constitutional treatment was the same in each case; an opiate being first given, and after a short interval stimulants (ammonia, æther, and camphor), combined with small doses of tinctura opii. When re-action commenced a purgative was administered, and followed by mild salines; when sloughing occurred to great extent, tonics (cinchona and quina), and a good diet, were adopted."*

Mr. Barrow, after stating the results of his observation on the value of flour and cotton, says:—"After close and long observation, I have come to the conclusion—a conclusion founded on facts—that the most efficacious remedy as a *direct* and *immediate* application to the burnt surface, is the turpentine dressing; but not alone, for I have combined with this in one and the same case, wool or wadding (such as ladies put in their dresses), winding round the first dressing several layers of this, giving thereby the greatest ease to the patient; and to this plan I would beg to direct the attention and serious consideration of all who may have to treat cases of burns or scalds. Care must be taken when wool or wadding is applied, that all portions which become too tense or too loose, be released or tightened, according to circumstances, and in all cases the greatest attention is necessary to avoid anything like a ligature around any portion of the body or limbs."†

Dr. J. Dixon Fidler, Surgeon to the Whitehaven Infirmary, and to the Earl of Lonsdale's coal-mines, in such burns as are received in coal-mines, applies first warm spirits of turpentine, by means of a soft camel-hair brush. He then, with the same brush, paints the whole surface with a liniment of about one part of spirits of turpentine and five of melted resin cerate. He then covers with flannel, and gives a full dose of opium. The after treatment consists in applying *melted* resin cerate twice a day, until suppuration takes place, and then *melted* wax ointment, until the burns heal. He often finds it necessary to apply a saturated solution of

* *Provincial Medical Journal*, 1848, p. 324.

† *Provincial Medical Journal*, 1848, p. 209.

sulphate of copper to keep down exuberant granulations. As soon as reaction takes place the regimen is strictly antiphlogistic.*

Dr. J. Thompson, Surgeon to the Whitehaven Infirmary, in severe burns with disorganization of the skin, uses the resin cerate in a melted state, applying it with a fine brush, and covering it with flannel. He says it may be used twice a day. When suppuration has commenced, he finds the simple cerate to be the best application. In superficial cases he employs the carron oil.†

Dr. Strange inclines to believe, from his own experience, that external stimulants are indicated almost solely in those severe cases in which internal stimulants are alone applicable, and for pretty much the same reasons,—viz., to rouse the system generally and locally from collapse.‡

The evidence respecting the efficacy of Dr. Kentish's plan of treatment is of a very conflicting nature. I find, however, that there is a growing impression among professional men, that it is doubtful whether its efficacy be superior or even equal to that of more simple methods of treatment. Formerly this was nearly the universal plan of treatment in severe burns, and it was introduced into, and continued, until a few years back, to be the prevalent treatment in, most of our large hospitals. Mr. Barrow§ mentions that it was the practice pursued at St. Bartholomew's in his time, and it was so in 1838, when I attended that hospital. Mr. Stanley says that cotton is now employed in its stead. In the Manchester Infirmary also, flour and cotton are used in place of it. There are, however, many practitioners who believe that it is a most efficacious plan of treatment, and the testimony of some of them to that effect has been given in the previous extracts. How, then, does it happen that Kentish's plan, after displacing other methods of treatment, and being enthusiastically praised by a great many observers, should, in its turn, be giving place to other remedies? After much careful thought and investigation, I have arrived at the opinion that it is being abandoned, not so much on account of its inferiority or inadequateness, but by reason of the rules laid down by Dr. Kentish being either not generally known or improperly carried out. I possess clear proof, that in some of the large hospitals it was put in practice in a manner which Kentish has

* Letter to S. C., 15th August, 1848. † Letter to S. C., 15th August, 1848.
‡ *Provincial Medical Journal*, 1848, p. 132. § *Ibid*, p. 210.

strongly condemned. And it appears to me that this has arisen mainly from the circumstance that Mr. Samuel Cooper, in his Dictionary of Surgery, has not taken any notice whatever of Kentish's matured and last published views; and does not seem to have been aware that there was a second edition of both his Essays in 1817, containing the latest and most explicit statement of his doctrines. In order to show how imperfect is Mr. Cooper's statement of Kentish's views, and at the same time to describe the treatment really recommended by Dr. Kentish, I have put in parallel columns the material portions of Mr. Cooper's abstract and the corresponding passages in Mr. Kentish's book.

After stating Kentish's theory, which he calls *fanciful*, Mr. Cooper proceeds:—

1. "With this view, holding the part to the fire, seems to Dr. Kentish the best mode of relief, but, as parts of the body are injured to which this cannot be done, stimulant applications must be used. The strongest rectified spirits, made still stronger by essential oils, are proper, and may also be heated as much as the sound parts can bear. These, and many other applications of the same class, will give the most speedy relief. They are, after a certain time, to be succeeded by less stimulant applications, until the parts act by common natural stimuli."—Cooper's Dictionary, 1838, p. 302.

1. The abstract on the other side is from Kentish's first edition, p. 113: the last sentence contains a most important omission. It should stand as follows:—

"These are only to be continued for a certain time, *otherwise they may afterwards cause the very ill they were given to cure*, and then to be succeeded by less stimulant applications," &c.—Kentish, 1st edition, p. 113.

In the second edition, 1817, p. 100, instead of "The strongest rectified spirits," &c., read, "*The strongest essential oils, the highest rectified spirit with essential oil*, to which caloric may be added also," &c. The last sentence is,—"These means are meant only for a limited time after the accident, and are then to be succeeded by milder applications; for, if the use of these were persisted in, they would cease to be sedative, and would excite an irritation similar to that which they were at first intended to relieve."

2. "The internal mode of relief is to give those substances which most speedily excite the system to great action, such as æther, ardent spirits, opium, wine, &c., by which

2. "The internal means of relief will be to administer those substances which will, in the quickest and speediest method possible, throw the heart and arteries into the most

means the solution of continuity of action is allowed to last the shortest time possible, and the unity of action is restored, which constitutes the cure." In another place he adds, "Æther and alcohol, and other stimulants, are to be immediately given, in proportion to the degree of injury, and repeated once or twice within the first twelve hours, and afterwards wine or ale to be ordered till suppuration takes place, when it will be no longer necessary to excite the system."

Kentish proceeds thus,—"I have generally added laudanum to the alcohol, from the general idea of its abating pain," &c., but Mr. Cooper omits this. In his second Essay, 1800, he says:—"*Large anodynes ought to be used, as they always produce the happiest effects;* and I have never seen any ill consequences from them." p. 59. Mr. Cooper omits this also.

3. Mr. Cooper mentions the substances approved of by Kentish, as external applications, and proceeds:

"In applying these, we are directed to proceed as follows. The injured parts are to be bathed two or three times over with spirits of wine, spirits of wine with camphor, or spirit of turpentine, heated by standing in hot water. After this a liniment, composed of the ceratum resinæ, softened with spirit of turpentine, is to be spread on soft cloth and applied. This liniment is to be renewed only once in twenty-four hours, and at the second dressing the parts are to be washed with proof spirit, or laudanum, made warm. When the secretion of pus takes place, milder applications

violent action compatible with life. Thus, *large doses* of æther, volatile alkali, ardent spirit, opium, wine, &c., given in hot water, are what should be administered in the first instance." —2nd edition, 1817, p. 101.

In the second edition, the passage, "Æther and alcohol, and other stimulants," &c., stands as follows: —"*A large dose of hot spirits and water, either brandy, rum, or gin, with sixty or a hundred drops of tincture of opium, and a teaspoonful of sal volatile or æther, should be exhibited.*" The patient "should be placed between blankets in a hot bed, and, if he shivers much, bottles of hot water are to be applied to his feet and the pit of his stomach. On the second day (that is, at the end of twenty-four hours), negus, with an occasional opiate, is to be administered. As secretion frequently appears on the third day, the necessity for stimulants will cease," &c.— p. 123.

3. Mr. Kentish's second edition, 1817, and his second Essay of 1800, differ materially from Mr. Cooper's abstract.

The injured parts are to be bathed with *essence of turpentine*, made so warm, by placing the cup in a basin of hot water, that you can bear the heat with your finger. "I prefer essence of turpentine for reasons already assigned; but if it is not at hand, alcohol may be substituted, or any substance of which alcohol forms a constituent part, e. g., spirit of wine with camphor, lavender water, brandy, rum, or Geneva, &c. When this has been plentifully done, take of common basilicon, according to the occasion; let it be rubbed upon a marble slab, with as much of the

must be made, till the cure is effected."

The above, along with the rest of the paragraph, is evidently intended for an abridgment of Kentish's first edition, pages 132 and 133, but it differs in several particulars.

essence of turpentine as will bring it to the consistence of a *soft ointment. In the former edition, I said to the consistence of a liniment; in consequence of which the College of Physicians, in their Pharmacopœia*, 1809, *have given a formula for a turpentine liniment which Dr. Powell, in his translation, informs us was adopted from my recommendation of it in burns. I am sorry the inaccuracy of my language should have led to misconception. The liniment of the College is too thick to be applied as a wash, and too thin to be applied as an ointment*," &c.—p. 118.

In another place he says, "Many surgeons who have applied the liniment. terebinthinæ (Ph. Lond.), have supposed that they have treated burns according to my principles, though they have continued its application until serious mischief has been induced."—p. 21.

But, to proceed with the parallel, instead of saying that the parts are to be washed with proof spirit, &c., his words are, in the second edition, "In some instances it may be necessary to repeat the wash of essence of turpentine on the second day, but in general a wash of heated tincture of opium will be preferable."—p. 119.

The foregoing extracts will prove that the greatest standard English work on surgery, and that which the practitioner and student would naturally consult for a description of Kentish's treatment, contains so inaccurate an account of it as would seriously mislead them. I believe that Mr. Cooper did not understand the main points in Kentish's treatment. One of the things which Mr. Kentish insisted upon strongly, was the simultaneous use, during the first twenty-four hours after the receipt of the injury, of stimulants externally and internally: for the latter purpose *giving laudanum in very large doses*, and for the former purpose, using oil

of turpentine, in preference to every thing besides, as a primary application. But Mr. Cooper, in his "First Lines," (edition of 1836,) page 101, when speaking of Kentish's plan, makes no allusion to his internal treatment! I fear that there are parties who may be using the linimentum terebinthinæ of the last edition of the Pharmacopœia Londinensis as if it were Kentish's ointment, whereas it is very different. The original form for linimentum terebinthinæ (Ph. Lond., 1809,) was,—℞. cerati resinæ, ℔ j., olei terebinthinæ, oss. The linimentum terebinthinæ (Ph. Lond., 1836,) is made as follows: ℞. saponis mollis, ℥ij., camphoræ, ℥j., terebinthinæ olei, ℥xvj. The preparation of 1809 was stronger than Kentish's application. The latter I need not say is stronger than the pure turpentine, with which he only washed the sores for a few minutes, before he put his ointment upon them. May we not account for a great deal of the contradictory evidence respecting the pain produced by the dressing, by supposing, when there was great pain from it, that either the large doses of opium internally were omitted, or that the ointment was improperly prepared? There can be no doubt that the early stimulating dressings were frequently continued beyond the period which he considered to be safe, and until great mischief was produced,—*dolor medicina doloris*. He knew this well, and in the second edition of his book remonstrated accordingly. I have read a case (published upwards of a quarter of a century ago, still after the publication of the second edition of Kentish's book,) in which the dressings of turpentine were repeated for fifteen days, that is, till death; and, from the histories of some other cases, I infer that this was the usual practice in that hospital. One is not surprised to learn that the turpentine treatment was soon abandoned there, and that the treatment now adopted is considered more efficacious.

Mr. Badley, in a letter to Dr. Kentish, published in the preface to the second edition of Kentish's book, makes the following remarks:—"I have also known a surgeon, equally disregarding the internal treatment, use the oil of turpentine, and in spite of the sufferings of his patient and the evidence of his senses, continue its use twice or thrice daily, for eight or ten days; and I have found this person satisfy himself, and vindicate his conduct, by bringing forward the authority of Dr. Kentish. It requires no stretch of imagination to conceive, that if a respectable man, well

acquainted with the powers and results of the ordinary modes of managing burns, and informed of yours only by description, were to see it exhibited and abused in the way I have mentioned, and made no further inquiry, he would be repelled by the appearances he might witness, and instead of regarding it as the *best* plan of treatment with which we are acquainted, would set it down as the very worst. I have myself arrived at the very opposite conclusion," &c. &c.*

Turpentine is admitted to be a useful application to wounds in which there is a tendency to mortification. But in the case of its application to burns attended with shivering or collapse, it not only seems to check the progress of the local mischief, but it acts as a general excitant, and it is also absorbed into the circulation. The case of the maid servant, who scalded her feet with equal severity, mentioned by Mr. Holland, is valuable, and is a fact which is in favour of the turpentine. Mr. Badley, in his interesting letter to Kentish, says, "After some of those accidents in which many men have been involved in one common fate, and the burns have been chiefly of the sloughing kind, I have known the patients taken indiscriminately, and part of them dressed with the carron oil (perhaps formerly the application in most general use), and the remainder treated upon your plan, and I can assure you that the consequences have been in an eminent degree confirmatory of the superiority of the latter, both as to ease and speediness of cure."† In these cases, of course, Kentish's internal treatment would be used. I cannot help thinking that Kentish's success depended quite as much on the simultaneous free exhibition of opium and alcohol with the turpentine, as upon the use of the turpentine, and that he is entitled to the originality of introducing such large doses in these accidents. Terebinthinate dressings are of great antiquity, but I am not aware that opium was ever *freely* administered in burns before Kentish pointed out its value. And as he gave it as soon as he arrived at his patient, and before he began to prepare his dressings, the patient would be in a state of partial insensibility when dressed; hence partly the immunity from pain, and the accounts we read of the patients falling asleep whilst the turpentine was being employed. Camphorated spirit of wine or ammonia immediately give remarkable ease in local burns, when no opiate

* Kentish, 2nd Edition, p. 38. † Kentish, 1817, p. 39.

has been given; so that it is probable that the turpentine may in many cases give comfort, even if no opium were administered at the same time. It might be used as a test-substance to determine the severity of the burn, as it would show the amount of loss of sensibility.

With respect to the value of stimulants externally in burns, the evidence appears to be conflicting. But after a careful consideration of the plans of treatment in vogue during so many ages, I am of opinion that the evidence strongly preponderates on the side of the efficacy of stimulants, both in large and small burns. If the application of heat can produce the sensation of cold and its symptoms (shivering, and chattering of the teeth), why may not the application of stimulants produce a feeling of comfort under altered conditions of the system? In small burns, where the smarting or burning pain is intense, cold and warm spirits of wine, camphorated spirit,* aromatic spirit of ammonia, gin, lavender water, vinegar, &c., have long enjoyed a great reputation. If they increased the local mischief, in addition to producing increased pain, I cannot believe that they would ever have come into use, or, being come into use, that they would have been retained so long as remedies, provided they had not been more efficacious than simple cold. Sydenham recommended alcohol,† but does not mention its superior efficacy, if made hot. Harris, his friend, however, recommends it to be used warm.‡ Alcohol may act by coagulating the albumen of the tissues, and contracting it so as to prevent vesication; further, I believe that it acts as an excitant; and, that it is not by producing cold by its evaporation that it does good.

The next point for inquiry was,—What is the value of cold applications in burns and scalds; and whether they are admissible in burns of great extent; and whether, in burns of small extent, cold water is better than any other application?

* "Camphorated spirit applied to recent burns, acts like a charm."—Notes of a conversation with Mr. Hampson.

† Sydenhami Opera, a Greenhill; 1844, pp. 255, 601.

‡ "Possum equidem affirmare, experientiâ aliquali edoctus, lintea *spiritu vini fervefacto* imbuta, et ambustis partibus ab aqua bulliente, ab igne, a pulvere Pyrio, vel a pice liquefactâ, adhibita sæpenumero, citius omnibus aliis medicamentis ambusta loca sanare, doloremque excruciantem tollere."—Harris. Dissert. Med. et Chirurgicæ, 1725, p. 97.

In burns of great extent, the universal opinion appears to be that cold applications are improper. Dr. Adams, of Banchory, says,—"I would never think of using cold applications when the burning is of great extent, and I have heard of very bad consequences from the use of them in such cases by inexperienced persons. In cases of scalds of a limited extent, I would say that I have found nothing answer so well as cold applications. I usually lay a piece of surgeon's lint over the part, and keep it constantly wetted with cold water, until the heat and stinging pain be effectually removed. When this purpose has been accomplished, tepid water, applied in the same manner, will be found more agreeable to the feelings of the patient; but some prefer substituting cotton or flour."*

Mr. Newnham, of Farnham, says,—"In burns of great extent, such is the depression of the powers of life, that I question the propriety of cold applications; in burns of a small surface, there may be no objection,"† &c.

Mr. Wood, of Rochdale, says:—"To begin with the mildest case of burn. A lady, sealing a billet-doux, scorches her finger with the taper; acting, as most ladies do, from impulse, she instantly plunges it into cold water, and in so doing, I maintain that she does the very best thing possible. By alternately plunging it into cold water, and blowing upon it,—by applying cold, in short, she puts a stop to the increased action of the vessels of the part, and consequently to the heat and pain. A surgeon does precisely the same thing by irrigating it with spirit-wash, by means of a little lint wrapped round the little finger. In half-an-hour the case is cured. My next case shall be one where a maid servant unwittingly plunges her hand and arm into a pail of boiling water, or a pan of boiling liquid falls off the fire upon a child on the hearth. Here is a very different case to the former one, and requiring very different treatment. In the child's case especially, the extent of injured surface renders the cold water both locally and constitutionally inadmissible. The patient is already in a state of rigor, and any extensive use of cold water would, in all probability, so depress the powers of life, as to risk the production of sloughing, where otherwise the result would have been merely

* *Provincial Medical Journal*, 1848, p. 42. † *Ibid*, p. 77.

destruction of the cuticle with inflammation, and possibly slight ulceration of the cutis and cellular tissue."*

Dr. Ogier Ward:—"My own experience of the extreme pain of cold applications would prevent my using them in small burns, and in large burns they are too depressing to be admissible."‡

Mr. Barrow:—"The late Mr. Henry Earle was accustomed, in burns of a minor description, to apply cold water, by keeping the parts constantly covered with cloths saturated with the pure element. I had an opportunity of witnessing a tolerably extensive trial of this remedy, but I cannot speak of it as possessing any decidedly efficacious properties. There was a certain amount of comfort experienced for a time, but for a very limited extent, and I think the subsequent inflammation and sloughing were generally increased."‡

Mr. Greenhow:—"Cold applications do well in slight burns, and I have found them especially useful in burns of the face, accompanied with extensive injuries of other parts. In some cases of this sort, from the explosion of gun-powder, I have employed lint dipped in cold water successfully, the other injured parts being dressed with turpentine, as before described. A severe example of this kind is at present convalescent in the infirmary of this place. The nature of the part, and necessarily exposed condition of the face, render the cold water dressing extremely convenient, and of easy application."§

Mr. Gall, of Ripley:—"I have not had much experience of cold applications, but should say that they are not safe in burns of great extent."‖

Mr. Evan Evans, of Bath:—"Cold is serviceable in burns of mild character."¶

Mr. Clough:—"I should have almost the same objections to apply cold in extensive or deep burns, as I should have to apply heat to a frost-bitten part."**

Mr. Hartley disapproves of cold when the skin is destroyed or blistered.

At the Bath United Hospital, "carron oil, covered with cotton, is the application in all severe cases, where the integument has been

* *Provincial Medical Journal*, 1848, p. 100. † *Ibid*, p. 131. ‡ *Ibid*, p. 211.
§ *Ibid*, p. 101. ‖ *Ibid*, p. 18. ¶ *Ibid*, p. 44. ** *Ibid*, p. 159.

destroyed; *in less severe cases* the cure is effected solely by cold applications."*

Professor Warren:—....."When the cuticle is not off, and the cutis and subjacent textures are not disorganized, cold water is the best remedy I am acquainted with. It has been advantageously used by layers of linen or cotton-cloth, frequently wet, and by continuous affusions. When the injury is not very extensive, ice may be very beneficially resorted to."†

The application of cold in burns seems to be a very natural remedy, and was strongly recommended by Sir James Earle. I need not, however, remark that he erred in confounding the sensation produced by heat with the physical presence of heat in the burnt part. In most cases, the temperature of the part from the conduction of heat into its substance will be very slightly, if at all, increased, so imperfect is the conducting power of the body. Sir James thought that the heat entered the part, and remained in it, and that the cold applications neutralized it. If these things had been so, the application of cold would obviously have been the best remedy for burns. But the question as to its value is somewhat doubtful. In the first place, the word *cold* is a very vague term. Dr. Arnott (as will appear presently) recommends the application of a low temperature to arrest temporarily the vital action in parts, and as a remedy in burns, &c.; but he draws so wide a distinction between its effects and those produced by ice only, that I postpone the consideration of the value of Congelation as a remedy for burns. Again, water of the ordinary temperature is called the application of cold, but Earle and Dzondi recommended ice-cold water: one of these would feel warm compared with the other. A cloth dipped in cold water applied to the burnt surface (except it be kept constantly wet with cold water), ought not to be regarded as the application of cold. The immersion of the burnt part in cold water, or the application of iced water, are what I understand by the application of cold. The application of cold water by means of rags is chiefly a non-conductor of heat, and comes under the same category as cotton, flour, &c.

The following quotation from Mr. Hunter's Treatise on the Blood is valuable, as expressing the personal experience of so

* *Provincial Medical Journal*, 1848, p. 436. † *Ibid*, 1849, p. 353.

distinguished an observer :—"Cold lessens all inflammations, and is a very good application where it can be applied, but it cannot be applied so universally as many others; however, *cold has this disadvantage*, that the pain, although removed while under the application, occurs with double force when it is removed, much more than from any of the other applications; and the reason is evident, for as the warmth returns, the pain is increased by the warmth, even in sound parts. On the contrary, it is recommended that when a part is burnt to hold it to the fire as close and as long as it can be held, which undoubtedly lessens the succeeding inflammation and soon gives ease. This I have often seen, and probably it can only be accounted for on the principle of producing the act of contraction in the vessels. I have taken a bucket of cold spring water with me when I have made an attempt on a wasp's nest, and put my hand into it after having being stung; and whilst my hand was in the water I felt no pain, but when I took it out the pain was greater than when I put it in."*

Taking the word *cold* in the sense in which it was used by Sir James Earle and by Dzondi, I do not find that cold is recommended or used by any one in the treatment of extensive burns. The application of any cotton or woollen fabric, saturated with water (though the water be 50° F.), can scarcely be considered to be the application of *cold*. The immediate effect of such a cold application is to increase the vascularity of the part, but if the dressing remain upon the part it slowly receives heat from it, and becomes, I believe, warmer than if it were a dry cloth, applied under the same conditions; further, the aqueous vapour which is generated requires a great amount of latent heat to convert it into vapour, and this vapour, too, is a *non-conductor* of heat: hence this, which a loose thinker would consider to be application of cold is, in reality, the application of a *non-conductor of heat*.

Whether cold applications, then, be useful in slight burns, is a very doubtful point. For if it be merely the *cold* which is beneficial, why do we not leave the parts open to the cold air? It is unnecessary to repeat that it is the universal custom to cover burnt parts with something. But it may be objected, that we exclude the burnt parts from the air, in order that the oxygen in the atmosphere may not prey upon them. Without absolutely denying

* Hunter's Works, vol. iii., p. 265.

that it is the oxygen which does mischief, I may observe that decomposition of animal matter takes place more slowly in *pure* oxygen than in atmospheric air, and more quickly in moist air than in dry air; and that the presence of air is not necessary for the decomposition of moist animal tissues. Further, so long as the cuticle is not destroyed (and it is in these cases only that cold is now recommended), is it probable that the oxygen of the atmosphere *can* decompose the parts beneath? So that if it be the cold which is beneficial, the most obvious plan would be to leave the part uncovered. I have a very lively recollection of the severe pain which I endured during an attempt to cure a burn of my hand, in my boyhood, by keeping it in cold water, or under a stream of water. My experience coincided exactly with Mr. Hunter's remarks.

III. NITRATE OF SILVER.

Mr. Higginbottom recommends the nitrate of silver as an external application.

"In the early part of my practice I used Kentish's plan for burns and scalds, considering it at that time the best method of treatment. For the last twenty years I have preferred the application of the nitrate of silver, particularly in the first and second class of burns and scalds, for the following reasons:—

"1st. The nitrate of silver in its application does not appear to increase the pain of *recent* burns or scalds, but soon after the suffering is much diminished by its subduing the heat and burning pain.

'Fire cools fire, in the scorched veins of one new burnt.'

"2nd. It most effectually excludes the air from the injured parts, and there is at once a covering superior to any other, formed and composed partly of the very surface itself.

"3rd. The nitrate of silver has the peculiar property of preventing subsequent inflammation, vesication, ulceration, and sloughing, therefore the burn or scald is limited in its extent, diminished in its severity, and consequently less dangerous, for the danger is generally in proportion to the extent of surface destroyed.

"4th. After the application of the nitrate of silver, the parts should be exposed to the air if practicable, to form an adherent eschar; this will be found invaluable in burns and scalds of the

face, neck, breast and abdomen, the latter being protected by a fracture-cradle when in bed, which will defend the parts and facilitate the formation of an adherent eschar. If, from accident or any other cause, the eschar should be removed, a renewed application of the nitrate of silver will be necessary.

"5th. Where the parts cannot be exposed to the air to form an adherent eschar, as on the back, &c., the nitrate of silver must be applied, and afterwards covered with plasters of the neutral ointment,—the unguentum plumbi compositum (London Pharmacopœia), spread on linen, and then secured lightly* by a bandage; the dressing must not be removed before the fourth day, at the same time allowing any adherent dressing or eschars to remain until they separate; after the separation, should there be any sore or inflammation, a slight application of the nitrate of silver, or black lint, may be applied, with or without the neutral ointment. The dressing may be repeated every third or fourth day, as required. The black lint is made as follows:—*Linteum nigrum.* ℞. Argenti nitratis, ʒij., aquæ destillatæ, ℥iv. misce. fiat solutio. Saturate an ounce of fine lint in the above solution; then let the lint be exposed in an open shallow vessel, to allow it to dry by evaporation.

"6th. I prefer the application of the *concentrated* solution of the nitrate of silver in burns and scalds, applied in the same way as I have recommended in the cure of erysipelas.† The surface should be made as clean and as *dry* as possible; any vesications or loose cuticle must be removed. A convenient instrument for the application of the solution is a small piece of sponge, secured on the eye of a common silver probe."‡

In another communication§ he adds,—"After the application of the nitrate of silver to a sore or ulcer, its action continues for three or four days, during which period its antiseptic properties are very apparent, for there is not the least fœtor, as it quite prevents the putrefactive process. This is a valuable property of the nitrate of silver, which I have omitted to mention, although I have observed this result in my practice for many years.

"I thought it might be as well to give *once more* the proportions of the concentrated solution of the nitrate of silver, which is as

* In the *Provincial Medical Journal*, 1848, *lightly* was erroneously printed *tightly*.

† See *Provincial Medical Journal*, 1847, pp. 458, 532.

‡ *Ibid*, 1848, p. 103. § *Ibid*, p. 158.

follows:—Eight scruples of nitrate of silver, twelve drops of nitric acid, and eight drachms of distilled water. I prefer this strong solution to a weaker one, as it can be readily and safely applied, either very slightly, or in a more severe degree, as surgical cases may require. In burns and scalds, one slight application on the inflamed surface, and two upon the denuded surface, I have found sufficient." (He administers opiates.)

Mr. Higginbottom's plan of treatment appears to me to be entirely in accordance with the principles previously laid down. The nitrate of silver has the immediate effect of a stimulant, and the secondary effect of forming, out of the tissues themselves, what he terms an adherent eschar, which is neither more nor less than a coagulation of the tissues, by which their conducting power is diminished. When the cuticle is not destroyed, the nitrate of silver would render it so hard and firm as to afford as much support and defence as a covering of cerate spread on lint. It may be objected to it, that in cases where the cuticle is loose and the cutis denuded, it would be an unnecessary waste of the tissues to form out of them a dead covering under which healing may take place. But the question is entirely one of experience, and I feel very much inclined to try the plan in some burn of moderate extent, for I have no doubt of its remedial powers.

Mr. Hunter, in his treatise on the blood, has the following pertinent remarks:—"The mode of assisting the cure of wounds by permitting a scab to form, is likewise applicable in some cases to that species of accident where the parts have not only been lacerated, but deprived of life. If the deadened surface is not allowed to dry or scab, it must separate from the living parts, by which means these will be exposed, and suppuration brought on; but if the whole can be made to dry, the parts underneath the slough will cicatrize, and the dried slough will at last drop off. I have seen this take place after the application of a caustic, and many other sloughs. Where this can be effected it is the best practice, as it will preclude inflammation and suppuration, which in most cases should be avoided, if possible. I have treated many cases in this way, and the living parts underneath have formed a skin as the slough separated. This will more readily take place where the cutis is not deprived of life through its whole substance; for it has a much stronger disposition and greater powers to restore

itself than the cellular membrane has to form a new cutis; indeed, the skin formed upon entire new flesh is very different from the original cutis; therefore, as the skin is the part most liable to these accidents, we have the best chance of succeeding in this way when the cutis alone is injured. This practice is the very best for burns and scalds, after the inflammation has either been considerably prevented, or subdued by proper applications or by time, for which there probably are more remedies than for an inflammation arising from any other cause, as if there was something specific in such causes."*

IV. FLOUR AND COTTON.

The introduction of flour and cotton being so recent, in comparison with most other remedies, the documents containing information respecting their value are so numerous that I will take the evidence respecting each, separately.

Wheat-flour.—It is remarkable how rapidly wheat-flour has come into use as an external application in burns. It appears to have been a domestic remedy in France as far back as 1774.† I am not aware, however, that the attention of the profession was formally called to its value until the year 1828, when the late Dr. Ward, of Manchester, published some facts in proof of its efficacy. In 1829, he published a pamphlet of eighty-three pages, octavo, the existence of which appears not to be generally known. The title of it is, "A new Method of Treating Burns and Scalds, and certain Cutaneous Eruptions. By Michael Ward, M.D., S.R.C.S.L., and late Surgeon to the Manchester Royal Infirmary. Manchester, 1829." As this pamphlet is never referred to by writers on burns, and as it is not in most of the large medical libraries of the kingdom, I infer that the remedy was brought into notice chiefly through the *Lancet*, and the newspaper press. A remedy so highly lauded as this was, and which was in everybody's house, and therefore always at hand when a burn occurred, could not fail to be tried by the public, and (as it is undoubtedly a very valuable application) to be extensively

* Hunter's Works, vol. iii., p. 265.

† Kentish on Burns, 1817, p. 39, where a case is quoted from Fourcroy's "La Médecine éclairée par les Sciences Physiques," published in 1791, in which a maid-servant, after keeping her burn arm under a stream of cold water running from a tap, covered it with flour, a remedy recommended to her by one of her fellow-servants.

adopted. It has for some time ranked with cotton in efficacy, and, like it, displaced Dr. Kentish's plan of treatment, in many of our large hospitals, as well as in the private practice of a great many surgeons.

Dr. Herbert Barker, of Bedford, writes :—"As dresser and House Surgeon under Liston, whose premature death the profession now so keenly laments, I had ample opportunities of observing the good effects of the external application of flour ; and so convinced was this distinguished surgeon of the superiority of that over all other applications, that he proscribed everything besides. His mode of applying it was by means of the common dredger, taking care to cover every part of the affected surface. He enjoined the repeated application of the flour to those parts where the discharge of serum oozed through the first applied portions of the powder. He was also careful not to disturb the application until it had completely caked together, and had become loosened by the discharges underneath.

"This is the plan of treatment which I have since invariably followed. The application of the flour is very soothing, and in a few cases in which other modes of treatment had been previously resorted to, the application of the flour has speedily been followed by the most marked relief of pain, and diminution of the consequent constitutional irritation. Flour of the finest and best quality should be used ; it should be lightly and freely applied, and the complete exclusion of the air should be secured by repeatedly dredging the parts where the escape of serum takes place ; perfect quiet should be enjoined, and the application should be allowed to remain until thoroughly undermined by the discharges. Several days, in some cases, will be required to effect this, when the masses of caked flour may be readily removed. I have then had recourse to water-dressing, by means of lint and oiled silk. Cicatrization, if tardy, has been promoted by the substitution of a weak solution of sulphate of zinc for plain water, and exuberant granulations have been effectually repressed by lightly rubbing over the surface a smooth piece of sulphate of copper. The most important indication in these cases is the alleviation of pain and constitutional irritation, by the thorough shutting out of the air ; and no application appears to me so effectually to accomplish this as the application of fine flour. It would seem to act less as a foreign body, and

better to supply the place of the cuticle, than any other application with which I am acquainted. Indeed, such good reasons have I had to be satisfied with this mode of local treatment, that, unless the weight of evidence which you may collect should greatly preponderate in favour of some other application, I shall not be induced to try any other."*

Mr. Dorning, of Swinton, has had extensive opportunities of seeing the burns which occur in the collieries of his neighbourhood. He observes:—"In advocating the use of flour in burns, my testimony will not be duly estimated, except I state that before I entered upon practice on my own account, I had been accustomed to see burns and scalds treated by another method. I was an apprentice to Mr. Robert Thorpe, one of the surgeons of the Manchester Royal Infirmary, in which institution burns were formerly treated with the linimentum terebinthinæ of the London Pharmacopœia for the first two or three dressings, and afterwards with ceratum plumbi. It is now upwards of twelve years since I commenced practice, and during that period I have again and again been called upon to attend colliers burnt by explosions in the coal mines, which in this neighbourhood are of very frequent occurrence, and during the whole of this time I have employed flour as a dressing, except in one case, when it occurred to me that I would apply flour to one arm, and cotton to the other (both equally severely burnt), in order that I might judge which was the best. The arm to which the flour was applied healed somewhat more rapidly than the other, and with less pain to the patient, thus confirming my impression of the great value of flour as a dressing in burns. I now use it in *all* cases, be they extensive or the contrary. In the slighter cases, I think its effects are more satisfactory even than in the severe. When the burn is upon the back I keep the flour in apposition by means of cotton, which I procure in long flakes, 'carded,' and apply from the shoulders to the waist, and then crossways round the waist, so as to effectually retain the flour upon the burnt surface. The flour must be of the *best quality* and applied freely. In December, 1843, I attended two of the Earl of Ellesmere's colliers, at Worsley, which were dressed with an inferior kind of flour furnished by the patients; they were proceeding less satisfactorily than I could have wished. I therefore procured some

* *Provincial Medical Journal*, 1848, p. 76.

fine flour in my own neighbourhood, and was surprised at the improvement the change had effected in a few days. I apply the flour with a dredger, and allow it to 'cake,' simply directing the attendant to remove any discharge with a piece of soft old linen, or cotton wool, and not to disturb the cake, but allow it to become detached of itself, when it must be removed, and the raw surface again covered with flour; and this process must be repeated until the 'cake,' on detachment, leaves a healthy surface, which it generally effects in fourteen or sixteen days. The pain produced by flour is, in my opinion, considerably less than is produced by any other mode of dressing, and most certainly not a *tenth* part so severe as the dressing with the linimentum terebinthinæ, above alluded to, occasions. There is also considerably less risk of contractions following the cicatrization of burns cured by flour, than those cured by other means. I may state that next to flour, I consider cotton the best application in burns.

"The ulceration remaining after severe burns I heal with ceratum calaminæ, unless it is in the vicinity of the hands or face, when I continue the use of flour; and in a case (Samuel Harmer, of Pendlebury), which fell under my care in March, 1844, in which the backs of both hands were ulcerated, I am convinced that subsequent contraction was prevented by steadily persevering in its use for nine weeks. In this case I was induced to persevere in the use of flour, from its similarity to one I had been called upon to attend in August, 1840 (that of Margaret Lloyd, of Pendlebury), which had been six weeks under the care of another medical gentleman, and during that time dressed with ceratum calaminæ. I continued the same treatment until an attack of illness, which confined me to the house five or six days, occasioned her removal to the Manchester Royal Infirmary, where the cure was completed; but subsequent irremediable contraction of the fingers took place, and I have little hesitation in recording my opinion, that the result would have been the same in Harmer's case, if I had pursued a similar plan of treatment.

"In the internal treatment of burns, I administer opium freely; —to an adult, three grains, as soon as called in, and repeat it in one grain doses, night and morning, and more frequently in very severe cases, at the same time exhibiting the liq. ammon. acet., with spt. æth. nitr., and sulphate of magnesia, every four hours,

until the bowels are acted upon, after which I continue the mixture, without the salt. Opium I find necessary through the whole of the treatment, and when the fever has subsided, I prescribe it in combination with tonics."*

The two gentlemen last quoted seem to think that flour is the best external application in all burns. Other correspondents admit that it is beneficial in certain cases, which they specify. Dr. Adams, of Banchory, says, "My experience of flour is of recent date. When the burning is at the same time extensive and superficial, I look upon either the one or the other (viz., flour or cotton,) as the most judicious application that can be used. But when the burning extends deeper, neither of them answers well, and some more appropriate application must be substituted in place of them, more especially the turpentine dressings." Mr. Wood says,—"Many years ago, when flour and cotton came into vogue, the following case occurred to me, and since then I have treated all similar cases in the same manner, and, making allowance for circumstances, with the same result. A maid-servant, tired with her work, lay down on the hearth late at night, and a pan, containing about three gallons of boiling water, fell off the fire, covering her neck, bust, and arms. I saw her immediately; she was in extreme agony, and extensive patches of vesication had already formed. She was immediately dredged with flour, and folded up in *finely carded* cotton wool. She took two doses of calomel and opium, and as she was of a very inflammatory habit, sulphate of magnesia was given freely for two or three days. She suffered no pain after the night of the accident; there was considerable exudation from under the edges of the dressing, which was not removed for eight days, when it was carefully detached, having formed a complete mask. It brought with it the whole of the cuticle, but there was not the slightest abrasion or ulceration of the cutis. At my request she wore a white muslin neckerchief, but at the end of a week it had not a mark or stain from discharge upon it. She was in fact well, if we except a somewhat deep efflorescence co-extensive with the injury."†

Mr. Gabb mentions the following case:—"On February 13th, 1847, James Palmer, aged 5 years, was extensively burnt by his clothes taking fire whilst left alone in the house. I arrived a few

* *Provincial Medical Journal*, 1848, p. 102. † *Ibid*, p. 100.

minutes after the accident, and when the remaining portion of clothes was removed, found the burnt surface occupying the upper two-thirds of the fore part of the right thigh, extending up the side of the abdomen to the thorax, over about a third of the surface of the right side of the thorax, surrounding the shoulder and the whole of the arm down to the wrist, the palmar surface of the thumb and all the fingers being more or less injured. Two or three small blisters were also found on the head. I had the child put directly into a warmed bed, lying on his left side, and applied flour by means of a common dredger over the whole injured surface. The flour gave such relief that the child almost immediately ceased to cry, and began to point with his left hand to parts where he felt desirous of having more applied. I prescribed a mixture of liquor ammoniæ acetatis, tinctura hyoscyami and mistura camphoræ, a dose to be taken every two or three hours, for the first day or two, and ordered the flour to be applied at intervals wherever moisture appeared, for a week, taking care to have plenty in the axilla, and between the burnt surfaces of the arm and side.

"During the first eight days the child was not tortured by any other dressing than the flour, and appeared to suffer but little pain after the first smart was relieved; he was, however, much depressed, had an exceedingly quick pulse, with considerable thirst, and little if any sleep for the first forty-eight hours after the accident, within which period I believe one torturing dressing would have killed him. On the seventh day, the discharge having become offensive, I applied a soft bread-and-water poultice over the whole, at bed-time, and in the morning, on removing the poultice, the crust formed by the flour came off with it, exposing over the greater part of the injury healthy granulations; but on the arm were some extensive sloughs not quite detached.

"I now dressed daily the whole injury with fine lint, wetted in warm water, and so covered it with oiled silk as to keep it moist. In a few days the sloughs had all separated, and from this time, indeed from its commencement, the progress of the case was very satisfactory, nothing being applied from first to last but flour and wetted lint.

"In a case of scalding of both feet and ankles in a child two years of age, I have found the same plan of treatment equally satisfactory, and even more so, if possible.

"The notes taken of this case at the time of its occurrence, were not intended for publication, or I should have been more particular in the observance of dates; I have no memorandum of the last time of dressing, but the cure was complete in about two months. The case has been brought forward merely as an illustration of the efficacy of the most simple of remedies, and a remedy which only requires to be tried to be approved."*

It is a remarkable proof of the relief obtained from the flour, that the child almost immediately ceased to cry, *and began to point* with his left hand to parts where he felt desirous of having more flour applied.

Mr. Hunt, of Herne Bay (now of London):—"My experience in burns and scalds has been very limited; I always use flour, and have never lost a patient by such an accident. My *rationale* is to prevent the access of air to the raw surface, and to supply a convenient dressing for extensive sores. Both of these indications are carried out by the flour dredger. Internal remedies, of course, I administer, as circumstances require, bearing in mind the shock the nervous system has received by the accident, and the loss of cutaneous exhalation from the surface where a large area of skin is destroyed."†

Mr. Evan Evans, of Bath, invariably at first uses flour.‡

Mr. Pope, of Cleobury Mortimer, employs flour mixed with a small quantity of calamina preparata.§

Mr. Lomax says that flour and cotton wool are used at the Lincoln Dispensary in all burns where there is vesication or abraded cuticle: but he adds, that the people he has to deal with generally prefer carron oil, being unable to understand how things so simple as cotton and flour can be healing. Where flour is used, he says that he is informed that the previous application of thin paste or mucilage is useful.‖

Mr. Webster, of the Derby Dispensary, says that "The burnt surface is covered as speedily as possible by the application of linseed oil and lime-water, occasionally mixed with turpentine; or by treacle, *flour*, or cotton wool. The energies of the system are at first supported by stimulants. If the discharge is excessive, the

* *Provincial Medical Journal*, 1848, p. 129. † *Ibid*, p. 18. ‡ *Ibid*, p. 42.
§ *Ibid*, p. 18. ‖ Letter to S. C., August, 1848.

parts are directed to be dusted with flour, starch, or chalk, finely powdered."*

Dr. B. J. Boulton smears the surface of an extensive burn with lin. calcis, and more or less turpentine, and then covers it with flour by means of a dredger, repeating it if necessary till a crust is formed.†

* Letter to S. C., Aug. 10, 1848.

† "Horncastle, Aug. 12th, 1848.

"DEAR SIR,—In the Dispensary here we have no settled or pre-arranged plan of treatment of burns and scalds. In this (an agricultural) district, severe cases of burns occur for the most part at the commencement of winter, amongst the children of the poor, from crowding round the cottage hearths. I have seen from six to eight cases in my own immediate district in the course of a severe winter. The parts burnt are generally the upper part of the body, chest, and neck, and often the face and arms. From observation, I am in the habit of pronouncing that where the charred surface equals in extent from one-fourth to one-sixth the superficies of the whole body, the case will prove fatal within twenty-four hours; and it appears to me that life is extinguished by two concurrent causes, 1st, the shock sustained by the nervous system; 2nd, asphyxia, from the engorged and over-loaded state of the air-cells, the sero-mucous accumulation resulting from the obstructed passage of insensible perspiration. When the burn is severe or extensive, I cannot think the application of cold, or the administration of opiates, admissible. Certainly warm stimulants, turpentine, brandy, or vinegar, most quickly allay pain and give a feeling of comfort, after which the best application I know is the lin. calcis, with more or less turpentine, smeared over the parts, and then dredged with baked flour, the smearing and dusting repeated at frequent short intervals, until a good crust is formed. This protects the parts from the air, prevents the pain of daily dressings, protects the smaller vesications, aborbs much of the serous oozing from the larger ones, and forms a sufficient artificial eschar to prevent much suppuration. Sesqui-carbonate of ammonia is the remedy I give, in often repeated doses, until reaction is established. I can say nothing of the *post-mortem* appearances, neither do I know any mode of preventing undesirable and unseemly cicatrices, nor any certain or effectual method of repressing granulations. Burns, and more especially scalds, of the upper part of the chest and throat, I have seen followed by croup, which has very generally been successfully combated with calomel, pushed rapidly to ptyalism. A short time ago I saw a child, five years old, which had been burnt severely a fortnight previously, and had been treated with oily moveable dressings. There was extensive suppuration over the chest and arms. I was called in because the child had rigors whenever the dressings were removed, and it died two days afterwards, very suddenly. In this district a simple guard, formed of two rods of iron (the cost about 1s. 6d.), would prevent 19 out of 20 of these sad cases, but this contrivance is never adopted amongst the poor until a child has been burnt. My directions, which are pretty generally known, are to apply rags soaked in turpentine or hot vinegar, to keep the extremities warm, and to give warm wine or spirit and water, until medical aid can be had.

"Is the solution of gutta percha in chloroform capable of being so applied over an extensive surface as to repress watery flabby granulations, and favour cicatrization?

"I have hastily sketched the plan of treatment which, according to my experience, is the best. I am sorry to be able to communicate no new facts in reply to your praiseworthy enquiry.

"And I remain, dear Sir,

"Your very obedient Servant,

"B. J. BOULTON, M.D.,

"Honorary Surgeon to the Horncastle Dispensary.

"S. Crompton, Esq."

Mr. Greenhow, who is the advocate of turpentine in severe burns, says that "cotton or flour answers well in slight burns without vesication."*

As regards the mode of applying the flour,† there appears to be little difference of opinion. The following is a copy of the directions on a card which Dr. Ward circulated; the original is in the possession of Dr. Lyon, to whom I am indebted for reminding me of its existence. As it, as well as copies of Ward's tract on burns, are very scarce, it may be interesting and useful to embody his directions in this Report:—

"Remove the clothes from the burn or scald as soon as possible after the accident, (great care being taken to avoid bursting the blister) then take a common kitchen dredger, and sprinkle the inflamed parts with flour, (the patient being placed in a horizontal position) either till the pain subsides, or so much flour is applied as to form a defence or covering from a quarter to half an inch in thickness. If the holes in the lid of the dredger be too small, or not so numerous as to allow the flour to escape with ease and freedom, then take off the lid, and hold the dredger in the right hand over the burn or scald, and sprinkle the flour equally and plentifully upon the injured parts, by hitting or tapping the dredger with the fingers of the left hand. If the pain be removed by the flour, (which has hitherto been the effect in every instance) the patient may then sleep, or take some mild nourishment, and as long as the pain is easy, nothing more must be done. When it returns, more flour must be applied to the painful parts, without disturbing those which are easy; and this method must be continued as long as is necessary. In slight cases, a few days will suffice to effect a cure. In serious and alarming ones, especially if the blisters be pricked, (which has hitherto been the regular custom, though a very pernicious one) it may perhaps be necessary to continue applying the flour at proper intervals, ten days or a fortnight, or probably longer. If the pain do not soon yield after applying a coating of flour of a proper thickness, (see above) the dredging or dusting must be continued, without regard to the quantity of flour used, either till ease be obtained, or the quantity

* *Provincial Medical Journal*, 1848, p. 101.

† Why not apply flour in the form of paste? In many cases it could be more conveniently applied thus.

be such as, if increased, would be inconvenient from its weight; then wait a while, and at the second and succeeding dredgings or sprinklings, the uppermost loose portions of flour, if any, may be removed before more is put on. The fingers must not be used in applying the flour, as they would make it warm, which would be improper; for a similar reason no rollers or bandages must be applied, (as they would increase the heat, and add fuel to the fire) and only such bed-clothes or other coverings as are necessary to keep the patient warm, but not too hot. But if it should happen that the flour cannot be kept in contact with some particular part long enough for its cooling and healing properties to take effect, in such rare cases a little thin old linen (not calico) may be applied cold, particular care being taken to avoid drawing it tight, and to remove it instantly if uneasy to the patient. It must also be remarked that if the blisters are by any means opened or burst, ulcers are then formed, which are very painful, and difficult to heal.

"N.B.—In accidents of this kind happening to children, (young infants more particularly) the use of flour has been found to produce ease and sleep almost immediately, after other means had been tried in vain."

There is a difference of opinion as to the period during which the flour shall be continued as a dressing. When the crusts become thoroughly undermined by the discharges, and detached, Dr. Barker does not apply fresh flour; but Mr. Dorning does so, and completes the healing, in most cases, under the crusts. Mr. Wilkinson, of Rotherham, who uses cotton as his primary dressing, sometimes uses flour to the ulcerated surface, (left after its removal) for the purpose of checking the discharge. After applying the flour, he covers it with an ointment. Here are some facts, then, which would lead to the inference that flour may be a beneficial dressing to extensive ulcers; a conclusion which one might have expected *a priori*. This is a point to which the attention of surgeons may be directed with a prospect of some beneficial results in the treatment of other extensive ulcers attended with profuse discharge, than those from burns. Mr. Wilkinson's words are—"To check the tendency to inordinate discharge, I generally use some absorbent powder, such as chalk or calamine; or if these should be found to irritate, (which they seldom do) I substitute flour,

dusting the sore over with one of them previous to an application of wax, lead plaister, olive oil, and calamine, in such proportions as to form a very firm cerate."*

It will probably be found that powdered gum arabic, or flour, mixed with powdered calamine, or prepared chalk, (which are such favourite applications to ulcers with profuse discharge) will be a useful combination, and that they will *set* and form a thin firm layer of artificial scab upon the sore, the particles of which will adhere together better than those of prepared chalk do when wetted with pus. It would appear that flour and cotton are esteemed of nearly equal value by those who have tried both. Mr. Bowring, of Manchester, informs me that at the Manchester Infirmary either of them is used; his own opinion being rather more favourable to cotton. At King's College Hospital flour is preferred.

Mr. Humphry, of Cambridge, says,† "that in Addenbrooke's Hospital, burns are treated with cotton or with flour; but that he is on the whole disposed to give the preference to the latter. It is cleaner, more easily applied, renewed with less pain to the patient, as well as being more soothing than the cotton." He thinks "that the cases treated with it have done better. It is applied as soon, and with as little exposure to the patient as possible, and its use is continued till the subsequent skin is furnished with fresh cuticle in slight cases, or till the ulcer consequent on the destruction of some part of the skin begins to granulate, and to assume a healing edge, after which the flour encrusting upon the margin of the ulcer seems to interfere with the process of cicatrization. Water-dressing is then substituted."

Professor Warren, of Boston, United States, says "flour and burnt flour, so long used, and so generally known, I have employed with good effect."

In the Bolton Dispensary, flour is the universal practice in *severe* burns.‡

Mr. Wills:—"*Flour* is a good remedy, but as is also the case with wool, it sticks to the sore, and causes a very unpleasant, and often a very painful, sensation of dryness and roughness, and I

* *Provincial Medical Journal*, 1848, p. 185.

† Letter to S. Crompton, 11th August, 1848.

‡ Verbal communication to S. C., by Mr. Jackson, the House-Surgeon.

have been obliged to remove the flour, and apply the warm water and oiled silk."*

Mr. Stanley elsewhere expresses his opinion that cotton is better than flour.

Mr. Barrow states the advantages and disadvantages of flour:—"The treatment of covering the whole burnt surface thickly with flour, and repeating it whenever it becomes saturated with discharge, I have, upon several occasions, adopted, but I cannot say with that marked success which many record. In minor cases it has a soothing influence, but in those where there is extensive destruction of skin, it has two very decided drawbacks,—the first being the difficulty of keeping the parts clean and free from offensive discharge, for when sloughing has once set in, it is impossible to cleanse the parts without much pain to the patient, and long exposure to the air; the second drawback being the irritation caused as soon as the flour cakes, irritation so excessive, that I have been obliged, on several occasions, to remove the dressing of flour, at least as far as practicable. These circumstances are, I conceive, quite sufficient to prevent the application of flour being adopted as a general rule in cases of burns, but I must not omit to mention where and when I have found the flour of advantage, and this has been when the injury has extended into almost every region of the body, and into those situations where it is impossible either to place, or to keep constantly applied, wool and other dressings."†

Cotton.—Dr. Ogier Ward says that cotton was used at the Belfast Hospital upwards of twenty years ago, and that this was the first hospital in these kingdoms into which it was introduced. It was afterwards employed in Scotland, more particularly in the Glasgow Infirmary. The cotton was used at that time without any additional application (and this continues to be the practice in many places to the present day), but in others some adjunct is made use of. Dr. Ward gives much information respecting the introduction of cotton.‡

Mr. Washington Murphy, of the Belfast General Hospital, in answer to an inquiry whether cotton is still used as the dressing to burns in that institution, says, in a note dated Belfast, 27th Sept., 1849,—"Cotton wool is still used in this establishment, but of course with some discrimination as to the nature of the injury

* *Provincial Medical Journal*, 1848, p. 104. † *Ibid*, p. 211. ‡ *Ibid*, p. 131.

Adopting the classification of Dupuytren, we use it in the first four degrees of burn. After having smeared the burned surface with the carron oil, we apply the cotton to the part, keeping it in its place by a bandage. The above is our constant practice."

Mr. John Steele, Superintendent of the Glasgow Royal Infirmary, says that "fleeced cotton continues to be almost the universal application in cases of burns occurring in our practice. The cotton is applied by means of bandages, and there does not seem to be any material change in the manner of applying it. Of course each surgeon has his peculiar views regarding the treatment of severe cases; I allude, especially, to the after-treatment. Water-dressing appears to me to be superior to any other dressing at this period, and is much adopted here."*

Cotton is very extensively used at the present time, and in many of our large hospitals it has entirely superseded the Kentishian plan of treatment. For example, in St. Bartholomew's Hospital it is used by itself in every degree of burns. Mr. Stanley says,— "The first treatment of burns and scalds, in all their degrees, at St. Bartholomew's, adopted by my colleagues and myself, is the application of very clean, soft, carded cotton to the injured surface. The only exception to this is in the burns of the face, where the application of the cotton not being convenient, we substitute for it the mask of linen, upon which is spread the liniment, composed of linseed oil and lime-water. My observation of the comparative effects of the various local applications which have, at different periods, been recommended for burns and scalds, strongly impresses me with the superiority of the cotton over every other application, on the following grounds:—It instantly subdues the pain, and thus saves the exhaustion of the system so often directly fatal in children; then, beneath the cotton, the reparative process in the injured skin proceeds most favourably. I like the cotton better than flour, because the latter cakes and hardens, and thus becomes irritating.† I tried, as I found it had been recommended, enveloping the injured parts first with the linen smeared with linseed oil and lime water, and then, over this, applying the cotton; but I found the linen, thus smeared, to become dry and hard, and thus, not so soothing to the part as the cotton applied alone, and in contact with the burnt or scalded surface."

* Letter to S. C., 16th November, 1849. † Mr. Barrow concurs in this.

Mr. Brown, of Preston, Lancashire, says that "from the first introduction of cotton (twenty years ago) I have trusted to it exclusively as a topical application, both in simple and more serious cases, with so much satisfaction and success as to induce me to prefer it to every other kind of dressing to the injured integuments."*

In the Lincoln County Hospital, Mr. Sympson, the House-Surgeon, states that the mode of treating burns and scalds adopted there, "consists, in all cases, in the local employment of cotton wool, and, if the patient be in a state of collapse, in the administration of diffusive stimulants. If not, however, in a state of collapse, the practice is, to give a large dose of opium."†

Mr. Edwardes, Surgeon to the General Dispensary, Wolverhampton, a gentleman of very large experience in the treatment of burns, says,—"In those cases where the shock to the nervous system has been so great as to endanger life, and render internal remedies the first and immediate consideration, I have invariably found stimulants of wine, brandy, æther, or ammonia and opium, most efficacious; but as I have usually found the sensation of extreme cold to be the most urgent suffering evinced by the patients in all extensive burns and scalds, and which I believe is mainly owing to the exposure of the denuded surface to the atmosphere, I at once proceed to the use of those means, the application of which, will, most thoroughly and effectually, exclude the air from the injured parts. This materially aids the internal remedies in restoring reaction; indeed, I consider it of paramount importance. If the injury is so situated that cotton can be properly applied, I always use it in preference to any other application. By cotton, I mean well-carded cotton, not that cotton-wadding which is sold in the shops, and is glazed on one side, to pad ladies' dresses with,—this is a very poor substitute. If, however, the face is the seat of injury, the application of boiled linseed oil, or white lead, or thick white paint, answers the purpose better than anything I am acquainted with; for, by drying upon the part, it forms an impervious covering, and effectually excludes the atmosphere. With these remedies I am prepared to say that all burns and scalds (whether the destruction of parts is deep, and the surface considerable, or whether simple vesication only is the result) will be more efficaciously combated than with any other. I know that by some

* Letter to S. C., March 11, 1848. † Letter to S. C., August, 11, 1848.

practitioners these means are said to fail. I also know, that it is not the means, but the manner of applying them, which gives rise to failure. If cotton is used, it must be applied evenly, in large quantities, and retained in its position by the loose adaptation of a soft bandage. If boiled oil or paint be the remedy, its application should be repeated as often as it hardens upon the surface, until such a coating is acquired as to render it a perfect mask, and quite impervious to the air. When there is an accumulation of discharge under the mask, it must be evacuated by cutting a small portion of the coating away in several places, and afterwards fill up the openings by a fresh application of the paint.

"Of course a repetition of the cotton will depend upon the extent of injury and amount of discharge. Frequently I find one or two dressings sufficient to effect a perfect cure in a burn which would require weeks or months to accomplish by the daily application of ointments; and to those who are familiar with the cries of distressing agony which always accompany the matutinal exposure of a burn, I need not point out how greatly superior must that plan be where the dressings have only to be changed once in every week or nine days."*

Mr. Gall says, "I have only recently used cotton; but from two cases which have lately occurred, I am so much pleased with its effects, that I shall always keep a supply ready for use. They were cases of severe burns of the arm and hand of children, from falling into the fire. The arms were enveloped in cotton, and healed very rapidly."†

Dr. Adams:—"Cotton I have long used, but my experience of flour is of recent date. When the burning is at the same time extensive and superficial, I look upon either the one or the other, as the most judicious application that can be used. But when the burning extends deeper, neither of them answers well, and some more appropriate application must be substituted in place of them, more especially the turpentine dressings."‡

Mr. Leach (whose contribution on treacle is elsewhere noticed) uses layers of carded cotton over the treacle. He says, "carded cotton is not liable to tear vesicles, which thin paper is, in any movement of the limbs. I have therefore abandoned the use of

* *Provincial Medical Journal*, 1848, p. 45. † *Ibid.*, p. 18.
‡ *Ibid.*, p. 42.

thin paper, where I can obtain carded cotton for my purpose, and I use layers of carded cotton over a thick coating of treacle."*

Dr. Glass Black strongly recommends that the cotton should never be removed from the surface of the sore; the outer portions may be cut off, and clean applied, but that covering the wound never.†

Mr. Greenhow:—"In slight burns without vesication, cotton or flour answer well. I may add, that when the injury is so general and severe as to forbid all hope of recovery, to envelope the entire person in cotton is perhaps the most comfortable plan that can be adopted."‡

Mr. Wilkinson, who resides in a district in which burns are very common, was induced to employ cotton, instead of Dr. Kentish's applications, by the following considerations:—"During my apprenticeship, and for some time after, I adopted Kentish's treatment, but owing to the pain which it produced I abandoned it, and now use with much satisfaction cotton-wool, laid upon the burnt parts after they have been smeared with carron oil, to a pint of which two drachms of liq. plumbi diacetatis have been added. The patient will generally experience relief from pain immediately, and this first dressing I allow to remain until it can be easily removed by the exhalation from the skin, or the desquamation of the cuticle itself, (for we frequently find in extensive burns, that we have every degree of injury, from a simple scorch to the complete destruction of the substance of the skin;) I therefore remove the wool piece-meal, according as it may be set at liberty by the discharge, or become offensive, and I only re-apply it after the same manner to such parts as may have to slough, and merely require a covering whilst nature is performing that process, so that the wool is only made use of as a means of protection to the highly sensitive surface, preventing access of atmospheric air, and, being a bad conductor, assisting the animal heat in promoting suppuration.§

Mr. Masfen, of Stafford, informs me that cotton is the favourite application at the Stafford Infirmary, and in Staffordshire generally.

Dr. Strange:—"In slight cases, where the destruction of the tissues is not deep, I *think* the cotton does as well as anything, or,

* *Provincial Medical Journal*, 1848, p. 42. † *Ibid.*, p. 78.
‡ *Ibid.*, p. 101. § *Ibid*, p. 185.

perhaps flour, of which I have used little since I have become satisfied of the great advantages of cotton. In severer cases, and where there will necessarily be a good deal of sloughing and suppuration, I prefer dressing the parts first with the lime-water, oil, and turpentine, spread thinly over the burnt surface with a feather, and then applying the cotton (carded) equally over the whole. This double application appears to sooth the pain, and will remain on for two, three, or more days, before requiring change. It is a very common practice, and one in favour with the colliers themselves, to dress the parts with a cerate composed of soap, turpentine, and resin, with some oil spread on lint, and bandaged over. But even if equally unobjectionable with the liniment, this mode of applying what is nearly the same thing, gives rise to more uneasiness from motion, etc., and to more pain on its removal."*

Mr. J. C. Davie, of Haddenham, prefers cotton to every other application, especially in those cases in which there is a disposition to sloughing. He thinks that here exclusion of the atmospheric air is very important, and that cotton fulfils this indication perfectly. As a non-conductor, he adds, that it tends to equalize the temperature of contiguous parts, etc. He covers the burnt part with finely-pulled layers of cotton, which are placed upon each other till a thick coating is formed, which he retains by compresses and bandage; taking care to remove the latter daily. He does not, in general, remove the dressing for eight or nine days, and when he does so, not till they have been well soaked with water; if any part of the wound be bare, he adds a little fresh cotton; if the cotton becomes offensive, he uses the chloride of lime lotion. He gives the two following histories of cases treated by him :—

"*Case I.*—November 24th, 1843, James Thurlow, aged four years, of Haddenham, had the integuments destroyed, covering the entire surface of the scapulæ; the right axilla; the circumference of the upper part of the humerus, the whole of the posterior and lateral parts of the same extremity, taking the course of the triceps muscle, and extending some way from the olecranon process; large detached portions on the right side of the thorax, and the top of the abdomen; the entire surface of the ilium, inguinal region, and upper-third of the thigh of the same side. The plan which I have before described was adopted; the lower arm was bent, and the

* *Provincial Medical Journal*, 1848, p. 132.

recumbent posture strictly enjoined. When the cicatrization had commenced, the affected joints were fully exercised every day, with due regard to the dressing being in exact apposition. Some weeks after he had an attack of scarlatina, and the only wound then unhealed was that over the ilium, and the adjacent parts, which became irritable, and its action very unhealthy, so that it was impracticable to continue the adhibition of the cotton-wool any longer. During this state of excitement of the system the wound was dressed with lint and warm water, afterwards with an ointment composed of bees' wax and linseed oil, with the occasional application of potassa fusa, and the cure was effected March 13th, 1844. He has the free and perfect use of the right upper and lower extremities; the skin over the shoulder blades, axilla, side, upper and lower arm, is smooth and without the usual contraction after such accidents; but the cuticular surface in the inguinal region is puckered, though mobility of the extremity below is not at all restricted.

"In this class of cases, where there are exuberant granulations, I prefer the potassa fusa to any other caustic. In some instances which I have witnessed after the medical practitioner had been dismissed, the cicatrized parts were attended with much pain and irritation, in consequence of the surface being above the natural skin, and the only remedy from which relief could be found, was the free application of the potassa fusa.

"*Case II.*—February 25th, 1845, my attendance was requested upon Ann Croxen, aged eight years, of Aldreth, a hamlet of this parish, who had been severely burnt, comprising the entire of the exterior of the front and lateral parts of the neck, together with the under part of the lower jaw; the right and left axillæ; the posterior and lateral parts of the right and left upper arm, along their whole extent; the right and left scapulæ, with the intermediate integument of the back, and the undivided lateral parts of the chest. She was submitted to the same plan of treatment as in the other case. After three months of unremitting assiduity on my part, I resigned it to the care of the parents, at which time the wounds of the right and left chest, left scapula, axilla, and arm, were well; cicatrization was somewhat advanced over the right scapula, axilla, and upper arm, but the remaining part of the case did not go on so prosperously as heretofore, which I consider to

have arisen from motion of this extremity not having been enforced, and the dressings not being in co-aptation. In consequence of the latter, the wound lost its healthy action. Unguents were employed, and ultimately this part of the cure was effected, but much less perfectly than in those parts wholly treated by the cotton-wool. I may here be permitted to remark, that in the like cases, where cotton has been misused, and the abrasion has been some time in existence, I have never been enabled to employ it with the same advantage as in the early stages. The present condition of the child is the following:—She has the free and unrestrained motion of the left shoulder; the new-formed skin, and that of the axilla, is smooth and pliable; the chin is not at all depressed, and she has the free motion of the mouth, but the skin over each sterno-cleido-mastoideus muscle is puckered; the exterior of the left side is smooth. Mobility of the right arm is less perfect than that of its fellow, though she can raise the arm as high as the head; it is restricted by a band of integument, from the side to the upper arm. I do not remember ever having before seen a burn of such extent, and involving such important parts, recover; yet, contrary to expectation, there was scarcely a militating circumstance which impeded the successful result of the case. In the diarrhœa following burns which might be supposed to arise from suppression of a discharge to which the constitution has become naturalized, I have found the sulphate of copper and opium most invaluable."*

Mr. Charleton, House-Surgeon to the Gloucester Infirmary, says that it is the custom in that hospital "to apply cotton-wool without ointment to vesicated burns not denuded of cuticle;" and "*to parts deprived of skin,* either by moderate burning or by scalding, our practice is to apply upon lint an ointment of equal proportions of simple cerate and resin cerate, and to cover that dressing, together with the surrounding reddened or blistered parts, with cotton-wool. The resin cerate gives tenacity to the dressing, and renders its application convenient, rather than possesses a peculiar curative effect."†

Mr. Hartley says, that extensive burns are treated at the Cheltenham Hospital with cotton-wool, except those of the face, to which flour is applied. The cotton remains on till suppuration is

* *Provincial Medical Journal*, 1848, p. 185.

† Letter to S. C.

established, and then it is removed, and the wound dressed with poultices or ointments, as appears most applicable.

Mr. Herbert Cole, House-Surgeon to the Worcester Infirmary:—"Cotton wool has been the invariable application, renewed occasionally till the sloughs came off, when the sores were dressed in the usual way, caustic, lint, and chalk pledget over, etc. etc. The application of the cotton has been so successful that we have rarely found it necessary to give opium. We have generally found brandy necessary, and as much milk as they can drink."*

Mr. Crossley mentions that the practice in the Derby Infirmary, in severe cases, is to envelope them in cotton-wool. If the patient survives, the cotton-wool is renewed, as required, for three or four days, and then a poultice applied to detach it.†

Dr. Strange:—"Of the comparative value of cotton and flour I cannot decide—probably nearly equal; but as far as I have seen, the cotton dressing is the more *manageable* of the two."

Dr. Ogier Ward:—"Though my experience is altogether in favour of the cotton treatment, yet I ought to mention that it is attended with some objections, particularly during summer, first from the fœtor of the discharges attracting the flies, which, breeding maggots, excite the horror of the friends, at the same time that they are sickened by the stench. Hence it requires some firmness on the part of the medical attendant to induce perseverance in the treatment. Again, the confined and fœtid pus has had in some instances an injurious effect on the patient, where the sodden portions of the cotton have not been removed frequently; and this operation requires some little dexterity, to avoid tearing off the cotton where it has become adherent to the newly-formed cuticle, which bleeds at the slightest touch, and then is more difficult to heal than at first."‡

Finally, it is very probable that many parties who have tried what they consider to be the cotton treatment, have not employed the best description of cotton, and therefore have had no opportunity of judging of the exact value of it. All who are in the habit of using it extensively, employ *carded* cotton, and they agree in representing it as being much more efficacious than either wadding or uncleaned cotton.

* *Provincial Medical Journal*, 1848, p. 325. † *Ibid*, p. 324.

‡ *Ibid*, p. 132.

VI. CARRON OIL.

The carron oil continues to be extensively employed, more so probably than any other application. I have noticed that there is some difference in the mode of preparing and applying it. It is generally prepared with linseed oil and lime-water: and Mr. Beever informs me that when the linseed oil is good, the preparation is better than when prepared with olive oil. Others prefer the olive oil. The following is Mr. Hampson's formula: ℞. olei olivæ et aquæ calcis, ā Oij.; spirit. camphoræ, ℥j.; træ. lavand. comp., ℥ss., Ft. lotio. It is necessary to mix them well by agitating them. A piece of good lint dipped in this is applied to the part, then wetted with more by means of feathers, and then it is covered with cotton wadding or wool. He informed me that bleachers use cocoa-nut oil, and that it answers very well. The Dublin Pharmacopœia directs it to be prepared with olive oil. At Carron Works, I find that they add sulphur to the linseed oil and lime-water;* and so form a liniment, which appears to be better than the old carron oil. The oil seems not to separate so soon from the aqua calcis, and it forms a very smooth and nice application. Sulphur, being a good non-conductor, seems to be a suitable addition to the liniment. I have received information respecting the mode of using carron oil from many parties. At the Manchester Infirmary it is extensively used for slight burns. At the Chorlton-on-Medlock Dispensary, Mr. Farquhar Milne informs me that it is the general remedy, and that it is applied warm. In the Wigan† and Haddock coalfields, the people are so fond of it that they will permit scarcely anything besides to be tried. At St. Helen's, a neighbouring town, they are equally prejudiced in favour of a different plan of treatment, which will be described afterwards. Dr. Warren, of Boston, says, "Lime-water and linseed oil I have used very often. It seems to alleviate the suffering of the patient, probably by securing the injured part from the atmosphere."‡ At the Cork Hospital, before they apply cotton, they smear the parts with carron oil. In some cases I have found that the clothes saturated with carron oil have been removed once

* Letter from Mr. Dawson, of Carron, to S. C., July 4, 1849.

† Verbal communication to S. C. from Mr. Fisher, Wigan.

‡ *Provincial Medical Journal*, 1849, p. 353.

or twice a day, and fresh ones substituted for them: but the usual custom is to keep the clothes wetted with the oil, and not to remove them.

Mr. Gall, of Ripley:—"The treatment I have hitherto adopted in extensive burns, since giving up flour, has been to cover the surface with lint, saturated with linseed oil and lime-water soap. If the burn is extensive and the patient is collapsed, this should be warmed. Once applied it should be allowed to remain as long as possible, until suppuration has taken place, and the discharge has become offensive. I have seen extensive burns do very well under this treatment."*

Mr. Mash, late House-Surgeon to the Northampton Infirmary, says that the carron oil was the usual application in that institution, except in cases where there has been loss of vitality. In these latter cases, ol. terebinthinæ is used; in mild cases, spirit lotions are applied.

Mr. W. J. Lomax, of the Lincoln Dispensary, uses the carron oil or the ceratum calaminæ indifferently in burns of slight extent.

Mr. Mudge adds a little liq. plumbi diacetatis to the carron oil; and thinks the internal treatment is of more importance than the external. Of local applications, he prefers much those which give no pain; and his internal remedies are not alcoholic stimuli, but refrigerants.†

VII. TREACLE.

Mr. Jesse Leach proposed the use of treacle, some years ago, and advocated its employment in an essay published in the *London Medical Gazette*, vol. xxiii., p. 192. In his communication to me, he mentions a modification in its application. Instead of using thin paper, he now applies the treacle to the surface, and covers it with layers of carded cotton. He prefers cotton because it is not liable to tear vesicles (as the paper does) during movements of the limbs. "In other respects he has the same opinion of the superior efficacy of treacle over any other application, in the treatment of *superficial* burns and scalds." In *deep* burns and scalds, he prefers terebinthinate applications.‡

* *Provincial Medical Journal*, 1848, p. 18.

† Letter to S. C., 14th August, 1848.

‡ *Provincial Medical Journal*, 1848, p. 43.

Mr. Bulley forwarded a long and interesting essay on the use of treacle, which is printed in the *Journal.** He applies treacle and water, heated to 98° F., in the proportion of one-part of treacle to three of water, over the burnt surfaces, by means of lint soaked in the solution and laid over the whole of the injured parts. "This dressing is to be changed night and morning, the lint having been kept moist during the day by occasional saturation with the mixture of the same temperature, most readily done by soaking a sponge in the fluid, and at intervals squeezing its contents over the lint while still in contact with the surface." He says that its action is *directly sedative*, and that its primary effects are to lull the pain and moderate the inflammation, which almost always exists in the integuments surrounding the parts which have been recently destroyed by fire, and which has a tendency to destructive progress if no effective means are used to arrest it. He considers that it exercises the same beneficial influence upon the deeper-seated tissues as upon the superficial. "Its next most obvious effect appears to be that of modifying the tendency to putrefactive decomposition, which destroyed parts are prone to undergo prior to their separation as sloughs; and that it is capable of exercising such an influence I have scarcely any doubt, having had repeated opportunities of observing it, especially in the cases I have related, where its action in this respect was very remarkable, as the slightest putrescent or unpleasant odour could not be perceived during the whole period of the treatment. I had an excellent opportunity of observing this latter circumstance in a case which, through the liberality of one of my colleagues, was placed under my hands for treatment. Although no less than 270 superficial inches of integument (principally of that covering the abdomen,) had been destroyed, I could not, nor could those more immediately about the patient, at any time observe any particular smell. I may mention that this patient lived a month, and at the time of her death, the whole of the integument having undergone the carbonizing changes observed in similar cases, had separated from the surface, which had begun to suppurate freely. On dissection there was no evidence of the duodenum or any other part of the intestines having been inflamed by metastasis, but she appeared to have sunk from the great suffering she had undergone, as well as from the shock, from

* *Provincial Medical Journal*, 1848, p. 155.

which she had never completely recovered. There was a slight turgescence of the posterior part of the right lung, but whether from subsidence or other cause could not be accurately determined.

"It remains only to endeavour to account for the smooth and regular cicatrization, which I have reason to believe is assisted by this method of treatment. It occurs, I think, in this way: the disorganized integument and cellular tissue, having undergone carbonization, remains adherent to the parts beneath, and while it is so in contact acts as an extraneous substance by excluding the air from the surface, and mechanically represses the growth of what would otherwise be exuberant granulations. As the carbonized integument is first observed to separate from the margins, the granulations round the periphery of the wound, by the contracting process which Dupuytren ascribes to the approximation of the margins to the central point, begin to cicatrize before the centre of the wound has become uncovered, which always happens last, and thus a gradual and even cicatrization follows."*

Mr. Higginbottom, it will be remembered, mentions that the nitrate of silver prevents a putrefactive odour in burns treated by it. With respect to treacle, the following remarks by Dr. Paris, on the preservative powers of treacle and honey, will be read with interest: —"For the purpose of forming active vegetable powders into pills, such as digitalis, conium, etc., I am informed by Mr. Hulme, of Longacre, that in his experience, molasses or treacle is the best constituent that can be selected, for it undergoes no decomposition by time, but maintains a proper consistency, and preserves the sensible qualities of the plant quite unimpaired for many years. I have deposited in the cabinet of the College specimens of such pills, of hemlock and fox-glove, which retain the characteristic odour of these vegetables, notwithstanding they have been now made for several years. Honey has likewise the property of preserving vegetable substances; seeds may be kept in it for any length of time, some of which on being taken out, washed and planted, will even vegetate. It has also been used for the preservation of animal matter; the bodies of the Spartan kings, who fell at a distance in battle, were thus preserved, in order that they might be carried home." Dr. Davy informs me that "the Veddahs, a savage race

* *Provincial Medical Journal*, 1848, p. 158.

inhabiting the wilds of Ceylon, even in that hot climate, effectually preserve their venison in honey."*

Mr. Robinson, of Bolton, uses treacle spread upon linen, and covered with a fleece of cotton, securing it in apposition by means of a bandage. In slight burns he uses a *warm* saturnine lotion applied with linen, and covered with cotton. He opens large vesicles with as small a puncture as possible.

Mr. Snape, of Bolton, employs treacle of its usual temperature, except in cold weather. He dips rags in it. He says that the common people prefer treacle to flour, believing that there is more *virtue* in it. He mentioned to me the case of a girl, aged ten years, burnt by her clothes taking fire, extensively on the chest and abdomen. She had been under a quack for two days, who had been applying cold water to a great extent. Enormous sloughing took place on the chest and abdomen, on the latter so deeply that the intestines were exposed and escaped three times. The epigastric artery was involved, and there was a good deal of hæmorrhage: the artery was tied. She recovered in about four months; the principal application having been chalk ointment.

Treacle is always at hand, and appears to constitute an excellent primary dressing in burns. It might be recommended to the public for that purpose, either applied pure or diluted, and covered with calico. If necessary the surgeon might apply cotton over all on his arrival. Might not flour be advantageously dusted upon the treacle after it is applied to the parts, so as to render it less liable to flow off them?

VIII. WATER DRESSING.—ST. HELEN'S TREATMENT.

The application of a dressing, which consists chiefly of water, is the general practice at St. Helen's, in Lancashire, and it has been in use there for thirty or forty years.

Mr. Gaskell is sure that he has seen some thousand cases of burn. He has practised at St. Helen's since 1810, and was apprenticed to Mr. Pilkington, under whom he saw a great many burn-cases. The treatment at St. Helen's varies according to the extent of the burn. In superficial burns, such as those occurring from explosions in coal-pits, the following is the formula for the

* Pharmacologia; 1833, p. 280.

lotion so much adopted at St. Helen's :—℞. Plumbi superacet, ℈j.; bol. armen; spt. lavand. co. ā ad libitum; aquæ, Cj.; Ft. lotio. Bits of rag are to be saturated with this lotion, and applied cold, until the smarting ceases; afterwards *warm*, until cicatrization is complete. After the rags are first applied, they are never removed till they smell offensively; but they are kept constantly wet with the lotion, by means of a sponge. If the burns are sloughing, he applices a poultice made with the lotion and bread. If the application of the cold lotion be not carefully watched, there is considerable danger of its preventing reaction. Where it seems probable that there will be sloughing, he never uses it, but the poultice. As soon as the smarting ceases, which is generally in four or five hours after the accident, the lotion is put upon the hob, and used warm. Flour was tried in one case, but the people objected to it, and said that there was nothing so good as the St. Helen's wash. Large doses of opium are given to the patient: about 100 drops for a dose.*

Mr. Casey, St. Helen's, uses the above lotion. He once tried to introduce the use of flour, but the people would not tolerate it. He thinks flour very good, especially in the burns of children. When suppuration is established, he adds a little sulphate of zinc to the lotion; has great faith in the efficacy of the roller bandage, and uses it as often as possible. Instead of using the lotion cold at first, he orders it to be used *warm* throughout the treatment of the case: the rags are first steeped in it, and then wrung out, so as to carry very little of the lotion, but they are not removed from the sore, but are wetted with a sponge. The women in the town are so much used to the dressing of burns, that the surgeons have no occasion to do it, except when the roller is required. In the Haddock coal-field, a mile or two distant, they use linseed oil and lime-water; but he thinks that no burns do better than those treated at St. Helen's with water (for he looks upon the treatment to be the application of water); and he believes that there are fewer foul cicatrices than in most places. Mr. Stracy, in extensive burns, gives a glass of warm spirit and water, with a *full dose of opium*, and keeps the nervous system quiet under the influence of it, until suppuration is established, when he gradually diminishes the dose.

* Notes of a conversation with Mr. Gaskell.

Mr. Daglish, after abandoning a modification of Kentish's plan, "has of late years, in burns of the first degree, used the following lotion (which is almost the same as Mr. Pilkington's) :—℞. Plumbi acetatis, ℈j.; spt. lavand. comp., ʒvj.; aquæ ad, ℔viij.; Ft. lotio. This lotion is very grateful to the patients, and by the time the opiate (which I always give immediately) begins to have effect, they generally express themselves relieved. This dressing we go on with as long as the patient expresses comfort from it; great care being taken that the cold lotion does not produce chilliness; should this be the case, the lotion should be used warm. If the case is a bad one, the clothes are changed the day after the accident; if slight, not for two or three days; afterwards, the dressing is done daily. If the suppuration is considerable, we begin to use a lotion containing two grains of sulphate of zinc in the ounce, instead of the former lotion. In burns of the second degree, when we use cold applications, greater care is required, and I am generally glad to begin the simple ointment dressing in three or four days after the accident, as, by so doing, I generally feel less apprehensive of mischief being induced in the chest. In the third class of burns, I still like the stimulating plan, namely, the first dressing of turpentine and laudanum, and the parts then covered with simple dressing, which is to be changed daily, taking care during the dressing (when the burn is an extensive one) to expose only small portions of the body at a time. In all degrees of burns I use an opiate as soon as I see the patient, and generally in a good dose at first, and afterwards in smaller doses, either with saline or a stimulating mixture, whichever is indicated. I have had as many as twenty cases of burn in a day, and frequently eight or ten at a time, after a severe explosion."*

Mr. Page, Surgeon to the Cumberland Infirmary:—"In cases where the injury is neither extensive nor severe, I believe that cold water is the most agreeable application for the patient, and equally good with many others. When the injury is of greater extent,—when the destruction of a large portion of the integuments renders it unwise to employ any means tending to increase the congestion of the internal organs, warm applications are made use of,—sometimes lint dipped in warm water and covered with oiled silk,—more frequently soft rags dipped in lime-water and linseed oil are

* Letter to S. C., 10th August, 1848.

employed. In severe cases, I look upon the internal remedies as those of by far the most importance to be considered; the supporting the system under the shock, and afterwards supporting it under the long-continued drain to which it is subjected, and also the appropriately meeting any affection of the internal organs which may arise. Opium I employ as little as possible, and in those cases only where I think the pain likely to be of greater injury than the effects of the drug, believing that death after extensive burns not unfrequently results, in part at least, from the congestion of the internal organs, —the brain, the lungs, the intestines,—consequent on the destruction of a large portion of skin (and this may occur immediately or at a more remote period), and believing also that opium tends to increase that internal congestion."*

Mr. Stone, formerly Surgeon to the Ancoat's Dispensary:—"I never use Kentish's plan of treatment now. In simple burns or scalds I employ the water dressing, *always* covering it completely with oiled silk. In severe cases I use the simple dressing at first, in preference to stimulation, on account of the almost immediate relief which the patient experiences, precluding, in a great majority of cases, any necessity for opiates. Afterwards, if slight stimulation be found desirable, I use camphor-water, or water medicated with tinct. myrrhæ. I find this plan admirably adapted for children, and for burns of the face and neck; one great advantage being the absence of mark or scar. I have lately had some rather severe burns, in men employed at naphtha works, and my firm impression is, that the cases were well in one-third of the ordinary period required for a cure under Kentish's method. The dressings are easily and rapidly performed, and the cleanliness of the plan is no slight recommendation."†

Mr. Towers, of the General Infirmary, Hertford:—"In instances where the cuticle is not abraded, we apply tepid water dressings, and in those in which it is much destroyed, we use flour or cotton in the early stages, and subsequently water dressings."‡

Mr. Norman's views on the treatment of burns are quoted at length under the head "Stimulants," to explain the peculiarity of his mode of using turpentine in the supparative stage of burns. He is an advocate of the use of water, hot or cold, according to the

* Letter to S. C., 12th August, 1848. † Letter to S. C., 5th August, 1848.
‡ Letter to S. C., 12th August, 1848.

severity of the case. He says,—"Slight cases of burn do not differ from the blister you produce by cantharides, and require only the same treatment. To more severe and extensive cases, I generally apply cloths wet with cold water; or, where a large extent of integument has been destroyed, cloths wet with warm water, frequently renewed."*

It will be remarked that Mr. Norman's plan of using the warm water differs from that of the great burn-practitioners at St. Helen's and Wigan. He renews the cloths frequently; they do not remove them for some time (sometimes not for several days), but keep them wet by means of a sponge charged with their lotion.

Professor Warren:—"*Warm water* has been used when the vitality of the textures was more or less impaired, *by means of thick compresses*, covered by a layer of gummed silk or India-rubber cloth."†

Mr. Charleton mentions a compound dressing, formed of a modification of the stimulating plan and the water dressing:—"To burns with the skin charred so as to render extensive sloughing certain (supposing the first shock be overcome), the application preferred is, solut. calcii chlorid, ℥ss., aquæ, ℥xvss. It is applied by lint moistened with it, and is covered with oil-silk."

IX. CONGELATION.

Dr. James Arnott, of Brighton, suggests the employment of a short and benumbing application of cold. Cold sufficiently great to produce the physiological changes in the part which he considers essential, is very different from the cold spoken of under the head *cold* applications, and the remarks which are there made respecting the value of cold, are not to be understood as applying to Dr. Arnott's application. In burns I have had no experience of the value of Dr. Arnott's method, but from what I have seen of its action, I am of opinion that he is advocating the use of a therapeutical agent of great power and value in many diseases. Whether it is admissible in burns, is a point that I am quite unable to determine. He draws a broad distinction between the action of ice and the temperature which will benumb and actually freeze the living tissues of the body; and he maintains (what is very probable) that a temperature of 32° F. may do much mischief, while a

* *Provincial Medical Journal*, 1848, p. 436. † *Ibid*, 1849, p. 353.

temperature much lower constitutes a remedial agent of great power, and (he says) unattended with danger. He says that he has repeatedly applied cold in that degree which has congealed the part of the body to which it was used, and that it has produced none of those evil effects which we read of in books as resulting from the thawing of frozen limbs. He "would dread the long-continued application of cold water in extensive burns, just as he would dread the plunging of a gouty limb into cold water; but he conceives that the frigorific acts very differently." He suggests the application of it by means of what he terms his current-apparatus, which consists of a pig's bladder of appropriate size, to which are attached two long India-rubber tubes, by one of which the cold liquid is drawn from the vessel which holds it, and by the other it is carried away as soon as it has passed through the bladder. The object is to have a current of very cold water running through the bladder whilst the latter is in contact with the affected part. If ice be kept in the vessel from which the bladder is supplied with water, it is obvious that by this means the affected parts would be subjected to an even temperature of about 32° F. Dr. Arnott suggests another plan, viz., placing pulverized salt and ice in a net spread upon a caoutchouc ring, and kept in contact with the injured parts. The temperature produced by this method is much lower than by the former, and coagulates the tissues. Of course it is maintained for a short time only. Further information respecting Dr. Arnott's views and contrivances will be found in his Essay on Indigestion; in the *Lancet* of August 22, and Sept. 9, 1848; and in the *London Medical Gazette*, Dec. 11, 1848.

X. OTHER PRIMARY REMEDIES.

Scorched Flour is mentioned by Dr. Warren. *Dextrine*, which is the chief ingredient in the gum by which adhesive postage stamps are attached, is, I believe, made from scorched flour.

Honey was mentioned to me by Dr. Barham, as having been found particularly efficacious by Dr. Caerleon, of Truro. It is certainly a very good domestic remedy, and nearly allied to treacle in its powers. As it is a good non-conductor, and so tenacious as to help in forming a good mechanical protection to the injured parts, I feel certain that it would become generally used were it less costly.

Mucilage of Arabic Gum.—This is also mentioned by Dr. Warren as being used at the Massachusetts Hospital. It is a good non-conductor, when made into a very thick mucilage, and as it dries it forms a scab with non-conducting powers, very probably nearly the same as natural scabs.

Impermeable Piline.—Mr. Markwick has recommended this substance, and has published some cases in which it was beneficial.* This substance consists of woollen cloth covered with Mackintosh's solution. The woollen is a very perfect non-conductor; and its non-conducting power is greatly increased by *backing* it with caoutchouc, which is itself a non-conductor, and further by preventing currents of air through the woollen renders it still warmer. It will require further experiments to decide in what cases it is most useful; and as too high a *non-conducting* power might be injurious in some cases and in some conditions, I must for the present decline giving an opinion of its value.

Charcoal.—Professor Warren says, "I have applied charcoal pretty extensively, in the form of powder, ointment, and poultice, and it has appeared to give relief, whether by exclusion of the air or by absorption of its oxygen, I know not." Charcoal is a most perfect non-conductor. I do not know any English surgeon who uses it. Calaminaris, creta, &c., are highly approved of in England as applications to suppurating sores, but I suspect they are beneficial chiefly by acting as non-conductors and absorbents; in these points, the charcoal would be still more useful, and it possesses the additional property of doing away with putrefactive smells, which is an advantage in the treatment of burns on the scabbing principle. Where there are daily dressings this last property would not matter. It may possibly be found that charcoal, by reason of its power of conducting electricity, is not so good as simple non-conductors of heat and idio-electrics.

India-rubber Cloth.—This is another of the American applications mentioned by Professor Warren in his most interesting communication. It is applied in thin layers to exclude the air.

Poultices.—"Cold poultices may be used in the early stage of burns without disorganization, and *warm* when the parts are destroyed. Their softness, moisture, and power of protecting,

* *Provincial Medical Journal*, 1848, p. 46.

place them amongst the most valuable of remedial agents."* "Many people in this district have a great partiality for warm poultices, and fancy that the patient experiences more relief from them than from any other means."† "Poultices are too weighty and very troublesome to be removed; barm or beer-ground poultices are beneficial in deep burns, but either may be applied on rags, and covered with oiled silk."‡

Narcotic Solutions.—Professor Warren says, "Watery solution of opium, of poppies, and of the leaves of hyoscyamus, I have known to give great relief from suffering when the cuticle was removed. If this is retained, they cannot be employed with any decisive effect, unless applied very extensively, and for some time. A decoction of tobacco produces more evident results, but this narcotic is too virulent to be used over a large surface."

Potatoe and Bread Poultice.—"In minor burns and scalds, in which the cuticle is only raised into blisters, or in which the injury to the deeper parts is very slight, after allowing the fluid to escape from the bladders thus formed, a poultice of potato and bread, finely grated, and mixed in equal parts, is as good and as simple a remedy as can be found; but even in these cases I strongly advise that the poultice should be prepared ready for application, before pricking the blistered surface, in order to exclude, as far as practicable, the external air, the sudden admission of which I have, upon more than one occasion, seen to produce pain so intense as to induce a state of almost complete prostration. As regards the application of ordinary poultices, in the second or any stage of burns, should the suffering be great, I always recommend that they should be made with the tincture of opium and water, and applied either warm or cold, according to the feelings of the patient, the proportions, as I have used them, being from half a drachm to one drachm of the tincture, to an ounce of water."§

Goldbeaters' Skin and Isinglass Plaster are recommended "for simple and inextensive burns," as a ready and effective dressing, by Mr. Evan Evans.‖

XI. THE PROGNOSIS.

Dr. Adams:—"My own experience in the treatment of burns has been principally confined to young and aged persons, and I

* Professor Warren. † Dr. Adams. ‡ Mr. Wills.
§ Mr. Barrow. *Provincial Medical Journal*, 1848, p. 209. ‖ *Ibid*, p. 44.

have no hesitation in declaring explicitly, that when extensive I have uniformly found them to be a most fatal class of injuries, and that, when of a limited extent, they have frequently proved troublesome to heal, especially in old persons. In general I have found that death either resulted in the course of a few hours, the system having sunk under the shock it had sustained, or that the patient was gradually worn out by the pain and discharges. I have seldom known the febrile reaction to be so strong as to occasion death. In the case of a girl, about ten years of age, a fatal trismus was the consequence of a scald upon the neck and chest."*

Mr. Greenhow:—"When the injury is extensive and deep, especially when occupying a large portion of the trunk, and in very young subjects, the prognosis is always unfavourable, though the issue is not necessarily fatal. Extensive burns of this description are not unfrequently succeeded by phthisis, even when the patient appears convalescent, as regards the immediate effects of the injury."†

Dr. Strange:—"The prognosis is dependent entirely upon the constituent symptoms. I have seen cases of the most severe and extensive burns recover almost without a bad symptom, but these have occurred to robust and previously healthy colliers. My fatal cases, except those destroyed at once, have been those of children, by whom, in consequence of their clothes taking fire, a more prolonged application of heat has been suffered than is the case in colliery explosions. Long continued collapse, with coma, almost imperceptible pulse, and coldness of the body, I have found invariably fatal."‡

Mr. Eddowes, the Coroner for Shropshire, says,—"I recollect seeing a child burnt to death, when the whole surface of the burn was so slight that a crown-piece would have covered the worst part. It lived about twenty-four hours. Had no medical assistance."§

Mr. Greenhow:—"On the chest and abdomen, burns of equal extent are attended with more hazard than on the extremities."‖

Mr. Newnham:—"*Extent* rather than *situation* I have found to be the principal cause affecting the result; at the same time there are situations of the body where the nerves are exquisitely sensitive, or are more liable to irritation, or are supplied in an especial

* *Provincial Medical Journal*, 1848, p. 42.

† *Ibid*, p. 101. ‡ *Ibid*, p. 133. § *Ibid.*, p. 44. ‖ *Ibid*, p. 101.

manner, which would, of course, *cæteris paribus*, add to the constitutional irritation and consequent danger."*

Mr. Higginbottom:—"The prognosis is favourable generally according to the greater or less extent of the skin destroyed. Unfavourable in children when the chest or abdomen is scalded or burnt."†

Dr. Adams:—"I have found burns about the head particularly fatal. Those about the feet are, of all others, the slowest in healing. Deep burns in the neck are obviously very dangerous, owing to the large vessels which are situated in that region. The only plan I have pursued in cases of apprehended danger from hæmorrhage, has been to avoid warm applications, and not to interfere much with the separation of the sloughs."‡

Mr. Gaskell feels quite sure that he has seen burns recover which occupied one-half of the surface of the body: and he adds that intense thirst and vomiting are the most frequent forerunners of death. Further, that in bad cases, diarrhœa usually begins at the end of fourteen days.

Mr. Hartley mentions, as a fatal sign, a peculiar writhing of the body, with little or no crying, in children.

XII. INTERNAL TREATMENT.

The *internal* or constitutional treatment is the most important point in the cure of most of those burns for which the public consult a professional man, and it is a subject which requires further investigation.§ While we have been searching for the best outward applications, we have neglected, I fear, the due consideration of the state of the system at large, forgetting that severe local mischief cannot cure itself, except through the system at large. The recent investigations into the morbid conditions of the internal organs after burns, have disclosed a state of things which we could *a priori*

* *Provincial Medical Journal*, 1848, p. 78. † *Ibid*, p. 103. ‡ *Ibid*, p. 42.

§ "I am inclined to think that the constitutional treatment in burns and scalds has not been attended to sufficiently."—Mr. Higginbottom, in a note to S. C., March 10th, 1848.

"I have long been impressed with the opinion that the constitutional treatment is the most important."—Mr. Daglish, in a letter to S. C., 10th August, 1848.

"In severe cases, I look upon the internal remedies as those of by far the most importance to be considered."—Mr. Page.

scarcely believe it to be possible to exist. For example, who would have supposed that when there is a large outward sore with a profuse discharge of pus from it, there would be fatal congestion in the brain, chest, or abdomen? and that this outward sore should be a cause of this internal congestion, seeing that when mischief in the lungs takes place, we frequently establish artificial ulceration externally for its relief? Whether external remedies act as non-conductors or otherwise, is not so important a consideration in severe burns, as what is to be done for that condition of the internal organs which has been proved to exist in these cases. Probably no very great improvements will take place in the local treatment of burns (for mankind seem to have arrived at the right practice, though they did not know the *principle*), but there is great room for amendment in the *internal* treatment, if we may judge by the fact that about 4000 persons die annually of burns and scalds in these kingdoms.* The necessity for the administration of stimulants, whenever the shock to the system is great, seems to be admitted by every one, and I do not find any information among my communications which requires special comment. The most important point is, whether opium shall be given in combination with them, and if so, in what doses. On this point (as on all others) there exists much difference of opinion in the profession. Kentish administered opium in very large doses (60 to 100 drops of laudanum, as was mentioned in a former page); but the general practice, at the present time, seems to be to administer it in smaller, though generally in full, doses. Mr. Gaskell and Mr. Casey, of St. Helen's, however, give it in doses of 100 drops; their patients are strong labouring men, colliers, etc. Opium has probably been dreaded by some practitioners, because patients burned severely frequently die comatose. But is this a sufficient ground for using it in smaller doses? Kentish says, "I have seen the patient die on the third day, in a state of coma, where very small doses had been given; whilst in other severe cases, where large doses had been freely administered, no such effect was produced."†

Mr. Gall thinks laudanum in full doses, frequently administered, the best remedy for the state of collapse. Mr. Hilton gave half a grain of acetate of morphia as soon as he saw his patient, and repeated the dose in an hour, if he continued to be in pain, and said

* Letter from Mr. Farr to S. C. † Kentish; *l. c.*, p. 77.

that he had seen the best results from such a practice. Mr. Greenhow says, "When the nervous system has received a great shock, internal stimulants are necessary, and *opiates are often of great service.*" Mr. Dorning "gives three grains of opium to an adult at his first visit, and afterwards a grain night and morning, and more frequently in very severe cases." Mr. Sloman prefers extract of henbane, in a full dose, with camphor, in ordinary cases, which appears to allay the irritability of the nervous system, without deranging the secretions; in more severe cases he gives Dover's powder or morphia, with ammonia. Mr. Davie gives a *full dose* of laudanum as soon as the patient is put in bed, with brandy, ammonia, etc., during the state of collapse. Mr. Wilkinson says, opium "is a most valuable auxiliary, during the inflammatory stage in particular, given in proportion to the amount of pain or constitutional irritation."

Dr. Adams, of Banchory:—"After very extensive burns, I have very commonly observed a great prostration of the vital powers, and have, therefore, generally administered wine and other stimulants to counteract this tendency. Brandy and other spirits, however, I have rarely administered, and never ammonia, as far as I recollect. Of course all such means require to be given cautiously, or altogether abandoned, as soon as any febrile reaction takes place; but at a subsequent stage of the treatment they may frequently be resumed with advantage. *Opiates* I generally give where there is much suffering, but of course they require to be administered with proper caution when there is any morbid tendency to coma or sinking."*

Mr. Edwardes, of Wolverhampton:—"With regard to internal remedies. In those cases where the shock to the nervous system has been so great as to endanger life, and render internal remedies the first and immediate consideration, I have invariably found stimulants of wine, brandy, æther, or ammonia and *opium*, most efficacious."†

Dr. Herbert Barker:—"With regard to the constitutional treatment, I have little to say more than that, in my hands, *the muriate of morphia has been found to be the most eligible form of anodyne.* It is followed by less inconvenience than any of the crude opiates. Stimulants have been found to be very beneficial in some cases of

* *Provincial Medical Journal*, 1848, p. 43. † *Ibid*, p. 45.

early depression of the vital powers, but it must be confessed that the greatest caution is required, and that it would be difficult to lay down precise rules for their administration. I have generally used from the first a liberal allowance of good beef-tea, and castor-oil is the only laxative I have dared to admininister in these cases, unless contra-indicated by nausea and vomiting."*

The free administration of opium will of course be borne better by those patients to whom stimulants have been applied externally, especially turpentine, and it seems to me to be probable that Kentish's success may be ascribed to this free internal use of opium and stimulants at the outset, nearly as much as to the external use of the turpentine. As far as I can discover, he was the first person who administered opium freely, and in his first essay he confesses that he did not know its value; in his second, however, as I have previously shown, he laid great stress upon its utility. Is not the system much in the same state as after profuse uterine hæmorrhage, where opium in large doses is so useful? and the nervous system in that state of exhaustion which we generally see in delirium tremens?

Mr. Barrow recommends opium, in doses of half a grain to a grain, for the vomiting which so often attends burns; for the excessive thirst, attended with irritability of the stomach, he has found soda-water and milk refreshing, nourishing, and beneficial.

Dr. Strange:—"Except in very extensive burns, in which sedatives and stimulants, in turn, are required at first, I have confined my internal remedies solely to meet the emergencies of the case, watching particularly the action of the mucous and serous membranes as exhalant surfaces. With reference to this question, however, I cannot agree with those who think that our main efforts ought to be directed to the providing a vicarious outlet for the suspended secretion of the skin. We have many analogous cases, as confluent small-pox, for example, in which a fatal issue does not seem to depend so much upon the suspension of the healthy action of the skin as a secreting and exhaling organ, as on the state of shock and alarm set up in the nervous centres, consequent upon the irritation of the peripheral extremities of so vast a number of nervous fibrils. To sooth disquietude, to support the failing

* *Provincial Medical Journal*, 1848, p. 77.

strength, to relieve congestion, will all, therefore, in turn, require our prudent efforts."*

Mr. Leach states a practical point of much value:—"You will find the internal use of brandy and new milk, in the proportion of two tea-spoonfuls of brandy to a tea-cupful of new milk, agree with a patient's stomach when every other liquid is loathed, and the vital powers apparently giving way under excessive purulent discharges and constitutional irritation. The use of this mixture has a soothing effect on the nervous system, and speedily promotes healthy granulations in deep-seated burns."†

Mr. Newnham, of Farnham:—"*Immediately* after burns, etc., I have usually found a gentle stimulant desirable, especially ammonia, rather than alcohol, and the subsequent medicinal treatment must be determined by the degree of reaction, and the kind of constitution in which it is taking place; each individual case being decided upon its own merits."‡

Mr. Sloman:—"I have always considered the *internal* treatment the most important part; all the fatal cases of burns that I recollect having seen, the patients have died very soon after the accident, and evidently from the effect produced upon the nervous system, and not from the exhaustion produced by the excessive discharge after suppuration has commenced."§

Blood-letting has been proposed in burns to relieve the internal congestion, but I do not find that it is adopted by any one in England.‖ Professor Warren says that local or general blood-

* *Provincial Medical Journal*, 1848, p. 132.

† *Ibid*, p. 44. ‡ *Ibid*, p. 78. § *Ibid*, p. 108.

‖ "The constitutional symptoms will vary according to age, sex, and temperament, as well as situation and extent of injury. I had a case of burn some time ago, which so strikingly illustrates the two last-named modifications, that I cannot avoid alluding to it here. A boy, about ten years of age, sustained a burn of the abdomen and thighs. Within twenty-four hours tympanites, with vomiting and constipation, supervened; in short, every symptom of peritoneal inflammation. I bled him from the arm, to complete muscular relaxation. The bowels acted freely immediately, and the little patient did well, although most of the skin of the abdomen sloughed. This is the only case wherein I have opened a vein on account of a burn, but it serves to show that we must not be deterred from treating a case upon established principles, because it was the result of an uncommon cause; and it likewise appears to reverse the theory of the homœopathists *(similia similibus curantur)*, as the external inflammation, instead of curing or preventing, actually occasioned the internal."—Mr. Wilkinson. *Provincial Medical Journal*, 1848, p. 185.

letting is useful where there is violent reaction. My space will not permit me to enter upon the consideration of the question.

The value of *aperients* also is a question of importance.

Dr. Herbert Barker:—"Castor oil is the only laxative I have ventured to use in cases of early depression of the vital powers, unless contra-indicated by nausea and vomiting."*

Mr. Wilkinson:—"Aperients are useful during the early stage, inasmuch as they reduce morbid or excessive heat, and act as revulsives to the skin; but when the suppuration stage has once set in, they cannot be too carefully administered, as the patient's strength might be injured thereby, a circumstance, of all things, to be guarded against, as nothing is more prejudicial to a speedy recovery than a diarrhœa, which not unfrequently comes on spontaneously when we least desire it."†

Mr. Barrow:—"The administration of purgatives in these cases has been long and is still a matter of some controversy; no observations, therefore, upon the subject of burns, would be complete without an opinion, and which I now offer with much caution and deference. To lay down any decided rule upon this head is, I am sure, quite impossible, for I have as often seen diarrhœa as constipation in these cases. If the former be present or arise, it ought to be stopped as speedily as possible, for if allowed to continue it only tends further to reduce the vital powers of our patient. If the latter, I am always quite satisfied for the bowels to remain quiet for a day or two, until the powers of the patient have rallied, and they are better able to bear the action of medicine; when this is given it must be with great caution, all drastic purgatives being avoided. The medicine which I recommended and have found most efficacious, is castor oil with some drops of laudanum, the quantity of both being regulated by circumstances. As regards diarrhœa, I would here observe that I have frequently seen that which Mr. Wood, of Rochdale, has mentioned, viz., that sloughing being over, the healing process going on to all appearance most favourably, at the end of a month or longer an attack of diarrhœa supervenes, which, if it does not destroy the patient, retards his recovery, and places his life in imminent danger. I am inclined to attribute this diarrhœa to the overloading of the stomach and bowels with nourishment to which the system has been previously

* *Provincial Medical Journal*, 1848, p. 77. † *Ibid*, p. 186.

totally unaccustomed, and thus by carrying nutrition too far, we are actually causing death by the very means which we believe to be life to the patient."*

Mr. Kentish recommended *saline* purgatives in burns. He says, (at page 122, second edition of his Treatise on Burns,)—"As secretion (from the burnt surface) frequently appears on the third day, the necessity for stimulants will cease, and they must give way for a different mode. *Saline purgative* medicines should be given after secretion takes place, both with a view of tranquillizing the system under the inordinate action excited by the stimulants, used at the outset, and to lessen the secretion of pus." At page 128, he says, "If the secretion of pus should continue profuse when the eschars are detached, *a counter-irritation upon the mucous membrane of the intestines will be necessary. A brisk cathartic with calomel and jalap, according to the strength of the subject, given once or twice a week, will astonishingly facilitate the cure.*" Mr. Henry Earle confirms the above statement as to the value of purgatives. At page 26 of his tract on Burns, he says, "Diarrhœa sometimes supervenes, and is occasionally beneficial when the discharge is very copious. From observing the occasional good effects resulting from spontaneous diarrhœa, when the discharge was profuse, in accelerating the healing process, Dr. Kentish strongly recommends the free use of purgatives under such circumstances, *and I have known them very useful.*"

XIII.

There are some facts which I cannot readily classify, yet they are too valuable to be omitted in this Report.

Mr. Wood:—"It has often occurred to me, in extreme cases, at the end of five or six weeks, when the sloughing is over, the granulations healthy and abundant, cicatrization going on rapidly, and the patient's strength improving daily, to witness a sudden diarrhœa come on, which has destroyed the patient in a few hours. How this is to be explained, except on the ancient doctrine of revulsion, I do not know. I think I have observed it most frequently when the abdomen has been the seat of the injury. Another circumstance has often struck me in these miserable cases. A child among the poorer classes, eight or ten years of age, has, up to the

* *Provincial Medical Journal*, 1848, p. 212.

time of the accident, been heavy, dull, and stupid in character, to a degree almost denoting the absence of the intellectual faculties. Its countenance has been a true index to the mind from its entire want of expression. In one month it is quite an altered being. The features become unnaturally old and sharp looking, while its perceptions and intelligence are quickened and developed in a remarkable degree. Probably the same amount of suffering from any other cause might have the same result, but it has not fallen to my lot to witness it."*

Mr. Wills mentions the following curious case:—"About five years ago, a child (female), aged nine years, had a severe burn of the right thigh. It healed very well for some time, but when there was a sore left, about four inches broad, and six long, it became stationary, and has remained so more or less ever since, notwithstanding all the many applications which have been made. Sometimes it is rather larger, sometimes less. It always looks well, and if a stranger saw it, he would say it was healing very well. Sometimes it bleeds, but the granulations always seem perfectly healthy. The girl is in good health, and stout, but latterly there has been something approaching vicarious menstruation (the catamenia never having appeared), for about every month there is rather an increase in the size of the sore, and bleeding occurs."†

Dupuytren ("Leçons Orales," 1836, p. 250,) gives a case of deviation of the menses through a similar wound.

Mr. Higginbottom asks,—"Whether the inhalation of chloroform would not be worthy of trial, particularly during the first dressing of a (burnt) patient?"‡

Dr. Adams:—"Ulcers after burns have a strong disposition to become fungous. To these I usually apply the unguentum æruginis, or a piece of lint, wetted in a solution of sulphate of copper. In a few instances, when nothing that could be had would make a sore of limited extent put on a healthy action, I have applied a small blister for an hour or two, so as to produce sloughing of the fungus, and healthy edges of the sore. In such a case I have known mercury administered internally, with the intention of its acting as an alterative of the state of the system, but I would never think of following this practice now; the strength should rather be supported, and quinine given freely. In a case of deep burning

* *Provincial Medical Journal*, 1848, p. 100. † *Ibid*, p. 104. ‡ *Ibid*, p. 103.

about the elbow, where the humerus was laid bare to a considerable extent, I applied the actual cautery with good effect, in promoting the granulation of the bone."*

Dr. Adams :—"Several instances of sudden death during apparent recovery have occurred in the course of my practice, but I have kept no report of any such cases. It does not occur to me that I ever met with a case in which death could have been referred to ulceration of the *duodenum*, although it would appear that such cases are not of unfrequent occurrence."†

Mr. Casey says that sulphate of copper in substance represses granulations effectually, and that it is less painful than sulphate of copper lint.

Mr. Greenhow objects to the destruction of exuberant granulations by caustic. "Contracted cicatrices are best prevented by the *non-application* of escharotics. The exuberant granulations attendant on burns are the process employed by nature to ensure an adequate extension of new skin. If this process is uninterrupted, the cicatrix becomes smooth and even, and the subsequent contraction is always increased in proportion to the destruction by caustics, of the healthy, though at first sight, perhaps, apparently too bountiful, granulations."‡

Mr. Gabb :—"If caustic, or anything approaching to it, be used, as the sulphate of copper, it should only be applied to the *outer margin* of the granulating wound, the granulations in the centre being left to complete their work, until the integument encroaches immediately upon them. Nothing but deformity can be gained by hastening the cicatrization of a wound,—by repressing what are too frequently called exuberant granulations, supposing the process capable of being expedited by such means."§

XIV.

Another point for inquiry was the management of contracted cicatrices from burns.

Mr. Whitehead has contributed the particulars of the cure of a case of extensive deformity,‖ resulting from contraction taking place during the cicatrization of a burn. The paper, which contains

* *Provincial Medical Journal*, 1848, p. 42.

† *Ibid*, p. 42. ‡ *Ibid*, p. 101. § *Ibid*, p. 130.

‖ See *Provincial Medical Journal*, 1848, p. 421.

many remarks on the pathological condition of the parts, is too long for insertion here, but is well worthy of perusal. The case is as follows:—

"E. B., daughter of respectable parents, resident in North Cheshire, received a severe burn from accidental ignition of her clothing, in August, 1830, when *eight* years of age. The injury implicated a considerable portion of the left, the front, and the whole right side of the neck, extending from the ear, jaw, and occipital scalp, to the chest and axilla in front, and lower part of the shoulder behind; also the boundaries of the axilla, the whole circumference of the arm at its upper third, and the entire half of the rest of the limb on its anterior aspect, from the last-named part to the hand. The left limb was also severely injured, but to a less extent. Twelve months afterwards, in August, 1831, the surfaces having been for a length of time completely cicatrized, the right fore-arm was found immoveably contracted upon the arm to the degree of an acute angle, in which posture it was maintained by a web of cicatrix extending between the distal extremities of the two portions of the limb, and occupying of course the whole intermediate space. The corresponding limb was similarly fixed, the displacement being, however, less considerable. She presented herself at the last-named date for the purpose of having the position of the limbs restored by operation. The skin of the neck was also deeply furrowed, and the head distorted, but an operation upon these parts was not deemed advisable on the occasion in question. The cicatrices on the arms were accordingly removed, and the limbs maintained in an extended state by means of splints. A thick cord was tied round each limb at the elbow joint, after a fashion long since recommended. Being at that time engaged in the pursuit of my elementary studies, I had an opportunity of witnessing from time to time the progress of the case. At the end of twenty-one weeks the cure was considered perfect, but in consequence of some degree of contraction being already manifest, the use of splints was ordered to be continued. Had this injunction been fully complied with, the issue would probably have been much more favourable than it proved to be. But once from the actual surveillance of the surgeon, daily attention to the measures enjoined soon became irksome, even to the anxious parent, and the apparatus was not long afterwards abandoned altogether.

"The contraction alluded to as existing at the time when the patient was returned to her friends, although but slight, was, nevertheless, susceptible of replacement, even by the application of considerable force. But in twelve months after the operation, both limbs were again fixed in nearly the same position as before, and the right one rendered all but useless. Bands of cicatrix had sprung up nearly equal in extent with, and much more resistant than, those which had been removed, and the deformity, which was subsequently further aggravated, remained unrelieved for *twelve* years following.

"In May, 1844, the patient, being 22 years of age, presented herself again to my notice. At this period the head was dragged downwards towards the right side in a very inconvenient and unsightly manner. The fibrous band subtending the angle at the elbow-joint, was equal in thickness to, and tangibly as firm as, the Tendo Achillis. The first operation was performed upon the neck, the incision commencing below the ear, the lower part of which organ was merged in the folds of the cicatrix; it was thence continued below the line of the jaw to a point opposite the middle of the chin. Division of the skin simply appeared to afford no relief whatever to the distortion, there being immediately beneath numbers of bands of a bright fibrous aspect, which effectually prevented the parts from resuming their natural position. These being successively divided with the bistoury upon a grooved probe, and the head raised, other sets presented themselves to view, which, when extended, still produced a tractive effect upon the cicatrix below. Bundle after bundle was in turn dragged forward and divided, from one extremity of the wound to the other, until caution suggested a cessation. The wound, which appeared dreadfully large, was cleansed and covered with simple dressing; it was quite healed in four weeks.

"The relief afforded by the above operation encouraged confident hopes of a successful issue from a like procedure upon the arm; this was accordingly practised on the 8th of June, 1844. The bistoury was plunged through the structure at the angle of flexure, as close upon the joint as safety to the neighbouring parts would admit, and thence carried forwards, emerging at the free edge. But this incision, which might, *a priori*, have been looked upon as all that was necessary, constituted comparatively a small share of

the operation. The divided parts immediately retracted considerably; but when extension was attempted, even but to a limited degree, a number of shining fibrous bands started forwards, completely hindering further movement. These were also divided and extension again attempted, when others of similar character were brought into view, occupying an elevated position in front of the joint, and opposing like resistance. In this manner successive groups of fibres had to be separated, layer after layer, before the limb could be brought into a straight line, which was not accomplished until all the deep-seated bands reaching across the joint on each side of the large vessels, and outwards towards the condyles, had been completely divided, including of course the fascial insertion of the biceps muscle. During the operation the median basilic vein was accidentally wounded; this it was found necessary to ligature on each side of the puncture, before further steps could be taken.

"The wound, which measured eight or nine inches in the long direction, and upwards of four inches transversely, was cleansed, and covered with simple dressing and a bandage. A splint was applied to the back part of the limb on the fourth day, but this appeared unnecessary, as there was no difficulty in easily maintaining an extended position; the apparatus was altogether abandoned at the end of three weeks, and never afterwards required. The wound was completely cicatrized in six weeks.

"About three months afterwards I divided, in a similar manner, the cicatrices bounding the axilla, on the same side of the body, with nearly equal success."

Drawings of the appearances before and after the operation are given in the *Provincial Medical Journal*, 1848, p. 421.

Mr. Charleton has also given an interesting account of the operations performed at the Gloucester Infirmary, with a tabular statement of the results. (See Appendix.)

Dr. Adams:—"In one case of burning at the ankle, where the tendons in front of the joint had become contracted, and the foot was getting into the state named *valgus*, I performed subsection of the *extensor* and *tibialis anticus*, with Stromeyer's knife, and then extended the foot, with the most satisfactory results."*

Dr. Herbert Barker:—"The position of the injured parts during cicatrization should, of course, claim the greatest attention in

* *Provincial Medical Journal*, 1848, p. 42.

reference to the prevention of deformity. So gradually and almost imperceptibly, yet so powerfully, will the process of cicatrization lead to the contraction of parts, that the surgeon cannot be too careful to guard against it. Where the limbs and surfaces of the joints have been involved, I have had recourse to the careful adjustment of splints, with considerable success, but it is necessary to keep them applied much longer than at first sight would appear to be required, in consequence of the *after-contraction* of the cicatrized surface. Of attempts to relieve deformities from cicatrization, I cannot speak favourably, having made the attempt in one case of union of the lower lip and chin to the front of the neck, but without success. A very successful case of this kind, however, is described and figured in Fletcher's "Surgical Notes and Illustrations."*

Mr. Greenhow:—"Cicatrices are best treated by separation from the subjacent textures by a broad incision and subsequent careful dressing, with the use of mechanical means for preserving or restoring the natural relation of parts which have been præternaturally approximated."†

Mr. Barrow gives the following case:—"A little girl, aged eight years, was brought to me on account of a contraction at the bend of the elbow-joint, and which, upon enquiry, I learnt had occurred nearly five years previously, following a rather severe burn, in which the sloughing had penetrated deeply; that, as the wound healed, so the arm became bent; that the cicatrix had been twice divided, and that on the last occasion a portion of the hardened skin had been removed; that considerable difficulty had been after each operation experienced in keeping the arm extended during the progress of the healing of the wound; and that a common straight splint, which had been fixed on the back of the arm, had caused so much pain and uneasiness as to oblige its removal, and, as a consequence the present deformity. I placed upon the arm my apparatus, and with a scalpel just slightly divided the cicatrix upon the first day, placing the arm at the angle which this division allowed, without causing pain, and there fixed it by means of the joint splint. Two days subsequently I again divided the cicatrix, again altered the angle of the arm, and at the same time the splint. This operation I repeated at five different periods, at about three days' interval, and at each time placed the arm and splint at the angle,

* *Provincial Medical Journal*, 1848, p. 77. † *Ibid*, p. 101.

which I found compatible with the child's comfort. The arm had become perfectly straight in about six weeks; the splint was, however, still retained upon the limb, the straight position being occasionally changed for an angle more or less acute as the fancy took me, thus avoiding the chance of tiring my patient, or of the arm becoming stiff. During the latter period friction and fomentations were frequently employed, whereby the cicatrized skin in a great measure regained its natural condition. The arm in about three months was equal in usefulness to that of its fellow. It is unnecessary for me to dilate upon the various operations proposed and performed for the cure of these contractions, many of which I have witnessed, and some myself done, but from which comparatively little good has resulted, especially when they have been for the relief of those contractions and hardened cicatrices which bind down the skin to the sternum, or confine the arm, close in the axilla, to the side. To avoid these I would recommend, that immediately granulation commences, a pad, in the shape of a horse collar, be formed of soft material, and placed between the healing surfaces, the external layer being, as in the case of splints before mentioned, the medicinal remedy we desire. This pad can be easily retained *in situ*, and if well made will be a comfortable resting place for the patient's chin, and if the occasion requires it between the arm and side, it can be with equal facility and comfort applied.

"Before dismissing the subject of operation in cases of contractions, I would venture to offer a word of caution to any young aspirant after operative fame, and who may not have seen many of these attempts to relieve deformity, for he will be sadly disappointed at the result, and not a little astonished at the depth to which he must cut, if he expects in any way to relieve his patient. Of all operations these are the most tedious, and the most unsatisfactory, besides being most acutely painful."*

XV.

Another subject of inquiry was,—What directions should be given to the public for the prevention of burns, and for their treatment in the interim between their occurrence and the arrival of a practitioner?

This is an important subject. When a child is severely burned,

* *Provincial Medical Journal*, 1848, p. 209.

it is probable that in many cases a fatal termination results from carrying the child through the streets to a hospital to be dressed. What can be more barbarous than such a proceeding? Yet it is one that takes place almost daily in most of our large cities and towns: the circumstances under which it is done being, in the extreme, cruel or thoughtless. The usual plan is to take the child upon the knee, and to cut off the remaining burnt clothing, then to wrap it in an apron or a blanket, and carry it to the hospital. When we recollect that the skin is either inflamed or loosened from the surface, we can readily imagine how much additional mischief will inevitably result from so carrying the child and again stripping it to be dressed at the hospital. The skin is often detached, vesicles are burst, and sores which would have been of little moment, are thus converted into serious constitutional burns. When we recollect, moreover, that for some hours after a burn has been inflicted, changes are taking place in the burnt surface, by which the extent and severity of the burn are increased; and, depending, not on the amount of heat applied to the surface, so much as on the capabilities of the system to resist injury (as exhibited in its freedom from shivering, etc.,) it must be obvious that it is absolutely necessary that the burnt parts should be instantaneously dressed with something, and that the patient should be kept quiet and placed in a bed as soon as possible. To carry a child through the streets, covered only with a blanket, each movement of the child or of the bearer of it detaching the softened and tender cuticle, is so obviously wrong and inhumane that some steps ought to be taken to prevent its occurrence. On the other hand, it is quite necessary that the patient should be immediately dressed with something. Perhaps medical aid cannot be obtained at once, and if a few minutes only were allowed to elapse, the time so lost would, in my opinion, often turn the scales, on so slight a matter does the preservation of life rest. It was to meet this state of things that the above question was proposed.

Dr. Adams:—"Perhaps no better directions can be given to the public at large than to follow the practice of the common people in this district; which consists in first smearing the part with linseed oil, either alone, or mixed up with lime-water, and then wrapping it closely with cotton, or a soft substance called wadding. To say the least of it, this application can seldom do harm, and it

admits of being easily removed when required. A most serious consideration in such cases is the removal of the patient's clothes, which sometimes so adhere to the burned parts, that they cannot be removed without occasioning great pain, and tearing the flesh. I know not any directions which can be given for conducting the operation, except to perform it with great caution; and in doubtful circumstances, rather to wait for the arrival of professional assistance, than run the risk of doing mischief."*

Dr. Herbert Barker:—"In conclusion, the application of flour to burns and scalds is probably that which could be more promptly and readily adopted by the public than any other. I would suggest, if the medical attendant be not within immediate call, that the patient be placed upon a firm bed or mattress, with the head somewhat elevated, and the injured parts of the surface uppermost; if the limbs be involved in the injury, that they be placed in a straight position; fine flour should then be perseveringly sprinkled over the affected parts by means of a dredger, so as thoroughly to cover the surface. Should the injury be severe, and the distance from the surgeon so great, as to render it impracticable for the case to be seen early, strong beef-tea may be freely administered, but in no case should stimulants be given, unless under medical direction. These are all the instructions on the subject which I consider as necessary for the public, and it is my decided opinion that the immediate application of flour in the manner directed would be followed by much less suffering than of any of the thousand and one popular remedies which we are accustomed to meet with."†

Mr. Newnham:—"I should say extinguish the flames instantly, by enveloping the patient with a rug, blanket, carpet, great-coat, or such like article; and then apply cotton-wool, to secure the burned parts from exposure."‡

Dr. Strange:—"The public ought to do nothing by way of treatment, in my opinion, but to envelope the burnt parts in cotton or flour, and to give a little brandy and water in extreme cases."§

Mr. Greenhow:—"The best preliminary treatment of burns is to bathe assiduously the injured parts with oil of turpentine."‖

Mr. Hartley says that he has seen a fatal collapse occasioned by

* *Provincial Medical Journal*, 1848, p. 43.

† *Ibid*, p. 77. ‡ *Ibid*, p. 78. § *Ibid*, p. 133. ‖ *Ibid*, p. 101.

the employment of cold water, yeast, etc., and he recommends that the patient should be simply enveloped in something which will exclude the air, till the surgeon's arrival.

Mr. Evan Evans :—"Better to leave the public without *directions* as to treatment, when medical attendance is so readily gained. The best habits for children and persons incapable of avoiding danger, are made of wool. I have heard it said that any material may be made fire-proof, by steeping in alum-water, but I should not like to risk it; dresses of muslin and gauze, or such light textures, should be avoided for all such persons."*

Mr. Higginbottom :—"To clothe with woollen garments; even aprons and pinafores for children of the same material. To envelope the patient in a soft linen sheet, to defend the body from the air, and if cold to cover over with a blanket; this will allow the surgeon to have a clear surface, that he may use his own method of treatment."†

Mr. Barham has forwarded to me a very interesting little pamphlet on the frequency of burns among children; the title of it is "The Infant Martyrs." An abstract of its contents appeared in the *Provincial Medical Journal*, 1848, p. 349.

The following effectual means of rendering wearing apparel incombustible, is of great value, and deserving of general adoption. It was discovered by my friend, Dr. Robert Smith, who has with great liberality disclosed it to the world :—

"I have often been surprised that, considering the number of materials which will not burn and the small number which do burn, we should be compelled to build houses so liable, without constant watchfulness, to instantaneous destruction; that we should go also to sea in vessels made of a most combustible substance filled with enormous fires, frequently under the care of ignorant men. I think, therefore, I may be excused when I endeavour to add to a knowledge of the mode of rendering substances incombustible, or the theory of the mode to be sought after, even if the addition which I make be but a very small one.

"Silicate of potash has been considered good. It is a soluble glass which was expected to cover the fibre of cloth or wood, and so protect it from heat. This does act to some extent, probably in the same manner as stones do when put into a fire of wood or coal;

* *Provincial Medical Journal*, 1848, p. 45. † *Ibid*, p. 103.

they take heat but give none, and are also bad conductors. If silicate of potash remained as a glass, it would act also by keeping out the air; but this does not seem to be the case, as it falls after a time to a powder.

"It struck me that the mode of preventing combustion was not by protecting the wood from the fire merely, as heat must cause combustible gases to rise from wood, whether there be incombustible substances mixed with it or not, and these gases will force their way to the surface where there is no longer any preventive to burning. My object, then, was to find a substance which would render the wood unfit to burn, and would cause it to give out gases which would not burn; so that whilst the wood itself was being preserved, except where in contact with the fire, the gasses would assist in extinguishing the fire.

"I first tried phosphate of magnesia and ammonia, thinking the ammonia given out would be of use in extinguishing the fire; but this was of no value, as a piece of calico required to be made quite stiff with it before it was rendered incombustible. The calico was prepared by dipping in a solution of phosphate of magnesia, in muriatic acid, and then in ammonia. It seemed to me that the earthy salts are of little use for the purpose required, and that the amount of solid matter incapable of evaporation left on the cloth, assists in a very small degree.

"Sulphuric acid, however, seemed to present the most promising characteristics of a substance incapable of burning, and of acting so strongly on vegetable substances as to make them incapable of burning. Sulphuric acid itself is a body perfectly burnt, or we may say over-burnt, having an atom of oxygen given to it by artificial means, so to speak, which atom is difficult to separate, and therefore not resembling the oxygen of many highly oxidized bodies. It requires a high degree of heat to raise it to vapour; and the vapour formed is sluggish and heavy, remaining long where formed, and quenching flame wherever it is. It destroys the texture of wood also and other vegetable substances, causing them to give out after a time gases which do not burn, mixed with some which do burn; but if there be enough of acid, forming a mixture which does not burn. The wood also cannot be again induced to become combustible until it be heated to redness, so as to remove all the sulphuric acid, leaving only charcoal.

"If sulphuric acid, then, could be introduced into wood just at the time that the fire was going to take place, the fire would cease to take place; and this we can do easily by saturating the wood with sulphate of ammonia. When there is no fire present, there is no sulphuric acid present, as such; but as soon as the heat rises ammonia goes off, and sulphuric acid is instantly presented to the wood. The ammonia does not come off quite pure, it is mixed with nitrogen and sulphurous acid; and this disengagement of gases is of advantage in extinguishing fire; when the heat rises to 536° the sulphuric acid is then left to act on the wood in part and to volatilize in part, and that which I have mentioned takes place. The outside of course would first undergo the change, and the inside would be protected by the incombustible outer part; if the fire continued to act long, the inner layer would undergo a similar change. I imagine, then, the acid acts in a double manner; it makes the wood refuse to burn and it puts out fire. As sulphurous acid is given off in this process, the action is also similar in one point of view to that of sulphur, which has long been used for fire in chimneys.

"I have no doubt that a house built of wood prepared in this manner might have a fire lighted on the wooden floor without danger, burning on the spot to which the fire was limited. A ship also would be safe, even if the cinders did fall from the grate in stormy weather.

"I know that muriate of ammonia has been used, and that it acts very well; but I think the sulphuric acid is superior, the ammonia being merely to keep it innocent; any other volatile base might do. I am sorry, however, that this is not perfect; its solubility in water is a great disadvantage, as it cannot be applied to clothes to be frequently washed. True, it is so cheap that it might be applied every washing where there are peculiar dangers; but if a person were standing very near the fire, the ammonia would in part be evaporated, and the acid remaining would be enough to injure the fabric. There are, however, cases, such as curtains, to which this could not apply, and where it would be valuable.

"Sir William Burnet's liquid is chloride of zinc; he uses it for preserving wood and canvas, and also for preventing fire. I am certainly surprised that more use has not been made of it, being, as far as I have seen of it, so efficient. I believe the manner in which the chloride of zinc acts is very similar to that of the

sulphuric acid, destroying the organic matter on the approach of heat, and rendering it incombustible. It can be introduced into wood at a specific gravity of 2000, I believe; sulphate of ammonia cannot easily be used above 1200. By heating the solution more may be attained. Sulphate of ammonia is cheap and easily procured and used, not hurting anything with which it may come in contact, and therefore more easily managed in households.

"The chloride of zinc is said to unite with the fibre. This cannot be said for the sulphate of ammonia. It would not, however, come from the centre of a beam of wood, even if immersed in water, as the water enters with great difficulty into wood; and the solution itself cannot be introduced without forming a vacuum in the saturating vessel, and so removing all the air from the wood.

"The first time I used this solution I found a large quantity of mould formed, and indeed it contains all the elements to increase its growth. The second time the solution was boiled in an iron vessel, and no mould formed on it; on the contrary, mould was destroyed by it. The sulphate of ammonia dissolves iron rapidly, and forms a double salt which is deleterious to such growths. I imagined any other metallic salt would do, and used ordinary chloride of manganese prepared in the laboratory, which killed all such fungi rapidly, and no more have grown after standing eleven months in contact with organic matter.

"I believe there are many ways in which this may be used. My wish was to find a substance suited for building fire-proof ships, and I believe this would do; at any rate the ships would be fire-proof, experience could alone tell if any other objection followed. It does not render the wood hard, heavy, or brittle.

"I believe it would be of the greatest advantage in mills, which now suffer so much from fire, diminishing or rather entirely removing the expense of insurance. It does not hurt colours; so that even coloured goods might be dipped when kept long in one place, or when sent in vessels abroad. Possibly some delicate colours may be attacked, but this must be a rare case.

"I am more desirous of seeing ships built of an incombustible material, the means of escape at sea being few and confined to few; and whilst there is any hope of doing it easily, I scarcely think it proper for any one to neglect what information may exist on the subject."*

* *Philosophical Magazine*, 1849, p. 116.

There are some points in the treatment of burns on which I wish to make a few observations.

It appears to me that the unfortunate separation of physic from surgery by the ecclesiastics led the surgeons of the middle ages, and, to some extent, those of the present day, to regard burns too much as *local* injuries; and that, notwithstanding the freedom of inquiry which distinguishes the surgeon of the present time, it is very difficult for him to emancipate himself from the habits and prejudices of preceding generations. I regard the present divisions of burns into classes or degrees as a hindrance to the advancement of our art; for, being founded on the effects produced on the tissues to which the heat is applied, and leaving out of sight the effects on the system at large, they are worthless as a guide in the treatment, and almost useless for the purpose of description. I have previously stated my objections to M. le Baron Dupuytren's, which is the most approved of these classifications.* I suspect, however, that his divisions, though given in our text books, have had little practical influence on English surgeons: for it will have been perceived that in the foregoing abstract the importance of internal treatment is repeatedly and ably insisted upon by them.

The combinations in which the heat occasioning burns is conveyed to the surface are so many, and its modes of application, as well as its duration, are so diversified as to give rise to alterations in the parts which defy classification. If the body inflicting the burn is a heated metal, the degree of its effects will depend not only on its temperature and the time during which it is applied, but on its conducting power. If the injury is inflicted by a heated fluid, it may possess in addition some chemical corrosive property, or it may be of a much higher temperature than water, or so viscous or adhesive as not to flow off the parts. But besides these conditions of the bodies inflicting the injury, there is a still greater variety in their effects arising from the extent of surface implicated, and in their influence upon it.

Immediately after their occurrence, the local conditions observed in burns and scalds are either a carbonized eschar, or instantaneous inflammation of the skin, with or without vesication, or an opaque

* See page 6.

yellow appearance of the cuticle (gelatinized?) As regards their superficial extent, and the degrees in which different localities may suffer, there is the greatest variety: the injury may be but little larger than the head of a pin, or it may involve the entire surface of the body, as where there has been immersion in a boiling liquid: while in cases of burning from the clothes taking fire, there is great variety in the appearance of different parts of the burnt surface, viz., vesication, erythema, perhaps detached cuticle, constituting appearances which defy description or classification.

The carbonized eschar is usually caused by the application of incandescent metal, the disorganized tissue adhering firmly to the living parts, and constituting a defensive covering to them, under which the primary processes of reparation may take place, if the patient survives. Burns with carbonized eschar are generally of small superficial extent, but of great depth, sometimes involving blood-vessels or penetrating the cavities. But it is generally easier to judge of the gravity of burns of this description than of those in which the skin is not crumpled or dried up at the moment of the application of the heat. Where the cuticle is opaque and loose, or the skin yellow and dirty, it may be predicted that there will be sloughing, but to what depth it will take place it is impossible to foretell. There is not less uncertainty as to the ultimate extent of the mischief in those cases where there is *extensive* erythema and vesication, for though the existence of vesication may be considered as a proof of the vitality of the skin, yet it is an indication of the existence of inflammation, which may speedily proceed, if not checked, to extensive or fatal sloughing. The inspection of such burns at the second or subsequent dressing often displays a condition of the parts not expected to exist; those which did not appear to be deeply burnt, being severely so, and others which seemed to be rather severely burnt, being scarcely affected. During the first dressing it is very difficult in most of the severe cases to estimate the extent of the mischief, for that will depend on the impression produced upon the nerves of the part, and through them upon the nervous centres: and it cannot be measured by the degree of erythema or vesication existing when it is necessary to dress the case. There is, perhaps, no circumstance which claims the attention of surgeons in the treatment of burns more than this tendency of the inflammation to pass the primary stage and to proceed with great

rapidity to vesication or sloughing, unless the equilibrium of the nervous system be restored, and the patient be speedily recovered by internal remedies and external applications to the sores, from the depressing shock of the accident. So long as the nervous system is embarrassed, the inflammation will partake of the destructive character of a passive inflammation occurring in one whose constitution is bad. When the equilibrium of the nervous system is restored, the extent of the local mischief soon becomes limited, but so long as it is not regained, there is little or no effort at repair, and the inflammation proceeds to sloughing: hence the supreme necessity in constitutional or vital burns of instant and continued attention to those symptoms which will serve us in judging of the condition of the nervous centres.

For the most part, it is only in burns of considerable severity that medical assistance is sought, such as those produced by ignition of the wearing apparel, or by the exposure of the body to hot fluids; and in general it is only after some little time after the injury that the surgeon first sees the patient. In hospitals half-an-hour or longer frequently has elapsed before the patient arrives there; and children burnt by their clothing taking fire are generally carried thither with no other covering than a blanket, in severe rigours. In these cases shivering is universally observed.

If the patients are kept at home, and a surgeon is summoned to treat them there, they are generally found to have had some application made to the parts, for every byestander thinks that he knows what is "good for" burns. The first act of the surgeon will be to cover loosely the patient with a cloak or blanket, if he is naked, or the burnt parts if they are exposed to the cold; and while doing so, to take a cursory glance at the extent of the sores, and see whether the cuticle has been torn off, and whether the cutis has perished, which may be known by the marked change in its colour, and by the absence of redness and vesication, perhaps in the centre of a patch of inflamed integument. The surface being temporarily protected from cold, the attendant's attention will be directed to the effects produced upon the system at large, the most marked of which in severe burns is the occurrence of shivering. If the patient is not shivering, it will be necessary to ask whether he has been very cold and had chattering of his teeth; to notice the frequency and power of the pulse, the character of the respiration, the

expression of the countenance as indicative of acute pain or of passive suffering. Of these signs, one of the most important is the existence of acute pain, as manifested by direct and loud complaints of it, by writhing, or by efforts to obtain relief by local applications. If the patient is calm and collected, and seems to feel the pain in the part in proportion to the superficial extent of the mischief, his condition is much more hopeful than if he were found reclining, and passively submitting to whatever those around him chose to do to his sores. When the pain continues to be intense, the vitality of the part is not destroyed; and, on the contrary, if it is not severe, there is danger of sloughing. This preliminary inquiry is of great use. It will occupy not more than two or three minutes, during which the surgeon will have ascertained how the accident occurred, how many minutes ago, and how far (if at all) his patient's nervous centres have been affected by the shock: information of inestimable value in a philosophical treatment of burns. And the surgeon will have been enabled to determine whether the burn is *local* only,* or whether it is *constitutional*. If the former, there will be no occasion for the immediate administration of internal remedies, and the dressing may be proceeded with at once. If, however, the injury is a constitutional burn,† it is all-important before dressing it to administer some internal remedy whereby to help to recover the system from the shock which it has sustained, and so restore the balance of the nervous power.

If the patient seems prostrate, his nose, ears, and extremities cold, has had rigors, or is in one, it is most important to administer at once some internal stimulant, alcohol with aromatics in hot water, &c., to apply bottles of hot water to the feet if they are not burnt. The system must be brought out of this depressed state as rapidly as possible, for either the patient will rapidly sink, or he will have to sustain a degree of reaction dangerous in proportion to the previous depression. Until the equilibrium of the nervous system is restored, and there is little or no tendency to shivering, the local injury will, in spite of all dressings perhaps, increase. In very severe burns, an adult patient may fall down dead in a few minutes after the accident. In cases of the next degree of severity, the patient is cold, has repeated rigors, speaks little, scarcely

* See page 8. † See page 8.

complains of pain, has a frequent pulse, a quick, and in some cases a laborious respiration, attended with a loud mucous râle, in a short time after the accident. I have seen the latter within half-an-hour afterwards in a case that was fatal.

In burns somewhat less severe, the patient complains loudly of the acuteness of the pain, has most marked rigors, but a less degree of depression of the vital powers than appears in the cases just described.

It appears to me that it will be found that opium is most useful in all these forms, combined with diffusive stimulants, but that much larger doses will be needed in the ~~former~~ *latter*, where the pain is so severe, than in the other; and that where the severity of the injury has been so great as to prostrate the nervous power below the healthy sensation of pain, there is congestion of the brain,—a condition which large doses of opium would tend to increase, at a time when the existing congestion sufficiently blunted the sensibility to the pain. My own experience is strongly in favour of full doses of this remedy early in the cases specified. It has occurred to me that it would be most useful, especially in hospitals, in these severest cases to expose the surface of the body previous to the dressing of the sores, or immediately afterwards, to hot vapour, by means of Dr. Gower's sudatorium, or to steam and hot vapour mixed, with the view of recovering the system from the shock, establishing a free perspiration of the sound skin, diverting the blood from the cavities, and thus relieving the serous and mucous membranes from that intense congestion which is frequently found in fatal cases. Not only as an early application does this remedy seem to me to promise to be beneficial, but likewise during the progress of the case, when it might be repeated frequently. Mr. Erichsen, at page 17, has observed that "on taking a general review of the constitutional treatment of burns, it may be stated that the first object should be to relieve the system of the abnormal quantity of fluid that must have accumulated in it, in consequence of the arrest, to a greater or less extent, of so important a secretion as the perspiration." He says this may be accomplished either by the administration of diuretics, by guarded blood-letting, or by encouraging the process of suppuration, if it be deemed prudent to wait till this be established. I fear, however, that these remedies afford but very little prospect of benefit

compared with that which may be expected from the one which I suggest, for diuretics are notoriously most uncertain, while the depression of the patient's powers will admit but of a very limited loss of blood. By the process which I suggest, the sound skin will be made to pour out a most profuse perspiration, and the system will be relieved from a great deal of fluid. Again, it acts immediately, and without impairing the power of the stomach, as is done by the administration of medicines by the mouth.

With respect to the external applications to burns, I have little to add to the very valuable information which my correspondents have contributed to the foregoing pages on that head. In *extreme* cases I certainly think that Dr. Kentish's early treatment is excellent, and that it affords the best prospect of saving life, and it is that which I would have adopted on my own person. Of ointments there is none so useful as the ceratum resinæ as a primary dressing, for it is not only an excellent application, but it resists rancidity, and therefore can be kept in readiness for use better than most others. I have tried cotton, flour, treacle, and linimentum calcis repeatedly, as well as most of the other remedies which have been in general use.

There are two or three more points on which I will touch before I conclude :—

Suppuration.—The earlier, suppuration is established, the more favourable is the prognosis. It is a test of the restorative power of the system, and is one of the earliest results of the restoration of the equilibrium of the nervous centres. By exact observations in numerous cases some important law might probably be deduced.

Dressings.—The removal of the dressings from a burn, and the substitution of fresh ones, ought to be regarded as being almost as trying to the constitution of a person suffering from a severe burn, as a surgical operation with the knife would be to a person in health; therefore it is important to avoid a single unnecessary dressing: hence the favour into which cotton and flour have risen. Besides this property, they possess the following essentials of a good dressing :—

1. That it shall be a non-conductor of heat.

2. That, without exercising any mechanical injury to the sore by its roughness or hardness, it shall form a defence against

external injury, and be susceptible of such adaptation to the wound as that it will not be easily disturbed by the motions of the body.

A third property of a good substance for a dressing is that it shall not favour putrefaction either by combining with the discharges or in any other way. The application of treacle seems to have a considerable power of preventing putrefaction, and, when covered with cotton, answers very well.

When burns have already been dressed with the usual domestic applications (which is often the case), it is best not to disturb them, for fear of detaching cuticle by removing them. If the burn is simply local it will get well. The dressings most approved by the public are the linimentum calcis, flour, or cotton, which are all excellent; and the surgeon need do no more than adjust and secure them, if he finds that they have been applied already. One outward dressing possesses so little advantage over another that it would probably be more than counter-balanced by the injury done by the removal of one to substitute another in its place.

Symblepharon.—Burns of the conjunctiva, from the entrance of hot fluids or molten lead into the eye, are difficult to manage during their cicatrization, and if there has been sloughing of the conjunctiva palpebralis, as well as that of the globe, it is not easy to prevent symblepharon. Symblepharon, when it occurs, is the most unmanageable of all contractions or adhesions resulting from burns. I lately had under my care a case of very extensive adhesion of the lower eyelid to the globe (including a third of the cornea), which had been divided several times, but had always reunited more firmly than before in spite of the utmost vigilance. When the case came under my care, there was some diminution in the size of the eyeball, and I expressed my belief that the eyeball was becoming atrophied. As the deformity was considerable, and there appeared to be no possibility of saving the globe except the eyelid could be severed from it, I tried the following plan:—Taking a piece of whalebone, I shaved it till it was very thin, yet of such tenacity as to bear the strain of a ligature. I shaped it so as to fit between the eyeball and lower eyelid of the sound eye, and I covered it with a thin covering of lint, and passed two ligatures through it, securing each of them by a knot on the same side. After dividing the adhesion, I passed this armed whalebone down between the eyeball and eyelid so as to keep the raw surfaces from

adhering again. In order to prevent the whalebone from being protruded by the granulations or the movements of the eye, I brought the ligatures through the lower eyelid, and tied them in front of it. When I saw my patient last, I thought the eyeball was undergoing a slow atrophy, but there was very great improvement in the deformity. In another case I would use ivory or porcelain instead of the whalebone and lint: the lint is objectionable because the discharges are retained in it, and become offensive and acrid. I am of opinion that by this contrivance the difficulty which has been generally regarded insuperable of preventing the readhesion of the eyelids to the globe, will be overcome.

I cannot conclude this report without returning my warmest thanks to those gentlemen who have so kindly communicated to me the results of their experience. I have already stated my opinion of the great value of their contributions. It has been my earnest desire to present so complete and faithful an abstract of them, as I trust will be satisfactory to my contributors, and to the members of the Provincial Medical and Surgical Association.

APPENDIX.

ON THE

TREATMENT OF BURNS, AND ON THE RESULTS OF OPERATIONS FOR THE RELIEF OF CONTRACTIONS FOLLOWING THEM.

BY G. W. CHARLETON, ESQ.,

RESIDENT SURGEON TO THE GLOUCESTER INFIRMARY.

THE treatment adopted in the Gloucester General Infirmary in burns and scalds may be thus enumerated:—

1. To undress the patient as gently as possible, so that as much skin may be retained as possible.

2. In *extreme cases*, when coldness and other symptoms of great depression of the vital power are present, to administer ammonia, opium, camphor, and to apply artificial warmth to the extremities.

3. To *scalds of the face*, or to the same part if burnt by the instantaneous bursting of flame from a furnace, or by the explosion of unconfined gunpowder, a liniment composed of lime-water and olive oil is usually applied with a feather. It concretes upon the surface, and forms a mask, under which, in a few days, the skin is repaired without deformity. By being so applied it does not interfere with the orifices of the nose and mouth.

4. To *parts deprived of skin*, either by moderate burning or by scalding, our practice is to apply, upon lint, an ointment composed of equal proportions of simple cerate and resin cerate,* and to cover that dressing, together with the surrounding reddened or blistered parts, with cotton wool.

5. To *vesicated burns, not denuded of cuticle*, cotton wool, without ointment, is applied.

* The resin cerate gives tenacity to the dressing, and renders its application convenient, rather than possesses a peculiar curative effect.

6. To *burns with the skin charred*, so as to render extensive sloughing certain (supposing the first shock be overcome), the application preferred is, solut. calcii chlor., ℥ss.; aquæ, ℥xvss. M. It is applied by lint moistened with it, and is covered with oil silk.

This dressing has the advantage of excluding air; of being as comfortable to the patient, if not more so, than other remedies; of preventing much offensive odour, which is common from burns, and of favouring the healing process. The latter it does with as little subsequent contraction, if not less, than any application with which we are familiar. It is cheaper and appears to be more curative than a solution of chloride of soda of the same strength.

When vesicles have terminated in ulcers, or when sloughing has done so, the sores are treated as ordinary ones with ointments, water dressing, etc. etc.

If cerebral, thoracic, or other symptoms occur, they are treated on general principles.

The cases treated in the foregoing modes were—

Of burns (recent)	77
Of scalds (recent)	29
	106

Particulars respecting the seat of injury, result, etc. etc., are given in the Tables I. and II.

For the effect of operations upon cicatrices of old burns, see the following cases:—

OPERATIONS FOR CONTRACTIONS FROM BURNS.

K. D., female, aged 7 years, was burnt two years before her admission into the hospital. She has a contracted cicatrix, which extends from the axilla to the wrist. The elbow cannot be extended beyond an angle of ∠ (75°).

Operation.—The cicatrix was dissected off. A filament of the external cutaneous nerve was laid bare; the fascia which extended from the tendon of the biceps, and, lastly, the tendon of the biceps itself, were divided.

By gradual extension afterwards, the limb was made nearly straight. Cicatrization steadily advanced, and she was considered cured October 27, 1836.

Nov. 9th, 1837, she was readmitted with ulceration of the new cicatrix, and contraction, which prevented the elbow being extended beyond an angle of 45°.

Very soon after leaving the hospital, Oct. 27, 1836, she was permitted to work with a needle. Contraction commenced and increased, without attention being paid to check it. She remained in the Infirmary till January 3, 1839, and then, having greatly improved, she was made an out-patient.

P. W., male, aged 6 years, received his injury ten months before coming here, with contraction of both upper extremities.

The left arm at axilla is bound down at an angle of ⦞ (65°). The band is like a prolongation from the posterior boundary of the arm-pit, and is in thickness half-an-inch.

Operation.—A portion of cicatrix, the shape and size of half a circle of two inches diameter, was removed, and an incision, in length four inches, was made from the inner extremity of the semi-circular incision upwards and slightly inwards. The arm was extended a little; the wound was dressed lightly, and the patient's body and arm were secured upon a board and mattress upon a bed. Extension was gradually increased and the wound diminished, partial and temporary ulceration occasionally occurring.

An abscess formed before the axilla; a gland protruded. The boy's health suffered, and after being upon the board, etc., for six months, he went home. He was subject to epileptic fits. Subsequently he became phthisical, and died, the wound produced at the operation having previously healed.

C. C. K., male, aged 5, was burnt a year and a half before he came here for treatment.

A contracted new integument occupies the whole of the locality between the lower jaw and the clavicles. The mouth is kept open, the lower lip is everted and depressed, so that it reaches the lower part of the chin, and saliva cannot be retained.

Operation.—The integument and a dense subcutaneous fibrous tissue were divided by an incision, in depth half an inch, which extended around the front of the neck a quarter of an inch below the depressed lower lip and chin. The wound was not made entirely through the thickened fibrous textures. When the lower

lip was raised to a level with the upper edge of the incisor teeth the wound gaped to the width of an inch.

Dry lint was applied to the wound. When suppuration was established the wound had become two inches in width, and the lip admitted of greater elevation than before. The chin was raised by a stay which, through the medium of a head band, had been kept tight by a strap which extended to the back of the head from a belt which was placed round the waist. Subsequently position was relied upon rather than the apparatus; his head was allowed to sink into a hollow of the bed. The healing process advanced, and he was permitted to get up, when he wore a stiff stock. Finally, he was discharged, very much improved in appearance, cured.

E. P., female, aged 8 years. She was injured three years before she came to the hospital.

She has a hardened and contracted cicatrix, which extends from the axilla to the first phalanx of the thumb. The principal contracting band is very thin, with the exception of its edge, where it is thick and cord-like. The elbow cannot be extended beyond an angle of 75°, thus ∠, and the wrist is drawn laterally to an angle of 45°.

Operation.—The cicatrix was dissected off, together with some deep-seated fibres, which were in contact with the fascia at the elbow and at the axilla, which restricted motion. The wound made extended one-third round the arm. The arm was extended to an angle of 45°, was dressed simply, and was placed upon a pillow. Subsequently extension was made at the time of each dressing, till the limb could be placed upon a straight splint.

The wound healed progressively, and she was discharged relieved, after being in the hospital eleven months. Five months after she went home the wound was very small, and she could keep the limb straight for a day or two without the splint.

John P., male, aged 7 years, was burnt four years ago. The lower lip, by the contraction from a burn, is usually everted and depressed, so as to cover the chin, yet the patient can, by depressing his chin and contracting the muscles of his lips, close his lips for a short period. The skin, which extends from the lower jaw to the neck, is soft and is loosely connected to the parts beneath. Vertical

thickened bands of skin are the chief sources of the deformity. The depression of the mouth is most considerable at its right angle.

Operation.—The thickened bands were raised; a double-edged scalpel was made to transfix and to divide them. As resistance continued, some subcutaneous fibres were cautiously divided. A transverse wound, which gaped to the extent of an inch, was the result. A portion of healthy skin was elevated from the neighbourhood, was twisted a little, and made to cover the wound caused by the division of the cicatrix.

The day after the operation, the patient could retain the lip in an elevated position better than before. Subsequently the wound which was made to procure sound skin, gaped, and the flap which was placed over the wound of the cicatrix, sloughed. Some relief was the ultimate result.

See accompanying Table for details.

A TABULAR ABSTRACT OF THE OPERATIONS FOR CONTRACTIONS FROM BURNS.

Initials.	Sex.	Age.	Ill before admission.	Seat of contraction.	Date of admission.	Date of discharge.	Duration of treatment.	Result.
		Years.						
K. D.	F.	7	2 years.	From axilla to wrist.	June 2, 1836. She was re-admitted Nov. 9, 1837.	October 27, 1836. January 3, 1839.	5 months. 14 months.	Cured ? Relieved, and made out-patient.
P. W.	M.	6	10 months.	The arm at axilla.	March 23, 1837.	April 11, 1838.	12½ months.	Relieved of contraction, but died consumptive.
C. C. K.	M.	5	18 months.	Lower lip and neck.	August 30, 1838.	Feb. 14, 1839.	6 months.	Cured.
E. P.	F.	8	3 years.	From axilla to thumb.	March 28, 1839.	Feb. 20, 1840.	11 months in Infirmary, 5 months at home. — 16 months.	Very much relieved.
J. P.	M.	7	4 years.	Lower lip and neck.	Nov. 7, 1844.	March 20, 1845.	4½ months.	Relieved.

The result of the operations on the foregoing five cases may be considered satisfactory, although the treatment was very painful and tedious, and was attended with risk of life.

A CASE OF DEATH DURING APPARENT RECOVERY FROM A BURN.

G. J., male, aged 30 years, received April, 1837, a burn of nearly the whole of his back and of his right knee. The slough separated; the whole of the injured parts granulated and healed slowly, until one-third only of the wound remained.

He took opium to relieve pain and to procure sleep. He was always pale, and at one time became œdematous. His appetite was defective, and he occasionally experienced obstinate vomiting and purging. He suffered pain in the epigastric region. Effervescing salines, diuretics, and cordials were administered, also bismuth and opium; the latter most relieved the sickness. At length he felt an aversion to medicine. Vomiting and purging, with the excretion of green bile, continued for a period of three days without relief; he became sleepy, and at length expired.

During the whole of the treatment he lay upon his abdomen, a period of sixteen and a half months.

Post-mortem.—The body was bloodless; at base of brain there were thirteen ounces of fluid; the lateral ventricles contained a few drachms of serum; the membranes in the longitudinal fissure (over the corpora quadrigemina) were adherent. The lungs were healthy, but small; the heart was healthy; the cavity of the chest was encroached upon by the liver; the liver was so large as to reach to the third rib of the right side,—it was very yellow, and was softer than natural; the gall bladder was distended with green bile; the stomach was softened and pale; the intestines contained principally green fluid, but in one part yellow fluid,—their mucous coat was healthy; the kidneys were healthy.

TABLE I.

	Males.	Females.	Total.	RESULT. Cured.	Relieved.	Not relieved.	Died.	AVERAGE. Age. Yrs. Mons.	Time in Infirmary. Months.	RESULT PER CENT. Cured.	Relieved.	Not relieved.	Died.
BURNS	42	35	77	26	8	–	43	15 2	4	$33\frac{7}{10}$	$10\frac{3}{10}$	–	$55\frac{8}{10}$

The foregoing may be classified thus:—	No.	Average age. Yrs.	Months.	Cured.	Relieved.	Died, within 24 hours.	Died, later than 24 hours.	Total of Deaths per cent.
1. Those of the trunk (breast, belly, side, or back) ...								
,, head (face or neck)	6	4	6	–	–	5	1	100
,, arms and legs								
2. ,, trunk, head, and arms	9	8	0	–	1	4	4	$88\frac{8}{10}$
3. ,, trunk, arms, and thighs (or legs)	8	10	2	1	1	4	2	75
4. ,, trunk and head	1	–	–	–	–	1	–	–
5. ,, trunk and thighs	2	–	–	–	–	1	1	–
6. ,, trunk and arms	13	14	0	4	2	3	4	$53\frac{8}{10}$
7. ,, trunk (chest, belly, side, or back)	7	27	2	–	1	3	3	$85\frac{7}{10}$
8. ,, head (or face), arms, and thighs	1	–	–	–	–	1	–	–
9. ,, head (or face) and arms (or hands)	14	15	6	9	–	4	1	$35\frac{7}{10}$
10. ,, head or face	2	–	–	2	–	–	–	–
11. ,, arms and legs	4	16	6	2	1	–	1	25
12. ,, arm or hand	5	30	0	4	1	–	–	–
13. ,, leg or foot	5	26	4	4	1	–	–	–
	77	–	–	26	8	26	17	–
						43		

TABLE I. (CONTINUED).

While the average age of the whole of the above was 15 years and 2 months, the number admitted of the age of 10 years and under was 43, or 55 per cent., and above 10 years was 34.

As the age increases, the extent of burns diminishes.

The average stay in the Hospital of those cured was	... ...	4	months.
,, ,, relieved	... ...	7½	months.
,, ,, who died more than 24 hours after being burnt	...	25½	days.

BY COMPARING THE BURNS WITH SCALDS, THESE DEDUCTIONS ARE APPARENT:—

1. In the patients who were *burnt*, males were $54\frac{5}{10}$ per cent., and in those who were scalded, males were $75\frac{8}{10}$ per cent.
2. The average age of the burned was 15 years and 2 months, and of the scalded was 24 years.
3. Of the burned, 55 per cent. were ten years of age or under, but of the scalded only 14 per cent.
4. The burnt, to be cured, were under treatment 4 months, and the scalded 6 weeks.
5. That of the total of burnt $55\frac{8}{10}$ died, and of the scalded $17\frac{2}{10}$ died.
6. That burns of two or more important and similar parts were less destructive than scalds, thus:—

	BURNS.		SCALDS.	
	No.	Died.	No.	Died.
Of the trunk, arms, and thighs.....	8 ..	6	2 ..	2
,, trunk and head	1 ..	1	1 ..	1
,, head and arms	14 ..	5	1 ..	1
,, arms and legs	4 ..	1	2 ..	0
	27	13 or 48 per cent.	6	4 or $66\frac{6}{10}$ per cent.

7. That burns and scalds of the trunk were more destructive than burns and scalds of a like extent of the extremities.
8. That in forming a prognosis, the region of the body injured, the extent of surface, and also the depth to which heat has injuriously penetrated, must be taken into consideration.
9. That children are more quickly and probably more certainly destroyed than adults by burns and scalds of the same extent.
10. That the younger the subjects the greater is the extent of burns to which they are liable.

TABLE II.

	Males.	Females.	Total.	RESULT. Cured.	Relieved.	Not relieved.	Died.	AVERAGE. Age. Years.	Time in Infirmary. Months.	Wks.	RESULT PER CENT. Cured.	Relieved.	Not relieved.	Died.
SCALDS.....	22	7	29	24	–	–	5	24	1	2	$82\frac{7}{10}$	–	–	17

	No.	Cured.	Relieved.	Died, within 24 hours.	Died, later than 24 hours.	Total Deaths per cent.
The foregoing may be classified thus :—						
1. Those of the trunk	–	–	–	–	–	–
,, head						
,, arms and legs						
2. ,, trunk, head, and arms	–	–	–	–	–	–
3. ,, trunk, arms, and thighs (or legs)	2	–	–	2	–	100
4. ,, trunk and head	1	–	–	1	–	100
5. ,, trunk and thighs	–	–	–	–	–	–
6. ,, trunk and arms	–	–	–	–	–	–
7. ,, trunk	–	–	–	–	–	–
8. ,, head (or face), arms, and thighs	–	–	–	–	–	–
9. ,, head (or face) and arms	1	–	–	–	1	100
10. ,, head (or face)	–	–	–	–	–	–
11. ,, arms and legs	2	2	–	–	–	–
,, a single part of the body	23	22	–	–	1	$4\frac{3}{10}$
	29	24	–	3	2	–
					5	

Only 15 per cent. of the patients scalded were under ten years of age.

The average stay in the Hospital of those cured was six weeks and six days; and of those who died later than 24 hours after the injury was received, was five weeks.